



PROTEIN RESEARCH FOUNDATION

Timely canola production tips and information



Compiled by the Canola Council of Canada



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Sclerotinia stem rot management

Key points

- All areas of the Prairies are at risk. Geography does not provide immunity to this disease.
- Prevalence of Sclerotinia stem rot has a direct correlation to above-average moisture. If a field has regular rains or high humidity or both from two weeks before flowering and through flowering, then infection will occur. If these conditions continue after flower, severity of the disease will be high and yield loss will be significant.
- If these conditions are present and canola has a yield potential of 30 bu/acre or greater, then a fungicide application at 20% - 30% flower is warranted. Fungicide may also pay for yield potential below that level.
- Assess disease levels before choosing a swathing date. Swath based on the best time for the healthy plants, not the diseased plants. Swathing Sclerotinia infected canola too early can reduce yield further and increase the potential green seed count, adding unnecessarily to the losses on the crop.

What is Sclerotinia stem rot?

Sclerotinia stem rot is caused by the fungus *Sclerotinia sclerotiorum*. The fungus overwinters as sclerotia, either in the soil or in stubble at the soil surface. With moisture and warm weather, these sclerotia germinate to each form up to 15 apothecia, tiny golf tee shaped mushrooms. After rain it takes ten to twelve days for apothecia to grow to a point where they release ascospores into the air.

Wind spreads ascospores all over the countryside, but only those that land on canola petals concern canola growers. Ascospores cannot infect plants directly. They need dead tissue, such as fallen petals adhering to leaves and stems, to continue their cycle. Decaying petals give ascospores the energy to produce hyphae that release oxalic acid and other infection agents, which the fungus needs to invade healthy plant tissue and infect the plant. Once inside the plant, the fungus grows up and down the stem, eventually cutting off moisture and nutrient flow and killing the plant.

The next generation of sclerotia are produced within the white mass of fungal hyphae, growing inside and in extreme cases, outside the stem. Because most fungicide sprays do not effectively penetrate the stem tissue to eradicate infection, living flowers are the best targets for fungicides to prevent Sclerotinia infection.

Sclerotinia risk factors

With widespread Sclerotinia infection in past years and with widespread canola production, all regions of the Prairies are at risk. The following factors will determine the level of risk based on field conditions this year.

1. Moisture

Moisture is the key factor in Sclerotinia stem rot risk. Good soil moisture and a few rain storms in the period starting two weeks before flowering and carrying through to infection after flowering will greatly increase the Sclerotinia stem rot risk. Alternatively low rainfall and low humidity through these stages will greatly reduce the disease risk. Fungicide applications rarely provide a benefit in these conditions.

Moisture can come from rain, relative humidity in the high 80s or morning dew. High humidity and dew are often enough for the disease to form. Keep in mind that humidity is often higher in the canola canopy than at the local weather station or in the farm yard – consider this when estimating disease risk. Interestingly, heavy rain can actually reduce the risk if the timing is right. Heavy and frequent rains can inhibit ascospore release by covering up apothecia and heavy rains can wash petals off the plants.

If a region had been dry for a couple of weeks leading up to flowering, had one large rainstorm, then turned dry again, one big rainfall event will not increase the Sclerotinia risk much. However, if that one big rainfall event is followed with high humidity and lots of dew (wet legs every morning you



Sclerotia resting body, the small black orb, on a severely infected stem. With moisture and warm weather, these sclerotia germinate the following summer to each form up to 15 apothecia.

Source: Kelly Turkington, AAFC. **Photo:** <http://www.canolawatch.org/wpcontent/uploads/2013/01/Sclerotia-on-severelyinfected-stem-Turkington.jpg>



Sclerotinia apothecia.

