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Diseases of Sweet Potatoes in Alabama.

(A Preliminary Report.)

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DISEASES OF SWEET POTATOES IN ALABAMA

E. MEAD WILCOX, PH. D.

INTRODUCTION.

The sweet-potato crop in Alabama is one of importance and one that, no doubt, will increase in value from year to year. At present Alabama stands fourth in order among the sweet-potato growing states. According to the census report for 1900, covering the year 1899, Alabama produced 3,457,386 bushels of sweet potatoes on 50,865 acres. Assuming the average value of the crop as \$0.49 cents per bushel, as done in this report, the average value of this crop per acre during 1899 was \$33.17. The following counties produced over 100,000 bushels: Dallas, Henry, Jefferson, Montgomery and Wilcox; and Montgomery county produced 163,832 bushels.

The value of the crop is much enhanced if it is possible to hold it until it can command the much higher prices that prevail during the winter and early spring. Methods of storage, therefore, deserve attention and it is our plan to make a thorough investigation of the subject in connection with some of the growers who now try to hold over a part or all of their crop. Some of the diseases which are mentioned in this bulletin are most serious obstacles to the storage of sweet-potatoes, and it is here largely, rather than during the growing season, that sweet-potato diseases cause the greatest losses. It has seemed wise in advance of the publication of our study of storage methods to publish here a summary of our present knowledge of sweet-potato diseases to include the work upon the subject done here and elsewhere.

It is hoped and urgently requested that all who grow sweet potatoes will assist us in this investigation by reporting all sweet potato diseases to this office promptly, accompanied by specimens of the diseased plants. In this manner

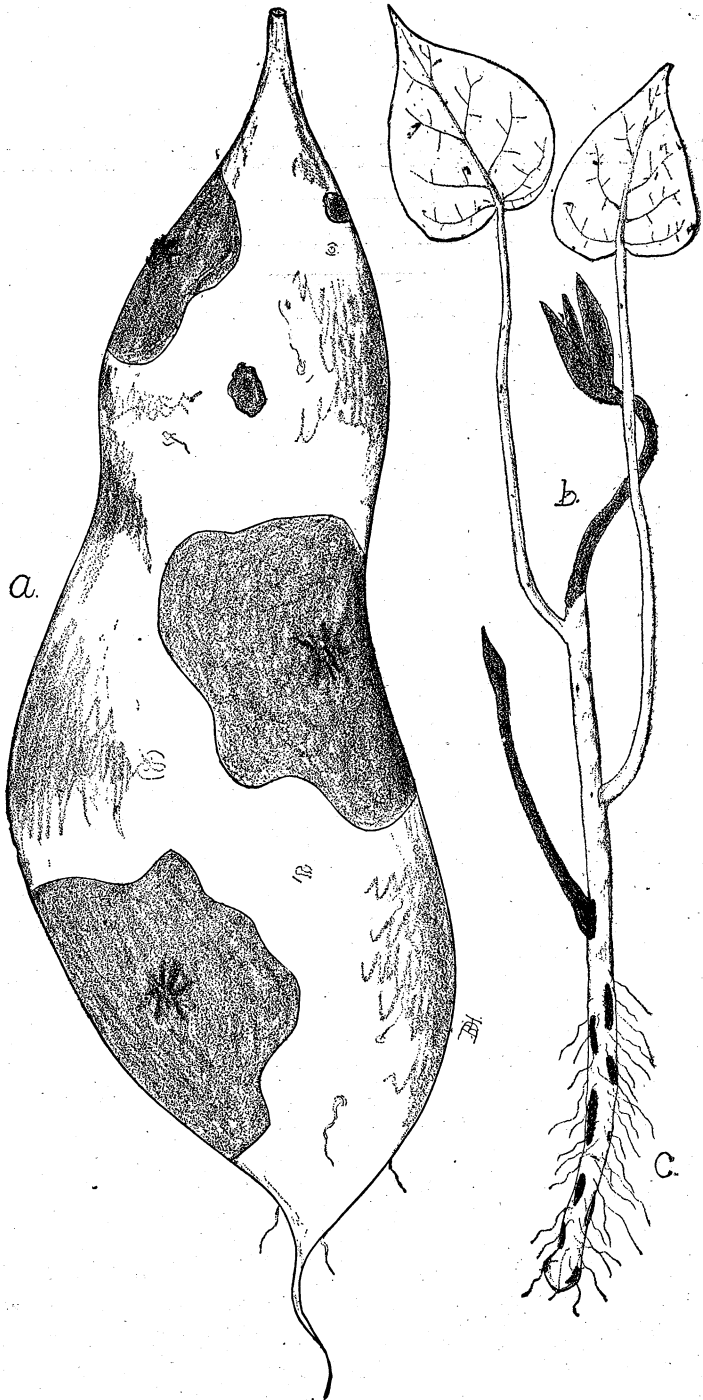


Figure 1.

