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HEMP DISEASES IN TEXAS

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When growing hemp (*Cannabis sativus*) commercially in Texas, there is a need to consider potential pitfalls—particularly insect pests and diseases. Unfortunately, there is very little information on hemp diseases in Texas. The current national host indices list just three fungal diseases of hemp in Texas, but this likely reflects a lack of observations. There will most likely be a "honeymoon" period of little or no disease with a small hemp acreage in Texas. However, as acreage increases, especially if hemp is grown under monoculture, diseases will become noticeable and might affect yield and quality.

This publication addresses diseases seen after one season of hemp production and other potential disease problems of hemp grown in Texas. The climate in many other states where hemp has been grown is quite different from Texas, affecting the diseases that occur. Usually, these climates are much wetter than Texas. Therefore, many foliar and bud diseases that are a problem in other states will not likely be a problem in Texas.

Figure 1. Wilting of hemp caused by the cotton root rot fungus (*Phymatotrichopsis omnivora*).

COTTON ROOT ROT (PHYMATOTRICHOPSIS ROOT ROT)

The most impactful disease facing hemp in Texas is cotton root rot (also known as "Texas root rot") (Fig. 1). This is a major soilborne fungal disease affecting many crops in much of Texas and parts of New Mexico and Arizona, but is absent everywhere else.

This disease, caused by a fungus (*Phymatotrichopsis omnivora*) is one of the earliest reported hemp diseases in Texas (1920s). The distribution of this pathogen in Texas is shown in Figure 2. It is absent in the High Plains and East Texas, but it is not necessarily present in every field in the rest of state.

The disease is prevalent in alkaline soils and where the annual mean temperature is 61°F or higher.

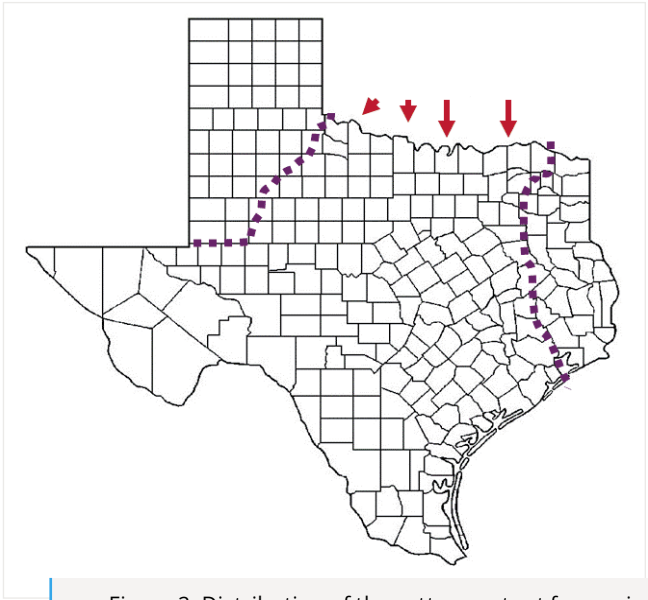

Figure 2. Distribution of the cotton root rot fungus in Texas. The arrows between the dotted lines indicate the portion of Texas where the fungus is likely to be found.

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The first symptom is wilting and yellowing of plants (Fig. 1), occurring with rot in the crown and roots (Fig. 3). Plants subsequently die. Symptoms typically occur in the hot months of summer. These symptoms are not diagnostic for the disease and a microscopic examination is required for positive diagnosis.

In fields where the fungus is present, the disease tends to occur in discrete, somewhat circular patches in the same spot, year-after-year, with larger spots occurring in wetter growing seasons. The presence of the fungus in a field is known after growing a susceptible host, such as cotton or alfalfa for several years. The fungus has a vast host range of most dicot plant species. Hemp should not be grown on spots in fields where this pathogen occurs. The hemp will die. The best prevention for this disease is to not plant hemp into infested soil.

Figure 3. Root rot of hemp caused by the cotton root rot fungus (*Phymatotrichopsis omnivora*).

