Was canola fungicide investment justified in low and medium rainfall environments in 2020?

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Take home messages

- Return on investment was strong in only two of five trials, with both these trials being in the south and having higher levels of upper canopy blackleg (branch infection) as well as some Sclerotinia. Best return was from a single fungicide spray at 30% bloom stage
- Application at the recommended timings (30% and 50% bloom) were more likely to result in a yield benefit than an early application (10% bloom)
- Reduction in disease infection did not necessarily result in a positive grain yield response, similarly a positive grain yield response did not always increase profitability
- Overall, with modest yield responses in a high production year, money may be better invested in inputs with a more reliable return on investment.

Introduction

Application of fungicide to manage disease in canola, especially Sclerotinia and upper canopy blackleg (UCB) is a common practice in the higher rainfall, eastern and southern areas of the GRDC Northern Region, but there is little data on the cost-effectiveness in low and medium rainfall zones. In mid to late winter 2020 canola crops had high yield potential across much of the GRDC Northern Region. With forecasts for further rainfall for the spring period, many growers and advisors were considering the need for fungicide in areas where application is not common.

In response Grain Orana Alliance (GOA) and Brill Ag established five canola fungicide response trials through southern and central NSW to determine the response to fungicide in low and medium rainfall environments in a high yield potential season. The trials tested several fungicide products and their timing. The trials were assessed for the common diseases Sclerotinia and UCB as well as the less common diseases Alternaria black spot and powdery mildew that were also present at most sites. This paper outlines the key findings on the effectiveness of fungicide to control each disease as well as the grain yield response from fungicide control and the economics of their application.

Methodology

Trial sites were geographically spread to represent a range of climates and farming systems (Table 1). Trials were a randomised complete block design with four replicates for each treatment. Each trial was sprayed with a ute-mounted boom spray onto existing commercially grown and managed crops to ensure that the canopy remained intact, minimising open space for air to circulate which may have suppressed disease development. The sprayed plots were usually 40-50 m² in size with a smaller area of approximately 15-20 m² harvested with a small plot harvester when the crop was

ripe (direct head) to minimise any potential influence from neighbouring treatments. All other crop husbandry prior to applications were completed by the grower.

Table 1. Site description for five canola fungicide response trials conducted in NSW, 2020.

Location	Region	Average annual rainfall	Average growing season rainfall	Variety
Ganmain	Eastern Riverina	475 mm	280 mm	HyTTec® Trophy
Kamarah	Northern Riverina	440 mm	220 mm	Pioneer® 44Y90 CL
Temora	South-west slopes	520 mm	310 mm	Pioneer® 45Y91 CL
Warren	Central-west plains	510 mm	210 mm	HyTTec® Trophy
Wellington	Central-west slopes	580 mm	300 mm	Victory® V75-03CL

Four products were used with multiple combinations of timings and rates (Table 2).

Table 2. Description of fungicide products used in five canola fungicide response trials conducted in NSW, 2020.

Trade Name	Active Ingredient 1	Group	Active Ingredient 2	Group
Aviator Xpro®	Prothioconazole	3	Bixafen	7
Miravis® Star**	Pydiflumetofen	7	Fludioxonil	12
Prosaro®	Prothioconazole	3	Tebuconazole	3
Veritas®	Tebuconazole	3	Azoxystrobin	11

***Miravis Star was applied under a research permit . It is currently under evaluation with APVMA.*

There were three application timings targeted at 10, 30 and 50% bloom (30 and 50% bloom only at Kamarah and Warren). The 30 and 50% timings are commonly suggested timings, with the 10% bloom timing added to reflect grower practice at those sites. Treatments at individual sites are shown in Tables 4-8 later in the paper. These spray timings are overlaid on daily rainfall in Figure 1. After good rains in early to mid-August at all sites, rainfall during the late winter/early spring period was generally below average.

