

Canola – will I get an economic response from applying a fungicide?

Steve Marcroft¹, Angela Van de Wouw², Susie Sprague³, Andrew Ware⁴, Kurt Lindbeck⁵, Andrew Wherret⁶, Andrea Hills⁷, Nick Perndt¹

¹Marcroft Grains Pathology, Horsham, Vic; ²School of BioSciences, University of Melbourne, Vic; ³CSIRO Agriculture & Food, Canberra, ACT; ⁴EPAG Research, Port Lincoln, SA; ⁵NSWDPI, Wagga Wagga, NSW; ⁶Livingfarm, York WA; ⁷DPIRD Esperance WA

Key findings

- The canola industry is now more reliant on fungicides, in some regions there is less emphasis on cultural practices to minimise disease.
- The decision to use a fungicide is not clear cut. You must first understand the disease risk profile of your crop.
- Fungicide decisions at seeding time need to be made prior to sowing and therefore prior to any disease scouting.
- Blackleg crown canker results from infection during early seedling growth. Prior to sowing, use the BlacklegCM decision support tool to identify high risk paddocks and explore management strategies to reduce yield loss.
- Early vegetative (4-10 leaf) foliar fungicide application should be based on the risk profile of your crop, after scouting for leaf lesions and the potential yield of the crop.
- Fungicide application for upper canopy infection is separate to the decision-making process for crown canker. Upper canopy infection fungicide application can result in very variable yield returns. You must understand your risk before applying a fungicide.
- Our knowledge on upper canopy infection (UCI) is improving and it is likely that decision making will become more reliable. A UCI App is expected to be released via GRDC investment when we have enough confidence on recommendations to aid decision making.

Will I get an economic return from applying a fungicide to my canola crop?

In recent times new fungicide actives and new timing recommendations have resulted in large yield responses. Many agronomists have reported 20% returns, but many others have also reported no yield returns. In our trials we've achieved up to 49% return but also zero. So how do you know where your crop will sit in 2021?

Obviously predicting a yield return will be very accurate if you know exactly how much disease will occur, but unfortunately the level of crop damage caused by disease is determined by a number of interconnected factors and to complicate it even further other diseases, such as sclerotinia, white leaf spot, powdery mildew and Alternaria, can also influence economic returns.

The key is to identify the risk for an individual crop and then determine the cost of application compared to the cost of potential yield loss. In most years this is relatively easy, for example, low rainfall year is low risk, high rainfall year and high yield potential is very easy to gain an economic advantage from fungicide application. But it is the decile 4 to 7 years where there is lots to be gained or lost from fungicide decisions.

Blackleg crown canker

Do I need a seed treatment and/or fungicide amended fertiliser?

Risk factors:

1. Canola growing region – high canola intensity and high rainfall = high risk. One in four year rotations and 500 m isolation between this year's crop and last year's stubble reduces risk.
2. Variety resistance – varieties rated R-MR or above have very low risk of developing crown cankers. MR will develop cankers but only if grown under high disease severity for example, canola/wheat/canola in high rainfall.
3. Pathogen population – if you've grown the same variety for a number of years and disease severity is increasing then you sow a variety from the same resistance group you will be at a higher risk of crown cankers.
4. Crop germination timing - severe crown canker is most likely to develop when plants are infected during the early seedling stage (cotyledon to 4th leaf). The driving factor for seedling infection is the length of time that the plant is exposed to blackleg infection while in the seedling stage. Therefore, the risk of seedling infection, which leads to crown cankers, is very variable from season to season. For infection to occur blackleg fruiting bodies on the canola stubble must be ripe and ready to release spores. Fruiting bodies typically become ripe approximately three weeks after the break of the season when the stubble has stayed consistently moist. Spores are then released with each rainfall event. Temperature also has a large influence as it will determine the length of time that the plant remains in the vulnerable seedling stage. Once plants progress to the 4th leaf stage they are significantly less vulnerable to crown canker. That is, older plants will still get leaf lesions, but the pathogen is less likely to cause damaging crown cankers as the fungus cannot grow fast enough to get into the crown. Typically, plants sown early in the growing season (April) will develop quickly under warmer conditions and progress rapidly past the vulnerable seedling stage whereas, plants sown later (mid-May) will progress slowly and remain in the vulnerable seedling stage for an extended period.
5. Modern farming system changes – our research has shown that inter-row sowing which enables full stubble retention has influenced spore release timings and spore release quantity. Stubble that remains standing stays drier between rainfall events, it therefore produces less spores early in the season, when seed treatments and fertiliser fungicide are most efficient. Standing stubble can then produce more spores later in the season, these later released spores will not cause crown cankers but may increase severity of upper canopy blackleg. Standing stubble that is knocked down 12 months later can then produce spores early in the second growing season.

