WHITE MOLD

Soybean Diseases





Overview

White Mold is a significant disease problem of soybean in the North Central region and Canada. The incidence and severity of white mold varies from year to year because of its sensitivity to weather conditions. Cool and moist conditions at the time of flowering are most conducive to the development of white mold.

White mold is caused by the soil inhabiting fungus, Sclerotinia sclerotiorum. It is easily distinguished from most other soybean diseases by the presence of a white cottony, moldy growth (mycelia) and hard, black structures known as sclerotia on infected plant tissues.

White mold can substantially reduce yield, especially when climatic conditions and management practices favor high yield potential. Severe white mold infection weakens the plant and can result in wilting, lodging and plant death.

In addition to causing yield loss, white mold can affect seed quality and seed production.

White mold has progressed from a sporadic disease to an annual threat to soybean production

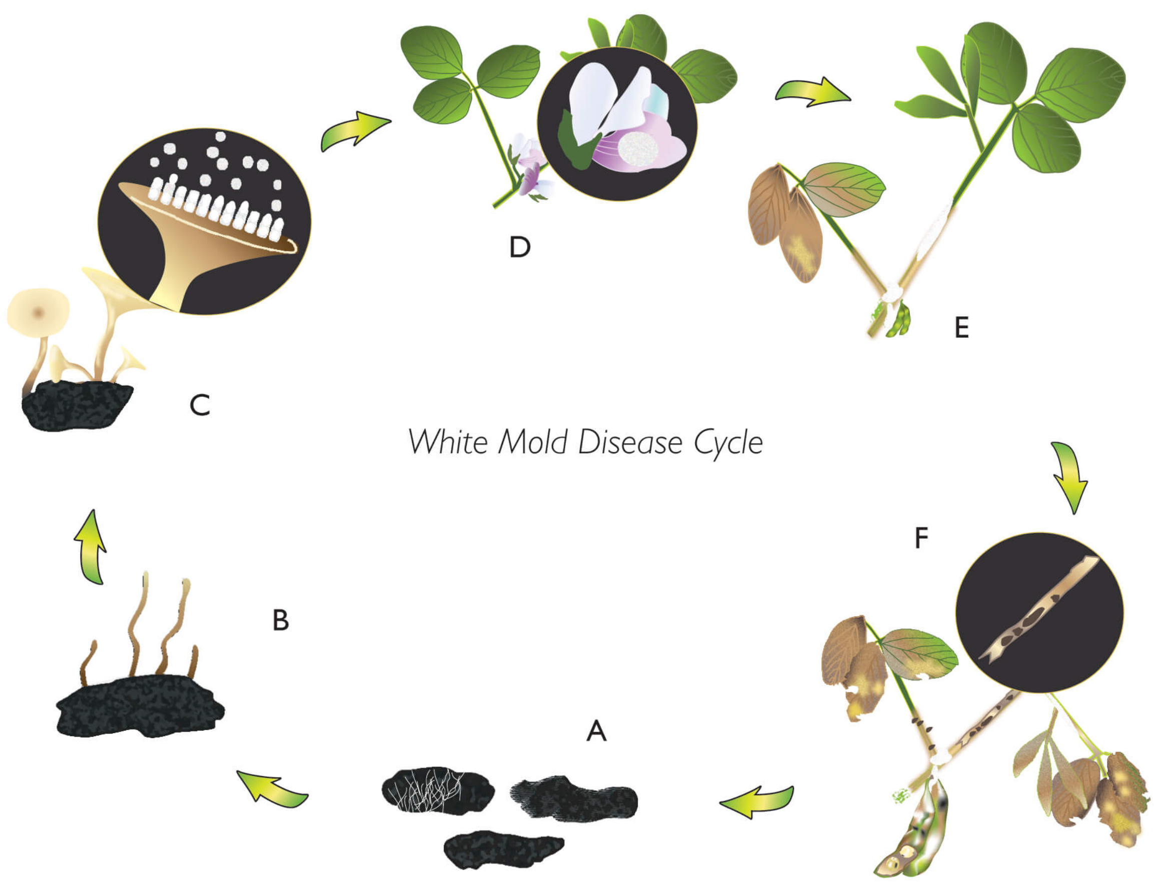
White mold was discovered on soybeans in central Illinois in 1948. Although it eventually became a chronic problem in Michigan, Minnesota, and Wisconsin, outbreaks were localized and occurred where soybeans were grown in rotation with other susceptible crops.

Beginning in 1990, however, the occurrence of white mold became more widespread in the Great Lake states, and by 1992, was present throughout all the North Central states.

Reasons for the sudden increase of white mold are not fully understood but are thought to be related to changes in cultural practices that promote a greater canopy density. The increase in white mold may also be due to changes in the genetic base of current soybean varieties, or changes in the white mold pathogen.

