An Evaluation of Seed Treatments for Controlling Insects and Diseases in Canola.

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Key Points

- In 2004, late sowing and dry spring conditions had a greater effect on canola yield than any disease or insects pests
- Jockey® seed treatment provided significant control of blackleg at Alectown. However, Jockey® did not increase grain yield.
- No disease control benefits were recorded from Maxim® or Jockey® canola seed treatments at Wirrinya, Gunning Gap or Red Bend.
- Maxim® seed treatment resulted in a significant grain yield increase in canola at Alectown.
- Gaucho® and Cosmos® did not reduce earth mite damage to canola seedlings under very high populations at Red Bend. Other control measures are needed when earth mite populations are very high.

Background

The aim of these trials was to evaluate the potential for grain yield responses from controlling insects and diseases in canola with commercially available seed applied treatments.

The use of seed applied insecticides such as Cosmos® (fipronil) and Gaucho® (imidacloprid) is seen as a convenient way of controlling earth mites, which are often present when canola seedlings are emerging.

The increase in canola disease pressure as a result of more intensive cropping rotations in conjunction with other factors has resulted in a perceived canola yield decline over the last few years. The use of seed dressings such as Jockey® (fluquinonazole) and Maxim® (fludioxonil + metalaxy-M) has the potential to limit some of these problems, particularly blackleg, in areas where disease pressure is high and/or where varieties of low to moderate resistance are grown.

Methods and Trial Design

Four trial sites were sown - Alectown, Gunning Gap, Wirrinya and Red Bend - as randomised blocks with 3 replicates. Alectown was sown into a pasture fallow 300m on the northern side of a paddock that was canola in 2003. Gunning Gap and Wirrinya were sown following wheat in 2003. The Red Bend site was located in the Red Bend Catholic College School farm, having been a weedy pasture for some time. The Gunning Gap, Wirrinya and Red Bend sites were long distances from 2003 canola stubbles.

The seed treatment products and rates used in the trial are listed in Table 1. Seed treatments were applied by Dovuro Seeds using commercial application techniques. The canola varieties AG Spectrum, AG-Comet and ATR Stubby were sown at 4 kg/ha. The Alectown, Gunning Gap and Wirrinya sites were

sown using a small cone seeder. The Red Bend site was sown by broadcast and harrowed in. The Alectown and Wirrinya trials were harvested using a small plot harvester. Sowing dates were Alectown - 1st June, Gunning Gap - 29th May, Wirrinya - 16th June and Red Bend - 8th June.

The results were statistically analysed using analysis of variance and spatial analysis where applicable. Detailed assessments of cotyledon diseases, insect pressure and plant establishment were carried out 4 and 8 weeks after sowing. Lodging and blackleg stem canker assessments at Alectown were done several weeks before harvest.

Table 1: Seed treatment products, rates and indicative costs at Alectown, Gunning Gap, Wirrinya and Red Bend in 2004.

Active	Product Name(s)	Registered for control of	Rate L/100kg	Indicative Cost $/100kg	$/ha*
Nil	Nil		Nil	Nil	Nil
Fipronil	Cosmos	Red legged earth mite[A]	0.4	$325	$13.00
Imidacloprid	Gaucho	Red legged earth mite, Blue Oat mite and Aphids[B]	0.4	$200	$8.00
Fluquinconazole	Jockey	Backleg (suppression)[C]	2	$163	$6.52
Fludioxonil + Metalaxyl-M	Maxim XL	Pyth/um spp, Rh/zocfon/a so/ani and seedling blackleg supression[D]	0.4	$130	$5.20
Fluquinconazole + Fipronil	Jockey + Cosmos	See above	2+0.4		$19.52
Fluquinconazole + Imidacloprid	Jockey + Gaucho	See above	2 + 0.4		$14.52
Fluquinconazole + Fludioxonil + Metalaxyl-M	Jockey + Maxim	See above	2 + 0.4		$11.72
Fluquinconazole + Imidacloprid + Fludioxonil + Metalaxyl-M	Jockey + Gaucho + Maxim	See above	2 + 0.4 + 0.4		$19.72

[A]BASF, 2004
[B]Bayer Cropscience, 2004
[C]Bayer Cropscience, 2004
[D]Syngenta, 2004
*assumes sowing rate of 4kg/ha

Table 2: Rainfall and water limited yield potential at canola seed treatment trials 2004.