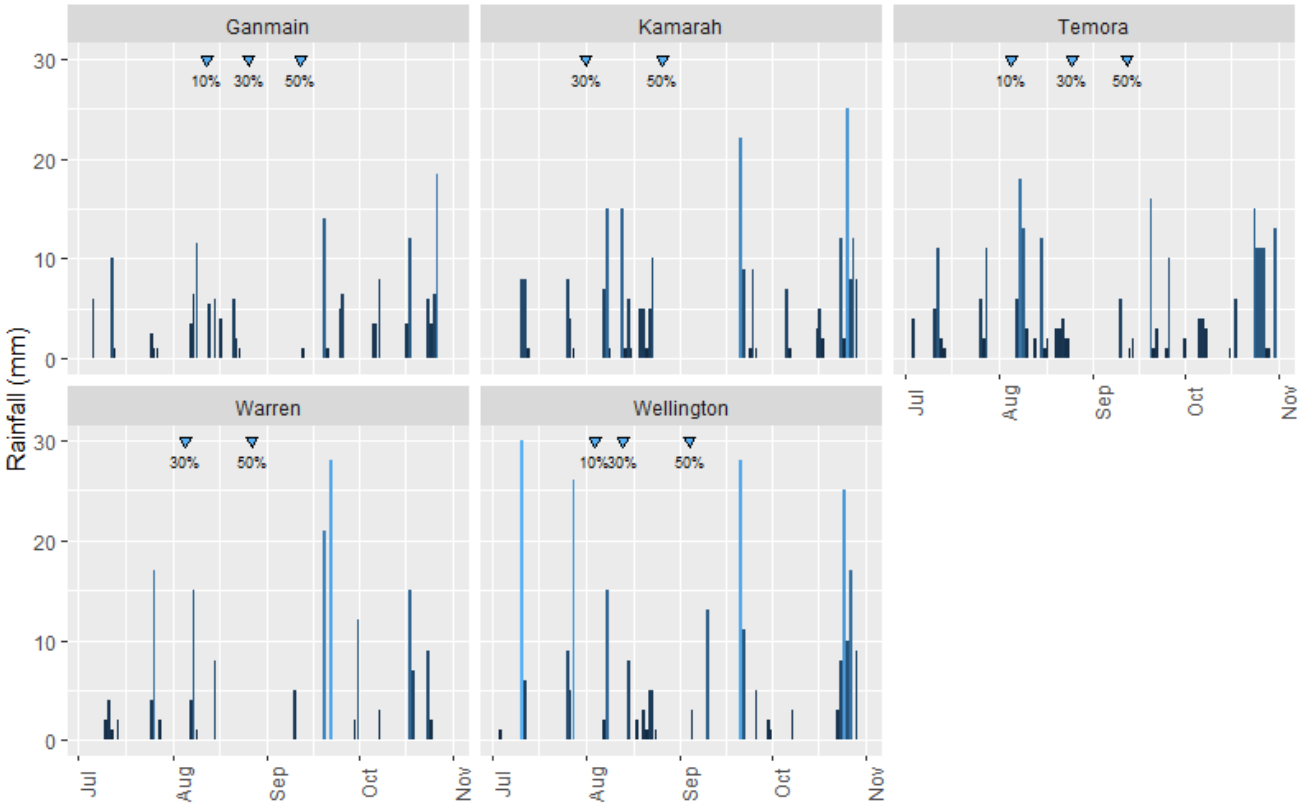

Figure 1. Daily rainfall received (vertical columns) and spray timings (inverted triangles) for five canola fungicide response trials conducted in NSW, 2020. Timings are bloom stage timing, e.g., 10% is 10% bloom stage.

Disease assessment

Diseases prevalence was assessed at one timing, targeted around 60-80 seed colour change (windrowing stage) with the methodologies detailed below.

Sclerotinia – two random sample areas of 1 m^2 were assessed in each plot, with the number of plants with Sclerotinia (basal, main stem and branch) counted along with the total number of plants in the assessment area to determine infection rates.

Upper canopy blackleg – a 0-4 score was allocated for the same two locations that were assessed for Sclerotinia:

- 0 = no infection observed
- 0.5 = at least one lesion found
- 1 = lesions present
- 2 = lesions common
- 3 = lesions common causing damage
- 4 = lesions common causing branch death

Alternaria black spot – the upper canopy blackleg scoring system was adapted for Alternaria with some minor tweaks:

- 0 = no infection observed
- 0.5 = at least one lesion found
- 1 = lesions present
- 2 = lesions common with 1-5% of pod/stem area infected

- 3 = lesions common with 5-15% of pod/stem area infected and low-level early pod senescence.
- 4 = lesions common with >15% of pod/stem area infected and high level of early pod senescence.

Powdery mildew – an assessment was made of the proportion of stem area infected with powdery mildew (two locations per plot as per Sclerotinia).

The trial results were analysed by ANOVA with 95% confidence level. Results are detailed in Tables four to eight below.

Results

Sclerotinia petal testing

Petal samples from 12 flowers from untreated areas were sent to the CCDM for determining the level of Sclerotinia present at each site. Sclerotinia was confirmed as present on petals at each of the five sites, with 100% of petals infected at Ganmain and Temora and down to 55% of petals infected at Wellington.

Table 3. Canola Sclerotinia petal infection rates at from five canola fungicide response trials conducted in NSW 2020.

Site	**Petals infected (%)**
Ganmain	100
Kamarah	78
Temora	100
Warren	87
Wellington	55

Geographic disease distribution

The highest levels of Sclerotinia infections were at the most south-eastern site Temora, where canola intensity and canopy moisture levels favoured disease development (Figure 2). There was no broader Sclerotinia infection of plants at Warren, despite petal tests confirming Sclerotinia as present at the site. Upper canopy blackleg (UCB) on branches ranged from only trace levels at the north-western site at Warren, to high levels of infection likely causing yield loss at the southern sites at Kamarah and Temora. Powdery mildew and Alternaria black spot (on pods) was most severe in the northern trials.

