Hemp Diseases in Texas

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There is intense interest in growing hemp (*Cannabis sativus*) commercially in Texas. Along with considerations of applying the best cultural approaches for growing it, there is a need to consider potential pitfalls, particularly insect pests and diseases. 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 probably reflects a lack of observations. With a small hemp acreage in Texas, there will probably be a "honeymoon" period of little or no disease, but 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, as well as other, potential disease problems of hemp grown in Texas. The climate in many other states where hemp has been grown is quite different than Texas and this will affect the diseases that occur. Usually, these climates are much wetter than Texas, so that many foliar and bud diseases that are a problem in other states will not likely be a problem in Texas.

Cotton Root Rot (Phymatotrichopsis Root Rot)

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

Fig. 1. Wilting of hemp caused by the cotton root rot fungus, *Phymatotrichopsis omnivora*.

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

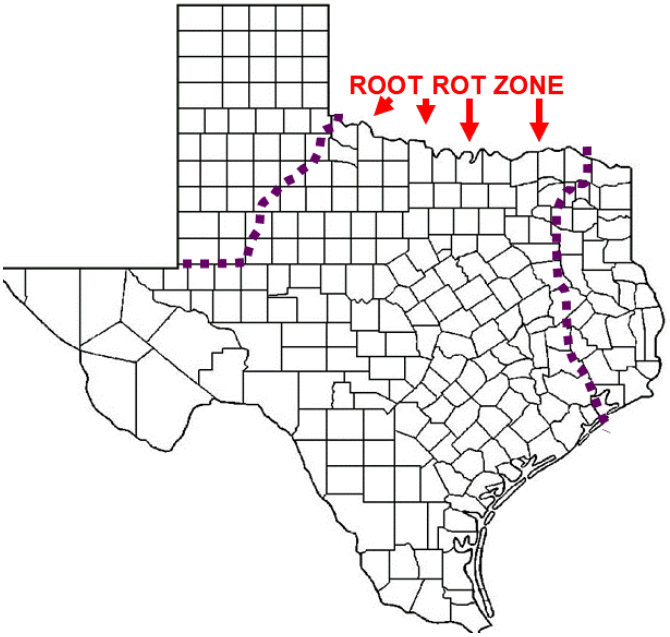

Fig. 2. Distribution of the cotton root rot fungus in Texas. Arrows between the dotted lines indicate the portion of the state where the fungus is likely to be found.

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

The first symptom is wilting and yellowing of plants (Figure 1), usually occurring in the summer months when temperatures are quite hot. The roots and base of such plants are rotted (Figure 3). These symptoms are not diagnostic for

Fig. 3. Root rot of hemp caused by the cotton root rot fungus, *Phymatotrichopsis omnivora*.

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 a little variation in size as affected by moisture during the current season. If a field has been cropped for several years with a susceptible host such as cotton or alfalfa, growers will know for sure whether the fungus is present or not. The fungus has a very wide 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 control for this disease is to avoid planting hemp into infested soil.

However, the problem with bringing native or 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 find out whether there was a previous history of crop production. This could be a challenge. Land currently in pasture could have been abandoned for cotton farming decades ago because of a severe cotton root rot infestation and there may be no records or surviving memory of that.

Quite simply, this is a difficult 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, 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 the fungus is triggered by high soil temperatures, 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 are the months when cotton root rot is usually seen.

Southern Blight

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

Fig.4. Wilt of hemp caused by the southern blight fungus, *Sclerotium rolfsii*.

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 United States. The fungus produces white growth and structures that look like mustard seeds (sclerotia) at the base of the plant, which are easily visible (Fig. 5).

Fig. 5. Appearance of southern blight fungus at the base of hemp and appearance of sclerotia.

In addition to high soil temperatures, infection by this fungus is favored when soil is moist or wet. It has been observed starting at the crown of plants grown on black plastic mulch. Diseased plants should be removed from the field before the survival structures are produced. Additional 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 soil.

Charcoal Rot

Charcoal rot of hemp is seen as wilting and dying leaves (Fig. 6). It is caused by the soilborne fungus. *Macrophomina phaseolina*.

Fig. 6. Wilt of hemp caused by the charcoal rot fungus, *Macrophomina phaseolina.*

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 (sclerotia) about the size of pepper grains when the lower stem is split open lengthwise (Fig. 7).

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

This disease is managed by preventing drought stress, for example, through proper irrigation management. Wider plant spacing can also reduce droughty stress. Although there is no known resistance, selection of varieties that tolerate drought stress could reduce the impact of this disease.

Hemp Canker

Hemp canker is caused by the soilborne fungus, *Sclerotinia sclerotiorum.* 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. Stems are hollowed and contain black survival structures (sclerotia) of the fungus (Fig. 9).

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

This pathogen has a wide host range of dicot plants, but its activity in Texas is somewhat restricted to cooler parts of the year (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 surrounding pasture.

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

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 and preventing free moisture on foliage.

Olive Leaf Spot

This is a fungus disease affecting foliage and is caused by *Cercospora cannabis*. The symptom is a tan to 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. In the greenhouse, it can be effectively managed by ensuring good ventilation and preventing water contact with foliage. To date, it has not been a problem in Texas fields.

Fig. 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.

Fig. 11. Appearance of powdery mildew on hemp leaves.

It occurs both on field-grown and greenhouse hemp. There are at least two species that occur on hemp. The species, *Golovinomyces spadiceus*, documented on hemp in Kentucky, is widespread in the United States 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.

Hemp Leaf Spot

The fungus, *Bipolaris gigantea*, causes distinct, white, circular spots on leaves (Fig. 12).

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

The pathogen is present in Texas, but this disease has not yet been documented on hemp. It is widespread in Kentucky and has also been seen on hemp in at least ten other states. It has only been recognized in the past few years, following widespread planting of hemp. The fungal pathogen has a wide host range of mostly grass species. It was reported in Texas on bermudagrass more than a century ago, and more recently, we documented it as a pathogen of barley in Burleson county. 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 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 greatest risk from this disease.

Fusarium Bud Rot

This fungal disease was seen in greenhouse hemp in Texas. It produces visible grayish fungal growth and causes a 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.

Fig. 13. Fusarium bud rot of hemp.

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

Botryodiplodia Stem Rot

Fig. 14. Botryodipolodia stem rot of hemp.

This fungal disease 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).

Fig. 15. Reproductive structures (pycnidia) of the Botryodipolodia fungus on a hemp stem.

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

Damping-off and Seedling Disease

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

Fig. 16. Dead hemp seedlings resembling damping-off.

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

Chimera

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

Fig. 17. Chimera on a hemp leaf.

These abnormalities are not a cause for concern.

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Texas Hemp Disease Diagnostic Service

The Texas High Plains Plant Diagnostic Laboratory in Amarillo is designated to handle hemp disease diagnoses which requires samples for laboratory analysis. This is a fee-based service for lab analysis of plant specimens. Sending a sample will also require a Texas Department of Agriculture transport permit. Contact Dr. Ken Obasa at (806)677-5600 or ken.obasa@ag.tamu.edu for more information and before submitting samples. Some plant diagnosis may be handled sufficiently with digital pictures, so if e-mailing, please send images of the problem.

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