BLACKLEG

IN WESTERN CANADA

BLACKLEG OF CANOLA IN WESTERN CANADA

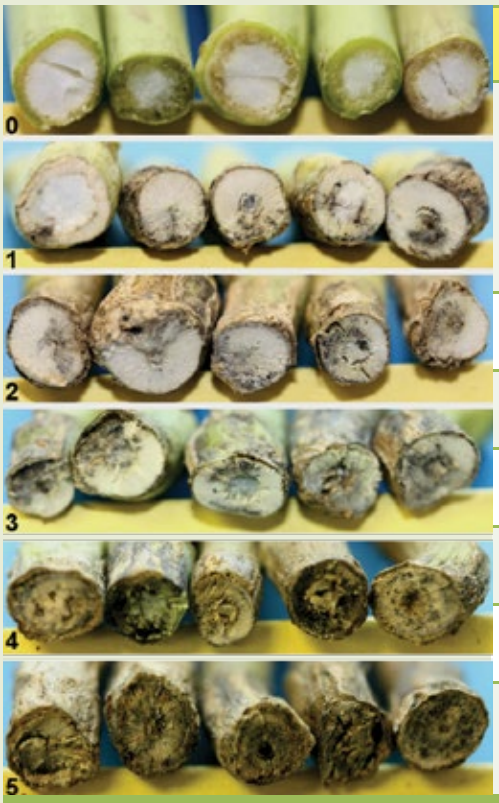
Introduction

Blackleg is a serious disease of canola, and other brassica crops, which can result in significant yield loss in susceptible varieties. It is caused by a complex of fungal species. Only the highly virulent species, *Leptosphaeria maculans* causes severe damage to canola in Canada, while the weakly virulent species, *L. biglobosa* generally does not cause serious infection or yield loss.

In heavily infested fields, a large percentage of plants may develop basal stem cankers. In most fields, however, the yield losses are minimal due to low disease levels, although yield losses of 50% or greater have been reported in western Canada. Blackleg-resistant varieties and good crop rotations helped minimize the disease impact in the 1990's and early 2000's. Recent increases in canola acres and short rotations, have the potential to increase blackleg inoculum levels and disease risk.

Key Points

- Blackleg is a fungal canola disease, which has increased in incidence and severity in western Canada in recent years.
- The pathogen population has been changing, which has made some major resistance (*R*) genes in current canola varieties ineffective in some fields.
- Learn to ID blackleg and scout for symptoms especially during or after swathing, to assess the risk for blackleg.
- Reduce blackleg risk by using resistant varieties, rotating resistance varieties and growing non-host crops (cereals or pulses) for 2-3 years between canola crops. Never plant canola on canola stubble.



Scouting for Blackleg Severity

Before swathing or immediately after, examine 10-20 plants at each of 5 sites along a "W" pattern in the field (50-100 total). Observe entire plant and look for grey leaf/stem/pod lesions with black pepper-like spots (pycnidia), or a basal canker or dry rot at the stem base. Clip the base of the stem in order to score diseased tissue in the cross section.

	0	No diseased tissue visible in the cross section
	1	Diseased tissue occupies 25% or less of cross section
	2	Diseased tissue occupies 26-50% of cross section
	3	Diseased tissue occupies 51-75% of cross section
	4	Diseased tissue occupies >75% of cross section with little or no constriction of affected tissues
	5	Diseased tissue occupies 100% of cross section with significant constriction of affected tissues; tissue dry

This factsheet was developed by the Canadian Blackleg Steering Committee, including members from: Agriculture & Agri-Food Canada, Alberta Agriculture & Rural Development, Alberta Innovates - Technology Futures, Canola Council of Canada, Manitoba Agriculture, Saskatchewan Ministry of Agriculture, and University of Manitoba.

Blackleg infections in western Canada are primarily initiated by spores (pycnidiospores and ascospores) produced on infected canola residue (rather than infected seed). Early infections can cause severe damage later in the season.

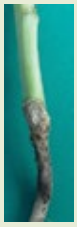
Asexual fungal fruiting bodies called pycnidia and sexual fruiting bodies, called pseudothecia, release microscopic spores that spread to canola crops.

Sexual "ascospores" (pictured above) **are airborne, resulting in a longer-distance disease dispersal.**

Asexual "pycnidiospores" (pictured above) **can be repeatedly spread through splashing water from rain or irrigation or by wind, contributing to secondary disease cycles.**

The earlier the infection occurs (on cotyledons, for example), the greater the likelihood of basal stem canker development and more severe yield loss. Infected residues may continue to produce pseudothecia for at least two years or until the residue breaks down.

Symptoms of the disease are often associated with wounds caused by hail damage or root maggot feeding.



Basal cankers weaken stem tissue, leading to yield loss

With the agronomic practices followed in western Canada there is no risk of blackleg spread from infected seeds or pods

Most important source of infection in western Canada: **pycnidiospores** spread from leaf lesions by rain splash

Blackleg symptoms can be found on all above ground portions of the canola plant including cotyledons, leaves, stems and pods. Lesions reduce photosynthetic capacity and cause loss of water and nutrients to the plant, resulting in yield loss.