we can become acquainted with the distribution and peculiarities of each of these and other diseases in this State. We shall be glad to learn also of the methods of storage now being employed in various parts of the State, and correspondence upon this matter is invited.

The present bulletin has been prepared largely from the notes submitted by W. M. Lewallen and H. F. McElderry as a thesis for the bachelor's degree June, 1906. To these gentlemen my thanks are due for the assistance rendered in this work and in the working out of the life histories of the various organisms, all of which will be published at a later date. Thanks are due Dr. B. D. Halsted, of the New Jersey Experiment Station for the loan of the cuts.

BLACK ROT.

This disease may be recognized by the formation on the root of olive-brown or greenish spots. See Fig. 1. A. At first these diseased spots may be very small but as the disease progresses they become larger and extend deeper into the tissues of the potato until finally the entire root may turn black. Potatoes affected with this disease acquire a very characteristic bitter taste and are utterly unfit for eating. The troublesome feature about this disease is the fact that it may escape notice at the time of harvest but, if storage conditions are favorable to the growth of the fungus, much damage to the crop may result during storage. This, unlike the soft rot, is a dry rot.

This same disease attacks also the young sprouts, and in this case is at times called "black shank." See Fig. 1. B. Dark colored spots or lines are formed and these in extreme cases may completely girdle the stem. In that case the plant will be killed outright, but in any case it is apt to be very much injured and rendered of very little value.

It must be kept in mind that if diseased roots are used to secure the "sets" that these sets are very apt to have the disease on their stems. And more than this, the disease may be carried over for several years in the soil, the fungus causing the trouble being able to live for some time in this manner.

The disease is caused by the fungus known to scientists as *Ceratocystis fimbriata*. This fungus produces three distinct sorts of spores and is therefore well provided with reproductive bodies. In addition to these methods of reproduction the fungus produces hard dark colored roundish bodies inside of the root known as sclerotia. See Fig. 2. These are simply compact masses of the vegetative filaments of the fungus, but each one of these masses is capable of developing the other stages and spores of the fungus. These black spots within a root in which the disease has made considerable progress are certain indications of the presence of the black rot.

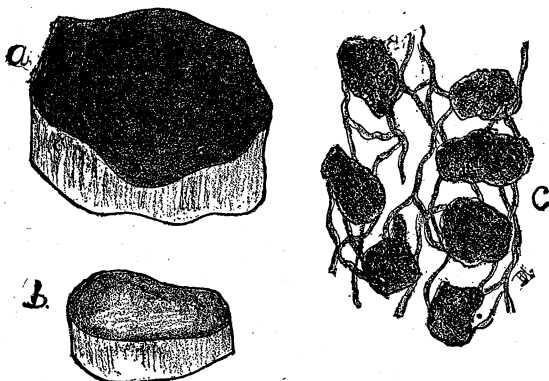


Figure 2.

The most important remedial measures to be suggested against this disease are the following:

1. Never employ diseased roots to secure sets.
2. Destroy by burning all diseased roots and sets and do not feed the diseased roots to animals if the resulting manure is to be placed upon the field where the potatoes are to be grown.
3. In general, commercial fertilizers are preferable in sweet potato culture on the above account and particularly in the beds employed for the growing of the sets.
4. As you select your sets it may be well to lift the root and discard sets coming from roots showing the rot.

5. Do not place diseased potatoes in storage as the loss may be very great.

6. The young sets if diseased may be sprayed with Bordeaux mixture.

7. If the disease has proven serious during the past year it would be well to mix a tablespoonful of sulphur with the soil about each set as it is planted.

8. Practice rotation of fields if one field becomes too badly infected with the fungus.

9. Collect and burn all diseased roots and stems!

DRY ROT.

This disease appears only on the underground portions of the plant. The whole upper end of the root becomes much wrinkled and covered with small pimples, and this condition rapidly progresses downwards until the whole of the root is diseased. The interior of the rot is converted into a dry powdery mass with very little change of color.