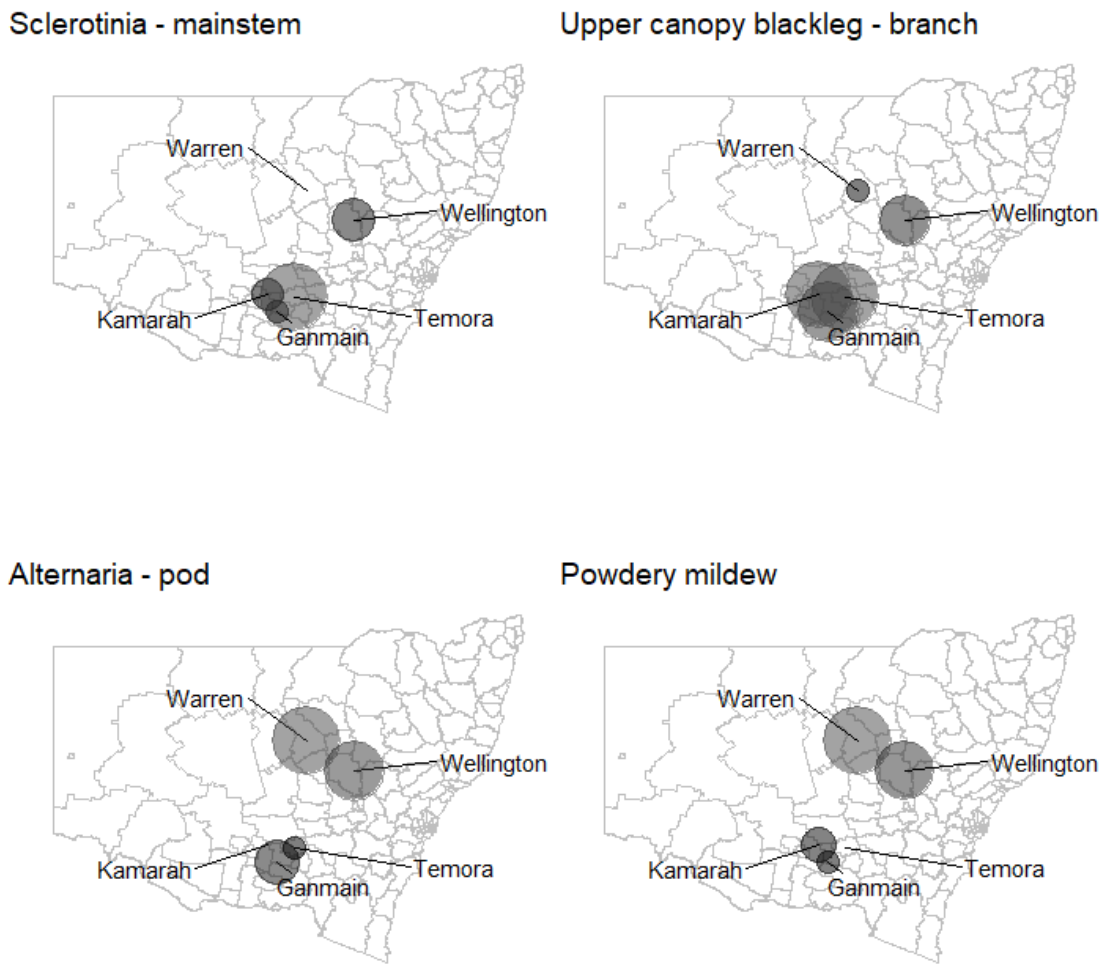

Figure 2. Severity of the diseases Sclerotinia stem rot (main stem), upper canopy blackleg (branch), Alternaria (pod) and powdery mildew across five canola fungicide response trials in NSW in 2020. Larger circles represent greater infection levels (data presented from untreated control). Data presented is dimensionless and no comparison can be made across diseases.

Ganmain

There was no grain yield response to the various fungicide treatments tested at Ganmain.

There was some reduction in Sclerotinia, UCB (branch), powdery mildew and Alternaria incidence, but disease levels were generally low. All fungicide treatments at the 30 and 50% bloom stage reduced Sclerotinia incidence compared to the untreated, but the 10% bloom fungicide treatment (Aviator Xpro only) did not reduce incidence. UCB (branch) was present but not at levels that would impact grain yield (rating of less than 2). Some reduction in incidence was achieved with single applications at 10 and 30% bloom applications of Aviator Xpro, second applications did not reduce incidence further than single spray treatments. A single application of Miravis Star at 30% also reduced incidence. Alternaria on pods was also common but not consequential, with incidence reduced by 50% bloom applications of Aviator Xpro. Powdery mildew was present at low levels, but disease incidence reduced further wherever Prosaro was applied at 50% bloom.

The Ganmain crop was HyTTec Trophy which has effective major gene (Group ABD) resistance to blackleg which may have reduced the severity of UCB infection. Although incidence on branches was

easy to find, it was generally not at levels that would impact grain yield. There was only low level of blackleg on pods (data not shown). A further factor that reduced infection risk of this crop was that it flowered the latest of all the crops, with most (30-50% bloom) of the flowering period coinciding with a dry four-week period in late winter/early spring. For the period 1 July to 31 October, Ganmain had the least rainfall (160 mm) of the five sites.

Table 4. Canola grain yield, quality and disease response to fungicide in a crop of HyTTec Trophy at Ganmain 2020.