Developing a management plan that is based on knowledge of field history and best disease management practices can help reduce losses from white mold. An effective management plan should include good record keeping, appropriate cultural practices, varietal resistance, and possibly chemical and biological control tactics.

Cycle



(A) The white mold fungus (Sclerotinia sclerotiorum) survives in the soil as sclerotia — hard, black structures that resemble mouse droppings.

(B) Sclerotia within the top two inches of soil can germinate to produce apothecia. Apothecia are small, tan, cup-shaped mushrooms about 1/8 to 1/4 inch in diameter. Shaded, moist, and cool soil favors germination.

(C-D) Apothecia produce airborne spores called ascospores that colonize senescing soybean flowers.

(E) Infection can spread into the stem at the node and is favored by moisture and cool temperatures. A dense canopy during flowering (growth stages R1 through R3) may provide an ideal microenvironment for spore production, dispersal, infection, and disease development.

(F) The fungus eventually girdles the stem and disrupts the transport of water and nutrients. This causes leaves and stems to turn brown and stand erect above the soybean canopy. Closer inspection of the stems may reveal a thick, white mold on the stems and branches. Sclerotia can form either on the inside or outside of infected stems and pods.

(A) The sclerotia fall to the soil during harvesting or remain in crop debris where they survive for many years. In the spring, sclerotia may germinate to form new apothecia, starting the disease cycle again.

Scouting

Scouting for mushrooms (apothecia) at canopy closure

The best time to scout for apothecia is at canopy closure. This is generally in late June and early July in the North Central region and will vary with row spacing.

Check the soil under plants growing in high soil moisture areas and closed canopies, especially during flowering. Check areas where moisture collects due to fogs, extended dew periods, and in pockets of poor air drainage.

Scouts should be aware of the difference between apothecia growing from sclerotia and other harmless mushrooms such as the one produced by the birds-nest fungus, growing on pieces of organic matter.

University of Wisconsin researchers have developed a white mold forecasting app known as Sporecaster that uses several variables including weather and the amount of soybean row closure in a field. You will need to scout your field to determine if the soybean crop meets thresholds such as canopy closure and the presence of flowers. For more information on how to use the app, including video tutorials, see "New smartphone app: Sporecaster, The Soybean White Mold Forecaster".

Scouting for white mold-infested plants during pod set

Check near tree lines or other parts of a field that experience less wind disturbance, parts of the field with thick canopies, and fields with a history of white mold. White mold often occurs in patches within fields. Within these patches, look for scattered dead plants.

Infected plants appear wilted, which might be mistaken for drought. Inspect the stems for water-soaked lesions that progress above and below infected nodes, and eventually encircle the stem.

Look for the distinctive white, cottony, moldy growth and sclerotia on infected plant tissues. These are signs of the fungus that are diagnostic for white mold and allow it to be easily distinguished from most other soybean diseases.

Management

The growth of the white mold fungus is strongly affected by environmental conditions in the crop canopy and is particularly favored by dense soybean canopies.

Rain events during flowering, and wet areas in fields due to fog and extended dew periods are especially favorable for white mold. Risk assessment for white mold is based on these factors, as well as the field history and soybean variety.

Seasonal Risk Factors

- Favorable weather including temperatures in the 70s to mid 80s °F and generally wet conditions
- Early canopy closure
- History of white mold in the field
- Susceptible varieties planted

Long-term risk factors

- Short rotations, rotations with other susceptible crops, or frequent use of susceptible varieties
- Poor management of susceptible broadleaf weeds
- Fields with pockets of poor air drainage, tree lines or other natural barriers that reduce air movement

Start with record keeping

Taking accurate notes about where and how much white mold occurs in each soybean field is important for future disease management planning. Tracking disease levels across years also will help determine the potential sclerotia (inoculum) load that may be present in a field. Recording disease and yield performance for different varieties will help in future variety selection for fields with a history of white mold.

Variety selection

No soybean variety is completely resistant to white mold, but partially resistant varieties are available. A partially resistant variety has significantly less disease incidence than a susceptible variety, but some disease will occur when conditions are favorable. Avoid planting highly susceptible varieties in fields with a history of white mold.

Variety selection should be based on resistance ratings determined across multiple locations and multiple years. Check with seed dealers and local Extension for variety tests that include varietal responses to white mold. Note that testing conditions and scoring methods vary within the seed industry.

Cultural Control

Crop rotation

- Short crop rotations, such as a soybean-corn rotation, will eventually lead to a build-up of sclerotia in the field. A minimum of two or three years of a non-host crop, such as corn or small grains (wheat, barley or oats) can reduce the number of sclerotia in the soil. Most sclerotia die over a three- to four-year period between soybean crops.
- Forage legumes, such as alfalfa and clovers, are less susceptible to infection but still can be infected by S. sclerotiorum.
- Soybean fields with a history of white mold should not be in two- or three-year rotations with other crops susceptible to white mold. These include edible beans, canola, cole crops (cabbage and broccoli) pulse crops (peas, chickpeas and lentils), sunflowers, and potatoes.

