Managing White Mold in Soybean

White mold is a fungal disease that can attack hundreds of plant species. Also known as Sclerotinia stem rot, it has become an annual threat to soybeans in northern growing areas throughout North America. The disease has spread in the last decade, likely due to cultural practices that have accelerated canopy development, such as earlier planting and narrower rows.

When cool, wet summer conditions favor development, as they did in 2009, white mold can severely reduce soybean yields. Though less problematic in 2010, long-term survival structures of this organism ensure that inoculum is always available to attack the next soybean crop should conditions allow. For that reason, growers in risk areas must treat white mold as a perennial threat to top yields and profits.

Disease Description and Life Cycle

White mold persists in soybean fields over time by survival structures called sclerotia. These dark, irregularly shaped bodies are about ½ inch long and are formed within the white, cottony growth both inside and outside the stem. Sclerotia contain food reserves and function much like seeds, surviving for years in the soil and eventually germinating, producing millions of spores beneath the plant canopy.

White mold spores are not able to invade plants directly, but must colonize dead plant tissue before moving into the plant. Senescing flowers provide a ready source of dead tissue for preliminary colonization. From these senescing flowers in the branch axils or stuck to developing pods, the fungus spreads to healthy tissue. Stem lesions develop and may eventually be overgrown with white mold. The disease can then spread directly from plant to plant by contact with this moldy tissue.

White mold on soybean stem

Wet, cool conditions are required throughout the white mold disease cycle, including germination of the sclerotia in the soil, spore release, infection of soybean flowers by spores and spread of white mold from plant to plant. As tissue rots and sclerotia form inside the stem, rapid wilting and death of the upper part of the plant may occur. Premature death of the entire plant can occur as the disease progresses.

Management of White Mold

White mold is often a disease of high yield potential soybeans, but abandoning high-yield management practices to control the disease is often counter-productive. Rather, a systems approach that includes avoiding disease spread, selecting tolerant varieties, adjusting cropping systems, and applying specific fungicides or herbicides can help to reduce white mold damage to your soybean fields.

Disease Avoidance

Sclerotia move from field to field in harvest equipment or in contaminated seed. Harvest equipment should be thoroughly cleaned when moving from infected to non-infected fields. Harvesting infected fields last provides additional safety. Soybeans harvested from infected fields should never be used for seed, because accompanying disease sclerotia are placed at the ideal depth for germination and infection of that crop and field during planting. Pioneer Hi-Bred avoids growing seed beans in fields with a history of white mold. In addition, seed is thoroughly cleaned and inspected to ensure that it is disease-free.

Long-Term Risk Factors for White Mold Development

Field/cropping history. Pathogen level will gradually increase if:
- Other host crops are grown in rotation with soybean
- Only 1- to 2-year intervals occur between soybean crops
- White mold susceptible varieties are grown

Weed management. Inoculum will increase if control of broadleaf weeds is ineffective.

Topography of field. Pockets of poor air drainage, tree lines and other natural barriers that impede air movement will create a favorable micro-environment for white mold development.

Pathogen introduction. White mold can be spread by:
- Contaminated and infected seed
- Movement of infested soil with equipment
- Wind-borne spores from apothecia from area outside fields

Variety Selection

Pioneer researchers assign each Pioneer® brand soybean variety a score for white mold tolerance on a one to nine scale, with higher scores indicating more tolerance. These scores reflect varietal differences in the rate at which the infection develops and the extent of damage it causes. Growers can use this rating to help choose the best variety for their field. However, because there's no complete genetic resistance available at this time, white mold may sometimes occur even with above-average tolerance scores. Your local Pioneer sales professional can suggest white mold tolerant varieties with a complete package of traits needed for top soybean production in your area.

Variety Improvement – Pioneer researchers have targeted improvement of white mold tolerance in Pioneer soybean varieties as a key research objective. To accomplish this goal, researchers use multiple approaches. A lab technique allows scientists to pre-select varieties with a base level of tolerance. These varieties are further screened at sites that include misting systems to create the right environmental conditions for disease development. By continued testing at multiple advancement stages and multiple locations, researchers can develop an accurate picture of the performance of new products in the presence of white mold pressure.

Researchers also improve varieties by selecting for plant types that are less disposed to white mold infection and more tolerant if infection occurs. This includes narrower and shorter canopies that retain less humidity beneath them. Improving standability helps keep plants upright even if infected.

Pioneer researchers also continue to screen novel, exotic, and alternative germplasm sources with native tolerance to white mold. Future possibilities include transgenic approaches – transferring resistance genes from other crops or organisms into soybeans.