Location	Rainfall (mm) Monthly Rainfall														Annual	Fallow	Growing season	Water limited yield potential[A]
	Nov	Dec	Jan	Feb	Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	De	Total	(Nov - Mar)	(Apr to O ct)	t/ha
Alectown	26	34	44	31	38	5	55	53	40	53	63	0	21	98	501	173	269	3.3
Gunning Gap	29	32	38	52	19	59	33	45	15	30	29	67	25	95	506	169	278	3.2
Wirrinya	0	14	72	66	5	6	15	63	21	25	31	54	29	95	482	157	216	2.2
Red Bend	22	68	54	73	22	26	33	58	22	32	45	34	46	123	566	239	249	3.2

[A]water limited yield potential (t/ha) = ((Nov to Feb) X 30% + (Mar) X 50%)mm + (Growing season rainfall -110)mm) X 15(kg grain/mm) /1000

Results and discussion

Seasonal conditions

2004 was not a good season for canola. A late season break meant that all trials were sown outside the recommended sowing window for canola. Growing conditions were favourable in June, but deteriorated in September, with very warm dry conditions. Good rainfall in late September arrived too late to be of benefit to the canola in these trials. Table 2 provides details of rainfall and water limited yield potential (using the French and Schultz model) at each of the trial

sites. Trial grain yields were poor and well below the theoretical water limited yield potential, with yields at Wirrinya < 0.5 t/ha, and < 0.9 t/ha Alectown. The Gunning Gap site was not harvested, but yields were estimated at <0.3 t/ha. The Red Bend site was also not harvested. The water limited yield potential figure assumes timely sowing, with the late break this was not possible and canola was sown 4-6 weeks outside the optimum sowing window. This means that the water limited yield potential over-estimates the effective yield given the field conditions at each of the sites in 2004.

Insect control

Variety effects

Considerable earth mite insect pressure (species not determined) was only observed at Red Bend. The earth mite pressure at this site was severe. No earth mite control practices had been implemented at this site in the past. AG Comet had significantly less earth mite damage at Red Bend than the other two varieties (Table 3). AG Comet was also the most vigorous emerging variety at Red Bend, Alectown and Gunning Gap.

Seed treatment effects Neither Gaucho® or Cosmos® (nor any combination of products) provided protection against the high earth mite population at Red Bend. The plots were assessed approximately 6 weeks after sowing. The fact that the nil treatment was still alive at this time given the very high mite population suggests the earth mites infested the trial several weeks after emergence. These products are promoted as providing protection of canola seedlings under low earth mite pressure (BASF, 2004; Bayer, 2004b). The Gaucho® label (Bayer, 2004a) claims 3-4 weeks protection after which other control measures may be needed in conjunction with the seed treatment. The Gaucho® label also states that control of diapause eggs the previous spring in pasture fallows is import to reduce earth mite numbers. Given the lack of any previous control techniques, and late infestation with very high earth mite pressure in the Red Bend trial, the lack of significant protection offered by Gaucho® and Cosmo® was expected. The Gaucho® and Cosmos® treatments gave no significant yield improvement or emergence benefits over the nil treatment at the sites that were harvested: Alectown and Wirrinya.

Disease control

The wet conditions in June and early July promoted some disease development, particularly at the Alectown trial. This trial site was located 300 m on the northern side of a paddock that had canola in 2003. The other 3 trial sites were a long distance from commercial canola crops.

Varietal effects

Detailed disease measurements were taken at Alectown and Wirrinya, because these were the only sites to show measurable levels of disease. Low levels of downy mildew and blackleg were present at Wirrinya. However, it had no effect on yield and as such this data has not been presented.

Blackleg disease symptoms at the infection levels present at Alectown were easily visually observed. AG Spectrum had significantly higher cotyledon blackleg disease levels than AG Comet (Table 3). However, ATR Stubby had the highest level of blackleg stem canker. This is to be expected as ATR Stubby has the lowest blackleg disease rating of 6.5 compared with AG Spectrum and AG Comet which each have a blackleg rating of7(McRae et al.,2005).

Table 3: Performance of the canola varieties AG Spectrum, AG Comet and ATR Stubby in 2004. Nil seed treatment. Pooled data when no significant treatment effect.

Measurement	Variety	Location Alectown	Gunning Gap	Wirrinya	Red Bend
Emergence and vigour score[a]	AG Spectrum	**2.9 a**	-	**2.2 a**	3.8 ab
	AG Comet	3.3 b		**3.2** b	4.0 b
	ATR Stubby	**2.8 a**		**2.4 ab**	3.7 a
	lsd (P<5%)	**0.1**		0.3	0.3
Earth mite damage (% of leaf area)	AG Spectrum	-	-	-	4.3 b
	AG Comet				2.5 a
	ATR Stubby				4.8 b
	lsd (P<5%)				1.1
Cotyledon blackleg disease (% of leaf area)	AG Spectrum	44.0 b	-	-	-
	AG Comet	23.0 **a**			
	ATR Stubby	34.0 b			
	lsd (P<5%)	10.4			
Blackleg canker (% incidence of severe stem girdled)	AG Spectrum	3.3 **a**	-	-	-
	AG Comet	**5.8 a**			
	ATR Stubby	13.3 b			
	1sd (P<5%)	**6.2**			
Yield (t/ha)	AG Spectrum	0.78 **ab**	0.42 b	-	~
	AG Comet	0.82 b	0.44 b		
	ATR Stubby	0.66 **a**	0.32 **a**		
	lsd (P<5%)	0.13	0.06		
Oil (%)	AG Spectrum	33.1 **a**	40.8 **a**	-	*"
	AG Comet	34.9 b	43.6 b		
	ATR Stubby	33.0 **a**	41.2 **a**		
	lsd (P<5%)	0.4	**0.5**		

[a]emergence and vigour scores 1 = poor, 5 = excellent
Missing data indicates those measurements were not taken at the relevant sites
Pooled data when no signifcant treatment effect

ATR Stubby yielded significantly less than AG Comet and Spectrum at Wirrinya, and significantly less than AG Comet at Alectown. Oil levels were very low. This was a common theme in commercial crops throughout the district. AG Comet had the highest oil levels.