Fungicide treatment and timing (% bloom)*	Yield (t/ha)	Oil (%)	Sclero MS (%)	Sclero Br. (%)	UC BL Br.	Alt. pod	PM (%)
Aviator Xpro 650 mL/ha 10%	2.47	44.2	5.7	0.6	1.4	2.5	10
Aviator Xpro 650 mL/ha 30%	2.59	43.5	0.3	0	1.4	2.1	5.4
Prosaro 450 mL/ha 30%	2.56	42.9	0.3	0	1.7	2.5	2.9
Miravis Star 30%	2.61	43.9	0.5	0	1.4	2	5
Aviator Xpro 650 mL/ha 10% + Prosaro 450 mL/ha 50%	2.48	44	0.8	0	1.7	2.4	2.7
Aviator Xpro 650 mL/ha 30% + Prosaro 450 mL/ha 50%	2.56	43.5	0.6	0	1.4	2.4	1.2
Prosaro 375 mL/ha 30% + Prosaro 375 mL/ha 50%	2.61	43.4	0	0	1.9	2.2	1.5
Aviator Xpro 550 mL/ha 30% + Aviator 550 mL/ha 50%	2.52	43.6	0	0	1.4	1.5	5.6
Aviator Xpro 650 mL/ha 50%	2.53	43.9	0.6	0.3	1.7	1.9	4.5
Prosaro 450 mL/ha 50%	2.47	43.8	0.3	0	2.1	2.8	1.6
Untreated	2.49	42.9	3.3	1.8	2.2	2.8	9.1
l.s.d. (*p<0.05)*	n.s.	1	1.2	0.5	0.8	0.5	3.2

** Product recommendations for timing of application in canola vary. Not all products have claims at the 10% timing used in these trials or for all diseases evaluated (no products have claims for control of Alternaria or powdery mildew in canola). Check product labels for details.*

Sclero MS = Proportion of plants with Sclerotinia infection on the main stem. Sclero Br. = proportion of plants with Sclerotinia infection on a branch. UC BL Br = Upper canopy blackleg branch infection with protocol outlined in methodology. Alt. pod = Alternaria pod infection score with protocol outlined in methodology. PM (%) is proportion of stem are infected with powdery mildew. Shaded cells indicate results are significantly better than untreated i.e., less disease or more yield/oil.

Kamarah

There was a positive grain yield response (up to 0.4 t/ha) to all single-spray treatments at Kamarah except Prosaro at 50% bloom. There was no additional benefit of two-spray strategies over one fungicide spray.

Sclerotinia (main stem) infection was low, but all treatments reduced the incidence of the disease except the single applications of Prosaro (both 30 and 50% bloom) or Aviator Xpro at 50% bloom. Fungicide application at 30% bloom (except Veritas) reduced UCB (branch) infection, from levels that would likely reduce yield in the untreated control. All fungicide treatments provided some (but not complete) reduction in the incidence of powdery mildew.

The period between 30 and 50% bloom was relatively wet at Kamarah which may have partly contributed to higher branch blackleg infection than Ganmain. A further contributing factor is that the cultivar 44Y90 CL, despite having effective crown canker resistance, does not have effective major gene resistance.

Table 5. Canola grain yield, quality, and disease response to fungicide in a crop of 44Y90 CL at Kamarah 2020.

Fungicide treatment and timing (% bloom)*	Yield (t/ha)	Oil (%)	Sclero MS (%)	Sclero Br. (%)	UCI Br.	Alt. pod	PM (%)
Aviator Xpro 650 mL/ha 30%	2.87	42.7	0	0	1.9		4.1
Prosaro 450 mL/ha 30%	2.89	43.3	0	0	2.2		5
Veritas 1 L/ha 30%	2.71	42.3	0.5	0	3.1		8.6
Miravis Star 30%	2.70	42.7	0	0	1.9		4.9
Aviator Xpro 650 mL/ha 30% + Prosaro 450 mL/ha 50%	2.78	42.5	0	0	1.5		3.2
Prosaro 375 mL/ha 30% + Prosaro 375 mL/ha 50%	2.70	43.1	0	0	2		4.9
Aviator Xpro 550 mL/ha 30% + Aviator 550 mL/ha 50%	2.75	42.7	0	0	1.6		3.4
Aviator Xpro 650 mL/ha 50%	2.74	42.6	4.4	0.6	2.8		7.5
Prosaro 450 mL/ha 50%	2.67	42.6	3.4	0	2.6		7.4
Untreated	2.49	42.7	2.8	0	3.4		15
l.s.d. (*p<0.05)*	0.20	1	1.1	0.5	0.6		4.2

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Sclero MS = Proportion of plants with Sclerotinia infection on the main stem. Sclero Br. = proportion of plants with Sclerotinia infection on a branch. UC BL Br = Upper canopy blackleg branch infection with protocol outlined in methodology. Alt. pod = Alternaria pod infection score with protocol outlined in methodology. PM (%) is proportion of stem are infected with powdery mildew Shaded cells indicate results are significantly better than untreated i.e., less disease or more yield/oil.

