

A GUIDE TO RED CROWN ROT IN SOYBEAN

Red Crown Rot (RCR) is a soilborne fungal disease that has been expanding its range in Midwestern soybean production since 2017. This disease can cause losses exceeding 30% in severely affected areas of fields if conditions are conducive. Here we discuss more about this disease and its identification and management.



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HISTORY

RCR is caused by a soilborne fungus, *Calonectria illicicola*. It is also known in older literature as *Cylindriocladium crotalarae* and *Cy. parasiticum* and can be associated with peanut production, where it causes *Cylindrocladium* black rot. It can infect over 113 plant hosts, including many legumes, such as alfalfa, and ornamental plants.¹

Historically RCR has been of limited concern to soybean production within the U.S., being located predominantly where peanuts are grown along with soybeans. With exceptions in Louisiana^{2,3} and limited areas in Mississippi⁴ in the late 1980's/early 1990's, RCR has rarely been a disease of concern in U.S. soybean production. For unknown reasons, the disease never grew or spread in soybeans to significant levels.

In 2017, several fields in Western Illinois showed widespread infection and significant yield and quality reduction exceeding 25 bu/A.⁵ In these fields, the level of infection indicated the disease had been present for several seasons and likely was misdiagnosed or undiagnosed.⁵ Since 2017, reports of RCR in the Midwest have increased and now the pathogen can be found at some level across much of Illinois and select counties in Indiana, Kentucky and Missouri.

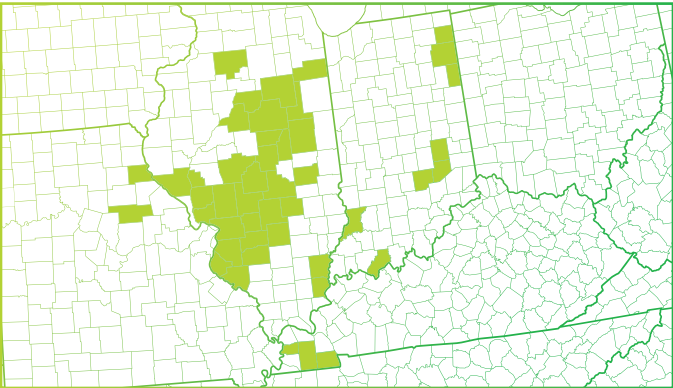


Figure 1: Crop Protection Network Red Crown Rot Map; 2/11/25

SIGNS AND SYMPTOMS

Field occurrence distribution

Calonectria illicicola is spread with soil movement. Often, when first detected it is located at field edges, entryways or heavily trafficked areas of the field. Over time the disease may spread across the field with equipment, or water, wind and animals. Frequently the disease is in small patches in fields, but in serious cases large portions of fields may be affected. In these cases, the disease likely was present for many years.

Infection, signs, and symptoms

The fungus survives in soil as microsclerotia which germinate and infect host roots. Soybeans are most seriously affected within the first three weeks after emergence.¹ If soil is warm and moist, the pathogen can destroy the seedling root system, resulting in significant stand loss and plant stunting (Figure 2).

Typically after R4, any plants surviving initial infections may show interveinal chlorosis similar to that observed for Sudden Death Syndrome, brown stem rot and Southern stem canker.¹ This is due to a toxin produced by the pathogen. The key to identifying RCR is the presence of small, dark red fungal structures at the base of soybean stems. Ensuring that RCR is properly identified is critical, as management strategies for the lookalike issues differ (Table 1).



Figure 2: Rotted root mass due to RCR

Table 1.

Disease/ Issue Name	Conditions favoring disease/issue
Red Crown Rot (RCR)	Wet, warm soils early in seedling development
Sudden Death Syndrome (SDS)	Wet, moderate soils early in seedling development
Brown Stem Rot	Wet, cool soil, continuous soybean reproduction
<i>Fusarium</i> root rot and wilt	Wet conditions
<i>Phytophthora</i> stem blight	Prolonged wet, warm soil
Potassium deficiency	Drought, poor K levels in soil

MANAGEMENT

Host resistance

Although sources of resistance have been identified in some soybean lines as well as wild legume sources, there are no commercially available varieties currently considered resistant to RCR. Cultivars do vary in their apparent resistance to disease, with some showing a high degree of susceptibility and others being much more resilient. In peanuts, host resistance, rotation and chemical intervention are used to manage this pathogen.

Rotation

Since the pathogen has a wide host range and can survive many years in soil, crop rotation is unlikely to have a major short-term benefit for RCR management. In affected areas, soybean should not be grown in rotation with other legumes, including alfalfa, clovers and peanuts.

