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GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

CANOLA

SECTION 9

DISEASES

MAJOR CANOLA DISEASES | BLACKLEG | SCLEROTINIA STEM ROT | VIRUSES

Diseases

9.1 Major canola diseases

Blackleg (caused by *Leptosphaeria maculans*) and Sclerotinia stem rot (caused by *Sclerotinia sclerotiorum*) are two major diseases of canola. Blackleg is less prevalent in northern NSW and Queensland; however, it is critical that blackleg be controlled by growing resistant varieties and having a 3-year break between crops to allow all the stubble to be broken down. Chemical treatment is available if considered necessary.

Several seed dressings only provide suppression of the blackleg fungus, for example those with the active ingredient (a.i.) fluquinconazole (Jockey®, Quantum®, Prowess™), whereas Maxim®XL (a.i.s fludioxonil + metalaxyl-M) provides suppression of blackleg as well as control of *Pythium* spp. and *Rhizoctonia solani*.

Impact®, Bayonet® and Jubilee® (a.i. flutriafol) are in-furrow treatments registered for the control of blackleg.

Sclerotinia stem rot is favoured by wet springs that produce cool, humid conditions in dense crops. Most broadleaf crops and many broadleaf weeds are hosts of *Sclerotinia*, including sunflowers (Figure 1).[1] Growers are advised to incorporate infected residues, maintain farm hygiene, control hosts and rotate with summer/winter cereal crops.[2]

Symptoms include fluffy external growth on the stems, in which numerous black bodies (sclerotia) are found. A possible control measure is a rotation of at least 4 years with no susceptible hosts.[3]

MORE INFORMATION

Ground Cover Radio 118: Biosecurity lesson in northern disease outbreaks

Ground Cover Radio 116: Early action the essence of canola protection

1 L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

2 L. Alexander, S. Thompson, M. Ryley, L. Serafin (2015), Sunflower Disease Management, Successful sunflower production using integrated disease management, http://www.grdc.com.au/TaT-SunflowerDiseaseManagement

3 L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

MORE INFORMATION

Foliar fungal diseases of pulses and oilseeds

Viral diseases in canola and winter pulses

Canola diseases. The Back Pocket Guide

Canola disease update

Sunflower Disease Management

Figure 1: *Sunflower crops can host sclerotinea.*

Photo: Sue Thompson, USQ.

Other fungal diseases reported in northern region canola crops include damping off. These diseases are also hosted by other broadleaf crops and weeds.

In 2013, Sclerotinia stem rot affected about 50% of canola crops in northern NSW. Outbreaks are dependent on the season, but the incidence of outbreaks is increasing in high-risk areas such as the high-rainfall zones of northern NSW, indicating that the level of residual inoculum is increasing, particularly under short rotations. The environmental conditions for development of Sclerotinia stem rot are very specific and will not occur every year, so even when the fungus is present, the disease may fail to develop if conditions are dry.

Blackleg is the most important disease of canola and has been reported as present in the northern region. Around 90% of the spores that infect a crop will originate from the previous year's stubble. Spores can travel 1–2 km on the wind, but a buffer of at least 500 m from the previous year's stubble is generally recommended. Two-year-old stubble is an issue only if the seasons have been dry. Treating seed with fungicide can protect seedlings from early infection.

Three virus species, Beet western yellows virus (BWYV, syn. Turnip yellows virus), Turnip mosaic virus (TuMV) and Cauliflower mosaic virus (CaMV), have been recorded in canola in Australia. Of these, BWYV is the most common and has potential to cause yield losses, particularly if infection occurs at seedling stage. Aphids spread these diseases from a range of pasture, crop and weed host species. [4]

4 GRDC (2014) Canola disease management in the northern region. GRDC Gound Cover, 21 March 2014, http://grdc.com.au/Media-Centre/Hot-Topics/Canola-disease-management-in-the-northern-region

Integrated disease management in canola relies on variety breeding and selection, cultural practices and timely application of chemicals such as fungicides. Burning stubble is not effective against blackleg or Sclerotinia stem rot. See more at: Canola disease management in the northern region.

