LOUISIANA PLANT PATHOLOGY
DISEASE IDENTIFICATION AND MANAGEMENT SERIES
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Taproot Decline of Soybean

Xylaria necrophora

Taproot decline of soybean (TRD), is an emerging fungal disease affecting soybean production in the southern U.S. TRD has been reported in several states, including Alabama, Arkansas, Louisiana, Mississippi, Missouri and Tennessee. To date, TRD been reported to cause annual yield losses ranging from 0.2% to 1.5%, with the greatest losses in Louisiana (1.18 million bushels) and Arkansas (0.57 million bushels)[1,2]. The emergence of the pathogen is currently under investigation, but historical specimens found in the region support the idea that the fungus has been present for decades, but its pathogenicity is only recently being characterized[3,4]. The symptoms of the disease can be confused with many other maladies of soybeans, and this may be the reason why it eluded researchers for so long.

Symptoms of TRD are generally most notable during the beginning of pod fill to full seed growth stages (R3-R6), during which small clusters of infected plants exhibiting foliar yellowing (interveinal chlorosis) and death (necrosis) are observed (Figure 1). Dead plants are usually found in the center of the cluster (Figure 1A). Infected plants are frequently in contact with leftover crop debris from the previous year, which often serves as the source of infection. Infected plants are also commonly surrounded by plants that appear healthy and do not exhibit symptoms. When infected plants are roughly pulled from the soil, stems often break at the crown. However, when infected plants are carefully removed from the soil, roots exhibit rot and are typically embedded with black fungal tissue (stroma) along the primary root and less frequently on lateral roots (Figure 2). When roots are split longitudinally, white cottony fungal growth (mycelia) can often

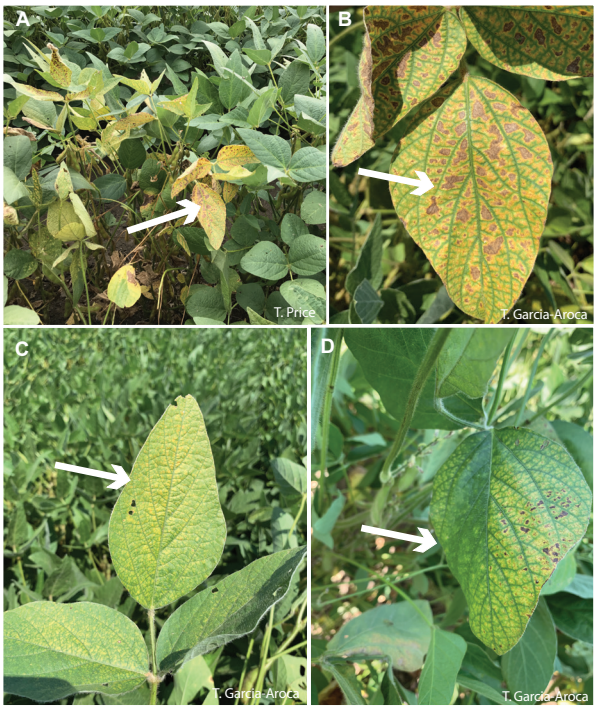

Figure 1. Foliar symptoms of taproot decline of soybean (TRD), including interveinal chlorosis and necrosis. (A) Groups of plants showing symptoms of TRD are generally observed in the field and surrounded by plants that appear healthy. (B) Severe symptoms of TRD. (C-D) Mild symptoms of TRD.

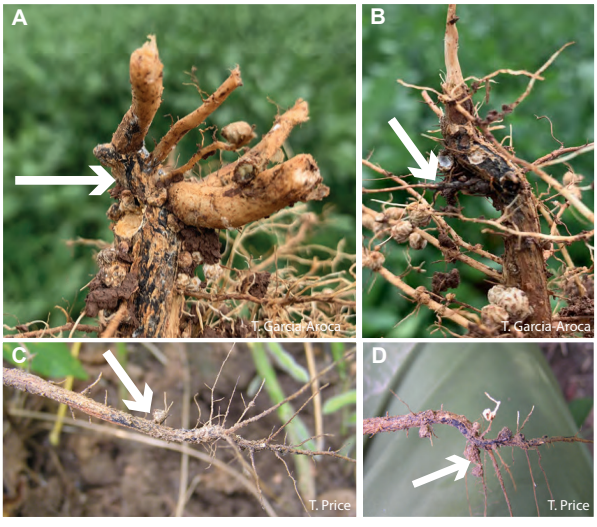

Figure 2. Root symptoms of taproot decline of soybean. Black fungal stroma is often visible on the surface of main (A-C) and lateral (B-D) roots of infected soybean plants.