The dry rot is caused by the fungus known as *Phoma batatae*. The spores of this fungus are produced in small flask-shaped cavities just beneath the surface of the potato root—these cavities give to the diseased potato the pimply appearance referred to above.

The only remedy to be applied in this case consists in taking care to collect and burn all roots showing this disease, so that the numerous small spores formed in the cavities described may not become scattered over the entire field.

SCURF.

This disease attacks the root only and on it first makes its appearance as a small brownish speck. This enlarges and large areas of the root may become affected, assuming a dark color and rough character and at times shrivelling to a considerable extent. The disease does not affect the interior of the root but is confined to the surface.

This also is a fungus disease and is caused by the fungus called *Monilochaetes infuscans*. So far we have not met this disease in Alabama. The most practical method of treat-

ment, where it is found, is simply to discard and burn all affected roots to avoid scattering the spores about the field.

SOFT ROT

This disease is rarely found at harvest time and never appears upon the stem or leaves of the plant. It is confined strictly to the roots and there even is largely a storage trouble. In Alabama it appears to be by far the most important of the diseases affecting the roots during storage. As a rule the fungus gains entrance to the root near the top at the point where it was separated from the stem at harvest time. As the disease extends throughout the root the latter becomes somewhat shrivelled. But the most characteristic indication of the presence of this disease is the fact that a diseased potato when broken open is found to consist of a black mass, the color being due to the spores which are formed in great quantities. If the skin of the potato is not broken no spores are formed and the fungus in that case simply grows throughout the interior of root. But in all cases the root soon acquires a very disagreeable and characteristic odor. The spores form only when the potato is broken or injured but the growth of the vegetative portion of the fungus destroys the value of the potato.

This trouble is due to the cosmopolitan fungus *Rhizopus nigricans*. The spores are born inside of globular sacs produced one at the end of threads that grow upright from the injured surface of the potato. These sacs are large enough to be seen readily with the unaided eye and if one is in doubt as to which fungus is causing trouble in any particular case it is only necessary to place a broken potato under a jelly glass and keep it moist for a few days. It will be found to be covered with a whitish coating composed of the interwoven vegetative threads of the fungus and with these many of the erect spore-bearing threads, the older of which have turned black due to the color of the contained spores.

The treatment to be applied against this rot may best be indicated by the following outline:

1. Since the fungus gains entrance to the roots through

injury of the root great care should be taken in digging and storing to injure as few roots as possible and to store none that are broken or badly bruised.

2. During the sweating period just after the roots are stored care should be taken to see that proper ventilation is provided and that the temperature be kept at about 70 degrees. The temperature, in case enough roots are stored to make the erection of a regular storage house profitable, may best be secured by means of a small stove.

3. Where the roots are stored in the usual dirt covered piles it is important not to let water get on them whenever they are opened to remove any potatoes. The fungus requires a certain amount of moisture for its most rapid development, and this is too often furnished by carelessness in opening these piles.

4. Do not store any potatoes affected with the soft rot; and remove and burn any that may be found in the storage bins during the winter.

SOIL ROT.

This unlike the preceding diseases is a strict field disease and no damage from it may be expected after harvest time. Its principal damage is done early in the season. It is characterized by the fact that the affected parts of the root cease to grow while the adjacent portions not only continue growing but remain perfectly healthy and edible. See Fig. 3. The first indication of the disease will be found generally about the base of one of the small rootlets and it seems that the fungus can gain entrance to the main root only through these young delicate rootlets.

This disease is caused by the fungus *Acrocystis batatas*. The spores in this case are so small that when they escape from the diseased portions of an affected potato they may be carried about in the field or to other fields in the air. In this manner fields become infested that have never grown a crop of potatoes.