Tillage

Tillage will not impact RCR due to the persistence of microsclerotia in the soil.

Other cultural practices

Limit potential spread between fields by harvesting or working infected fields last. Ensure equipment is thoroughly washed after working in impacted fields. Minimizing trips across the field during the season will reduce potential spread between seasons.

Chemical intervention

Because the potential impact of the pathogen on soybeans is most severe the first three weeks after germination, protection of the seedling and its development is crucial. There are currently some seed treatments labeled to suppress this disease in soybeans.



Figure 3: Diagnostic characteristics of RCR including (A) red structures at the base of the plant and (B) interveinal chlorosis.



Figure 4: Sudden Death Syndrome signs and symptoms including (A) blue fungal growth and (B) interveinal chlorosis.



Figure 5: Brown Stem Rot symptomology in a soybean stem. Image courtesy of Dr. Dean Malvick, professor of Plant Pathology, University of Minnesota.

Major Distinctive Signs and Symptoms

- Pinhead, orange/red balls at base of stem and roots. Interveinal chlorosis. Defoliation. (Figure 3)
- Interveinal chlorosis of leaves. Defoliation. Blue fungal growth on roots. (Figure 4)
- Interveinal chlorosis of leaves. Stems split and center pith retains brown, corky, ladder-like appearance. (Figure 5)
- Red/brown rotted roots, wilting of plants.
- Black rotted roots, purple lesion that extends from soil line up main stem. Blighted plants.
- Yellow leaf margins, interveinal chlorosis. Upper leaves can be symptomatic if issues occur after R3.

SYNGENTA SOLUTIONS

Saltro® fungicide seed treatment:

Saltro has a 2(ee) label for RCR suppression in Arkansas, Illinois, Indiana, Iowa, Kentucky, Missouri, Ohio and Tennessee. In addition to RCR, Saltro protects against SDS and nematodes.

Victrato® seed treatment:

Victrato is the first federally-labeled seed treatment management tool for RCR suppression. Victrato delivers revolutionary, unparalleled potency to protect against nematodes, SDS and RCR.



Hamel, Illinois; 9/6/2024.
Disease Present: Red Crown Rot

VICTRATO (50G) + BASE



BASE ALONE

Further Reading:

1. Kleczewski, Nathan, and Seth Geisler. "Assessment of selected commercially available seed treatments on suppressing the effects of red crown rot on soybeans under a controlled environment." *Plant Disease* 106.8 (2022): 2060-2065.
2. Jiang, Chang-Jie, and Xianzhi Xie. "Soybean red crown rot: Current knowledge and future challenges." *Plant Pathology* 72.9 (2023): 1557-1569.
3. Antwi-Boasiako, Augustine, et al. "Identification of QTLs and Candidate Genes for Red Crown Rot Resistance in Two Recombinant Inbred Line Populations of Soybean [Glycine max (L.) Merr.]." *Agronomy* 14.8 (2024): 1693.

Citations:

1. Kleczewski, N. M., Bradley, C. A., Hartman, G., Kandel, Y., Mueller, D., & Salamanca, L. R. (2023). "A diagnostic guide for red crown rot of soybean." *Plant Health Progress*, 24(1), 123-129.
2. Berner, Dana Kent. *Distribution and management of and soybean resistance to Calonectria crotalariae, the causal pathogen of red crown rot of soybean*. Louisiana State University and Agricultural & Mechanical College, 1991.
3. Kuruppu, P.U.D.S., 1998. *Factors affecting root colonization by Calonectria ilicicola and development of red crown rot disease on soybean*. Louisiana State University and Agricultural & Mechanical College.
4. Roy, K. W., K. S. McLean, G. W. Lawrence, M. V. Patel, and W. F. Moore. "First report of red crown rot on soybeans in Mississippi." (1989): 273.
5. Kleczewski, N., et al. "First report of red crown rot of soybeans caused by *Calonectria ilicicola* (anamorph: *Cylindrocladium parasiticum*) in Illinois." *Plant Disease* 103.7 (2019): 1777-1777.

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Syngenta supports a FIFRA Section 2(ee) recommendation for Saltro for suppression of Red Crown Rot in Arkansas, Illinois, Indiana, Iowa, Kentucky, Missouri, Ohio and Tennessee. Please see the Section 2(ee) recommendation to confirm that the recommendation is applicable in your state. The Section 2(ee) recommendation for Saltro should be in the possession of the user at the time of application.