9.2 Blackleg

Blackleg is the most important disease of canola, and management of the disease need not be complex. The most effective strategies to reduce the severity of blackleg include growing varieties with an adequate level of resistance for the district, separating the present year's crop from last year's canola stubble by at least 500 m, and using a fungicide seed dressing or fungicide-amended fertiliser.

Typically, ~90% of spores that infect new-season crops originate from the previous year's stubble. However, significant numbers of spores from 2-year-old stubble may be produced if seasonal conditions have been dry or the stubble is still largely intact. Spores can travel 1–2 km on the wind, but most originate more locally. A buffer distance of at least 500 m and up to 1 km is recommended. Use of fungicide seed dressings containing fluquinconazole or fertiliser treated with flutriafol will also assist in minimising the effects of blackleg and protect seedlings from early infection, which later causes stem canker development. Although raking and burning can reduce canola stubble by up to 60%, it is the least effective strategy in managing blackleg and is therefore not generally recommended.

All current canola varieties are now assessed for the presence of resistance genes and classified into resistance groups. If the same variety has been grown for two or more seasons, consider changing varieties for this season. Consult the Blackleg management guide, autumn 2015 Fact Sheet to determine the resistance group for your current canola varieties and select future varieties that belong to a different group. [5]

Blackleg most commonly causes lesions on the cotyledons and leaves of canola plants early in the growing season. It then grows without symptoms through the vascular tissues to the crown where it causes a necrosis resulting in a crown canker at the base of the plant. This crown canker causes yield loss as it restricts water and nutrient uptake by the plant. Blackleg can occur on all plant parts, however, leaf lesions and crown cankers are the most commonly observed symptoms. [6]

In 2010, cankers on the upper stems and branches were observed in a small number of commercial crops. These cankers appeared to cause yield loss as the pods on

MORE INFORMATION

GRDC Fact Sheet: 2016 Spring Blackleg management guide

GRDC funding canola stubble screening for fungicide-tolerant blackleg

Managing blackleg and Sclerotinia in canola. The Back Pocket Guide

Ground Cover Radio 118: New advice for ascochyta blight and blackleg management

Kurt Lindbeck NSW DPI discusses blackleg management in canola. GRDC Radio (Northern Update) 118: New advice for ascochyta blight and blackleg management

5 P Matthews, D McCaffery, L Jenkins (2016) Winter crop variety sowing guide 2016. NSW DPI Management Guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2016.pdf

6 K Lindbeck, S Marcroft, A Leo, A Van de Wouw (2016) Canola diseases - the 'watch outs' for 2016. GRDC Update Papers 16 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Canola-diseases-the-watch-outs-for-2016

affected branches senesced prematurely leading to early pod shatter. Interestingly, preliminary data suggest that stem/branch cankers are not correlated with the presence of traditional crown cankers.

In 2011, 2012 and 2013 cankers on upper stems and branches were observed each year but symptoms were not generally severe. In 2014, the symptoms were more widespread and in some cases caused significant yield loss. In 2015, upper stem and branch cankers have been reported from a number of districts in southern NSW and has caused serious yield loss in some instances. Reports have also been received of symptoms of upper canopy infection being mistaken for sclerotinia stem rot. [7]

Possible causes of upper stem and branch infection

With the adoption of no-till cropping systems, many canola crops are now sown earlier in the growing season or even into dry soil. These crops are developing earlier, elongating and in many cases flowering in late winter. In the past, crops typically remained in the vegetative growth stage during the winter period, elongating at the onset of spring. Ideal conditions for infection by *Leptosphaeria maculans* (constant leaf wetness that coincides with ascospore release) occur during winter. This suggests that the stem/branch cankers result from direct infection at the stem elongation/flowering growth stages due to advanced development of the crop.

Management of upper stem and branch infection:

- Try to ensure stem elongation occurs in the normal flowering window, not in winter when blackleg intensity is at its highest.
- Reduced blackleg severity by maintaining 500 m distance between your crop and the previous season's stubble.

