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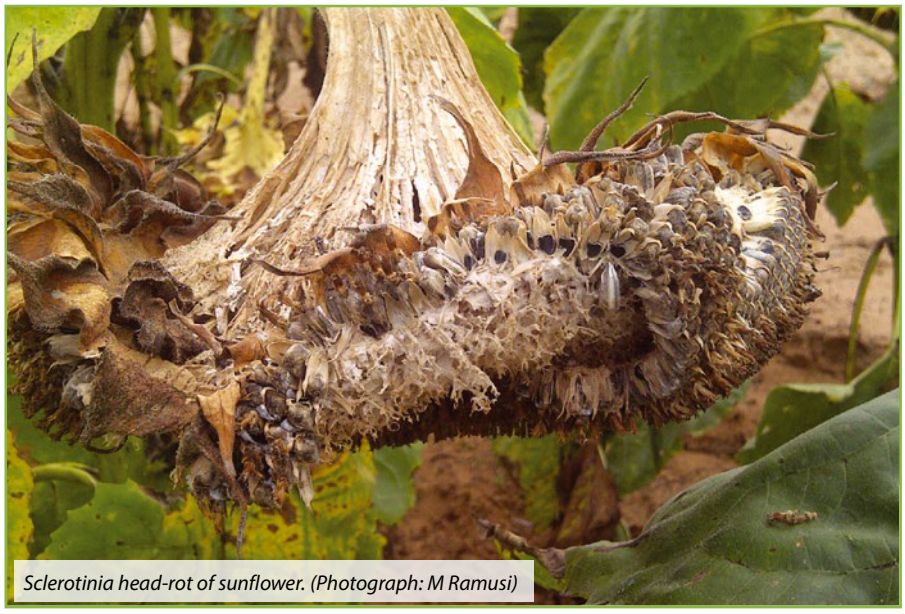
SCLEROTINIA
– a disease of note in numerous crops

Crop farmers often suffer enormous yield losses because of sclerotinia. While it is a formidable foe, there are interventions to make it as difficult as possible for the pathogen to infect.



Sclerotinia head-rot of sunflower. (Photograph: M Ramusi)

Losses of up to 65% are possible due to *Sclerotinia sclerotiorum*, the causal organism of stem and/or head rots. In South Africa, the sunflower and soya bean industries are the most severely affected by this disease. Sclerotinia stem rot can, however, also occur on crops such as dry bean, groundnut, cowpea, lupine and canola.

Results from a national disease survey conducted during the 2013/14 season on sclerotinia head rot of sunflower, revealed that disease severities as high as 65% have been recorded at Welgelegen and Kroonstad. Similarly, soya bean producers suffer losses either directly as a loss of yield or indirectly from reduced grain quality, with losses estimated to be as high as 60% in South Africa in certain seasons and localities.

Economic impact

As stated, *S. sclerotiorum* is capable of infecting all dicotyledonous plants. With limited options available with regard to crops that can be utilised within crop rotation systems, the economic impact caused by this disease could result in farmers resorting to maize monoculture, which is less than ideal.

Producers must be able to outsmart the pathogen by taking away things it requires to infect its host. During its lifecycle, *S. sclerotiorum* has certain phases that has to be completed. The sclerotium, which is the survival structure of this fungus in or on the soil, is a hard, irregular darkened and rounded mass of dormant hyphae. Sclerotia can vary in size and shape according to the host tissue they grew in. These structures can survive within the soil for as long as four years and withstand dry heat of up to 70°C.

Favourable conditions

When conditions are favourable (approximately ten days of wet soil and temperatures of 11 to 15°C), the sclerotium can germinate in one of two ways. Most common is through the production of apothecia. All above-ground infections result from this type of germination. Sclerotia that are within 5cm of the top soil germinate and produce apothecia.

Apothecia can be seen as the incubators for the next phase in the lifecycle, the ascospores. Saturated soils (of up to ten days) and prolonged periods of low soil temperatures (5 to 15°C) are favourable for the production of apothecia, which usually appear after the crop canopy has at least partially closed to shade the soil surface.