However, the problem with bringing native or grass pasture land into hemp production is that there is no easy way of knowing whether the fungus is present in that field. There is no soil test for the fungus and it is not usually feasible to plant an indicator crop, such as cotton or alfalfa ahead of planting hemp. When using pasture land, try to determine a previous history of crop production. This could be a challenge. For example: Land currently in pasture could have been abandoned for cotton farming decades ago because of a severe cotton root rot infestation. There may be no records or surviving memory of that.

Quite simply, this is a complex disease to control. There are no resistant varieties. Crop rotation and fallowing are ineffective. The only effective fungicide is labeled only on cotton, grapes, and alfalfa, which is not an option, as hemp is usually "organically" produced. Organic soil amendments, such as manure and sulfur, could be effective when applied at a rate of tons/acre. Another possible strategy could be "temperature escape." As high soil temperatures trigger the fungus, it might be possible to grow and harvest a crop before soil temperatures substantially increase. In much of Texas affected by cotton root rot, July through August is when cotton root rot is usually seen.

SOUTHERN BLIGHT

Southern blight, caused by a soilborne fungus (*Sclerotium rolfsii*), causes a sudden wilt of hemp, without yellowing (Fig. 4).

This fungus is similar to the cotton root rot fungus, in that it has a wide host range of plants and is favored by high soil temperatures, but it is much more widespread throughout the Southern U.S. The fungus causes a wilt and stem rot, and produces white growth and structures that look like mustard seeds (i.e., sclerotia) at the plant base, which is easily visible (Fig. 5).

In addition to high soil temperatures, infection by this fungus is favored when soil is moist or wet.

Infection starts at the crown of plants grown on black plastic mulch. Diseased plants should be removed from the field before the survival structures are produced. Other cultural control approaches include crop rotation with non-hosts such as grass, corn, or wheat, using wider plant spacings, deep plowing to bury sclerotia, and adding straw or straw compost to the soil.

Figure 4. Wilt of hemp caused by the southern blight fungus (*Sclerotium rolfsii*).

Figure 5. The appearance of Southern Blight fungus at the base of hemp and appearance of sclerotia.

CHARCOAL ROT

Charcoal rot of hemp is seen as wilting and dying leaves (Fig. 6). A soilborne fungus (*Macrophomina phaseolina*) causes this disease.

This fungus is widespread throughout Texas and has a wide host range of both dicot and monocot plants, but it only causes symptoms on drought-stressed plants. The disease can be confirmed in the field by the presence of small, black fungal structures (i.e., sclerotia) about the size of pepper grains when the lower stem is split open lengthwise (Fig. 7).

This disease is managed by preventing drought stress (e.g., proper irrigation management). Wider plant spacing can also reduce drought stress. Although there is no known resistance, planting varieties that tolerate drought stress could reduce the impact of this disease.

Fig. 6. Wilt of hemp caused by the charcoal rot fungus (*Macrophomina phaseolina*).
Photo by Reagan Noland, Texas AgriLife Extension, San Angelo.

Figure 7. Appearance of black sclerotia of the charcoal rot fungus within the lower stem of a hemp plant.

HEMP CANKER

The soilborne fungus (*Sclerotinia sclerotiorum*) causes hemp canker. The initial symptoms are white fungal growth associated with a water-soaked appearance of the infected plant stems (Fig. 8). Later, the plant tissue becomes dried and has a bleached tan to white appearance. Finally, the stems are hollowed and contain black survival structures (i.e., sclerotia) of the fungus (Fig. 9).

This pathogen has a wide host range of dicot plants, but its activity in Texas is somewhat restricted to cooler parts of the year (e.g., winter to early spring). Surprisingly, this disease was observed in a Texas greenhouse in the spring. The source of infection was possibly airborne spores originating from a surrounding pasture.

Hemp canker is not likely to become a problem in field-grown hemp in Texas. In winter and spring greenhouse production, the disease could be prevented by ensuring good ventilation to prevent free moisture accumulation on foliage.

Figure 8. Early symptoms of hemp canker, showing white growth of the pathogen (*Sclerotinia sclerotiorum*).

Figure 9. Later symptom of hemp canker, showing bleaching of infected plant stem and petiole and black sclerotia of the fungus (arrow).