Cropping Systems

Tillage – Sclerotia germinate from the top two inches of soil. Below that depth, they can remain dormant for up to 10 years. Because of its longevity in the soil, it is difficult to devise a strategy to control white mold with tillage. Deep tillage buries sclerotia from the soil surface but may also bring prior sclerotia into their zone of germination. If the disease is new to a field and a severe outbreak has occurred, a deep tillage followed by no-till or shallow tillage for many years may help. Research studies have shown that no-till is generally superior to other tillage systems in limiting white mold.

Rotation – Rotation with a non-host crop is an effective means of reducing disease pressure in a field. Non-host crops include corn, sorghum, and small grains. Susceptible crops to avoid in a rotation include alfalfa, clover, sunflower, canola, edible beans, potato and others. Depending on soybean tolerance, field history and other factors, more than one year away from soybeans may be required. Because sclerotia survive for up to ten years in the soil, rotation is only a partial solution.

Production Practices

It is well-established that many current practices that increase soybean yields also increase white mold. Early establishment of a dense soybean canopy increases the likelihood that the cool, high-humidity conditions required for disease development will occur. Many common management practices lead to early, dense canopy formation, including early planting, drilled or narrow rows and high plant populations.

Whether growers should abandon their yield-enhancing practices to help control white mold is debatable. In areas with lower white mold levels or a drier climate, production practices which increase yield but also increase white mold levels may still be highest yielding. However, in areas with higher white mold levels and a normally cool, wet climate, some change in production practices may be necessary.

In fields with a history of high white mold incidence, plant pathologists recommend managing the canopy by choosing wider rows and avoiding high plant populations. This is in addition to growing tolerant varieties and rotating to non-host crops. Good weed control and specific chemical applications are other production practices that may help reduce disease levels in fields with a history of severe white mold.

Row Width – Numerous studies over many years have demonstrated a yield advantage for narrow-row soybeans. Pioneer research from 16 site-years showed about a 5% advantage for both 7-inch rows and 15-inch rows over 30-inch rows. University studies have generally demonstrated a greater advantage for narrow rows in northern states, and little or no advantage in southern states. Many growers in white mold areas have chosen 15-inch rows because they often yield as well as 7-inch rows in research studies, and may reduce white mold incidence in some cases.

Planting Date – Later planted soybeans are generally shorter and less branched, and therefore later to canopy closure. Some planting date studies show that later planting results in less incidence of white mold. However, yields are generally reduced when planting is delayed past mid-May in northern states. The tradeoff between less yield reduction due to white mold, but more yield reduction due to late planting may not be favorable, especially in years of low disease pressure.

Plant Population – In fields with high risk of white mold, seeding rates should be sufficient for uniform stand establishment, but shouldn't be aggressively high. Actual rates will vary depending on planting date, seedbed conditions, row width and seed quality.

Weed Control – White mold has over 400 plant hosts, including many broadleaf weeds. Host weeds that are also common weed species throughout soybean growing areas include lambsquarters, ragweed, pigweed and velvetleaf. In addition to acting as host to the disease, weeds can also increase canopy density, which favors disease spread.

Chemical/Biological Products – Several products are labeled for control or suppression of white mold in soybeans, including herbicides, fungicides, and biological control agents.

Herbicides – Cobra® and Phoenix® herbicides, each containing the active ingredient lactofen, currently list white mold suppression on their labels. According to the labels, this suppression is not due to fungicidal activity, but one that may involve Systemic Acquired Resistance (SAR). Cobra should be applied at the rate of 6 to 8 fl.oz. per acre, and Phoenix at 6 to 12.5 fl.oz/acre at or just before first bloom (R1). Some studies have shown significant yield increases due to Cobra application. Read and follow all label instructions.

Fungicides – Four fungicides are labeled for control of white mold on soybeans: Domark®, Endura®, Topsin® M, and, under a Section 2(ee) label for specified states, Proline®. However, studies with fungicides have often showed inconsistent results. In addition, proper timing of application and penetration of the fungicide through the soybean canopy to the flowers are critical for success. For this reason, foliar fungicides are not often recommended. If used, pathologists generally suggest applying when soybeans are producing flowers on the lower half of the plant. Drop nozzles may be helpful to ensure spray coverage of those flowers.

Biological Control Agents – Contans® WG is a commercial formulation of *Coniothyrium minitans*, a fungus that has specific action against the resting survival structures (sclerotia) of white mold. According to the manufacturer, Contans WG can be applied to the soil or crop residue in the fall, or before planting in the spring, and must then be incorporated into the upper soil layer. At least three months are required for the active ingredient of Contans WG to impact sclerotia prior to their normal time of infection.

Pioneer researchers are testing this new approach to white mold management in research plots. Applications made in 2010 will be evaluated in the 2011 growing season.

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