Blackleg tolerance to Fluquinconazole

In regions where canola is grown intensively growers depend on fungicides to support variety resistance. The only commercially available fungicides are different forms of triazoles (DMIs; Group 3). Due to the widespread use of fungicides with the same mechanism of action, and the propensity for *L. maculans* to overcome variety resistance, the canola industry has concerns that *L. maculans* may develop triazole resistance. [8]

See Canola diseases - the 'watch outs' for 2016 for results of a GRDC survey on fungicide tolerant blackleg populations.

Key points

- Never sow your canola crop into last year's canola stubble.
- Monitor your crops in spring to determine yield losses in the current crop.
- Choose a cultivar with adequate blackleg resistance for your region.
- Relying only on fungicides to control blackleg poses a high risk of fungicide resistance.
- If your monitoring has identified yield loss and you have grown the same cultivar for three years or more, choose a cultivar from a different resistance group. [9]

7 K Lindbeck, S Marcroft, A Leo, A Van de Wouw (2016) Canola diseases - the 'watch outs' for 2016. GRDC Update Papers 16 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Canola-diseases-the-watch-outs-for-2016

8 K Lindbeck, S Marcroft, A Leo, A Van de Wouw (2016) Canola diseases - the 'watch outs' for 2016. GRDC Update Papers 16 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Canola-diseases-the-watch-outs-for-2016

9 GRDC (2016) 2016 Spring Blackleg management guide. GRDC Fact Sheet, http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide

9.2.1 Steps to beating blackleg

Step 1. Determine your farm's risk

Use Table 1 to determine your farm's blackleg risk. Combined high canola intensity and adequate rainfall increase the probability of severe blackleg infection.

Table 1: *Regional environmental factors that determine risk of severe blackleg infection.*

Environmental factors	Blackleg severity risk factor								
	High risk			Medium risk			Low risk		
Regional canola intensity (% area sown to canola	>20	16–20	15	11–14	11–14	10	6–9	5	<5
Annual rainfall (mm)	>600	551–600	501–550	451–500	401–450	351–400	301–350	251–300	<250
Total rainfall March–May prior to sowing (mm)	>100	>100	>100	>100	91–100	81–90	71–80	61–70	<60

Step 2. Determine each crop's blackleg severity in spring

- Assess the level of disease in your current crop. Sample the crop any time from the end of flowering to windrowing (swathing). Pull 60 randomly chosen stalks out of the ground, cut off the roots with a pair of secateurs and, using the reference photos in Figure 2 below, estimate the amount of disease in the stem cross-section. Yield loss occurs when more than half of the cross-section is discoloured.
- A dark-coloured stem is a symptom of blackleg (Figure 2). Stem cankers are clearly visible at the crown of the plant. Severe cankers may cause the plant to fall over as the roots become separated from the stem.
- If you have identified that you are in a high-risk situation (steps 1 and 2), use steps 3 and 4 to reduce your risk of blackleg for future seasons.
- If you are in a low-risk situation and you have not identified yield loss due to blackleg infection when you assessed your crop, continue with your current management practices.