If sowing an R rated variety in a one in four-year rotation in mid-April the probability of getting an economic return from a seed treatment or fertiliser-amended fungicide is very low. Sow a MS rated variety in a canola / wheat / canola rotation at the end of May and you will likely get a large return from your fungicide application. The challenge with seed treatments and fertiliser-amended fungicide is that the decision to use these products are made a long time before sowing and therefore you will not know the germination date and therefore the individual season risk. But you will know the risks associated with your canola region, variety blackleg rating and distance to last year's stubble.

Do I need a vegetative foliar fungicide application?

Vegetative foliar fungicides (4-10 leaf) are also designed to protect plants from crown cankers, this application timing will extend the length of protection that you receive from your seed treatment. They are likely to give an economic return under four circumstances.

1. You've done everything wrong and your crop is getting severe disease.
2. You are in a high-risk environment chasing maximum yield and may be growing a variety with slightly inferior disease resistance. For example, the highest yielding variety in your region may be a MR (or you've retained canola seed etc).
3. The pathogen population has changed and your resistant variety has become susceptible. This could also be the case if you retain open pollinated (OP) canola seed each year.
4. The season is very conducive for blackleg. You know from previous monitoring that your normal variety is resistant in your environment but a wet season and early spore maturity has meant that disease severity is much higher than usual.

The main advantage you have when trying to determine if you will get an economic return from a foliar fungicide is that you can wander into your crop and assess the level of disease before you apply a fungicide.

1. No lesions = low disease risk; fungicides unlikely to give economic return.
2. Infected cotyledons and 1st 3 leaves = high disease risk; fungicides likely to give an economic return.
3. Dying plants from crown canker = extreme disease risk; fungicides likely to give an economic return.

Leaf lesion severity will give an indication to the likelihood of an economic return from a fungicide application. However, you must take into consideration the variety blackleg rating. All varieties that are reliant on quantitative resistance may get the same level of leaf infection. However, an R rated QR variety will not develop crown cankers whereas a MS-S variety may die, a MR variety may get partial crown infection. You also need to take into consideration the seed treatment and fertiliser amended fungicides used as these fungicides will reduce crown canker even on crops with severe leaf lesions. In most cases if you have sown a variety with adequate resistance and used as seed or fertiliser treatment then you will not need a vegetative foliar but monitor your crop and make an in-season decision.

The timing of foliar vegetative fungicide is not critical, 4-6 leaf application will provide the best protection as it will be active as the seed/fertiliser treatments run out of steam. However, by waiting to the 8-10 leaf stage you will still get good efficacy (reduced compared to the 4-6 leaf) but you will have a much better idea of how the season is progressing from a blackleg and yield potential perspective.

We recommend using the BlacklegCM App to help in making blackleg management decisions. BlacklegCM uses your variety and crop management options to predict yield loss and economic returns from fungicide applications. You can do comparisons with changed disease management options, changed varieties and changed fungicide applications. The real power of the app is that it allows you to play with as many different scenarios as you wish, and it will remind you of all the parameters that will cause yield loss for when you are working out the potential risk of your canola crop.

Upper canopy blackleg fungicide application

Blackleg Upper Canopy Infection (UCI) refers to infection of the upper stem, branches, flowers and pods and whilst we are constantly improving our understanding regarding these new symptoms, there is still a very large knowledge gap of how individual varieties react to UCI. Furthermore, our research shows that similar symptoms of UCI can cause very severe economic impact in one season and have no economic impact in another. As such, our recommendations for managing blackleg UCI is constantly evolving.

Should I apply a fungicide for UCI protection?

Currently, there is no way to predict economic return accurately. A GRDC investment is working on improving knowledge including determining timing of infection leading to yield loss, weather parameters associated with yield loss and strategies for screening for genetic resistance.

However, you can still determine if your crop is likely to be a high, moderate or low risk situation.

1. Date to commencement of flowering. Crops that flower earlier in the season are at a higher risk, they will flower in cooler wetter late winter/early spring which is more conducive for blackleg infection.
2. Time from the commencement of flowering to harvest. We hypothesis that the fungus requires a certain amount of time from when it initially infects the plant to when it causes the damage (internal infection) that leads to yield loss. The longer time period from infection to harvest = increased risk of yield loss.

The date to 1st flower and the date from 1st flower to harvest are good predictors of yield loss. This knowledge can in hindsight explain why in some regions/years yield loss can occur whilst in other years yield loss may not occur. Obviously, these key dates change between regions, for example, if two crops flower on August 7 but the mallee crop is mature on October 25 and the western district crop matures on November 25 then there is higher potential for damage to the western district crop.