Temora

There was a positive grain yield response of up to 0.6 t/ha at Temora. Aviator at 10 and 30% bloom but not 50% bloom improved yields as did Miravis Star at 30% bloom. Prosaro at 30% did not increase yield but did at 50% bloom. Most (but not all) two-spray treatments improved yield.

Sclerotinia infection was highest of all five sites at Temora, but still only a moderate infection level of 12.2% of main stems infected where no fungicide was applied. Aviator Xpro at 10 and 50% bloom, and Veritas at 30% bloom did not reduce Sclerotinia incidence. Aviator Xpro at 10% followed by Prosaro at 50% bloom did not improve yield. Application of Aviator Xpro at 10 and 30%, Miravis Star at 30% bloom and all the two spray strategies reduced UCB (branch), but the best treatment still only reduced the score to a range from 1.5 to 2.1. Application of Prosaro and Veritas at 30% bloom and Prosaro and Aviator Xpro at 50% bloom did not reduce branch blackleg. Miravis Star at 30%, Aviator Xpro followed by Aviator Xpro (30 and 50% bloom) or Prosaro or Aviator Xpro at 50% bloom reduced Alternaria incidence on the pods but did not give full control.

A two-spray strategy generally provided good reductions of both Sclerotinia and blackleg, but no two-spray treatment resulted in higher grain yield than a single application of Aviator Xpro at 30% bloom.

Table 6. Canola grain yield, quality, and disease response to fungicide in a crop of 45Y91 CL at Temora 2020.

Fungicide treatment and timing (% bloom)*	Yield (t/ha)	Oil (%)	Sclero MS (%)	Sclero Br. (%)	UCI Br.	Alt. pod	PM (%)
Aviator Xpro 650mL/ha 10%	3.50	43.2	13.8	1.5	1.5	2	*Nil*
Aviator Xpro 650 mL/ha 30%	3.73	43.5	3.1	1.5	2.1	1.9	*Nil*
Prosaro 450 mL/ha 30%	3.37	43.6	2.6	0.3	2.9	2.1	*Nil*
Veritas 1 L/ha 30%	3.45	42.9	9.9	2	2.9	2.1	*Nil*
Miravis Star 30%	3.58	43.2	2.3	0	2.1	1.4	*Nil*
Aviator Xpro 650 mL/ha 10% + Prosaro 450 mL/ha 50%	3.73	42.6	6.1	0.3	1.7	1.9	*Nil*
Aviator Xpro 650 mL/ha 30% + Prosaro 450 mL/ha 50%	3.46	43.1	1	0	1.9	1.6	*Nil*
Prosaro 375 mL/ha 30% + Prosaro 375 mL/ha 50%	3.70	43.5	1	0	2.1	1.8	*Nil*
Aviator Xpro 550 mL/ha 30% + Aviator 550 mL/ha 50%	3.71	43	1.3	0.3	2	1.6	*Nil*
Aviator Xpro 650 mL/ha 50%	3.45	43.1	7.4	0.8	2.6	1.2	*Nil*
Prosaro 450 mL/ha 50%	3.62	43.6	4.6	0.8	3.3	2.1	*Nil*
Untreated	3.07	43.7	12.2	3.6	3.1	2.4	*Nil*
l.s.d. (*p<0.05)*	0.44	0.8	6.3	1.7	0.7	0.7	n.s.

** Product recommendations for timing of application in canola vary. Not all products have claims at the 10% timing used in these trials or for all diseases evaluated (no products have claims for control of Alternaria or powdery mildew in canola). Check product labels for details.*

Sclero MS = Proportion of plants with Sclerotinia infection on the main stem. Sclero Br. = proportion of plants with Sclerotinia infection on a branch. UC BL Br = Upper canopy blackleg branch infection with protocol outlined in methodology. Alt. pod = Alternaria pod infection score with protocol outlined in methodology. PM (%) is proportion of stem are infected with powdery mildew. Shaded cells indicate results are significantly better than untreated i.e., less disease or more yield/oil.

Warren

No fungicide treatments resulted in a significant increase in grain yield.

There was no Sclerotinia infection at Warren and low (inconsequential) levels of upper canopy blackleg. The main diseases apparent were powdery mildew and Alternaria infection on pods and stems. Powdery mildew infection was the highest of all five sites, with 67% of stem/branch area infected with powdery mildew by crop maturity (windrow timing) in the untreated control. Fungicide treatments with Prosaro applied at 50% bloom reduced powdery mildew incidence to close to very low levels with no benefit to yields (Prosaro does not claim control of powdery mildew in canola on its label). Alternaria infection on pods was high with only two-spray fungicide treatments providing a small level of control. The Warren site also had high levels of Alternaria on stems/branches, with all fungicide treatments giving some reduction in incidence (data not shown). Unlike branch blackleg observed at other sites, Alternaria did not manifest into cankers that eventually resulted in branch death but were usually superficial. It is difficult to ascertain if Alternaria infection on pods had any effect on grain yield, as no fungicide treatment resulted in clean pods. It is likely that fungicide would need to be applied when all pods are formed (e.g., end of flowering) to achieve good control of Alternaria, but all fungicide products need to be applied by the 50% bloom stage.