Halsted has shown that kainit and sulphur sown broadcast in the field before planting will greatly reduce the amount of the soil rot even when the soil is known to be

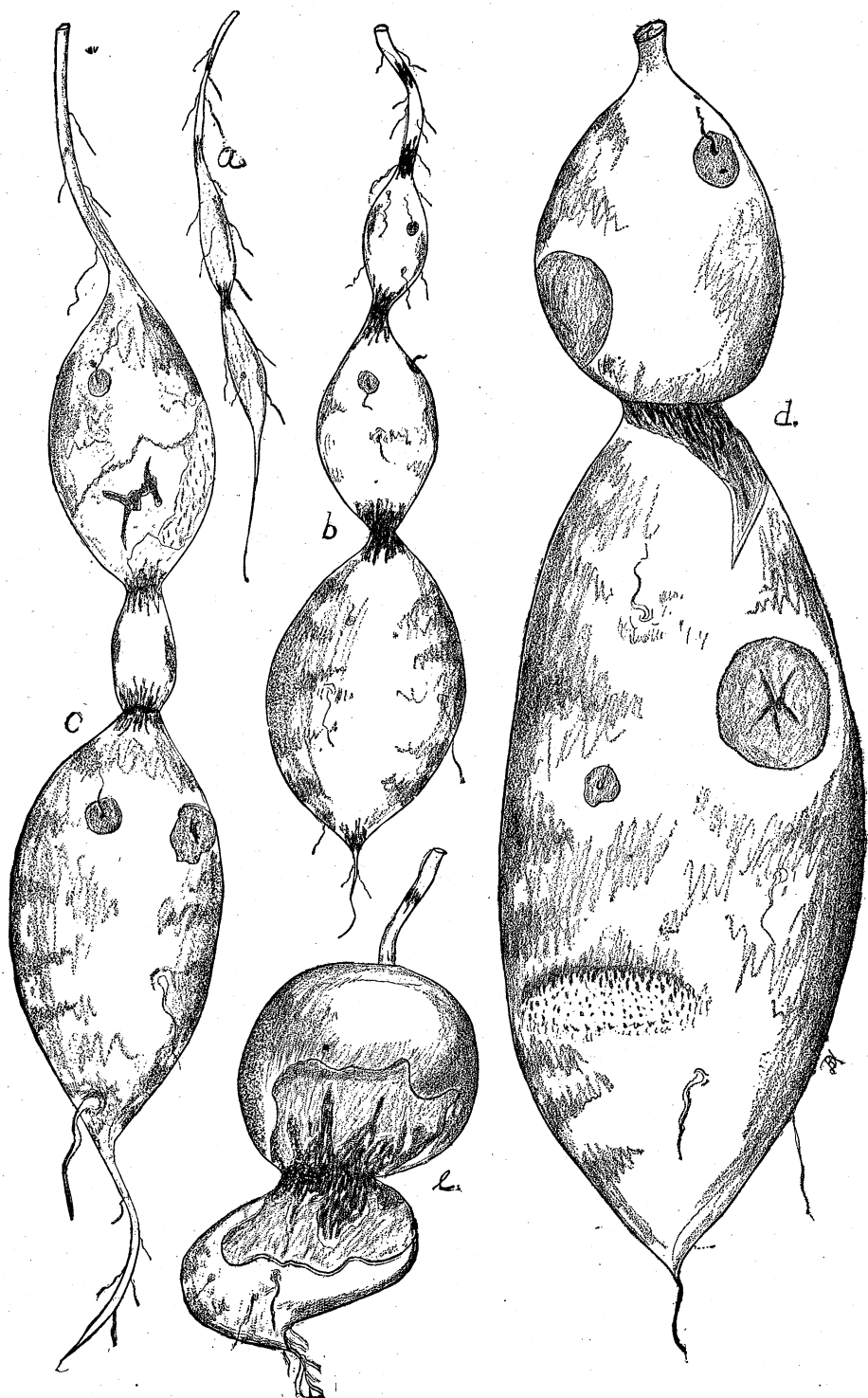


Figure 3.

badly infested with the spores of the fungus. He suggests three or four hundred pounds of each per acre. It is remarkable that this disease is most serious during dry seasons and this may be due to the fact that the plants are at such times unable to overcome the injury of the fungus and put out new roots.

STEM ROT.

This disease first appears in that portion of the stem at the surface of the ground and grows from there in both directions. See Fig. 4. And generally the entire vine dies

