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Effect of flowering date on upper canopy infection by blackleg – Wagga Wagga 2016

Rohan Brill, Danielle Malcolm, Warren Bartlett and Sharni Hands (NSW DPI, Wagga Wagga);
Dr Susie Sprague, John Graham and Melanie Bullock (CSIRO, Canberra)

Key findings

- Blackleg infection of flowers, pods, branches and upper stems can be collectively termed as upper canopy infection (UCI).
- Early flowering of canola increases the risk of UCI.
- Fungicide can reduce disease levels and increase grain yield, but does not provide full disease control.
- Matching sowing date and varietal phenology so that flowering occurs in late winter will reduce UCI.

Introduction

Blackleg, caused by the fungus *Leptosphaeria maculans*, is found in all canola-growing regions of Australia. Yield loss has mostly been associated with crown cankers, which limit water and nutrient uptake. All above- and below-ground plant parts are susceptible to infection by the fungus, but infection on upper stems, branches, flowers and pods (termed upper canopy infection or UCI) has, until recently, been limited.

It is hypothesised that the increased level of UCI in recent seasons is due to crops flowering in an earlier window. Early flowering (early to mid-winter) exposes plants to greater levels of infection as spore release coincides with cool and moist conditions.

The aim of this experiment was to investigate the role of flowering time in upper canopy infection development, and determine any associated yield penalty.

Site details

Location	Downside, approximately 25 km north-west of Wagga Wagga
Soil type	Gravelly red–brown chromosol
Previous crop	Faba beans
Fallow rainfall	243 mm (November 2015–March 2016)
In-crop rainfall	625 mm (April 2016–October 2016)
Soil pH_{Ca}	5.3 (0–10 cm, 29 April)
Soil nitrogen	133 kg/ha (0–120 cm, 29 April)
Nitrogen applied	Urea (46% nitrogen) 217 kg/ha, 28 March (broadcast then incorporated by plot seeder) Urea 217 kg/ha, 8 June (broadcast)
Soil phosphorus	31 mg/kg (Colwell)
Starter fertiliser	70 kg/ha mono-ammonium phosphate (MAP) (11% nitrogen, 22.7% phosphorus, 2% sulfur)

Treatments

Variety

Pioneer® 44Y89 (CL): Blackleg rating moderately resistant (MR). Resistance group BC.

Fungicide

1. Nil.
2. Seed and fertiliser fungicide – Jockey® Stayer® (167 g/L fluquinconazole) applied to seed at 20 L/t and Intake® Combi Sapphire (500 g/L flutriafol) applied to MAP at 2.85 L/t.

3. Seed and fertiliser plus early foliar fungicide – as for treatment 2 plus application of Prosaro® (210 g/L prothioconazole and 210 g/L tebuconazole) at bud visible stage.
4. Seed and fertiliser and early foliar fungicide, plus flowering foliar fungicide – as for treatment 3 plus two applications of Prosaro® during flowering, targeted at 20% bloom and 50% bloom. This treatment is termed as 'full'.

Sowing date (SD)

SD1: 31 March
SD2: 13 April
SD3: 2 May

Methodology

The experiment was a full factorial (all combinations) of fungicide and sowing date. The sowing dates created different flowering dates to assess the effect of flowering date on disease infection levels. Fungicides were applied based on the crop growth stage.

Blackleg infection of pods, branches and upper main stems, as well as premature pod loss due to infection, was assessed at crop maturity by scoring 20 individual plants/plot. Each plant was given a separate score for each of the symptoms using a 0–4 scale, whereby:

0 = no disease symptom
0.5 = small amount of symptom present
1 = <10% pods or tissue area affected
2 = 10–29% pods or tissue area affected
3 = 30–49% pods or tissue area affected
4 = ≥50% pods or tissue area affected.

Table 1. Foliar fungicide application timing and start and end of flowering dates for treatments in each sowing date for Pioneer® 44Y89 (CL) canola at Wagga Wagga in 2016. Fungicide application at bud visible was applied to treatments 3 and 4. Fungicide application during flowering was only made to treatment 4.

