PURDUE UNIVERSITY | Extension

Botany and Plant Pathology
ag.purdue.edu/btny
BP-043-W

Photo credit: Darcy Telenko

DISEASES OF SOYBEAN

White mold

Authors:
Audrey Conrad and Darcy Telenko

Purdue University Botany & Plant Pathology

www.btny.purdue.edu

Sclerotinia sclerotiorum is a soilborne pathogen of soybean which causes the disease white mold, also called Sclerotinia stem rot. White mold can be found throughout the soybean producing region of the United States, including Indiana. Disease risk is highest in northern Indiana where the climate provides ideal conditions for white mold to develop. White mold has the potential to produce significant yield losses when the pathogen is present, the soybean variety is susceptible, and the environmental conditions are ideal.

Developing an integrated disease management strategy based on field history can help reduce losses as a result of white mold infection.

This publication describes:

1. Disease signs and symptoms
2. Disease cycle
3. Management strategies

Photo credit: Audrey Conrad

Figure 1.
Plant displaying classic white mold symptoms of wilting and premature senescence of leaves.

Causal Agent

White mold is caused by the soilborne fungus *Sclerotinia sclerotiorum. S. sclerotiorum* is capable of causing disease on hundreds of different plant species including soybean, dry bean, pea, canola, peppermint, potato, sunflower, and tomato. The pathogen can also infect several weeds such as red root pigweed, ragweed, common lambsquarters, velvetleaf, and dandelion.

Signs and Symptoms

White mold usually appears between July and August when the soybean plants are beginning to flower, and is often first noticed when plants in an otherwise healthy field prematurely senesce. Early disease symptoms include water-soaked lesions on the main stem. Lesions can also appear on petioles and pods. As the disease progresses, the lesions appear bleached and encircle the stem. The leaves will remain attached to the stem but turn brown, and eventually the entire plant will die. Severely infected plants may not produce seed.

Disease signs include fluffy white mycelium growing from the bleached lesions. Small black structures called sclerotia may also form on or in the stem. Sclerotia are specialized structures that are capable of surviving harsh weather conditions. The sclerotia can be 1/8-inch to 3/4-inch long and are initially soft but harden with age. When cut, the inside of the sclerotia are white.

Disease Cycle

S. sclerotiorum overwinters in the soil in the form of sclerotia that germinate to produce apothecia under cool (15 to 20° C) and wet (-0.03 to -0.07 MPa) environmental conditions in the spring. Only sclerotia within the top inch of soil will germinate to produce apothecia. Sclerotia can persist in the soil for several years, though the viability of the sclerotia declines over time.

Apothecia, the spore producing fruiting body of the fungus, are light brown in color, 1/8-inch to 3/4-inch in diameter, and consist of a cuplike structure on a short stalk. Apothecia can be easily confused with the fruiting body of bird's

Photo credit: Audrey Conrad

Figure 2.
Sclerotia of various shapes and size (left) and approximate size of sclerotia (right).

Photo credit: Audrey Conrad

Figure 3. Fluffy white mycelium of *S. sclerotiorum* on main stem of soybean plant.

Photo credit: Audrey Conrad

Figure 4. Mycelium and sclerotia of *S. sclerotiorum* on stem of soybean plant.

nest fungi. Bird's nest fungi break down dead plant material and are frequently found on the soil surface in minimum tillage systems. This fungus does not cause any disease of soybean.

The apothecia produce spores which are transported to the soybean plant by wind. The spores can infect the plant through a wound or natural opening. Once infection occurs, mycelium grows from the infected plant tissue and produces sclerotia which drop to the soil completing the disease cycle.

Photo credit: Craig Grau (Bugwood.org)

Photo credit: Kaitlin Waibul

Figure 5.
Apothecia of *S. sclerotiorum* (left) and bird's nest fungi (right).

Management

White mold is best managed using an integrated approach. The most effective defense against white mold is to keep the fungus out of a field, but if an outbreak does occur, the following recommendations can be used to manage the disease. Further detailed management information is available through the Crop Protection Network.

Row Spacing and Planting Population

In infested fields, 15-inch row spacing or wider and planting populations of 125,000 to 150,000 plants per acre may lower the the chance for white mold development. Wider row spacing and decreasing the planting population allows for more air circulation at the soil surfance while the soybean plants are beginning to flower. More air flow decreases humidity in the canopy and near the soil surface, resulting in a less favorable environment for apothecia development, spore formation, and spore release.

Tillage

Inconsistent results have been reported regarding the effect of tillage on white mold development. Deep plowing can bury sclerotia reducing the chance for sclerotia germination. However, if buried sclerotia are brought to within the top two inches of the soil surface, some will still be viable and can germinate to produce apothecia.

Crop Rotation

Rotating to non-host crops is one of the most important strategies to reduce the chance for white mold development. Rotation must be carefully considered as the sclerotia can remain viable in the soil for several years. A corn-soybean rotation is better than continuous soybean, however the viability of the sclerotia will not sufficiently decline in one growing season. In fields with a history of white mold, a longer rotation, such as corn-soybean-winter wheat, would provide a greater impact and allow for a longer period of time for sclerotia viability to decline.

Resistant Varieties

To date, complete resistance to *S. sclerotiorum* has not been identified. Differences in tolerance exist between varieties and seed dealers provide ratings that reflect the rate at which white mold develops for each variety.

Chemical and Biological Control

Several fungicides and biofungicides are available and labeled to limit or suppress white mold, but proper timing and good canopy coverage are important. The fungicides and biofungicides should be applied no later than beginning pod (R3) growth stage at 15 to 20 gallons per acre (GPA). Full label application rates are essential to delay the development of resistance. Several resources are available which provide efficacy data for various fungicide and biofungicide products. The University of Wisconsin has also developed two apps to assist with the decision of when to make an application for the control of white mold.

Harvest

White mold infested fields should be harvested last to avoid spreading the disease to other fields and the combine should be thoroughly cleaned afterwards. If white mold is restricted to a portion of the field, that area should be harvested last and independently from the rest of the field.

Summary

White mold is caused by the pathogen *S. sclerotiorum* and can result in severe yield losses under ideal environmental conditions. The pathogen can overwinter in the form of sclerotia which makes management of the disease especially challenging. An integrated approach should be used in fields with a history of white mold. White mold management strategies include increasing the row spacing, decreasing planting populations, rotating to a non-host crop, selecting a tolerant variety, and if needed the application of fungicides or biofungicides.

Citations

Boland, G. J., and Hall, R. 1994. Index of plant hosts of *Sclerotinia sclerotiorum*. Canadian J. of Plant Path. 16:93–108.

Hartman, G. L., Rupe J. C., Sikora, E. J., Domier, L. L., Davis, J. A., and Steffey, K. L., eds. 2015. *Compendium of Soybean Diseases and Pests*. Fifth Edition. The American Phytopathological Socity.

Acknowledgements

The authors would like to thank Drs. Tom Creswell and John Bonkowski for their peer review of this publication.

Additional Resources

Crop Protection Network - White Mold

Crop Protection Network - Scouting for White Mold

Crop Protection Network - Pesticide Impact on White Mold

Crop Protection Network - Integrated Management of White Mold

A Farmer's Guide to Soybean Diseases

Sporecaster App (White Mold Forecasting)

Sporebuster App (White Mold Fungicide Value Calculator)

Find Out More

Check out the Purdue Field Crop Pathology Extension Website