Figure 3. *Fungal reproductive structures of Xylaria necrophora called stromata that commonly develop on infected soybean debris.* ***(A-B)*** *Stromata of X. necrophora on soybean debris.* ***(C)*** *Stromata of X. necrophora on soybean debris on the ground next to an infected plant.*

be evident within the pith. The foliar symptoms of TRD can be confused with many other soybean maladies, including chemical phytotoxicity, which is typically from the demethylation inhibitors (DMI, triazole); red crown rot; decline due to root-knot nematodes; southern blight; stem canker; and sudden death syndrome. The fungus produces reproductive structures (stromata, Figure 3A-C), sometimes referred to as "dead man's fingers," on infected soybean roots and debris. These reproductive structures are usually white at the tip but are sometimes pinkish when young and turn black at maturity. Stromata usually develop on infected soybeans, soybean debris and additional plant debris; these structures can be quite small and easy to overlook (up to 1 inch in length). In general, the appearance of reproductive structures occurs following periods of frequent rainfall that coincide with the soybean crop lapping the row middles. In conjunction with the aforementioned foliar, root and stem indicators, stromata can be used to help identify the presence of TRD.

The fungus *Xylaria necrophora* was recently identified as the pathogen causing TRD[3,4]. The newly described fungal species can survive on soybean debris from previous seasons, and infected plant debris can serve as inoculum for newly established soybean fields. Therefore, fields in soybean monoculture and reduced tillage regimes are most vulnerable to TRD. The optimum growth temperature of the fungus, based on lab experiments, is approximately 81 degrees Fahrenheit[4], which is consistent with temperatures that occur inside the plant stem/root system, soil and plant canopy during the growing season. Additional methods of pathogen spread and conditions favorable for disease development have not yet been determined.

Research on the effectiveness of management options for TRD is limited. Current management suggestions are based on field observations along with laboratory, greenhouse and field experiments, as well as the current knowledge of pathogen biology. These strategies focus on cultural practices aimed to prevent the infection of disease-free fields and/or reduce the amount of inoculum from previous seasons in fields where the disease was observed. The use of chemicals for seed treatment and in-furrow/at-planting application is currently under investigation. These practices include:

PRACTICE CROP ROTATION.

Rotation to cotton, corn, grain sorghum, rice or sugarcane will likely result in reducing the incidence and severity of TRD. Even though the reproductive structures (stromata) of *X. necrophora* have been observed on debris of some of these crops, they are currently not considered hosts. Planting fields to nonhost crops should help reduce the amount of inoculum carried over between seasons.

TILL FIELDS AFTER HARVEST/BEFORE PLANTING.

Tilling (reduced, conventional, etc.) facilitates the breakdown of soybean debris and can subsequently

reduce the amount of inoculum available to infect plants the following season, causing a reduction in TRD incidence.

USE RESISTANT CULTIVARS.

Some commercially available soybean cultivars have shown resistance to TRD in greenhouse and field experiments[5]. In order to keep up with industry turnover, cultivars are screened annually at the LSU AgCenter Macon Ridge Research Station (See additional resources).

FOLLOW GOOD SANITATION PRACTICES.

Avoid moving soil from fields where the disease has been observed to fields where it has not been observed. Clean soil and crop debris from machinery, clothes, boots, tools, etc. used in fields where the disease has been observed before working or using in fields where the disease has not been observed.

ADDITIONAL RESOURCES

List of susceptible, moderately resistant, and potentially resistant cultivars by the LSU AgCenter: https://www.lsuagcenter.com/profiles/truffin/articles/page1567710127499.

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