SCLEROTINIA STEM ROT *(Sclerotinia sclerotiorum)*

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The occurrence of *Sclerotinia* has shown an increase in Australia and Canada, with an increase in surface area under canola cultivation. In the Western Cape the surface area under canola has doubled during the past three seasons. Because the climate in the Overberg and Swartland is highly suitable for the development of the disease it occurs very commonly, especially in the Overberg over the past four seasons (2011 to 2014).

Sclerotinia is a disease that infects canola, but also many other broadleaf crops. Lupins are very susceptible to it and in the Swartland it is found on this crop as far up as the Eendekuil area. Weeds such as devil's thorn and wild radish are also disease hosts, but peas and broad beans are, however, less susceptible.

Sclerotinia stem rot (*Figure 1*) only occurs sporadically when the weather conditions are favourable for the development of the disease. Consequently it varies between years, production regions and even from country to country.

Risk factors

Moisture

Moisture is essential for the development of *Sclerotinia*. High soil moisture content with light rain occurring in the period two weeks prior to bloom and during the flowering stage will greatly increase the risk for *Sclerotinia* infection, while dry weather conditions will limit the development of the disease.

Moisture for the development of *Sclerotinia* can be supplied by rain, dew, foggy weather and even a high relative humidity (>80%) in the air. Since the humidity of plants in a stand of canola is mostly higher than measured by weather stations, weather station measurements are not a good yardstick. Heavy rain downpours in the flowering stage can reduce the *Sclerotinia* risk, because it can reduce the release of spores as the water covers *Sclerotinia apothecia* and rinses it from the plant petals.

Signs of Sclerotinia on the stem of a canola plant.

Take note

The risk of infection is low after a few weeks of drought followed by rain, which is followed by a dry climate afterwards with little dew. In case high humidity and dew is experienced in the period after the rain, the spores need two weeks to develop and to be released from the *Sclerotinia apothecia*. In case such conditions occur late in the flowering stage, a fungus spray treatment will not contribute any longer to higher grain yields (*http://www.canolawatch.org/2013/01/09/sclerotinia-stem-rot-management/*).

Temperature

Temperature is less significant than moisture, but still has a big influence. Night and early morning temperatures of approximately 15°C, with heavy dew, are ideal for the development of *Sclerotinia*. Infection does not take place in the heat of the day, but at night.

Warm days will decrease infection, because the infected flower petals dry out and are blown off the plant. In hot, dry conditions the plant weans its lower leaves. In case the leaves fall before the infection spreads from the flower petals, it will limit *Sclerotinia* stem rot.

Leafy canopy

Sclerotinia is highly dependent on the microclimate in the canopy of the stand of canola. Key factors that influence microclimate are:

Cultivar: Cultivars that develop bigger leaf surface areas increase the risk. There is more space for flower petals to fall onto, while the leaves trap moisture and can create an ideal (humid) microclimate. Plants that grow high and topple over easily are also more susceptible to *Sclerotinia*.

Fertilisation: Canola plants in soils with a high nutritional status have more and bigger leaves and consequently a denser leafy canopy, which increases humidity and thereby the risk.

Toppling over: Plants that topple over do not dry off as quickly. In case they are infected, the plant-to-plant contact will aid in spreading the disease.

Planting date: The infection levels of canola fields with different sowing dates can differ. The occurrence of *Sclerotinia* stem rot is dependent on the climate and flowering stage of the canola plant. Planting dates that cause canola plants to bloom in moist conditions and favourable temperatures can increase the occurrence of the disease.

High sowing density: A high sowing density results in plants competing better with weeds and ripening more uniformly, but having a denser leafy canopy as a result. Dense stand also results in stems being thin and tending to topple over easily.

Symptoms of Sclerotinia.

Key facts

Lower plant standing is not immune to *Sclerotinia* stem rot. Logic dictates that less plants per square metre have more open spaces with a less dense leafy canopy to capture moisture. This would only be true on fields with less plants and a low yield potential. In a lower plant standing, canola plants have more, as well as bigger, leaves and stems, and a longer flowering period. This can increase the risk of *Sclerotinia* due to flower petals falling over a long period, and with the bigger leaves there is more space for flower petals to fall on.

Wide rows and a lower sowing density can very well lower the risk, but it is dependent on weather conditions. Wind moves more easily between plants when rows are wider, and in so doing, dries off plants and soil. Wider plant rows will hold no benefit in case moist conditions occur during the flowering stage.

Crop rotation

Since the disease can survive for so long in the soil (up to ten years), crop rotation has little influence on the occurrence of *Sclerotinia* stem rot. (See, however, the lifecycle of *Sclerotinia* in canola in *Figure 5* and the section on management of the disease below that.)

Risk table

The risk table (*Table 1*) that was developed in Sweden can be used to determine the risk of *Sclerotinia* occurrence. The list should be completed at the time when 75% of the plants have three flowers (start of flowering). The greater the risk for *Sclerotinia*, the better the chance will be that it is economically justified to apply chemical control. In Sweden, it was found that a count of 40 justifies chemical control, but it is dependent on the canola price and costs of control. It is important to give crop rotation a minimum of five points, since neighbouring camps can pose a risk.

The disease will still occur, even if spray treatment is administered at the correct recommended time. Chemical control will only limit the degree of infestation. Two spray applications will lengthen the protection period, but will still not eradicate the disease, in case the disease incidence is high. *Table 2* contains the list of registered fungicides for canola.

Table 1: Sclerotinia stem rot risk list: Start of flowering (75% of the plants have three flowers).