OLIVE LEAF SPOT

This is a fungus disease affecting foliage and is caused by *Cercospora cannabis.* The symptom is a tan to a brown spot surrounded by a diffuse, yellow halo (Fig. 10). The disease has been seen in field-grown, as well as greenhouse hemp. The disease is favored by several hours of continuous leaf wetness. It can be effectively managed in the greenhouse by ensuring good ventilation and preventing water contact with foliage. To date, it has not been a problem in Texas fields.

Figure 10. Olive leaf spot, caused by the fungus, (*Cercospora cannabis*).

POWDERY MILDEW

This is a fungal disease affecting foliage and is favored by high humidity, but not free water on leaves.

Powdery mildew occurs both on field-grown and greenhouse hemp. There are at least two species that occur on hemp. One of the species, *Golovinomyces spadiceus,* is widespread in the U.S. and also infects sunflower and okra. In the greenhouse, this disease can be managed by ensuring good ventilation. Increased plant spacing in the field may also be helpful.

Figure 11. The appearance of powdery mildew on hemp leaves.

HEMP LEAF SPOT

Hemp leaf spot, caused by the fungus, *Bipolaris gigantea,* is seen as distinct, white, circular spots on leaves (Fig. 12).

The pathogen is present in Texas, but this disease has not yet been documented on hemp grown there. It is widespread in Kentucky and has also been seen on hemp

Figure 12. Hemp leaf spot, caused by *Bipolaris gigantea.*

in at least 10 other states. However, it has only been recognized in the past few years, following widespread planting of hemp.

The fungal pathogen has a host range of mostly grass species, but non-grasses as well. It was reported in Texas on bermudagrass more than a century ago, and more recently, it was documented as a pathogen of barley in Burleson County, Texas. In a 2019 Kentucky epidemic, it suddenly appeared throughout fields, even though the weather had been dry for several weeks. It is capable of causing substantial yield loss in very wet years. This pathogen may very well make an appearance on hemp grown in Texas, but yield loss will probably be a function of how wet the growing conditions are—as well as the relative susceptibility of the variety. East Texas likely has the most significant risk from this disease.

FUSARIUM BUD ROT

This fungal disease, associated with a species tentatively identified as *Fusarium equiseti,* was seen in greenhouse hemp in Texas. It produces visible grayish fungal growth and causes bud rot (Fig. 13). It resembles gray mold, which is caused by a different fungus (*Botrytis cinerea*). These diseases can be differentiated by microscopic examination.

This disease is not well understood and is likely spread by airborne spores. Unfortunately, the most effective control is not known at this time, but good ventilation and air circulation would be helpful.

Figure 13. Fusarium bud rot of hemp.

Figure 15. Reproductive structures (pycnidia) of the Botryodiplodia fungus on a hemp stem.

BOTRYODIPLODIA STEM ROT

This fungal disease, associated with a species that has not yet been precisely identified, was seen in greenhouse hemp in Texas. Leaves suddenly wilt and the wilting can be traced back to lesions on the stems, where small, black, slightly raised fungal structures can be seen (Fig. 15).

This disease is not well understood and is likely spread by airborne spores. The most effective control is not known at this time, but since diseases caused by this type of fungus are fostered by splashing water and wet plant surfaces, good ventilation and air circulation would be helpful.

Figure 14. Botryodipolodia stem rot of hemp.

DAMPING-OFF AND SEEDLING DISEASE

Problems with seed germination and stand establishment have been reported on hemp throughout Texas. There may be multiple causes, including soilborne fungal pathogens (such as *Pythium* sp. and *Rhizoctonia solani*). As a result, seeds fail to germinate or seedlings wither and die shortly after germination (Fig. 16).

Diagnosis of fungal causes of damping-off and seedling diseases requires a laboratory analysis. Such problems

Figure 16. Dead hemp seedlings resembling damping-off.

can be prevented by using sterilized growing media to establish seedlings. Bear in mind that sometimes commercial growing media might be contaminated with fungal pathogens. Use a growing medium with good drainage and do not over-water.

CHIMERA

Chimeras are uncommon genetic aberrations that occur in plants and are usually seen on leaves (Fig. 17).

These abnormalities are not a cause for concern.

Figure 17. Chimera on a hemp leaf.