3. Spring rainfall and temperature. Our preliminary data suggests that UCI given enough time will cause damage to the vascular tissue in the stems and branches resulting in yield loss to the pods. However, similar levels of disease can cause different amounts of yield loss depending on the weather during pod fill. Pods that ripen without moisture stress and during cool weather can tolerate more disease, imagine a partially blocked xylem, on a cool day the plant can still get sufficient moisture, but on a hot day the partially blocked xylem cannot deliver enough moisture.
4. Genetic resistance. This is the missing piece of the puzzle. We do know that effective major gene resistance (Resistance Groups) will stop blackleg and if your variety has effective major gene resistance your crop will not get any UCI. However, it is difficult to determine if you do have effective major gene resistance as it depends on the blackleg population on your farm. The best way to determine major gene resistance is to monitor your crop for leaf lesions. Major gene resistance is effective across all plant parts so if there are no leaf lesions it means that there could be no blackleg present or more likely that your variety has effective major gene resistance.
5. The other resistance is variety quantitative resistance, this is often indicated by the blackleg rating of your variety. Although it is possible for varieties to have a high blackleg rating from major gene but low quantitative resistance. However, if your variety has a R rating then it should either have effective major gene or excellent quantitative resistance. But what does good quantitative resistance mean for UCI control? To be honest the answer is “we don't know”, but we do know that varieties with good quantitative get the UCI symptoms but we are suspicious that these varieties may then get less damage to the vascular tissue than more susceptible varieties. This could be the same as how varieties react at the seedling stage, that

is, a MR rated variety and a MS variety both get leaf lesions but the MS then develops more crown canker and subsequent yield loss. The reality is that we need to develop a robust blackleg rating system for UCI – we're working on it.

6. Fungicide application timing. Our work has shown a wide window of response times with good results (assuming that you have a damaging level of disease) from 1st flower to 50% bloom. However, we suggest aiming for 30% bloom for a number of reasons. Firstly the 30% bloom stage is as late as you can go and still get good penetration into the canopy, your main aim is to protect the main stem which will have a greater impact on yield compared to individual branches. Secondly the 30% bloom spray will control any initial infections that have already occurred. Thirdly the 30% bloom timing will provide protection for a few weeks into the future, therefore UCI will only start occurring again after the 50% bloom stage, hopefully by then any infections will occur too late to cause significant yield loss. In 2020 we even saw this 30% time provide some protection onto pods but not at all sites and in previous years the 30% timing has not provided pod protection.
7. Pod infection is unlikely to be controlled through fungicide application. Pod infection occurs when there are rainfall events during podding and the fungal spores land directly on the pods and cause disease. We have found that severe pod infection can lead to an additional 20% yield loss. Unfortunately, no fungicides are registered for application during podding due to maximum residue limits (MRL) regulations. Major gene resistance will control pod infection.

What are the steps to determining a UCI spray decision?

1. Leaf lesions – presence of leaf lesions indicates that blackleg is present and that your variety does not have effective major gene resistance. No leaf lesions = no reason to spray.
2. New leaf lesions on upper leaves as the plants are elongating – this observation is not critical but does give an indication that blackleg is active as the crop is coming into the susceptible window. However, a number of wet days at early flower will still be high risk even if there were no lesions on new leaves up to that point. Remember it will take at least 14 days after rainfall to observe the lesions. More lesions = higher blackleg severity.
3. Date of 1st flower and targeted date of harvest - the earlier in the season flowering occurs is higher risk. This date will vary for different regions. Generally, shorter season regions can more safely commence flowering at an earlier date compared to longer season regions. Earlier harvest date results in less time for the fungus to invade the vascular tissue and cause yield loss. Consequently, if you're in a long growing season rainfall region and your crop flowers in early August and is harvested in December you are in a very high risk situation.
4. Yield potential – yield potential is simply an economic driver. A 1% return on a 3 t/ha crop is worth more money than a 1% return on a 1 t/ha crop.

How can I determine if I should have sprayed for UCI?

1. Check for external lesions.
2. Cut branches and stems to check for blackened pith, which is indicative of vascular damage and likely yield loss
3. Observe darkened branches, these branches go dark after vascular damage and are indicative of yield loss.
4. Pod infection will cause yield loss, unfortunately there is nothing that can be done to prevent pod infection.
5. Leave unsprayed strips to check for yield returns.

Which fungicide active should I use?

There are two parts to this question. Firstly, in terms of which active will give better control, few side by side comparisons have been undertaken for blackleg control. But, the GRDC blackleg rating project has undertaken comparisons for the seed treatment fungicides, data suggests that the SDHI fungicides provide protection for a longer period of time compared to the DMI fungicides. Ultimately, crop timing and determining your risk and therefore potential economic return are more important factors when choosing a fungicide.

The second aspect of choosing an active is in regard to managing the risk of fungicide resistance. Resistance towards the DMI fungicides has been detected within ~30% of Australian populations over the past three years whilst no resistance has been detected for the SDHI fungicides. However, excessive use of the SDHI fungicides has the potential to select for fungicide resistance. Therefore, limitations on the number of applications for each fungicide active within a growing season have been developed and can be found at the CropLife website:

<https://www.croplife.org.au/resources/programs/resistance-management/canola-blackleg/>

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Useful resources and references

BlacklegCM App for iPad and android tablets:

www.grdc.com.au/resources-and-publications/all-publications/publications/2020/blackleg-management-guide

Canola: the ute guide:

<https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-27/canola-the-ute-guide>

Marcroft Grains Pathology website: www.marcroftgrainspathology.com.au