Field symptoms often appear as prematurely ripened, lodged, or dead patches. Foliar symptoms include gray lesions with or without dark borders and may contain the spore-producing pycnidia, which appear as pepper-like black spots.

The tell-tale symptom of blackleg is a canker or dry rot at the stem base. Basal stem cankers consist of hard, dry, woody tissue that, when cut in cross section at the soil line, reveal blackening of the vascular ring and cortex. Severe stem girdling impedes transport of water and nutrients, and weakens the stem to cause lodging.

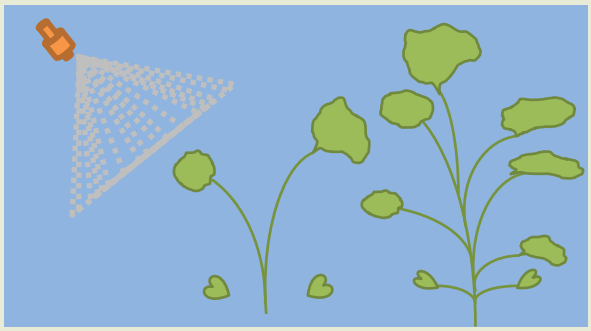
Management: Plant certified disease-free seed, and use a chemical seed treatment. Second, avoid planting canola into fields with infested canola stubble. Third, the use of resistant canola varieties is the cornerstone of blackleg management. Provincial Seed Guides can provide information on blackleg resistance in canola varieties. While the specific *R* genes carried in different canola cultivars are yet to be known, it may be possible avoid selection against specific *R* genes by rotating canola cultivars from different seed companies within the crop rotation. This may maximize the likelihood of genetic diversity in canola rotations.

The canola industry is working towards the development of a *R* gene labeling system for canola varieties that will help producers in making informed variety selection and rotation decisions.

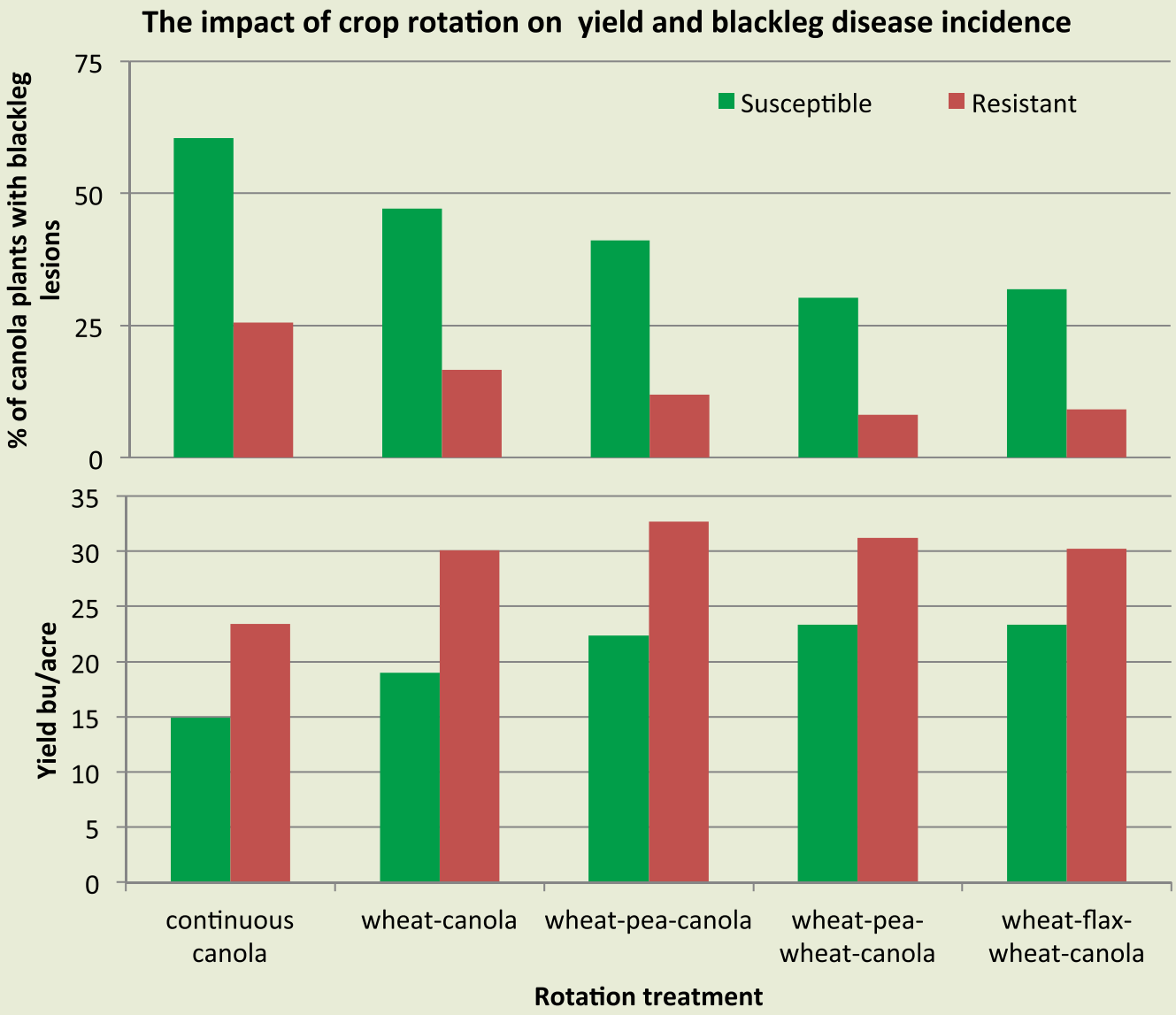
Due to the fact that the blackleg pathogen does not survive in soil, it only persists as long as the canola residue (approximately 2-3 years). Therefore, blackleg can be successfully managed by using adequate rotation away from susceptible crops. A one in four rotation is recommended and, when used with resistant varieties, the strategy will provide optimal management of blackleg in most years.