Source: Faye Dokken-Bouchard, Saskatchewan Ministry of Agriculture. See more apothecia photos on page 9 and 10. **Photo:** http://www.canolawatch.org/wpcontent/uploads/2011/06/apothecia-2-Dokken-Bouchard_opt.jpg



walk through the field) it may be enough to sustain the fungus. Note that if conditions stay wet after a few weeks of dry conditions, it will take about two weeks before the release of spores from apothecia germinated by this rain will infect petals. If flowering is close to wrapping up within that time, a fungicide spray may not benefit the crop.

2. Temperature

Moisture has a much larger influence than temperature, even though temperature can influence severity. Night and morning lows of 15°C are ideal for *Sclerotinia*, especially with heavy dew. Infection may not advance during the heat of the day, but it will grow at night.

Infection can be high in hot weather as long as the moisture is there. Hot days can reduce *Sclerotinia* stem rot infection rates if heat causes infected petals to dry up and blow off the plant. Heat may also cause canola plants to drop lower leaves at an accelerated pace. If infected leaves drop before infection spreads to the stem, the heat will have indirectly stopped the infection.

3. Canopy conditions

Sclerotinia disease level is highly dependent on the microclimate within the field. Factors that result in moisture-laden canopies include:

- Variety selection – higher disease levels will occur in varieties that have more leaf area (which usually means high yield potential, more area for falling petals to land on and greater canopy closure which tends to trap moisture in the canopy), tall stature, and/or poor standability.
- High fertility levels – higher nitrogen rates or the addition of manure results in heavier, more dense and thick canopies, which tend to increase humidity in the canopy.
- Degree of lodging – lodged crops tend not to dry out quickly and increased direct plant-to-plant contact will increase disease spread from infected to healthy tissue.
- Seeding date – neighbouring canola fields with different seeding dates and maturities may have different levels of *Sclerotinia* damage, depending on how their flowering stages coincided with weather conditions conducive to disease infection and development.
- High plant populations – dense stands are good for competition with weeds and earlier, more uniform maturity, but they tend to result in moist canopies. In addition, higher plant populations usually result in plants with smaller, weaker stems that are more prone to lodging. However, thin stands are not immune either.

Conventional wisdom would be that with fewer plants per square foot, the canopy would be more open, less humid and at lower risk of infection. This might be true for a thin canopy with low yield potential, but if a canopy of two to three plants per square foot fills in, it will have very large plants with lots of leaf material, lots of branches and a longer flowering period. This could actually increase the risk of yield loss from *Sclerotinia*, because the crop is flowering longer and dropping petals into the canopy over a longer period. With larger leaves and more branches, these plants have more surface areas for petals to land.

In general, growers cannot bank on wider row spacing and low seeding rates to reduce risk. Any risk reduction from these strategies requires the weather conditions to cooperate. If winds move dry air through the canopy and keep the crop dry for much of the day, then a more open canopy may be beneficial. However, if wet conditions predominate throughout flowering, then any risk reduction will be minimal. Once plants are infected, a few hours of hot and dry conditions each afternoon may stop the pathogen for a short part of the day, but it will restart again in the evening with cool humid conditions.



With ample moisture evident in this canopy, these petals fallen near the main stem will likely lead to *Sclerotinia* infection unless they have been sprayed.

Photo: <http://www.canolawatch.org/wpcontent/uploads/2013/01/Petals-falling-onleaves-small.jpg>

Good soil moisture and a few rain storms in the period starting two weeks before flowering and carrying through to infection after flowering will greatly increase the *Sclerotinia* stem rot risk.



4. Rotation

Seeing as the environment is such a large factor in Sclerotinia infection rates and with so many acres of host crops (e.g. canola, beans, lentils, sunflowers) across the Prairies, rotation on any field does little to reduce the Sclerotinia risk.

The risk assessment score card

The score card (**Table 1**), which was developed in Sweden, outlines the risk factors that can increase the incidence and severity of Sclerotinia stem rot in canola. Fill out the checklist for each field shortly after first flower – when 75% of the canola plants have at least three open flowers. The greater the risk score for a field, the higher the probability of a positive economic return from a fungicide application. Results in Sweden have suggested that fields scoring 40 or higher will likely benefit from a fungicide, but canola prices are higher and fungicide prices are lower than when the score card was developed, so a score of 30 to 35 might be a better starting point. When filling in the card, score at least a five for rotation risk, no matter the rotation on a particular field. Even if one field has a one year in four canola rotation, odds are some fields close by are in a tighter rotation.

