Red Crown Rot in Soybeans

CROP BULLETIN

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KEY POINTS

- Red crown rot is a fungal disease of soybeans that has been common in the southern U.S. for years but is now spreading in the Midwest.
- Red crown rot causes deterioration of the stem and roots and premature senescence and can result in significant reductions in yield.
- Later planting in infested fields, improved soil drainage, and management of root-feeding insects and nematodes can help reduce the impact of red crown rot.

NEW TO THE MIDWEST, BUT NOT NEW

- Red crown rot is a fungal disease of soybeans caused by the soilborne pathogen *Calonectria ilicicola* (anamorph: *Cylindrocladium parasiticum*) and characterized by fungal structures on the stem and root that give it a reddish appearance (Figure 1).
- Red crown rot is a new disease of soybeans in the Midwestern U.S., having first been detected in Pike County, Illinois, in 2017 (Kleczewski, 2020).
- In the years since its initial detection, red crown rot has spread through central Illinois and into Kentucky (Bradley, 2021).
- *C. ilicicola* was first identified in 1950 and has been a pathogen of soybeans in the southern U.S. since the 1970s and in Japan since the 1960s.
- *C. ilicicola* has a broad host range and is a disease in several other crops, including peanut, ginger, and blueberry. Red crown rot is common in areas of the south and southeast where soybeans are grown in rotation with peanuts.

Figure 1. The key identifying characteristic of red crown rot in soybean is the presence of tiny red balls on the crown and stem near the soil line.

Figure 2. Foliar symptoms of red crown rot – interveinal chlorosis and necrosis – are indistinguishable from those caused by SDS, so inspection of the stem and crown is necessary to determine the causal pathogen.

INFECTION AND SPREAD IN SOYBEANS

- *C. ilicicola* is soilborne and causes deterioration of the root and stem in soybeans.
- Infection is favored by wet conditions following planting and will often show up in low-lying and poorly drained areas of a field.
- Disease progression is favored by warm, wet conditions during the growing season.
- Warm soil temperatures between approximately 77°F and 86°F favor disease development, with infection decreasing when soil temperatures exceed 86°F.
- Secondary spread during the growing season can be caused by the ejection of mature ascospores from the perithecia on the stem, which are distributed by splashing and runoff from rainfall.
- Later in the season, the fungus can produce a toxin that accumulates in the leaves, causing interveinal chlorosis followed by necrosis (Figure 2).

Figure 3. Soybean plant with senesced leaves caused by red crown rot infection.

- Severely affected plants will senesce prematurely, with the leaves staying attached to the plant (Figure 3).
- *C. ilicicola* overwinters in soils as microsclerotia, which can survive for several years without the presence of a host crop.
- Microsclerotia are spread by the movement of plant debris and infested soil particles, which can be carried by wind or transported between fields by equipment or livestock.

SYMPTOMS AND IDENTIFICATION

- Red crown rot infection is often detected after the R3 stage with the appearance of yellowing on the leaves, although root and stem rot can occur without producing foliar symptoms.
- Foliar symptoms can be very similar to those of other common soybean disease such as sudden death syndrome, brown stem rot, and southern stem canker, so inspection of the stems and roots is necessary to determine the causal pathogen.
- Foliar symptoms typically do not appear uniformly across a field, often showing up as single plants or small patches of infected plants randomly throughout the field.
- The key distinguishing characteristic of red crown rot is the presence of perithecia on the crown and roots just below the soil line, which look like tiny red balls and will give the crown a reddish coloration.
- Under wet conditions, the perithecia can extend above the soil line on the lower stem.
- Other factors can cause a reddish coloration of the lower stem, so it is important to look closely to confirm the presence of fungal tissues.
- White fungal hyphae can also appear on infected tissue.
- The pith in the crown of an infected plant may have a gray discoloration.
- Plants with severely rotted roots can be easily pulled from the soil. Diseased plants may have more than one pathogen present.

MANAGEMENT CONSIDERATIONS

- Yield losses of 25% to 30% have been documented for red crown rot infections in soybeans in Louisiana and Mississippi, where the disease has been present for years.
- Severely infected areas can be significantly impacted; however, red crown rot usually only affects patches within a field.
- Management options for red crown rot are limited and no rescue treatments are available to mitigate plant damage and yield impact once infection has been detected.
- Delaying soybean planting in fields known to be infested with *C. ilicicola* can help reduce the severity of infection.
- Management of pathogenic nematodes can help reduce the severity of red crown rot. Nematode damage to the roots can create access points for infection by soilborne pathogens. Crop
- rotation into a non-host crop can help reduce inoculum load in the soil.

Figure 4. Perithecia on a soybean plant with red crown rot.

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