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SCLEROTINIA STEM ROT OF SOYBEANS

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Sclerotinia stem rot (SSR) of soybeans, caused by the fungus *Sclerotinia sclerotiorum* (Lib.) de Bary is an important disease of soybeans. *Sclerotinia sclerotiorum* was first confirmed in South Africa in 1979 and has become increasingly more common and severe over the years. Crop losses due to SSR range from 0-100% and in South Africa up to 60% yield loss has been recorded.

Symptoms

Symptoms may be observed on stems, leaves, pods and seed. Symptoms of SSR include water-soaked lesions that rapidly progress along and around the stem. Infected stems become bleached and stringy. Lesions may change from tan to white as the disease progresses in stem tissue, which results in the development of a fluffy white mould on the surface of infected stems (Figure 1). Severe infection weakens the plant resulting in wilting, lodging and death of the plant. Sclerotinia stem rot often results in brown dying patches in the field. Sclerotia may be produced inside and outside of stems and pods (Figure 2). These symptoms allow it to be easily distinguished from other soybean diseases.

FIGURE 1: *Appearance of a fluffy white mould on the surface of soybean stems infected with Sclerotinia sclerotiorum (Steadman et al., 1996)*

FIGURE 2: *Formation of sclerotia of Sclerotinia sclerotiorum on an infected soybean stem (Anonymous, 2004)*

Disease epidemiology

For SSR to develop, an environment favourable for infection and disease development, a susceptible, flowering soybean cultivar and ascospores / sclerotia must all occur simultaneously. Infection occurs either by ascospores or mycelial germination. *Sclerotinia sclerotiorum* can survive for at least five years in the soil as sclerotia. When soils are shaded, moist and cool (4-16°C), sclerotia within the top 5 cm of the soil profile can germinate to produce apothecia. Apothecia are small (3-6 mm), tan cup-shaped mushrooms (Figure 3) that can produce millions of sexual spores called ascospores. The ascospores colonize senescing flowers and the fungus then uses this nutrient source to infect the plant through the stem.

Mycelial infection occurs when sclerotia germinate in the presence of exogenous nutrients. The mycelium subsequently penetrate the host cuticle by mechanical pressure. Soybeans are most susceptible to infection during the early reproductive growth stages.

Prolonged cool and wet conditions are the primary factors influencing SSR development. Canopy temperatures of less than 28 C, coupled with leaf wetness of 42-72 hours are optimal. At low relative humidity (< 25% RH) ascospores are less efficient than germinating sclerotia causing infection. A film of water on the plant surface allows for the development of lesions and increases plant tissue damage.

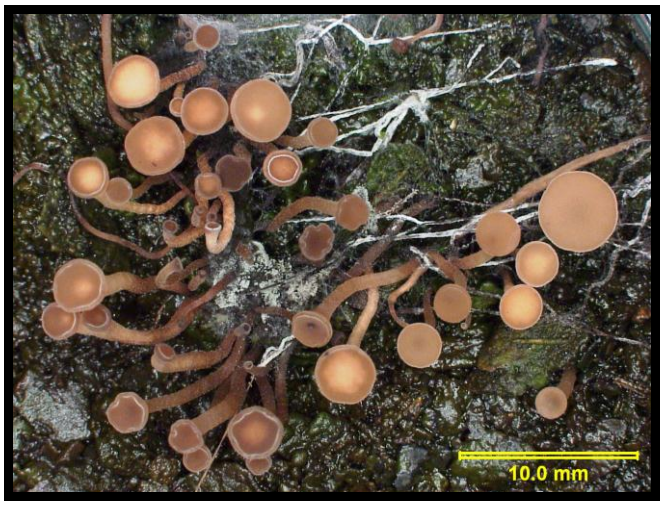

FIGURE 3: *Cup-shaped apothecia, which result from the carpogenic germination of sclerotia of Sclerotinia sclerotiorum (Visser, 2007)*

Management

No single disease management practice effectively prevents infection of soybeans by *S. sclerotiorum*. The integration of various measures may reduce disease severity and minimize yield loss, such as

- **Chemical Control**

  Seed treatments may prevent the spread of SSR inoculum in infected soybean seed. Procymidone, benomyl and thiophanate-methyl fungicides are registered for the control of SSR. Fungicides can provide good control of SSR if applied correctly (water volume and timing are critical).

- **Cultivar selection**

  It is recommended to choose less susceptible varieties or varieties which show high yield under disease pressure when planting in soils known to have a history of disease.

- **Sanitation**

  Sanitation involves all activities which eliminate or decrease the amount of inoculum present in a field and prevent the spread of the fungus to uninfected clean stands. All equipment must be cleaned of soil which may contain sclerotia and plant debris when moving between fields. Certified seed should also be used, thereby reducing the risk of introducing the pathogen into uninfected fields

- **Crop rotation**

  Sclerotinia stem rot has a wide host range, limiting the crops which may be used in rotation. Planting soybeans after SSR infected crops should be avoided. Rotation with a non-host crop such as maize, wheat or other grasses will provide time for the fungal population to decrease and reduce the risk of severe disease presence.

- **Tillage**

  Deep tillage initially may reduce disease incidence by removing sclerotia from the upper soil profile, which will reduce the number of apothecia produced. However, sclerotia can remain viable in the soil for up to five years and may return to the soil surface with subsequent tillage operations. Although more sclerotia are found near the soil surface in no-till systems, sclerotia may degrade faster in no-till soils compared to tilled-soils.

- **Irrigation management**

  Excessive irrigation during flowering should be avoided to minimize moisture at the soil surface and in the crop canopy.

  Low moisture levels within the soybean canopy are critical for reducing the potential for SSR. Avoiding excessive irrigation is especially important during the critical periods of infection from early flowering (R1) to early pod development (R3).

- **Canopy management**

  Early planting, narrow row width, high plant populations and high soil fertility accelerate canopy closure and favour disease development. Disease risk is reduced with 40 cm row spacing as compared to 20 cm rows.

Integrated pest management practices of scouting, monitoring for disease, and taking accurate notes about where and how much SSR occurs in each soybean field from year to year, is important for disease management. Tracking disease incidence across years will help in determining the potential sclerotia load present in a particular field.

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