In general, late applications are not as effective as applications at 20% flower, since the main stem flowers first and these flowers are more likely to drop on main leaves and against the main stem.

Table 1: The checklist, developed in Sweden, can help determine if it will pay to spray for Sclerotinia stem rot.

SCLEROTINIA STEM ROT CHECKLIST		
(For each risk factor, circle the risk points that apply to your field.)		
RISK FACTOR	POSSIBLE ANSWERS	RISK POINTS
Number of years since last canola crop	More than six years	0
	Three to six years	5
	One to two years	10
Disease incidence in last host crop	None	0
	Low (1% - 10%)	5
	Moderate (11% - 30%)	10
	High (31% - 100%)	15
Crop density	Low	0
	Normal	5
	High	10
Rain in the last two weeks	Less than 10 mm (0,4")	0
	10 mm - 30 mm (0,4" - 1,2")	5
	More than 30 mm (1,2")	10
Weather forecast	High pressure	0
	Variable	10
	Low pressure	15
Regional risk for apothecia development	None found	0
	Low numbers	10
	High numbers	15
TOTAL RISK POINTS FOR ALL RISK FACTORS =		

Source: <http://www.canolawatch.org/wp-content/uploads/2011/06/Sclerotiniacheck-list1.png>



The hail factor

Hail cannot cause Sclerotinia stem rot and there is no evidence that this pathogen will enter plants directly through a hail wound. However, hail can move petals and stripped leaves – the food source for the germinating Sclerotinia spores – down into the canopy, which may increase the level of infection.

Alternatively, hail could move those petals off the leaves onto the ground, reducing infection. Hail at flowering can extend the flowering period, which extends the susceptible period for Sclerotinia.

Will it pay to spray?

If the above risk factors are present, then yes, spray will quite likely pay and may pay very well. However, payback is not guaranteed. Growers who are unsure could leave a few check strips and compare yields for treated versus untreated parts of the field.

Fields sprayed with fungicide in the 20% - 50% flower window can still have Sclerotinia. Fungicides reduce the severity of infection, but will not eliminate Sclerotinia completely, especially if conditions are favourable all through flowering. Spraying twice will help prolong the protection when the flowering period is extended, but even that will not completely eliminate the disease when pressure is high.

Sclerotinia tolerant varieties

Growing Sclerotinia tolerant varieties may reduce the infection level, but Sclerotinia stem rot will still occur in these varieties. With extended moisture through the Sclerotinia risk period, fungicide will often provide a return on investment even when these varieties are grown.

When to spray?

Petals are the spray target. Spraying is not effective until the flowering stage. Fungicides do not cure infection, but are used to prevent spores from growing on petals after petals have fallen onto leaves and stems and started to decay. It is easier to spray petals at the top of the canopy rather than after they have fallen – this is why living flowers are the target.

Timing should be within the window from 20% - 50% bloom (some products are registered for only 20% - 30% bloom). At 20% bloom no petals have dropped and no pods are forming. At 30% bloom, petal drop has just begun and side branches are just starting to bloom. Canola can reach 20% flower four to five days after first flower. You should thus prepare to assess the Sclerotinia stem rot risk as soon as flowering starts.