Table 7. Canola grain yield, quality, and disease response to fungicide in a crop of HyTTec Trophy at Warren 2020.

Fungicide treatment and timing (% bloom)*	Yield (t/ha)	Oil (%)	Sclero MS (%)	Sclero Br. (%)	UCI Br.	Alt. pod	PM (%)
Aviator Xpro 650 mL/ha 30%	3.72	41.3			0	3.6	19.5
Aviator Xpro 800 mL/ha 30%	3.60	41.1			0	3.6	17.1
Prosaro 450 mL/ha 30%	3.52	41			0	4	17.7
Veritas 1 L/ha 30%	3.39	40.2			0	3.6	20.6
Miravis Star 30%	3.56	40			0	4	43.1
Aviator Xpro 650 mL/ha 30% + Prosaro 450 mL/ha 50%	3.70	39.6	*Nil*	*Nil*	0	3	2.5
Prosaro 375 mL/ha 30% + Prosaro 375 mL/ha 50%	3.75	40.6			0	4	5.3
Aviator Xpro 650 mL/ha 50%	3.43	40.9			0.2	3.2	16.9
Prosaro 450 mL/ha 50%	3.47	40.5			0.2	3.6	5.8
Untreated	3.43	40.5			0.2	4	67.4
l.s.d. (*p<0.05)*	0.35	1.6	*n.s.*	*n.s.*	*0.1*	0.4	14.8

** Product recommendations for timing of application in canola vary. Not all products have claims at the 10% timing used in these trials or for all diseases evaluated (no products have claims for control of Alternaria or powdery mildew in canola). Check product labels for details.*

Sclero MS = Proportion of plants with Sclerotinia infection on the main stem. Sclero Br. = proportion of plants with Sclerotinia infection on a branch. UC BL Br = Upper Canopy Blackleg Branch infection with protocol outlined in methodology. Alt. pod = Alternaria pod infection score with protocol outlined in methodology. PM (%) is proportion of stem are infected with powdery mildew. Shaded cells indicate results are significantly better than untreated i.e., less disease or more yield/oil.

Wellington

There was a positive (0.2-0.3 t/ha) grain yield response for two of two-spray fungicide treatments, but no single-spray treatments increased yield. Sclerotinia infection levels were low and upper canopy blackleg infection levels were moderate at Wellington. All fungicide treatments except Prosaro and Veritas at 30% bloom provided control of Sclerotinia and upper canopy blackleg branch incidence. Powdery mildew incidence was moderate with best control where Prosaro was applied at the 50% bloom stage. Alternaria infection levels in the untreated control were high on pods (score of 3.9) and stems (score of 4, data not shown for stems) with best reductions from the single Aviator Xpro 50% bloom application (score of 1.4). Fungicide application did a better job of reducing Alternaria on the stems than on pods, again due to the inability to spray fungicide beyond 50% bloom stage to protect all pods. The large differences between Alternaria scores on the stems did not manifest into major differences in grain yield, indicating that Alternaria may have only been superficial.

Table 8. Canola grain yield, quality and disease response to fungicide in a crop of Victory V75-03CL at Wellington 2020.

Fungicide treatment and timing (% bloom)*	Yield (t/ha)	Oil (%)	Sclero MS (%)	Sclero Br. (%)	UCI Br.	Alt. pod	PM (%)
Aviator Xpro 650mL/ha 10%	3.78	43.1	1.1	0	0.7	3.4	24.4
Aviator Xpro 650 mL/ha 30%	3.71	42.9	0.6	0	0.7	3.5	21
Aviator Xpro 800 mL/ha 30%	3.75	43.4	0.4	0.4	0.9	3.1	15.9
Prosaro 450 mL/ha 30%	3.51	43	5.8	0.3	1.9	3.6	15.2
Veritas 1 L/ha 30%	3.62	43.1	3.5	3.3	1.4	3.6	18.2
Aviator Xpro 650 mL/ha 10% + Prosaro 450 mL/ha 50%	3.90	43.3	0	0	0.4	3.3	4.4
Aviator Xpro 650 mL/ha 30% + Prosaro 450 mL/ha 50%	3.77	42.7	0.5	0	0.7	3.4	8.2
Prosaro 375 mL/ha 30% + Prosaro 375 mL/ha 50%	3.81	43.2	0.8	0.3	0.7	3.2	5.2
Aviator Xpro 650 mL/ha 50%	3.76	43.7	1.1	0	1.1	2.1	12.5
Prosaro 450 mL/ha 50%	3.77	42.5	0.9	0.4	0.8	3	6.1
Untreated	3.64	43	4	1.7	1.9	3.9	18.8
l.s.d. (*p<0.05)*	0.17	0.9	2	2.2	0.6	0.6	8.7

** Product recommendations for timing of application in canola vary. Not all products have claims at the 10% timing used in these trials or for all diseases evaluated (no products have claims for control of Alternaria or powdery mildew in canola). Check product labels for details.*

Sclero MS = Proportion of plants with Sclerotinia infection on the main stem. Sclero Br. = proportion of plants with Sclerotinia infection on a branch. UC BL Br = Upper Canopy Blackleg Branch infection with protocol outlined in methodology. Alt. pod = Alternaria pod infection score with protocol outlined in methodology. PM (%) is proportion of stem are infected with powdery mildew. Shaded cells indicate results are significantly better than untreated i.e., less disease or more yield/oil.