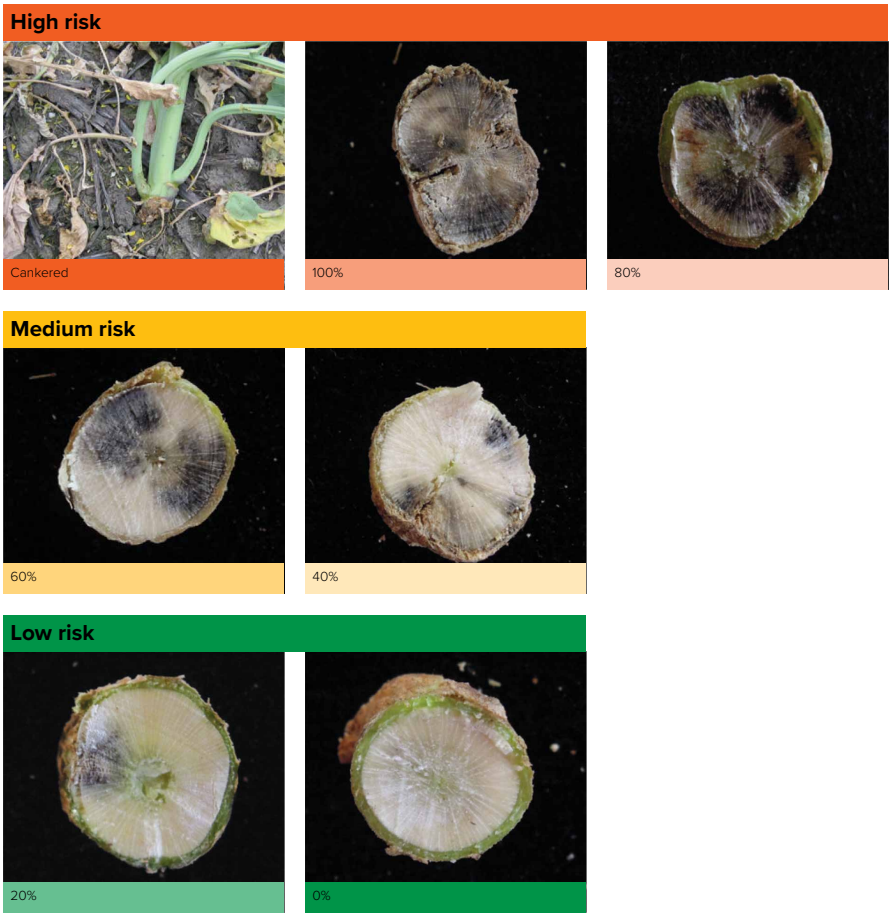

Figure 2: *Crop blackleg severity.*

Step 3. Management practices can reduce the risk of blackleg infection

If your crop monitoring (see step 2) showed yield loss in the previous year, the following practices can be used to reduce blackleg severity. Complete the following process for each canola paddock to be sown.

For each of the seven management factors listed in Table 2 below (and in the Blackleg risk management worksheet accompanying the 2016 Spring Blackleg management guide, circle where each canola paddock fits to determine the risk of blackleg. For example, for 'blackleg rating', if your cultivar is ATR-Stingray, circle MR, indicating a low risk of blackleg; or for 'distance from last year's canola stubble', if your proposed canola crop is 200 m away, high risk is indicated.

- Complete all seven management factors to determine which practices are causing increased risk and how they can be reduced. For example, for 'distance from last year's canola stubble', choose a different paddock, at least 500 m away from last year's stubble, reducing the risk from high to low.

Table 2: *Management factors used to determine which practices are increasing the risk of blackleg infection.*

Blackleg rating of cultivar	VS	S–VS	S	MS–S	MS	MR–MS	MR	MR–R	R
Distance from last year's canola stubble	0 m	100 m	200 m	300 m	400 m	500 m	>500 m	>500 m	>500 m
Fungicide use	No fungicide		Foliar applied fungicide		Seed dressing fungicide	Fertiliser applied fungicide	Seed dressing + fertiliser applied fungicide	Seed dressing or fertiliser applied + foliar fungicide	Seed dressing or fertiliser applied + foliar fungicide
Years of same cultivar grown	Same cv. or resistance group for >3 years			Same cv. or resistance group for 3 years			Same cv. or resistance group for 2 years	Same cv. or resistance group for 2 years	Same cv. or resistance group for 2 years
Distance from 2-year-old canola stubble					0 m	100 m	250 m	250 m	250 m
Canola stubble conservation				Inter-row sowing	Disc tillage	Knife-point tillage	Burning or burying tillage	Burning or burying tillage	Burning or burying tillage
Month sown				June–Aug.	15–31 May	1–14 May	15–30 April	15–30 April	15–30 April
Dual purpose grazing canola					Grazing canola				

For blackleg rating of cultivar: VS, very susceptible; S, susceptible; MS, moderately susceptible; MR, moderately resistant; R, resistant; see text below (Blackleg rating) for further details.