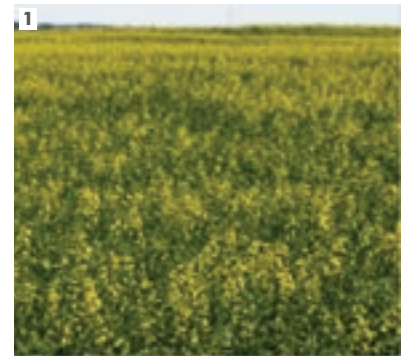
Spraying at 20% - 30% bloom ensures that a large number of flowers have opened and the spray will cover petals before they drop. Split applications – two lower rate applications 7 to 14 days apart – can be worthwhile if conditions are good for fungal growth and the crop flowers for a long period. Split applications might also be best for crops with plants at multiple stages. The first application can be made when the first plants reach recommended staging. If necessary, a second application can be made when the remaining plants are ready to be sprayed. Not all products are registered for a split application.

Late applications

If conditions are dry at the early flower stage and it then rains at 40% - 50% flower, spraying at the end of the window may be effective – especially if branching or strong plant recovery from heat or drought stress extends the flowering period.

Applications after 50% flower are not on fungicide labels and may be inside the pre-harvest interval (<http://www.canolawatch.org/2011/08/04/pay-attention-to-pre-harvest-intervals/>) for some fungicides.

In general, late applications are not as effective as applications at 20% flower, since the main stem flowers first and these flowers are more likely to drop on main leaves and against the main stem. These main stem petals lead to



Photos 1 and 2 show canola at 10% bloom. Within a few days, the crop will be at 20% bloom – the earliest stage to spray for Sclerotinia stem rot management. Photos 3 and 4 show 50% bloom.

Source: BASF. Photo: <http://www.canolawatch.org/wpcontent/uploads/2012/06/Photoquiz7.jpg>



infection that girdles the main stem. Also, earlier infections have more time to develop and cause more damage to the plant. At or after 50% flower, most of the flowering is on side branches. These petals tend to drop onto upper leaves and side branches, causing minimal damage to the main stem. However, if the crop lodges, infection on side branches can spread to main stems. Using spray volume and pressure that drives fungicides down into the canopy may still provide some protection at these stages.

Remember that fungicide does not provide a curative benefit, therefore any infection present before application will not be stopped. A late application may stop subsequent infection, but infection that is already present can spread throughout the plant and from plant to plant in cases of extreme lodging, reducing the effectiveness of this late application.

Spraying hailed crop

Canola beat down by hail at early flowering can recover and start to bolt and re-flower again. In that case, growers may see a benefit from spraying for Sclerotinia again if yield potential is above 25 bu - 30 bu/acre and conditions are moist (rain, humidity and/or dew). Keep in mind that some fungicides are registered for only one application per year. If you already sprayed that product, switch to a different one.

What to spray?

Table 2: There are many fungicide groups available and growers are recommended to rotate fungicides.

FUNGICIDES REGISTERED FOR IN-CROP SCLEROTINIA STEM ROT CONTROL				
PRODUCT	APPLICATION WINDOW	SPLIT APPLICATION	PRE-HARVEST INTERVAL (PHI)	FUNGICIDE GROUP
Astound	20% - 50% flowering	No	35 days	9 and 12
Lance	20% - 50% flowering	Yes, 7 - 14 days apart	21 days	7
Proline	20% - 50% flowering	No	36 days	3
Quadris	Prior to 30% flowering	No	30 days	11
Quash	20% - 50% flowering	No	45 days	3
Rovral	20% - 50% flowering	Yes	38 days	2
Serenade	20% - 30% bloom	Yes, 7 - 10 days apart, if necessary	None	44
Vertisan	20% - 50% bloom	Yes, 7 - 14 days apart (DuPont recommends one application)	21 days	7

Source: <http://www.canolawatch.org/wpcontent/uploads/2013/01/Fungicides-for-sclerotinia.png>

Adding insecticide

Tank mixing insecticide with Sclerotinia fungicide can work when insects are also at thresholds. If the insect threat to crop yield is low, this insecticide treatment can actually have a detrimental effect on yield – this is because pollinators are especially active during the flowering stage – the Sclerotinia fungicide stage. Some studies have shown pollinators can contribute 13% - 16% to canola yield. Taking out pollinators with insecticide will reduce this yield benefit and the spray may also eliminate many beneficial insects that could prevent future outbreaks.