Fungicide economics

To determine the economic benefit of the fungicide treatments, grain yield was multiplied by price (allowing for oil increments) and costs of fungicide product and application costs were subtracted. This partial gross margin was then analysed as a variate in the same way that grain yield was analysed (Miravis Star was not included in the economic analysis as it has not yet commercially available).

We assumed a price of:

- $550/tonne for canola (+/- 1.5% for each 1% oil above or below 42%)
- $54.50/L Aviator Xpro
- $74.50/L Prosaro
- $21/L Veritas
- $13/ha application cost

At Ganmain there was no (statistical) difference in the partial gross margin (gross income less treatment and application costs) of any treatment compared to the untreated control. There was a higher partial gross margin at Kamarah only from the application of both Aviator Xpro and Prosaro at 30% bloom. At Temora, the highest partial gross margin was from a single spray of Aviator Xpro at 30% bloom. At both Warren and Wellington, there was no economic benefit of any fungicide treatment compared to the untreated control.

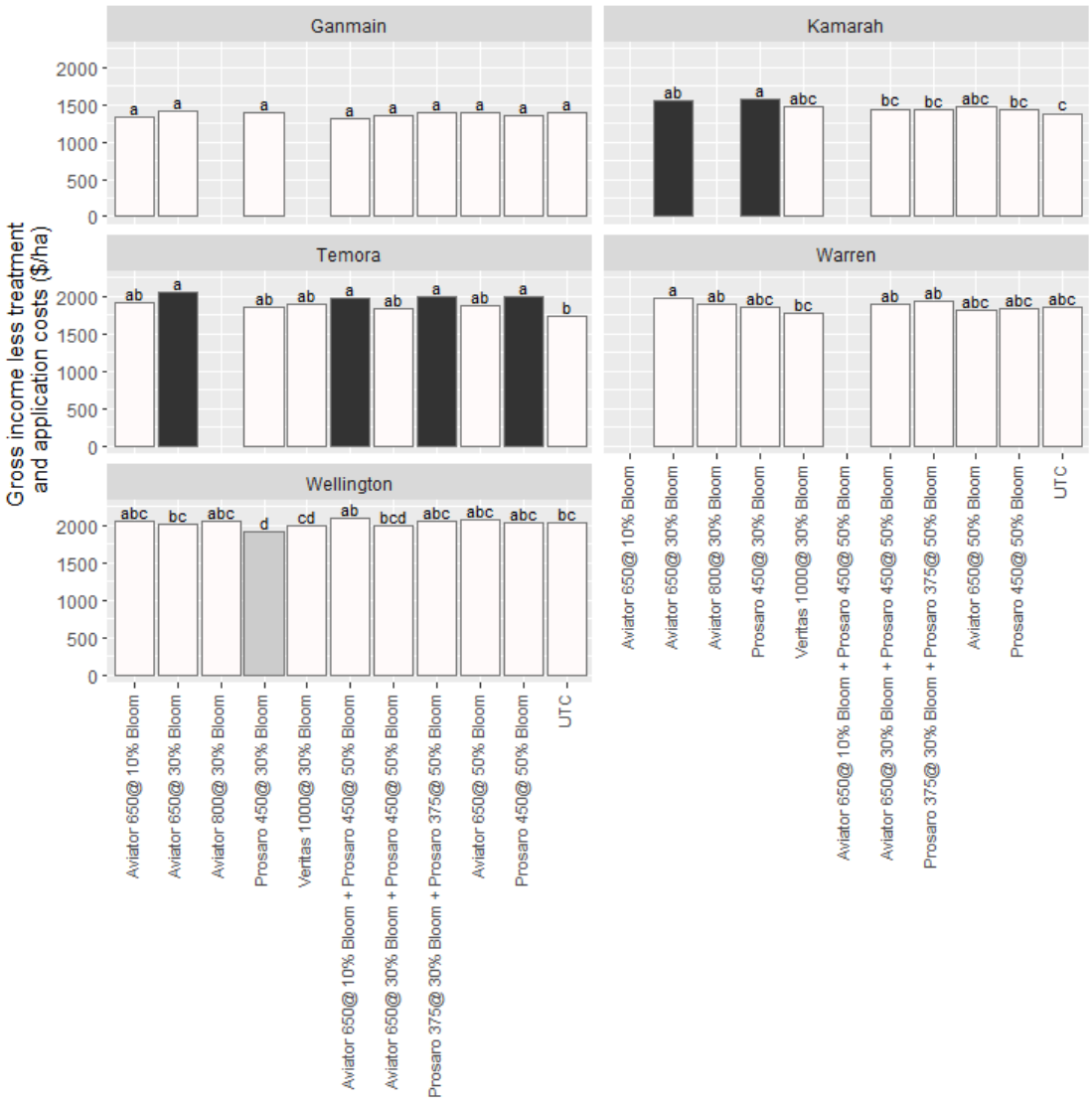

Figure 3. Partial gross margin (gross income less fungicide product and application costs) of fungicide treatments across five sites in NSW in 2020. Treatments with the same letter are not significantly different at p=0.05. Treatments in black are significantly higher than untreated control (UTC) and treatments in grey are significantly lower than UTC.

