FACT SHEET

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COTTON ROOT ROT

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Phymatotrichum root rot caused by the fungus *Phymatotrichum omnivorum* also is known by several other names such as cotton root rot, Texas root rot and Ozonium root rot. It is one of the most destructive plant diseases and attacks more than 2,000 species. However, either the fungus infects but does not kill monocotyledonous plants (grasses, etc.), or these plants are all highly resistant. In Texas, the disease is economically important in cotton; alfalfa; ornamental plants; and fruit, nut and shade trees. The fungus is prevalent in calcareous clay loam soils with a pH range of 7.0 to 8.5 and in areas with high summer temperatures. Therefore, the disease is limited to the southwestern United States.

Phymatotrichum root rot has been reported in Texas counties from the Red River to the Rio Grande and from Tom Green County to the Neches River.

Disease Symptoms

Disease symptoms are most likely to occur from June through September when soil temperatures reach 28° C. (82° F.). The first symptoms are slight yellowing or bronzing of the leaves. The upper-most leaves wilt within 24 to 48 hours after bronzing, followed by wilting of the lower leaves within 72 hours. Permanent wilt occurs by the third day, followed by death. The leaves remain firmly attached to the plant. Affected plants die suddenly, often after excellent growth. Large trees and shrubs may die more slowly.

Usually roots are invaded extensively by the fungus at the time of wilting. When pulled from the soil, root bark is decayed and brownish, and woolly strands of the fungus frequently are apparent on the root surface. Affected plants pull out of the soil with little effort. Under moist conditions, sporemats sometimes appear on the soil surface. These mats are 2 to 16 inches in diameter, at first snow-white and cottony and later appearing tan and powdery. On large roots and tubers, there are numerous small, cushion-like sclerotia or resting bodies about the size of a pinhead. At first they are light tan, but later appear dark and warty.

The fungus generally invades new areas by continual slow growth through the soil from plant to plant. Occasionally, it spreads more rapidly on the roots of transplanted infected plants. The fungus can survive in the soil for many years, and often it is found as deep in the soil as roots penetrate. Affected areas often appear as circular areas of dead plants in fields of infected crops. These areas gradually enlarge in subsequent years as the fungus grows through the soil from plant to plant. The infested areas may increase 5 to 30 feet per year in cotton.

Causal Organism

Phymatotrichum omnivorum exists in the soil in three distinct forms: (1) hyphae and strands (rhizomorphs), (2) sclerotia and (3) sporemats and condia.

Hyphae and strands. The fungus produces root-like (rhizomorph) strands that grow through the soil until contacting the descending plant roots. Strands surround a root and grow toward the soil surface. Immediately below the soil surface, the fungus proliferates around the hypocotyl, producing a cottony, mycelial growth. Below this mycelum, the bark is destroyed and the fungus fills the vascular tissue of the plant. Following death of the plant, sclerotia form in the strands.

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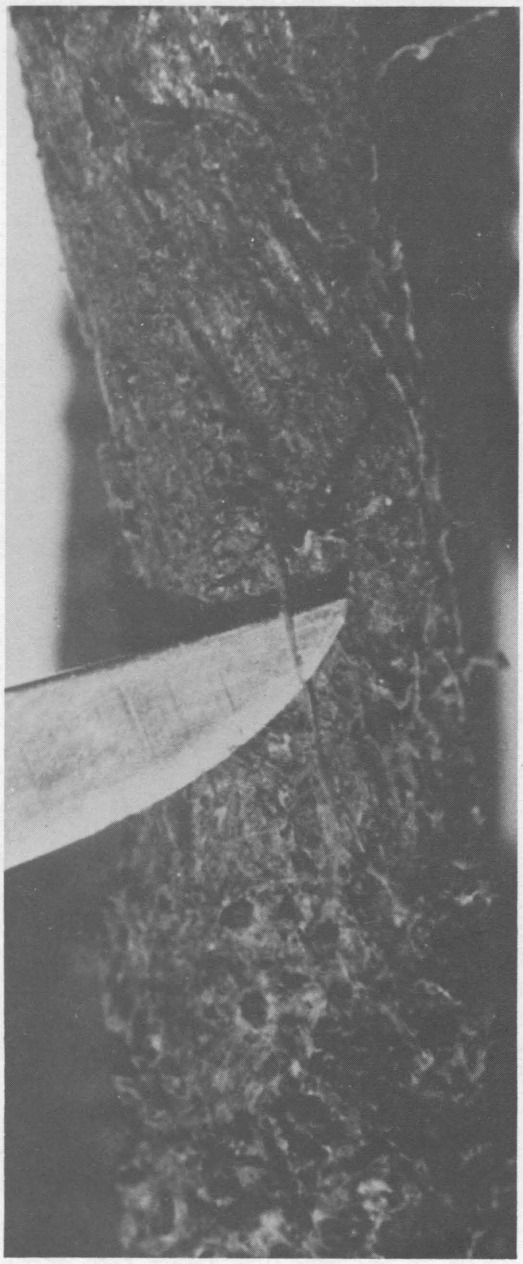

Sclerotia. Sclerotia form from strands and the cells divide, grow and enlarge. These sclerotia are small (1 to 2 millimeters in diameter), densely compacted masses of thick walled cells. Sclerotia are first white, changing to buff, brown and black with age. They are irregular shaped, generally taking the shape of the spore space where they are formed. Sclerotia enable the fungus to persist in fallow soil or soil planted to resistant crops for several years. Sclerotia have been found up to 12 feet deep in some soils.