Risk factor	Categories	Risk point
Crop rotation: Years after canola	>6 years	0
	3 to 6 years	5
	1 to 2 years	10
Sclerotinia occurrence in the last host crop (e.g. canola, lupin etc.)	None	0
	Low (1 – 10%)	5
	Moderate (10 – 30%)	10
	Heavy (31 – 100%)	15
Sowing density (plant standing)	Low	0
	Medium	5
	High	10
Rain in the last two weeks	<10mm	0
	10 – 30mm	5
	>30mm	10
Weather forecast	Dry	0
	Erratic	10
	Good chance of rain	15
Local risk for the development of *Sclerotinia apothecia*	None found	0
	Low numbers	10
	High numbers	15

Source: *http://www.canolawatch.org/2013/01/09/sclerotinia-stem-rot-management/*

When to apply control

Flower petals are the target. Chemical control is ineffective before the flowering stage. Chemical remedies do not combat infection, but prevent the spores from germinating on the flower petals after they have fallen on the leaves. It is easier to spray flower petals with chemical agents while the plant is still in bloom – it is consequently the most suitable time for chemical control.

The timing of chemical control has to occur within the 20 to 50% flowering stage. (Certain products are registered for only 20 to 30% flowering stage. Read the product label carefully.) At the 20% flowering stage, no flower petals will have fallen yet. Canola can reach the 20% flowering stage within four to five days. Therefore, attempt to detect *Sclerotinia* risk timely. A spray application at 20 to 30% flowering stage ensures that many flowers are already open and that they are treated with products before they fall.

A late spray application can only be effective if it was initially dry and was followed by rain during 40 to 50% in bloom, as plants recover after heat or drought that extends the flowering stage. It is, however, seldom more effective than control during 20 to 30% in bloom.

Table 2: Fungicides for canola.

Characteristics Active ingredient	**Score** Difenoconazole 250g/ℓ	**Amistar Xtra** Azoxystrobin Cyproconazole 200g/ℓ and 80g/ℓ	**Prosaro 250EC** Prothioconazole Tebuconazole 125g/ℓ and 125g/ℓ
Volume water			
Air ℓ/ha			30 – 40
Soil ℓ/ha	300	200 – 450	300
Procedure	Systemic	Systemic	Systemic
Registration			
+Dosage/ha			
Altenaria			
(*Alternaria* spp)	500mℓ (g)	1 000 – 2 000mℓ (g)	None
Blackleg	500mℓ (g)		630 – 760mℓ (g)
Leptosphaeria maculans			630 – 760mℓ (ℓ)
Sclerotinia stem rot		1 000 – 2 000mℓ (g)	630 – 760mℓ (g)
			630 – 760mℓ (ℓ)

NB: List possibly not complete. Follow product label. (New registrations may be added in future.)

Identification of *Sclerotinia* stem rot:

- *Sclerotinia apothecia* develops on *Sclerosia* in winter. It resembles small mushrooms with a "golf-tee shape".
- Fuzzy white (mycelia) grows on the plant stem.
- The plant stops growing above the point of infection. The vascular tissue gets damaged by the fungus and the plant cannot absorb water and nutrients.
- The affected part of the plant is grey-white or brown-white in colour.
- Black-brown *Sclerosia*, resembling mouse droppings, of up to 15mm in length develop inside and on the stem.

Lifecycle of *sclerotinia*

- In favourable conditions, small structures (apothecia) that can resemble mushrooms develop on the *sclerotia* and spores are released from there and spread by the wind (*Figure 2*). The spores are released 10-14 days after apothecia are formed. The ideal temperature for apothecia to develop varies between 11 and 15°C.
- The spores germinate on the old flower petals that serve as nutrition.
- Infected flower petals fall on the leaves or against the stem, where the mycelium penetrates and infects the plant.
- Climate during bloom plays a key role in disease development, as it requires moist conditions. The optimum temperature for development is 15°C, but it will even develop in up to 25°C if sufficient moisture is available.
- *Sclerosia* develops in the plant stem and can survive three to four years in the upper 5cm of the soil and up to ten years if worked in deeper. Apothecia develop only on *sclerotia* that occurs in the top few centimetres of the soil when the climate is favourable.

Management of the condition

- Follow a four-year rotation with non-susceptible crops (grains). Lupins are even more susceptible to *Sclerotinia* than canola and *sclerotia* can survive up to ten years in the soil, in case it occurs deeper (>5cm) in the soil.
- Adjacent fields are significant. Keep history of the field and current crop in mind. If possible, plant 500m away from previously infected field.
- Plant susceptible crops upwind of the contaminated area, according to prevailing winds.
- There is no cultivar available in South Africa with resistance to *Sclerotinia*.
- Clean seed has to be sown. During harvesting, *sclerotia* can end up along with seed.
- Wider plant rows can promote airflow for plants to dry off quickly.
- Observe the season when the plants start blooming. Fill out the *Sclerotinia* stem rot risk list and determine the risk of the particular crop.
- Control broadleaved weeds such as devil's thorn and wild radish, since they are also hosts of the disease.
- After planting, chemical control is the only option to manage the disease. The cost of spray applications must be weighed against the yield increase and price of canola.
- Fungus control has to be applied before infection is visible. (Use the *Sclerotinia* stem rot risk list to determine the risk.)
- The best stage of chemical control is 20 to 30% in bloom. (Follow indications on the product label.)
- A minimum of 100ℓ of water per hectare must be sprayed, preferably along with the chemical agents. Chemical agents only have an effect for a limited period. Determine what this is and consider costs before a follow-up spray treatment is attempted.
- The accepted norm for calculating losses is 0,5% loss in yield for every 1% plant infection. With substantial infections, it is closer to a ratio of 1:1.

Sclerotinia apothecia, small structures that can appear like mushrooms.

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