Discussion and conclusion

Many southern and central NSW canola crops in low-medium rainfall zones had a foliar fungicide applied to them in 2020. The primary driver was protection from Sclerotinia stem rot predicted by a wet first half to the cropping year leading to higher yield potential and medium-term forecasts predicting above average rain through spring. The secondary concern was UCB, especially in southern regions. The presence of Sclerotinia spores was confirmed by petal testing at all trial sites and blackleg was observed at all sites. Despite presence of these diseases at all sites, improvements in grain yield were not common or consistent and economic benefits from fungicide were evident at only two sites.

Petal testing indicated that Sclerotinia inoculum was present at all sites. That visual inspections at Warren and Wellington did not find any apothecia would tend to indicate that infections may have

come from neighbouring paddocks. On the other hand, the presence of inoculum was not a good predictor of the ensuing levels of infection.

At all sites, a period of dry weather was experienced through late August and early September which may have limited the development of Sclerotinia in the canopy, however, all sites received good rainfall thorough the early flowering period and again during the late flowering period at most sites.

However, Sclerotinia and blackleg were not the only diseases present in these trials and, although separate assessments were made on the impact of fungicide treatment on the multiple diseases present, it is impossible to attribute yield response (where observed) to any one disease. Yield responses may have been due to reduction in infection of one or more diseases.

Sclerotinia and blackleg were at low levels in the two northern trials (Warren and Wellington) whereas powdery mildew and Alternaria infection were relatively high but spraying fungicide did not provide an economic benefit at these two sites. (None of the products tested have label claims for these two diseases in canola).

Some reduction in Alternaria was achieved with fungicides but it was difficult to ascertain the level of yield loss as even a two-spray strategy was not enough to fully protect pods. The latest spray timing on label is 50% bloom and at this stage only 20-30% of pods have formed. Powdery mildew was a talking point at windrowing time in many crops in the central-west. We found good reductions in in symptoms where Prosaro was applied at 50% bloom yet there did not appear to be significant yield losses even at high levels of infection. Prosaro does not have a label claim for control of powdery mildew in canola.

There was a more compelling case for the economic benefit of fungicides in two of the three southern sites, but not with all treatments. Both responsive sites (Kamarah and Temora) were in cultivars without effective major gene resistance to blackleg, so yield response may have been due to upper canopy blackleg (branch) infection as well as Sclerotinia (especially at Temora). A single spray of Aviator Xpro at 30% bloom provided the most consistent economic benefit in the two responsive southern sites, at Temora returning a net $323/ha net advantage over the untreated.

Overall, despite the presence of several diseases including Sclerotinia and UCB and high yield potential, positive responses to fungicide applications were not universal across sites. In hindsight the dryer conditions in late Autumn to early Spring may have limited disease progression and hence reduced the necessity for fungicides. However, as fungicides are prophylactic, growers and advisors can only work with the information they had at the time.

Many growers and advisors saw the application of fungicide as an insurance policy rather than as an investment and were comfortable knowing they had some of the best crops they had ever grown protected from the potential negative yield effects of key fungal diseases. There are several other ‘investments’ that could be made into a canola crop where returns are more predictable (such as nitrogen) and ideally the investments that give a reliable return should be addressed before spending more money on ‘insurance’.

However, given that 2020 was such a good season with very high yield potential, and that economic benefits were not always present, should give growers the confidence that in seasons with only ‘average’ grain yield potential, expenditure on fungicide may not be justified and money may be better invested elsewhere.

Management factors that growers can implement in 2021 to reduce fungicide requirement during the flowering period include:

- Select cultivars with effective major gene blackleg resistance. Monitor updates to the GRDC Blackleg Management Guide to guide decision making
- Match phenology and sowing date so that crops do not flower too early. Early flowering will usually result in greater exposure to disease - especially upper canopy blackleg

- Closely monitor short-term forecasts as diseases require moisture for infection
- Consider using some of the decision support tools that may quantify the risks of canola diseases and the need for fungicide applications.
    - One example promoted by Bayer can be found at- https://www.crop.bayer.com.au/-/media/bcs-inter/ws_australia/use-our-products/product-resources/prosaro/prosaro_420_sc-factsheet-sclerotinia_control.pdf
        - Download the SclerotiniaCM and BlacklegCM decision support Apps for your tablet or iPad device
- Avoid sowing canola in or near paddocks that have had high levels of disease infection recently
- When a fungicide is required, apply at the correct time (~30% bloom) and with good coverage to avoid needing a second fungicide.

By reducing the need for fungicide, growers may be able to invest in other inputs where higher returns are guaranteed.

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