Ascospores produced by the apothecia are forcefully ejected and can spread within the same crop or to other crops by means of air currents as far as 50m from the source. At this point in its lifecycle *S. sclerotiorum* requires a host. If sunflowers are in close proximity, the spores will infect the flowers of the sunflower head during

Sclerotia, the survival structures of Sclerotinia sclerotiorum, can vary in size and shape depending on the host it grew in. (Photograph: Pannar Seed and M Craven)

Sclerotinia stem-rot of soya bean (A) and dry bean (B). (Photograph: M Craven and the Dry Bean Group)

Sclerotinia stem-rot of sunflower. (Photograph: M Ramusi)

wet weather, resulting in head rot. If soya bean or canola is the neighbour to the pathogen, the flowers of these plants will be colonised.

Basal stem infections

Sclerotia can also germinate through the production of small hyphae that grow through the soil and infect roots directly, resulting in basal stem infections. This method of infection is common in sunflowers, but less common in canola.

Once the pathogen has gained access to the plant, it produces oxalic acid, which kills tissue, as well as extracellular enzymes, which digest tissue, and enables rapid ramification of the fungus. Lesion development follows suit and is favoured by humid conditions and moderate temperatures (20 to 25°C), and is usually accompanied by a white mould growth.

Some general guidelines can limit the impact the pathogen can have on the yield.

Varietal selection: The focus must firstly be on whether cultivars are available that have tolerance to the disease. Resistance against the disease, in most crops, is not available. Tolerance, however, indicates that although a cultivar is infected and the disease manifests, the yield is not significantly affected.

Tolerance is influenced by weather conditions and will not be as effective in all environments or seasons. Sclerotinia stalk rot of soya beans can similarly be managed through proper varietal selection. It is advisable to choose cultivars which have shown high yield under disease pressure when planting in soils with a history of the disease.

Row spacing: Under low to moderate disease pressure, sclerotinia stem rot of soya bean increases as the row spacing is narrowed. Under high disease pressure, row spacing may have no effect on disease severity. Lower seeding rates can also be considered to increase airflow through the canopy, reducing the moisture that facilitates infection.

Crop rotation: Every year, a portion of the pathogen population dies because of adverse weather conditions or the activities of other organisms. Rotation with a non-host crop such as maize, sorghum, wheat or other grass will provide time for the fungal population to drop and reduces the risk for severe disease.

Spore-producing apothecia which develop on sclerotia buried in the ground. (Photograph: Pannar Seed and the Dry Bean Group)

Minimum tillage: Deep ploughing can bury sclerotia deep enough that they can no longer germinate and release spores. However, buried sclerotia survive longer than those on the soil surface. Subsequent ploughing in the following seasons can bring them back near the soil surface. In contrast, minimum tillage and no-till practices favour the natural decline of the fungal populations.

Biological control: Contans® WG (*Coniothyrium minitans*) is a commercial biological product developed for the control of *S. sclerotiorum* in agricultural soils. The best and most economical times for application are during pre-planting or post-harvest on the stubble of a previously diseased crop, and incorporated in the upper soil layer. For the greatest impact Contans® WG should be applied three months prior to soya bean flowering.

Chemical control: Seed treatments may be used to reduce the spread of sclerotinia stem rot of soya bean in the field. Fungicides can provide good control of sclerotinia stem rot of soya bean if applied correctly. There are limited fungicides registered for control of sclerotinia and timing is critical.

With sunflowers, desiccants that result in early dry-down can be considered. When sprayed on the crop after physiological maturity, the impact of further development of sclerotinia head rot and sclerotia development can be reduced.

Weed management: Many of the 400 different plant species which are susceptible to infection by *S. sclertiorum,* are broadleaf weeds. Weeds should, therefore, be removed accordingly from within, as well as from surrounding fields.

For more information, contact the ARC Grain Crops Institute in Potchefstroom on 018 299 6100.