Step 4. Blackleg resistance groups

Canola cultivars have different combinations of blackleg resistance genes. Over time, growing cultivars with the same blackleg resistance genes has led to changes in the virulence of the blackleg pathogen, which has enabled it to overcome cultivar resistance. By rotating between cultivars with different resistance genes, you can reduce the probability of resistance breakdown and reduce disease severity.

Based on steps 1 to 3, are you in a high-risk region or have you observed increasing blackleg severity and grown the same cultivar in close proximity for ≥3 years?

- No. Your current management practices should be sufficient to manage blackleg resistance adequately.
- Yes. You may be at risk of the blackleg fungus overcoming the blackleg resistance of your cultivar. It is recommended that you grow a cultivar with a different combination of blackleg-resistance genes (see Table 3 in 2016 Spring Blackleg management guide). You do not need to change resistance groups (cultivars) every year. [10]

10 GRDC (2016) 2016 Spring Blackleg management guide. GRDC Fact Sheet, http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide

9.2.2 Blackleg rating

All varieties are rated according to the independent Australian National Blackleg Resistance rating system, in which all canola-breeding companies are participants. The ratings, based on relative differences between varieties, are as follows:

- resistant: R
- resistant to moderately resistant: R–MR
- moderately resistant: MR
- moderately resistant to moderately susceptible: MR–MS
- moderately susceptible: MS
- moderately susceptible to susceptible: MS–S
- susceptible: S
- susceptible to very susceptible: S–VS
- very susceptible: VS

Varieties with a rating of 'resistant' (R) in areas of high blackleg risk and at least 'moderately resistant' (MR) in areas of lower blackleg risk will normally give sufficient disease protection. [11] The blackleg-resistance ratings for all varieties for 2015 are available in the Blackleg management guide, autumn 2015 Fact Sheet (see Table 3 therein). [12]

MORE INFORMATION

GRDC Fact Sheet: 2016 Spring Blackleg management guide

9.3 Sclerotinia stem rot

Sclerotinia stem rot is a fungal disease that can infect a wide range of broadleaf plants, including canola. Disease development is favoured by prolonged wet conditions in late winter followed by periods of prolonged leaf wetness during flowering.

The complexity of the disease cycle of sclerotinia stem rot results in disease outbreaks being sporadic compared to other diseases. There are several key stages that must be synchronised and completed in order for plant infection to occur. Weather conditions must be suitable for the pathogen at each stage. These stages of development include:

- softening and germination of soil borne sclerotia
- apothecia development and release of ascospores
- infection of petals by air-borne ascospores
- senescence of infected petals in the presence of moisture and subsequent stem infection.

Weather conditions during flowering play a major role in determining the development of the disease. The presence of moisture during flowering and petal fall will determine if sclerotinia stem rot develops. Dry conditions during this time can quickly prevent development of the disease, hence even if flower petals are infected, dry conditions during petal fall will prevent stem infection development. [13]

Outbreaks of sclerotinia stem rot tend to be sporadic, with levels of disease varying between seasons and regions in southern NSW and northern Victoria, so growers are advised to get out into their crops to monitor the situation.

The disease can cause yield reductions of 30 to 40 per cent in heavily infested crops in high-rainfall years, and in 2015 the first warning signs appeared in early August, with apothecia observed in canola crops in southern NSW, and continued wet weather through the month providing periods of extended leaf wetness and opportunities for disease epidemics to develop (Figures 3 and 4).