Sowing date	Fungicide application date at bud visible	Start of flowering date	Fungicide application dates during flowering	End of flowering date
SD1: 31 March	26 May	22 June	27 June, 28 July	8 September
SD2: 13 April	16 June	17 July	28 July, 23 August	15 September
SD3: 2 May	28 July	18 August	23 August, 20 September	27 September

Results

Effect of fungicide pre-flowering

For SD1 and SD3, fungicide had no effect on grain yield or blackleg infection when applied before flowering, either to seed, with fertiliser or via foliar spray.

Fungicide treatment 2 increased grain yield for SD2 by 0.29 t/ha, but the reason for this was unclear.

The following section focuses on the comparison between treatments 1 and 4, effectively comparing 'nil' fungicide with a 'full' fungicide regime.

Effect of fungicide post-flowering

For SD1, flowering started on 22 June, and approximately monthly thereafter for each later sowing time (Table 1).

The amount of UCI (at maturity) was greatest from SD1 due to its very early flowering, and declined with later sowing dates (Table 2). Pod infection was the main symptom, with relatively low levels of main stem and branch infection. Applying fungicide during flowering for SD1 did not reduce blackleg incidence on pods (approximately 50% of pods), but did reduce premature pod loss. Approximately 25% of pods were prematurely lost in the SD1 treatment where no fungicide was applied, but this was reduced to less than 10% with two foliar fungicides applied at 20% and 50% bloom. The foliar fungicide applications to SD1

increased grain yield by 0.99 t/ha, but as pod infection was not fully controlled by two fungicide applications, the yield loss from blackleg was likely to be even greater.

Fungicide reduced pod infection incidence in the SD2 and SD3 treatments, however, premature pod loss was much lower for these two later sowing dates. The fungicides applied during flowering (20% and 50% bloom) resulted in a 0.29 t/ha grain yield benefit for SD2, but no benefit for SD3. There was also a benefit of 0.29 t/ha for SD2 from applying fungicide to seed and fertiliser (data not shown). Some grain yield benefit could possibly be attributed to controlling sclerotinia stem rot, however, incidence was low (<6%).

Table 2. Effect of sowing date and fungicide treatments on symptoms of upper canopy blackleg infection and grain yield of Pioneer® 44Y89 (CL) at Wagga Wagga in 2016.

Sowing date	Treatment	Pod infection (0–4 scale)	Premature pod loss (0–4 scale)	Main stem infection (0–4 scale)	Branch infection (0–4 scale)	Grain yield (t/ha)
31 March	Nil	3.87	1.78	1.38	1.40	2.88
	Full	3.48	0.74*	0.87*	0.63*	3.87*
13 April	Nil	2.78	0.15	0.27	0.16	2.99
	Full	1.58*	0.03*	0.08*	0.01*	3.57*^
2 May	Nil	2.00	0.13	0.26	0.36	2.91
	Full	1.22*	0.14	0.16	0.17*	3.01

^ There was a 0.29 t/ha yield advantage by the addition of fungicides to seed and fertiliser alone (data not shown).

* Indicates significantly different from Nil treatment for data within each sowing date.

Conclusion

Crops flowering early in the winter period (June/July) are at greater risk of upper canopy infection of blackleg than crops flowering later (August). The greatest yield loss in this experiment was associated with high levels of premature pod loss due to blackleg infection, which occurred in the earliest flowering crop (SD1: 31 March). Premature loss of infected pods tends to occur close to harvest after flowering has finished, with the plant unable to compensate by producing more flowers or set more seeds per pod.

To ensure flowering occurs in the optimum window to avoid an unnecessary disease burden, sowing date and varietal phenology need to be matched. For example, selecting a slower variety such as Archer for a 31 March sowing would delay flowering until August while still enabling early sowing. Alternatively, consider the economics of fungicide application if earlier flowering provides a yield benefit.

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