

Frost damage identification in canola – symptoms and risk assessment

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Key findings

- Canola is susceptible to frost damage risk during its reproductive development phase.
 - Late-season frosts can have negative economic implications.
 - Accurate frost damage identification is important for making appropriate management decisions.
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Introduction

Radiation frost can occur when air temperature drops below 2 °C. Frost can be detrimental to canola grain yield and quality depending upon the crop growth stage. Generally, late spring frosts at pod development and grain-filling are economically damaging and result in grain yield reduction and poor oil quality. Correctly identifying frost-affected crops is important for crop assessment early in the cropping season and to allow for appropriately timed management decisions.

Frost risk assessment Frost risk factors

Damage to canola crops from frost can vary depending on a number of factors within a paddock including:

- temperature
- soil:
 - » type
 - » moisture
- cloud cover
- wind speed
- position in the landscape
- crop:
 - » species
 - » development stage
 - » nutrition
 - » density.

Generally, low-lying paddocks with light soils are more prone to frost risk. Frost damage can be random resulting in high yield variability within paddocks and individual plants.

Canola is most susceptible to frost risk during reproductive development from early flowering to the grain-filling stages. Canola can compensate for early flowering frost stress by producing more flowers if soil moisture is not limiting. However, the most economically damaging frosts for canola are spring frosts, which can occur during late-grain-fill. These frosts can kill developing seeds after flowering has finished and plants are unable to recover by producing more pods.

The risk of frost damage is also elevated when there are other abiotic or biotic stresses such as drought stress, heat stress, poor nutrition and disease pressure.

Frost identification

- Inspect the canola crop between late bud to grain-filling phase if night temperature falls below 2 °C. Revisit the paddock two to three days later to inspect for visible damage. Symptoms might not be obvious until five to seven days after the frost.
- Check low-lying areas first, followed by other areas at least 2 m into the paddock as plants on the outer edge can have less damage.
- Monitor pod development and seed-fill following a frost by tagging reference plants in a few spots and checking these a few days later for signs of senescence or continued development.

Frost symptoms

Bud stage

Bud discoloration occurs after frost stress in canola i.e. buds change colour from green to creamish white (Figure 1).



Figure 1 Bud discoloration in canola after a frost event.

Early flowering

Frosted plants lose flowers and abort young pods (Figure 2). Open flowers can be aborted after a frost whereas young buds and pods remain unaffected.



Figure 2 Frost damage symptoms in canola at early flowering stage.

Pod set

Frost at pod set results in abortion and death of developing seed (Figure 3). This can cause gaps in pod set and twisting of the inflorescence. The frosted pod surface can turn yellow/green and/or develop a pale blistered surface.



Figure 3 Pod abortion in two canola varieties evident at maturity.

Grain-filling

Damage during grain-fill is particularly evident after a severe late frost when developing grain turns into a mushy green mass that dries into a small black or brown speck (Figure 4). The extent of damage can be assessed by opening pods from tagged plants and checking for healthy and damaged seed.

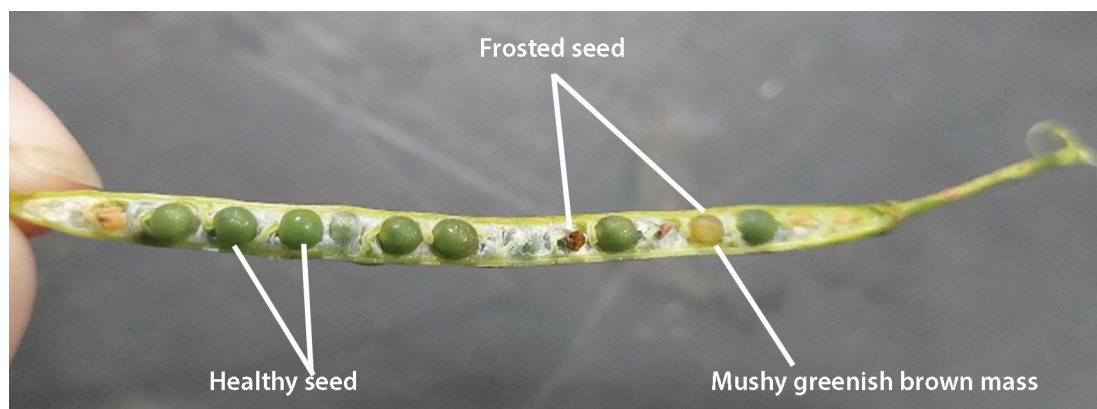


Figure 4 Frost damage symptoms on developing grain in a canola pod. Photo: Danielle Malcolm.

Frost management tips

Monitoring weather and temperature data

Frost risk occurs when air temperature falls below 2 °C (Bureau of Meteorology (BOM) prediction), however actual frost risk depends on the temperature at canopy height. BOM predictions measure temperature at 1.4 m height (standard) in a Stevenson screen and therefore it might or might not correlate well with crop height temperatures. Temperature at canopy height might be a few degrees lower than temperatures measured in a Stevenson screen. Therefore, it is important to monitor local temperatures (using iButtons, Tiny tags etc.) at paddock level and consider soil and topographic variability within each paddock.

Right phenology

No canola variety is tolerant to frost. Using more than one variety and targeting sowing windows to optimise flowering times will help to reduce frost risk in early-sown crops and heat risk in late-sown crops. As a frost avoidance strategy, a mix of sowing dates, crop types and maturity types are recommended.

Input management

Frost risk can also be managed by manipulating/avoiding in-season nitrogen application in frost prone areas, depending on the cropping season. High nitrogen application can exacerbate frost risk.

Seasonal conditions such as moisture availability play an important role in compensation from frost stress. Canola is indeterminate and flowers over 30- to 40-days. Canola can therefore recover from early flowering frost stress by producing more flowers if soil moisture availability is not limiting and other abiotic or biotic stresses are absent.

Useful resources

Frost damage identification in canola <https://www.youtube.com/watch?v=6uruleESkk8>

Frost damage identification in wheat <https://www.youtube.com/watch?v=YeOIZNmwxU>

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