When looking for Sclerotinia stem rot, look for areas in the field with lodged or prematurely ripened plants.



Sclerotinia and swath timing

In fields badly infected with Sclerotinia stem rot, swath when the healthiest plants are ready. These plants will provide most of the yield. Swathing early will not preserve seeds in badly infected plants – those seeds are unlikely to mature no matter when you swath – and swathing healthy plants before for example 30% seed colour change may not allow those healthy seeds to mature and fill fully.

Swathing in little rain or in the evening dew will limit shattering of mildly infected plants that may have some yield, but have dried down prematurely. Fields with a large percentage of diseased plants may be poor candidates for straight cutting due to the increased shattering risk.

Pre-harvest disease assessment

Pre-harvest is a good time to scout canola fields for disease severity. Identifying diseases at this stage is part of next year's disease management planning.

When looking for Sclerotinia stem rot, look for areas in the field with lodged or prematurely ripened plants. Examine the basal (bottom) to middle of the stem. Sclerotinia leaves a bleached or tan lesion on the stem. In serious cases, white, downy growth appears on green stems and as the stem dries, it will be bleached or brown (like a bone) and shredded, typically around the entire stem. Hard, black sclerotia bodies (typically similar in appearance to mouse droppings, but larger) can be found inside the stem or on the ground near the stem. Visit <http://www.canolawatch.org/2012/08/29/diseases-to-look-for-while-harvest-scouting/> for more information on how to identify various diseases, including blackleg that may be present and visible at this stage.

Planning for next year

For infested fields, think back to the risk profile in the field when you were making the fungicide decision. If you didn't spray, what made you decide not to spray? If you did spray and Sclerotinia infection rates are still high, at what stage did you spray? At what rate? What were the conditions? (Some fungicides lose efficacy if sprayed above 25°C.) Answers to these questions will help with the spray decision next year.



Sclerotinia on stem at harvest time.

Photo: http://www.canolawatch.org/wpcontent/uploads/2013/01/sclerotinia3_300-copy.jpg



More photos



Sclerotia inside the stem.

Source: Beth Hoar. **Photo:** <http://www.canolawatch.org/wpcontent/uploads/2013/01/cw2-image-diseasesclerotinia-sclerotia-bodies-stem-1-hoarcopy.jpg>



Sclerotinia infection on stem. With humidity in the canopy, this will continue to grow until the whole stem is dead.

Photo: <http://www.canolawatch.org/wpcontent/uploads/2013/01/sclerotinia-stem-rot-early-infection-on-stem.jpg>



Sclerotinia apothecia are quite small.

Source: Faye Dokken-Bouchard, Saskatchewan Ministry of Agriculture. **Photo:** http://www.canolawatch.org/wpcontent/uploads/2011/06/apothecia-3-penny-Dokken-Bouchard_opt.jpg



Sclerotinia stem rot at the base of a canola stem.

Source: Anastasia Kubinec, MAFRI. **Photo:** <http://www.canolawatch.org/wpcontent/uploads/2012/08/base-sclerotinia-small-Kubinec.jpg>



A late application may stop subsequent infection, but infection that is already present can spread from plant to plant within the canopy, likely making this late application ineffective.

Photo: <http://www.canolawatch.org/wpcontent/uploads/2012/07/petals-sclerotiniasmall.jpg>



Sclerotinia stem rot can spread from stem to stem when infected stems touch healthy stems. That is why the disease can be worse in lodged crop.

Photo: <http://www.canolawatch.org/wp-content/uploads/2012/08/Sclerotinia-from-directcontact-small.jpg>



Ask a follow-up question

Email to: whetterj@canolacouncil.org

Source

Canola Watch – free, unbiased, timely and research focused
January 9, 2013 – Issue 1 (<http://www.canolawatch.org/category/2013issue-1/>)

Categories

- Disease (<http://www.canolawatch.org/tag/disease/>)
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