



Martin-Gatton
College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet

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Red Crown Rot of Soybean

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INTRODUCTION

Red crown rot is a soybean disease that was first confirmed in Kentucky in 2021 and first confirmed in the neighboring state of Illinois in 2018. Historically, red crown rot had been considered a disease that occurred in states further south than Kentucky (i.e., Louisiana and Mississippi). From measurements conducted within a few Kentucky soybean fields in 2021, small areas affected by red crown rot had grain yields that were approximately 70% less than non-symptomatic areas of these fields. Although the current distribution of red crown rot in Kentucky appears to be limited, the disease has the potential to cause major yield losses.

SYMPTOMS & SIGNS

Symptoms of red crown rot can occur on leaves, lower stems, and roots of soybean plants.

On **leaves**, symptoms first appear as chlorotic (yellow) flecks that occur between veins (FIGURE 1). These chlorotic flecks may continue to develop into interveinal chlorosis (yellowing between the leaf veins, while veins remain green) and interveinal necrosis (dead areas between the leaf veins, while veins remain green) (FIGURE 2). Leaf symptoms are caused by a phytotoxin produced by the causal fungus, which moves through the plant and accumulates in leaves. These leaf symptoms generally are not observed until soybean plants reach the reproductive stages of development (beginning flowering and beyond).



FIGURE 1. YELLOW (CHLOROTIC) FLECKS OCCURRING ON SOYBEAN LEAFLETS BETWEEN THE MAIN VEINS, CAUSED BY RED CROWN ROT. **FIGURE 2.** INTERVEINAL CHLOROSIS (YELLOWING BETWEEN THE VEINS) AND NECROSIS (DEAD TISSUE BETWEEN THE VEINS) ON SOYBEAN LEAFLETS, CAUSED BY RED CROWN ROT.

Lower stem and root symptoms may be observed prior to leaf symptoms. Infections result in a reddish discoloration of lower stems (areas just above the soil line) and roots (FIGURE 3). During the late soybean development stages (pod and seed development and later), white fungal growth (mycelia) may develop on roots and lower stems, and fungal fruiting structures (perithecia) also may develop (FIGURE 3). Perithecia are red to reddish-orange, spherical, and less than 1/16 inch in diameter (FIGURES 3 & 4).



FIGURE 3. RED DISCOLORATION OF LOWER SOYBEAN STEM AND ROOTS CAUSED BY RED CROWN ROT, AND WHITE MYCELIA (WHITE FUNGAL GROWTH) AND RED, SPHERICAL FRUITING BODIES (PERITHECIA) PRODUCED BY THE RED CROWN ROT FUNGUS.

FIGURE 4. REDDISH-ORANGE SPHERICAL FRUITING BODIES (PERITHECIA) ON A SOYBEAN ROOT, PRODUCED BY THE RED CROWN ROT FUNGUS.

FIGURE 5. A PATCH OF PREMATURELY DEAD SOYBEAN PLANTS SEVERELY AFFECTED BY RED CROWN ROT.

Areas of symptomatic plants in fields generally occur non-uniformly within patches. Soybean plants that are severely affected by red crown rot may die prematurely, while non-affected plants remain green (FIGURE 5).



CAUSE & DISEASE DEVELOPMENT

Red crown rot is caused by the fungus *Colonectria illicicola*. This fungus overwinters and survives in the soil as specialized structures known as microsclerotia. The fungus may begin to infect soybean roots shortly after planting. The greatest infection of roots occurs when soil temperatures are between 77°F and 86°F. The fungus has a broad host range, which includes alfalfa and peanut as other agriculturally important hosts.

DISEASES WITH SIMILAR SYMPTOMS

Red crown rot can be confused with other soybean diseases, which can make diagnosis difficult. The most accurate diagnosis requires a laboratory analysis, and symptomatic soybean samples from Kentucky fields can be submitted to the University of Kentucky Plant Disease Diagnostic Laboratory through your local Kentucky county Extension office.

Potential look-alike diseases that have symptoms of interveinal chlorosis/necrosis on soybean leaves include **sudden death syndrome (SDS)**, **southern stem canker**, and **brown stem rot**. Of these three diseases, only SDS and southern stem canker are currently known to occur in Kentucky, while brown stem rot occurs further north than Kentucky. Although these diseases have similar leaf symptoms to red crown rot, red crown rot generally can be distinguished by the reddish discoloration of lower stems and roots. Observance of the red, spherical perithecia on lower stems and roots is also distinctive to plants affected by red crown rot.

Lower stem and root symptoms caused by **Rhizoctonia root rot** also can potentially be confused with symptoms caused by red crown rot. *Rhizoctonia* root rot may cause reddish-brown lesions on roots and hypocotyls (FIGURE 6); however, these lesions tend to be sunken and girdling, whereas the red discoloration caused by red crown rot generally is not. In addition, *Rhizoctonia* root rot is more likely to first be observed when plants are in the seedling to early-vegetative stages, and red crown symptoms may appear later in the season. Also, perithecia will only be present on lower stems and roots of plants affected by red crown rot.



FIGURE 6. REDDISH-BROWN SUNKEN AND GIRDLING LESIONS ON SOYBEAN HYPOCOTYLS AND ROOTS DUE TO RHIZOCTONIA ROOT ROT.

DISEASE MANAGEMENT

- Rotating to a non-host crop for 2 or more years may help reduce inoculum levels of the red crown rot fungus in the soil.
- Treating soybean seeds with a fungicide seed treatment that includes red crown rot on the label may help protect against early infections by the red crown rot fungus.
- Planting soybeans when soil temperature is less than 77°F may help reduce infections by the red crown rot fungus.
- Management of soybean cyst nematode (SCN) may help reduce potential interactions between SCN and the red crown rot fungus, which have been shown to have an antagonistic effect on soybean plants when both are present.
- Currently, no commercial soybean varieties are marketed with resistance to red crown rot.
- Additionally, no foliar fungicides include red crown rot on their labels, and fungicides will not be effective in managing red crown rot if applied.

ADDITIONAL RESOURCES

- An Overview of Soybean Seedling Diseases (CPN-1008)
<https://cropprotectionnetwork.org/publications/an-overview-of-soybean-seedling-diseases>
- An Overview of Stem Canker (CPN-1006)
<https://cropprotectionnetwork.org/publications/an-overview-of-stem-canker>
- An Overview of Sudden Death Syndrome (CPN-1011)
<https://cropprotectionnetwork.org/publications/an-overview-of-sudden-death-syndrome>

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