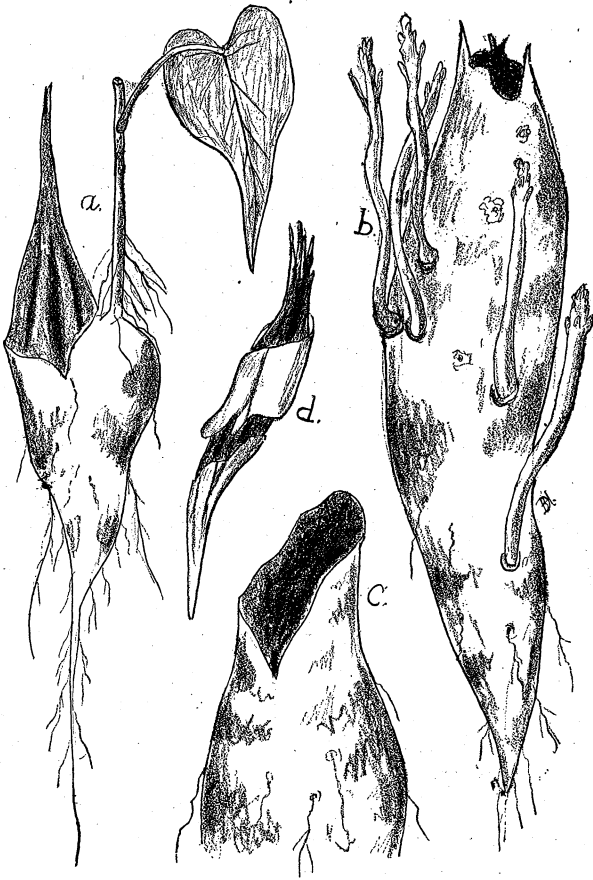


Figure 4.

as a result of this injury to the base of the stem. In the meantime the rot extends downward into the roots and the whole hill may be rendered of no value. This is also a field disease and does no damage during storage of the roots.

This disease is caused by the fungus *Nectria ipomoeae*. The spores of this fungus also retain their vitality for some time in the soil.

No method of treatment is known except that of long rotation periods between potato crops to starve the fungus out.

WHITE ROT.

This is one of the most serious troubles with us in Alabama, and during the past three years roots affected with this trouble could be found in any of the local markets. The fungus attacks the roots only and changes the tissues of the root into a granular whitish substance. No odor is generated and hence the trouble is generally overlooked but cultures of the fungus have often been made to establish the identity of the decay.

The fungus is a species similar to the mold that often appears upon decaying bread or other organic materials. The spores are produced in immense numbers and are greenish-blue in color. They live in the soil for some time and this determines the proper method of treatment to be followed.

Care should be taken not to plant sets coming from roots infected with this disease and none of the diseased roots should be placed in the storage bins. No other method of treatment is at present known.

BLACK ROT.

Burnette, F. H.

1894 Black Rot. (*Ceratocystis fimbriata*, E. & Hals.) Bull. La. Exp. Stat. ii-30: 1086-1089. fig. B-C.

Chester, F. D.

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- 1895 Black Rot (*Ceratocystis fimbriata*) Farmers' Bulletin 26: 21-22. fig. 2.
- Halsted, B. D.
- 1890 Some Fungous Diseases of the Sweet Potato. The Black Rot. Bull. N. J. Exp. Stat. 76: 7-14. fig. 3-10.
- 1891 Black Rot. Rept. N. J. Exp. Stat. 1890: 339.
- 1891 Field work of the season. Rept. N. J. Exp. Stat. 1890: 341-344.
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- 1892 Field Experiments with Soil and Black Rots of Sweet Potatoes. Rept. N. J. Exp. Stat. 1891: 260-266. fig. 15. This is a reprint of Special Bulletin M.
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- McCarthy, G.
- 1892 Some enemies of truck and garden crops. Sweet Potato. Bull. N. Car. Exp. Stat. 84: 19-20.
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- 1899 Some Diseases of the Sweet Potato and How to Treat Them. Black Rot. Bull. Md. Exp. Stat. 60: 149-154, 167. fig. 44-51.

DRY ROT.

Duggar, J. F.

1895 Dry Rot (*Phoma batatae*) Farmers' Bulletin
26: 22.

Halsted, B. D.

1890 Some Fungous Diseases of the Sweet Potato.
The Dry Rot. Bull. N. J. Exp. Stat. 76: 23-25,
32. fig. 16.

1891 Dry Rot. Rept. N. J. Exp. Stat. 1890: 340.

Townsend, C. O.

1899 Some Diseases of the Sweet Potato and How to
Treat Them. Dry Rot. Bull. Md. Exp. Stat.
60: 163-164, 167-168. fig. 58.

SCURF.

Duggar, J. F.

1895 Sweet-Potato Scurf. (*Monilochaetes. infus-*
cans) Farmers' Bulletin 26: 23.

Halsted, B. D.