Tillage

- The impact of tillage on white mold development is variable, although several studies have indicated lower levels of disease in no-till.
- Deep tillage may initially reduce white mold incidence by removing sclerotia from the upper profile, which may reduce the number of apothecia produced. However, sclerotia can remain viable for more than three years if buried 8 to 10 inches in the soil and may be returned to the soil surface in subsequent tillage operations.
- Although more sclerotia are found near the soil surface in no-till systems, they may degrade faster because of weathering, compared to tilled soils.

Canopy management

- Early planting, narrow row width, high plant populations, and high soil fertility all accelerate canopy closure and favor disease potential. However, maintain yield potential when modifying these practices.
- High plant populations (175,000 plants or greater) have been associated with increased white mold incidence. Consider decreasing plant populations in fields with a history of white mold; however, be sure populations maintain yield potential.
- Wider row spacing (more than 20 inches) can sometimes reduce white mold, but this does not always result in increased yield.
- The application of manure should be avoided on fields with a history of white mold.

Weed control

- Many common weeds are also hosts of S. sclerotiorum, including Canada thistle, common vetch, redroot pigweed, curly dock, shepherd's-purse, common burdock, dandelion, sow thistle, common chickweed, field pennycress, toothed spurge, common cocklebur, henbit, velvetleaf, common lambsquarter, common purslane, common and giant ragweed, wild mustard and others. High weed populations of any kind in a soybean field also may contribute to the plant canopy, favoring disease development.

Irrigation

- Avoid excessive irrigation until after flowering. Low moisture levels are critical for reducing the potential for apothecia formation and white mold development. Infrequent, heavy watering is better than light, frequent watering.

Chemical Control

- Some foliar-applied fungicides and herbicides have efficacy against S. sclerotiorum, although none offers complete control. Fungicides inhibit infection and growth of S. sclerotiorum, but how inhibition occurs depends on the specific fungicide. Currently, fungicides from three different chemistry classes are registered for white mold control in soybeans. All fungicides have limited movement in plant tissues, and only upward movement is possible — none moves downward in the plant where infection by S. sclerotiorum often takes place. A regularly updated list of fungicides and their efficacy on white mold is available from the *Crop Protection Network* at https://cropprotectionnetwork.org/resources/publications/fungicide-efficacy-for-control-of-soybean-foliar-diseases.
- Complete control of white mold using only chemical management strategies is generally not attainable, and, therefore, it should be considered only as one component of an integrated white mold management program. Reduction of white

mold incidence achieved by fungicides in university field trials ranged from 0 to approximately 60 percent.

Biological Control

- Biological control may be valuable as a long-term strategy to reduce sclerotia in a field. The fungus Coniothyrium minitans is the most widely available and tested biological control fungus for managing white mold. It is commercially available as Contans®. Application of C. minitans should occur a minimum of three months before white mold is likely to develop. This allows adequate time for the fungus to colonize and degrade sclerotia. Degraded sclerotia will not produce apothecia and, therefore, will not produce ascospores to initiate infection of soybean.
- There are limited data available to document the efficacy of C. minitans for white mold management in soybean. Most studies published to date have focused on crops other than soybean. From this limited research, sclerotia numbers have been reduced by as much as 95 percent and white mold incidence has been reduced from 10 to almost 70 percent. More studies are underway.

Distribution

Scouting White Mold, Crop Protection Network CPN-1010B, 2015

Scouting for Soybean Stem Diseases, Crop Protection Network CPN 1002, 2015

Scouting for White Mold in Soybean trifold version, Crop Protection Network CPN-1002A, 2015

Soybean White Mold (Sclerotinia Stem Rot) video, Plant Management Network, 2016

Sporecaster, the Soybean White Mold Forecaster (Smartphone app), University of Wisconsin

Resources

Scouting for White Mold in Soybean
Crop Protection Network CPN-1010B, 2015
https://cropprotectionnetwork.org/resources/publications/scouting-white-mold

Scouting for Soybean Stem Diseases
Crop Protection Network CPN 1002, 2015
https://soybeanresearchinfo.com/wp-

content/uploads/2019/03/CPN1002_ScoutingSoybeanStemDiseases051515.pdf

Scouting for White Mold in Soybean trifold version
Crop Protection Network CPN-1002A, 2015
https://soybeanresearchinfo.com/wp-
content/uploads/2019/03/CPN1002_ScoutingSoybeanStemDiseases.CARD_.051515.pdf

Soybean White Mold (Sclerotinia Stem Rot)
University of Wisconsin, 2016
http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/WhiteMold/

White Mold
Crop Protection Network CPN-1005, 2015
https://cropprotectionnetwork.org/resources/publications/white-mold

SOYBEAN RESEARCH
& INFORMATION NETWORK

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