Research on burning or burying of stubble showed minor or no effect on blackleg.

Finally, a protective fungicide spray can reduce severity and prevent yield loss in situations where the variety has lost resistance and disease pressure is high. Fungicide application should be done as an early preventative treatment (2 to 6 leaf stage) in high risk fields with good yield potential.



Risk Factor	0–1 Low Risk	2–3 Medium	4–5 High Risk
Field History			
Scouting	Always	Sometimes	Rarely
Variety	Resistant (R)	MR or MS	Susceptible (S)
Crop Rotation	3-4 year break	2 year break	1 year break or less
Canola Rotation	Different Variety	Same Variety	Same Variety
Canola Buffer	>400 meters to next canola crop or stubble	100-400 m / 50-100 m to next canola crop or stubble	0 to 50 meters to next canola crop or stubble
Foliar Fungicide	Preventative fungicide application	None	None
Weather	Dry	Average	Wet
Other IPM	Good control of canola-related weeds, residue management practices	Poor control of canola-related weeds, reduced tillage, straw chopping	Volunteer canola and related weeds present, zero tillage, lots of residue



Data from Kutcher, H.R., Brandt, S.A., Smith, E.G., Ulrich, D., Malhi, S.S., and Johnston A.M. 2013. Blackleg disease of canola mitigated by resistant cultivars and 4-yr crop rotations in Western Canada. Canadian Journal of Plant Pathology. 25(2): 209-221. Figure used with the permission of the publisher Taylor & Francis Ltd. (www.tandfonline.com)

It is understood that the economics of canola production may, at times, entice producers to push rotations to canola every year or every second year. While this may seem wise for reasons of short-term profitability, it is important for canola producers to keep in mind the risks associated with short rotations, including:

- Reduction in canola yield.
- A rise in blackleg disease potential which can affect many fields or farms regionally.
- Selection for resistance-breaking races of the blackleg fungus, which can lead to erosion of resistance in commercial cultivars in as few as two or three seasons of continuous canola.
- Build-up of other plant diseases such as root rot complex, sclerotinia, and clubroot.
- An increased reliance on fungicides, which is more costly and carries associated risks of development of fungicide resistance in various pathogens.
- Other agronomic concerns including weed control and establishment of insect pests.
- **THE PURPOSE OF A GOOD CROP ROTATION IS TO MAINTAIN DIVERSITY IN THE CROPPING SYSTEM.**

Resistance to *L. maculans* in canola can be in the form of quantitative or adult plant resistance and qualitative or race-specific resistance. Plants and pathogens have co-existed throughout their evolution. Changes in pathogen virulence are continually balanced by changes in the resistance of the host (and vice versa). Therefore, when a resistant cultivar is introduced the pathogen population may change to overcome it. In nature this is a slow and gradual process. Plant breeding accelerated the development of resistance, but loss of resistance can also be accelerated without judicious use of these cultivars.

Research has indicated that many western Canadian canola cultivars carry a good level of adult-plant resistance; infected plants show slower infection development and reduced disease impact relative to susceptible varieties. This type of resistance can be more resilient to changes in a pathogen population.

In order for resistance genes to be effective in canola, they need to correspond to the avirulence genes present in the pathogen population. Preliminary research conducted in western Canada, shows that *Rlm3* is the major *R* gene found in canola cultivars, either on its own or in combination with other genes such as *Rlm1*. However, pathogen surveys indicate there is a high level of virulence towards *Rlm1* and *Rlm3* in the current pathogen population, meaning these specific *R* genes are no longer effective in western Canada. Additional *R* genes are being evaluated for uses in new canola varieties.

Canola	Pathogen (*L. maculans*)	
	Avirulent (*Avr*)	Virulent (*avr*)
Resistant (RR or Rr)	– (resistant)	+ (susceptible)
Susceptible (rr)	+ (susceptible)	+ (susceptible)

Resistance genes in canola will correspond only to the avirulence (*Avr*) genes in the pathogen.