Sporemats and conidia. The fungus often forms sporemats on the soil surface during warm, rainy weather. These mats vary in size from 2 to 16 inches in diameter and are white to tan colored. They are composed of large celled, branched fungal strands that later produce conidia. The conidia appear sterile, and their role in the spread of the disease has not been documented.

Control

Phymatotrichum root rot is one of the most difficult plant diseases to control. Fungus behavior in different crops and soils and its activity from year to year in the same field are so erratic that it is ineffective to rely on one approach. A control program should consist of a systematic course of treatment involving several recognized control methods.

Control Methods

Rotation. Research shows that rotations of 3 or 4 years with a monocotyledon crop have reduced disease incidence up to 60 percent on cotton in some instances. Shorter rotations are less effective.

Organic amendments. Significant control of Phymatotrichum root rot has been achieved by using various crops as green manure amendments. A delay in infection of cotton is readily apparent and has resulted in a 90 percent reduction in root rot. Wheat, oats and other cereal crops are effective in delaying infection and reducing losses when incorporated in soil in the spring before cotton is planted.

Deep plowing. Use of a moldboard plow to flat break infested areas 6 to 10 inches deep has markedly reduced the incidence of disease. Flat breaking immediately after cotton harvest reduces the strands' ability to form sclerotia. Thus, the upper 6 inches of soil, where 90 percent of the roots of a cotton plant are found, should have a reduced sclerotia level.

Plant barriers. This technique consists of planting a resistant crop such as sorghum around an infected area in a field. These barriers either exclude or limit the spread of disease within the field. This technique assumes that the barrier plant does not harbor the pathogen in its root system.

Fertilizer applications. Root rot of cotton is reduced by applying fertilizers high in certain nitrogen forms. When nitrogen is applied as ammonia in a manner to fumigate as much soil as possible, research shows a reduced incidence of root rot.

Early plant maturity. A technique, which has been used successfully for cotton, is to plant early maturing varieties as early as possible in the season so that the crops reach maturity before the plant is killed by the disease. Disease activity increases from June through August; therefore, complete production before or during this period.

Resistant varieties. Development of plants resistant to Phymatotrichum root rot using conventional breeding concepts has been difficult due to the pathogen's wide host range. However, use of breeding concepts which alter the kinds of microorganisms that

inhabit cotton roots is giving a microbial type of resistance. Varieties having partial and moderate levels of such resistance are Tamcot CAMD-E and Tamcot SP37H, respectively.

Controlling Phymatotrichum Root Rot in Cotton

1. Map fields to define areas infested with cotton root rot.

2. Immediately after harvest, shred stalks, moldboard plow and flat break infested areas 6 to 10 inches deep. Base the depth on equipment and horsepower of tractor. Use sufficient speed to insure good inversion of the plow slice.

3. Prepare field and bed land for sorghum after a 2-week delay.

4. Use maximum recommended amount of fertilizer for sorghum or corn production and apply the nitrogen as ammonia. Apply the ammonia to fumigate as much soil as possible below the depth of flat breaking.

5. Plant sorghum or corn next season.

6. After sorghum or small grain harvest, immediately prepare land for cotton using minimum fertilization.

7. Next spring, plant cotton as early as possible using an early maturing variety such as Tamcot SP37H or CAMD-E.

8. Repeat cycle by again mapping infested areas and deep plowing.

Note: To control root rot, use a total program. By significantly controlling the incidence of root rot at the end of the first rotation, almost total control is possible by the second rotation. Continual monitoring and repeating treatments may be necessary from time to time.

Severe damage	**Moderate damage**	**Occasional damage**
1. Moldboard (6 to 10 inches) right after cotton.	1. Moldboard right after cotton (infested areas only).	1. Moldboard right after cotton (infested areas only 5 to 7 inches deep).
2. Plant sorghum and use anhydrous ammonia applied as deep as possible.	2. Plant sorghum second year. (Use anhydrous ammonia applied as deep as possible.)	2. Plant sorghum or small grain.
3. Turn in sorghum residue (moldboard).	3. Plant short season cotton.	3. Plant short season cotton.
4. Plant small grain (third year).		
5. Plant short season cotton (fourth year).		

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