1890 Some Fungous Diseases of the Sweet Potato.
The Sweet Potato Scurf. Bull. N. J. Exp. Stat.
76: 25-27, 32. fig. 17.

1891 Scurf. Rept. N. J. Exp. Stat. 1890: 340-341.

Townsend, C. O.

1899 Some Diseases of the Sweet Potato and How to
Treat Them. Scurf. Bull. Md. Exp. Stat. 60:
164-165, 168. fig. 59.

SOFT ROT.

Burnette, F. H.

1894 Soft Rot. (*Rhizopus nigricans*, Ehr.) Bull.
La. Exp. Stat. ii-30: 1085-1086. fig. A.

Duggar, J. F.

1895 Soft Rot. (*Rhizopus nigricans*) Farmers' Bull.
26: 22. fig. 3.

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The Soft Rot. Bull. N. J. Exp. Stat. 76: 4-7.
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Quaintance, A. L.

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SOIL ROT.

Duggar, J. F.

- 1895 Soil Rot. (*Acrocystis batatas*) Farmers' Bull. 26: 22.

Halsted, B. D.

- 1890 Some Fungous Diseases of the Sweet Potato. The Soil Rot. Bull. N. J. Exp. Stat. 76: 14-20, 31. fig. 11-13.
- 1891 Soil Rot. Rept. N. J. Exp. Stat. 1890: 339-340.
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- 1891 Field Experiments with Soil and Black Rots of Sweet Potatoes. Special Bull. N. J. Exp. Stat. M: 1-19.
- 1892 Field Experiments with Soil and Black Rots of Sweet Potatoes. Rept. N. J. Exp. Stat. 1891: 260-266. fig. 15. A reprint of Special Bulletin M.
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- 1895 Some of the More Injurious Fungi Upon Market-Garden Crops. Sweet potato. Rept. N. J. Exp. Stat. 1894: 359.
- 1895 Experiments with Sweet Potatoes. Bull. N. J. Exp. Stat. 112: 13-20. fig. 4-6.
- 1896 Experiments with Sweet Potatoes. Rept. N. J. Exp. Stat. 1895: 276-280, 282-283. fig. 24-27.
- 1897 Experiments with sweet potatoes. Rept. N. J. Exp. Stat. 1896: 319-327. fig. 23-24.
- 1898 Experiments with sweet potatoes. Rept. N. J. Exp. Stat. 1897: 362-372. fig. 38-40.

1899 Experiments with sweet potatoes. Rept. N. J. Exp. Stat. 1898: 348-351. fig. 18.

1900 Experiments with soil rot of sweet potatoes. Rept. N. J. Exp. Stat. 1899: 345-354. fig. 5.

Townsend, C. O.

1899 Some Diseases of the Sweet Potato and How to Treat Them. Soil Rot. Bull. Md. Exp. Stat. 60: 154-158, 167. fig. 52-53.

STEM ROT.

Duggar, J. F.

1895 Stem Rot. Farmers' Bulletin 26: 23.

Halsted, B. D.

1890 Some Fungous Diseases of the Sweet Potato. The Stem Rot. Bull. N. J. Exp. Stat. 76: 20-22, 31-32. fig. 14.

1891 Stem Rot. Rept. N. J. Exp. Stat. 1890: 340.

1892 The egg-plant stem rot. Rept. N. J. Exp. Stat. 1891: 281-283. fig. 20-22.

1895 Some of the More Injurious Fungi Upon Market-Garden Crops. Sweet Potato. Rept. N. J. Exp. Stat. 1894: 359-360. fig. 41.

1897 The Stem Rot of Sweet Potatoes. Rept. N. J. Exp. Stat. 1895: 327. fig. 25.

Townsend, C. O.

1899 Some Diseases of the Sweet Potato and How to Treat Them. Stem Rot. Bull. Md. Exp. Stat. 60: 160-162, 167. fig. 56.

WHITE ROT.

Duggar, J. F.

1895 White Rot. Farmers' Bulletin 26: 22.

Halsted, B. D.

1890 Some Fungous Diseases of the Sweet Potato. The White Rot. Bull. N. J. Exp. Stat. 76: 22-23, 32. fig. 15.

1891 White Rot. Rept. N. J. Exp. Stat. 1890: 340.

Townsend, C. O.

1899 Some Diseases of the Sweet Potato and How to Treat Them. White Rot. Bull. Md. Exp. Stat. 60: 162-163, 167. fig. 57.