

Blackleg resistance and management in canola

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Blackleg, which is caused by the fungus *Leptosphaeria maculans*, is one of the most serious canola diseases in the world. In instances where it has overcome cultivar resistance, it has been causing extensive damage resulting in huge losses.

Major vs minor resistance

Major or qualitative resistance genes prevent the blackleg pathogen from penetrating the plant, and can be observed in the field as a lack of leaf spots and crown cankers. While the qualitative gene is indicated in resistance groups from A to F, a plant can contain more than one gene, e.g. ABDF (Hyola 350).

The blackleg pathogen possesses the ability to quickly overcome qualitative resistance (in as little as three years). The resistance gene does not lose its efficiency as such. It exerts selection pressure on the pathogen population but, as the pathogen has so many races, those that are not suppressed by the particular resistance gene have the opportunity to multiply, thus becoming the dominant population within a few years. The resistance gene still suppresses the same races as before, but these races are now in the minority. This means that cultivars that rely mainly on qualitative resistance, can become susceptible to blackleg in future.

Minor or quantitative resistance genes are pieces of DNA (quantitative trait locus) that possess traits pertaining to blackleg resistance. It does not prevent leaf infections but partially suppresses the development of cankers in the crown area and stems. The greater the number of minor or quantitative genes, the lower the percentage of crown infection.

It is more difficult for the blackleg pathogen to overcome quantitative resistance as each gene carries some



Blackleg leaf spots.

degree of resistance. As such, cultivars can maintain their resistance for a longer period.

The quantitative genes in cultivars only become apparent once qualitative resistance has been lost. Canola loses its resistance at 0,15 units per year on a scale of 0 to 9 (1970 to 2000). There is no test for quantitative resistance prior to a plant losing its qualitative resistance.

Types of infection

Leaf infection or spots: Leaf infection does not affect yield. However, it does represent the onset of crown cankers as the pathogen grows from the seedling's leaves through the vascular tissue to the crown to form cankers. Leaf infection also spreads through spores to the canopy, causing upper canopy infection.

Crown cankers: These develop as a result of the fungus growing from young

leaves through the stem to the crown area. Crown cankers have the greatest potential of causing yield losses and plants must be protected against this. While the external symptoms may not appear to be that severe, the internal vascular damage can result in substantial yield losses. Interestingly, researchers have found that symptoms of internal vascular damage lead to stems turning black on the inside.

Upper canopy infection (UCI): Blackleg can infect all parts of the canola plant. UCI is a collective term used for infection of the flowers, peduncles, pods, and the upper part of the main stalk and side branches. UCI is often associated with an earlier flowering period as cultivars are planted earlier and crops undergo more rapid phenological development during autumn and winter. Physical damage by insects, hail or frost can also cause the fungus to

infiltrate the plant, which can lead to UCI symptoms on the main stalk and pods.

Impact of infection

The effect of blackleg on yield will depend on when infection occurred, and which parts of the plant had been affected. However, research has indicated yield losses of up to 30%.

Flower loss due to infection of the flowers or peduncles does not have a major impact on yield, as the canola plant compensates by producing more flowers. However, if the fungus infects the associated side branches, it can affect seed set and grain fill of the pods. Infection of the pods or peduncles after pod formation can result in substantial losses.

Infected side branches and infection of the upper part of the main stalk can influence all developing flowers and pods above the point of infection, resulting in reduced pod and seed set as well as the development of smaller seeds.

Serious infections can cause stems and side branches to break, can result in premature maturation which causes pods to open, and can cause difficulty in determining the correct cutting stage due to differences between infected and uninfected seeds.

Management strategies

Genetic resistance: Although not all qualitative resistance genes can protect against direct infection, it can prevent parts of the plant from developing spots. Genetic resistance can therefore prevent

blackleg crown cankers and UCI. It is important to alternate between cultivars with different resistance genes. (Local options are limited as there is substantial overlap between the qualitative genes in cultivars.)

Onset of flowering: There is a strong correlation between when canola plants start to flower and yield loss due to UCI. Trials performed under controlled conditions show that plants infected in the upper stalk and side branches at the onset of flowering, resulted in the greatest yield loss compared to plants which flowered or were infected at a later stage. Yield loss occurred as a result of a reduction in seed size, seeds/pods and/or pods/m². Oil content may also be lower.

Severe UCI can be prevented by slightly postponing the flowering period and not planting too early. This may, however, coincide with the increased release of ascospores, which in turn may result in an increase in crown cankers.

Fungal control of UCI: Where UCI does occur, findings indicate that fungal agents used for *Sclerotinia* control can be used to effectively reduce infection.



Crown cankers in canola, which led to the plants dying off.



Blackleg infection in the stem.



Typical symptoms of upper canopy infection. (Photograph: Steve Marcroft)

The application of certain agents for *Sclerotinia* at around 30% flowering can also protect against blackleg infection during early flowering. However, while it can control flower, peduncle, stalk and side-branch infections, it will not affect crown cankers. No products have been registered locally for treating UCI.

Keep in mind that high levels of pod infection occur during seasons characterised by late rainfall. As blackleg is seedborne, the seeds forming in those pods will already have been infected and must not be retained for planting during the following year. 🌱

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