11 P Matthews, D McCaffery, L Jenkins (2016) Winter crop variety sowing guide 2016. NSW DPI Management Guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2016.pdf

12 GRDC (2016) 2016 Spring Blackleg management guide. GRDC Fact Sheet, http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide

13 K Lindbeck, S Marcroft, A Leo, A Van de Wouw (2016) Canola diseases - the 'watch outs' for 2016. GRDC Update Papers 16 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Canola-diseases-the-watch-outs-for-2016

Prolonged wet weather through winter and early spring are ideal for the development of apothecia, the fruiting structures of the sclerotinia fungus. [14]

Figure 3: *Sclerotinia stem rot can cause yield losses of up to 30 per cent in canola.*

Photo: Kurt Lindbeck, NSW DPI

Figure 4: *Early infection of canola leaves by sclerotinia often starts at the base of the leaf.*

Photo: Kurt Lindbeck

Yield losses range from nil to 20% in some years, but losses have been as high as 35%. Districts with reliable spring rainfall and long flowering periods for canola appear

14 E McNamara (2016) Sclerotinia tops canola watch list. GRDC Media, https://grdc.com.au/Media-Centre/Media-News/North/2016/06/Sclerotinia-tops-canola-watch-list

MORE INFORMATION

Ground Cover Issue 122: Stop the rot – early intervention key to disease control

Ground Cover Radio 122: Northern region extension

to develop the disease more frequently. Continual wheat–canola rotations are also very effective at building up levels of soil-borne sclerotia. [15]

Burning canola stubble will not control the disease effectively, because *Sclerotinia* survives mainly on or in the soil. Crop rotation with cereals, following recommended sowing times and ensuring that crops do not develop heavy vegetative growth, which is likely to reduce air circulation, are the best means of reducing the impact of the disease.

The inconsistent relationship between the level of stem infection and yield loss makes it difficult to predict an economic response from using foliar fungicides in any one year. The specific environmental conditions for development of Sclerotinia stem rot will not occur every year. For example, in dry conditions, even if the fungus is present, the disease may fail to develop.

The fungicide Prosaro® (a.i.s prothioconazole + tebuconazole), and iprodione and some procymidone products, are registered for the management of Sclerotinia stem rot.

Use of foliar fungicides

At this time there are no commercial canola cultivars available on the Australian market with resistance to sclerotinia stem rot. Management of the disease relies on the use of cultural and chemical methods of control. Foliar fungicides should be considered in those districts which are at a high risk of disease development (e.g. districts where the disease frequently occurs, long flowering period and reliable spring rainfall). There are several foliar fungicides currently registered for use in Australia to manage sclerotinia stem rot.

Points to consider when using a foliar fungicide to manage sclerotinia stem rot:

- The most yield loss from sclerotinia occurs from early infection events. Early infection is likely to result in premature ripening of plants and produce little or no yield.
- Plants become susceptible to infection once flowering commences. Research in Australia and Canada has shown that an application of foliar fungicide around the 20–30% bloom stage (20% bloom is 14–16 flowers on the main stem, 30% bloom is approx. 20 flowers on the main stem) can be effective in significantly reducing the level of sclerotinia stem infection. Most registered products can be applied up to the 50 per cent bloom (full bloom) stage.
- The objective of the fungicide application is to prevent early infection of petals while ensuring that fungicide also penetrates into the lower crop canopy to protect potential infection sites (such as lower leaves, leaf axils and stems). Timing of fungicide application is critical.
- A foliar fungicide application is most effective when applied before an infection event (e.g. before a rain event during flowering). These fungicides are best applied as protectants and have no curative activity.
- In general, foliar fungicides offer a period of protection of up to three weeks. After this time the protectant activity of the fungicide is compromised. In some crops development of lateral branch infections later in the season is not uncommon if conditions favourable for the disease continue. The greatest yield loss occurs when the main stem becomes infected, especially early. Lateral branch infection does cause yield loss, but at a much reduced level.
- Use high water rates and fine droplet sizes for good canopy penetration and coverage.

Consult the Sclerotinia Stem Rot in Canola factsheet for further information. This publication is available from the GRDC website. [16]

15 GRDC (2014) Canola disease management in the northern region. GRDC Ground Cover, 21 March 2014, http://grdc.com.au/Media-Centre/Hot-Topics/Canola-disease-management-in-the-northern-region

16 K Lindbeck, S Marcroft, A Leo, A Van de Wouw (2016) Canola diseases - the 'watch outs' for 2016. GRDC Update Papers 16 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Canola-diseases-the-watch-outs-for-2016

Key points

- An outbreak of Sclerotinia stem rot is highly dependent on the season.
- Prolonged wet or humid conditions during flowering favour the disease.
- Consider past outbreaks of the disease as a guide to potential yield loss.
- Avoid growing canola in paddocks with a history of Sclerotinia stem rot over the past 4 years, or in adjacent paddocks.
- Well-timed fungicide treatments, when canola crops are at 20–30% flowering stage, can be highly effective in reducing the level of infection.
- No Australian canola varieties have known resistance to the disease. [17]

9.4 Viruses

Managing viruses centres on implementing best agronomic practice:

- Retain standing stubble to deter migrant aphids from landing.
- Sow at the optimal seeding rate and sowing time, because earlier sown crops are more prone to aphid attack.
- Control in-crop and fallow weeds to remove the in-crop and nearby sources of virus infection. [18]

BWYV was found in most tested canola crops throughout NSW. However, substantial yield losses appeared to be limited to a few paddocks where early infection occurred. BWYV is a persistently transmitted virus that infects a wide range of crops and weeds. Its main vector is the green peach aphid (*Myzus persicae*).

Virus control strategies should be based on preventing infection, because infected plants cannot be cured. Preventive measures to avoid BWYV infection in canola include seed treatment with systemic insecticides that are effective for green peach aphid control and sowing in standing wheat stubble.

Growers are advised to check canola crops early in the season for aphid presence. If aphids are found, an effective insecticide should be applied.

There is no indication that the occurrence of BWYV in canola poses a threat to neighbouring pulse crops.

High infestations of aphid species other than green peach aphid were observed in other broadacre crops in June–July 2014. Widespread infestations of cowpea aphid throughout Queensland and NSW resulted in very high levels of infection of BYMV in faba bean and, possibly, lupin crops. [19]

Of the three virus species recorded in canola in Australia, BWYV is the most common and has potential to cause yield losses in canola. Commercial canola varieties appear resistant to TuMV. However, some lines of condiment mustard and juncea canola (both *Brassica juncea*) have been severely affected by TuMV in trials in northern NSW. The importance of CaMV in canola and *B. juncea* is not known.

All three viruses are spread by aphids from weeds, which act as hosts. BWYV can come from a range of weed, pasture and crop species. Turnip weed, wild radish and other *Brassica* weeds are important hosts of TuMV. Substantial yield losses from viruses, particularly BWYV, can occur even when there are no obvious symptoms.

Seed treated with an imidacloprid product or Poncho® Plus (imidacloprid + clothiandin) is recommended to protect crops from early infestation with aphids. [20]

MORE INFORMATION

- Sclerotinia stem rot in canola Fact Sheet
- Canola diseases. The Back Pocket Guide
- Canola disease update 2015 (NSW)
- Economics and timing of fungicide application to control Sclerotinia stem rot in canola

MORE INFORMATION

- *Beet western yellows virus* (synonym: *Turnip yellows virus*) and green peach aphid in canola
- Canola diseases. The Back Pocket Guide
- Watch for chickpea viruses near canola

MORE INFORMATION

- Virus diseases in canola and mustard
- Reducing aphid and virus risk
- Virus development in canola crops during 2014 in NSW and implications for the oilseed and pulse industry

17 GRDC (2014) Canola disease management in the northern region. GRDC Gound Cover, 21 March 2014, http://grdc.com.au/Media-Centre/Hot-Topics/Canola-disease-management-in-the-northern-region

18 GRDC (2014) Canola disease management in the northern region—details. GRDC Gound Cover, 21 March 2014, http://grdc.com.au/Media-Centre/Hot-Topics/Canola-disease-management-in-the-northern-region/Details

19 eXtensionAUS. Latest on canola disease—2015 GRDC Update Papers. eXtension, https://extensionhub.com.au/web/field-crop-diseases/-/latest-on-canola-disease-2015-grdc-update-papers

20 P Matthews, D McCaffery, L Jenkins (2016) Winter crop variety sowing guide 2016. NSW DPI Management Guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2016.pdf