Seed treatment effects

Jockey® and Maxim® seed treatments were found to have some significant beneficial effects at Alectown. No seed treatment effects were recorded at Wirrinya. The individual varieties at Alectown showed similar response trends to the Maxim® and Jockey®, although the magnitude of response was different.

Individual variety data has been pooled at Alectown to reduce the level of statistical error and allow a better comparison between the seed treatments Jockey© and Maxim®.

Jockey® was found to provide a significant reduction in cotyledon blackleg disease area (Figure 1). Maxim® had no effect on cotyledon blackleg disease area. However, the combination of Jockey® + Maxim® provided significant better control of cotyledon diseases over Jockey® alone. No downy mildew was observed at Alectown.

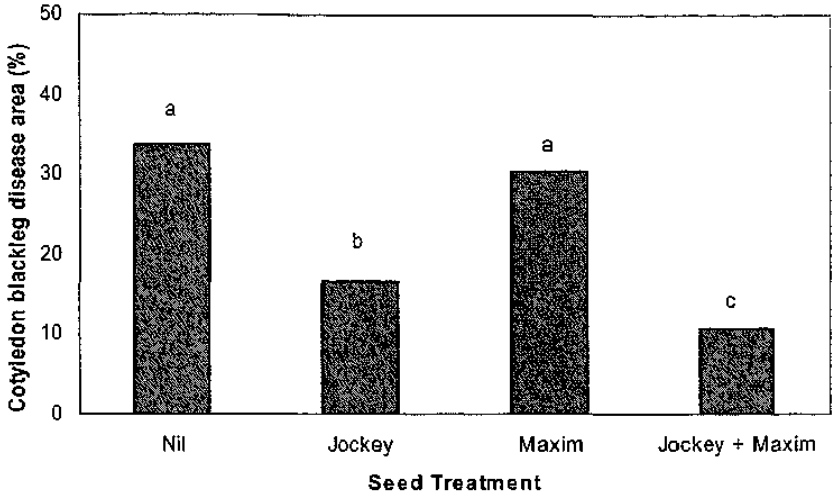

Figure 1: The effect of seed treatment on cotyledon disease area (%) of canola at Alectown 2004. Pooled data for ATR Stubby, AG Spectrum and AG Comet. Results with different letters are significantly different (P<0.05).

A similar trend was found for blackleg canker (Figure 2). However, in this case the Jockey® resulted in a significant reduction in blackleg canker compared to the Maxim treatment, but not when compared with the Nil treatment. The combination treatment of Jockey® + Maxim® was not significantly different to Jockey® alone.

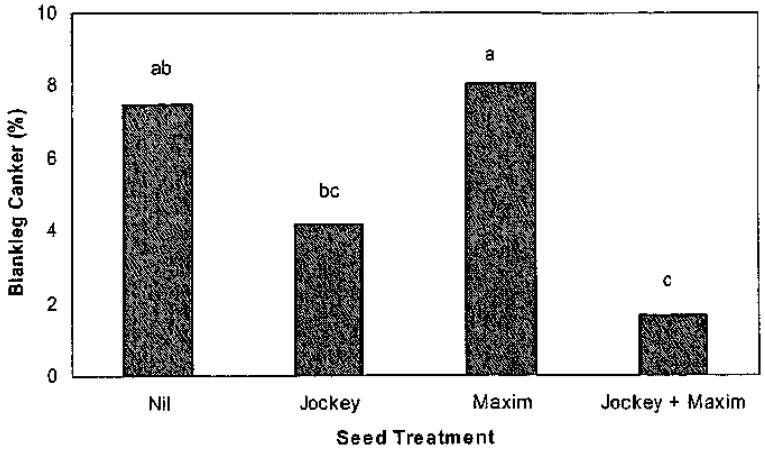

Figure 2: The effect of seed treatment on blackleg canker (% incidence of severe stem girdled) of canola at Alectown 2004. Pooled data for ATR Stubby, AG Spectrum and AG Comet. Results with different letters are significantly different (P<0.05).

Jockey® resulted in significantly less lodging at harvest than the Nil (Figure 3). Maxim® did not reduce lodging significantly when compared to the nil.

The combination treatment of Jockey® + Maxim® was no different than Jockey® alone for lodging.

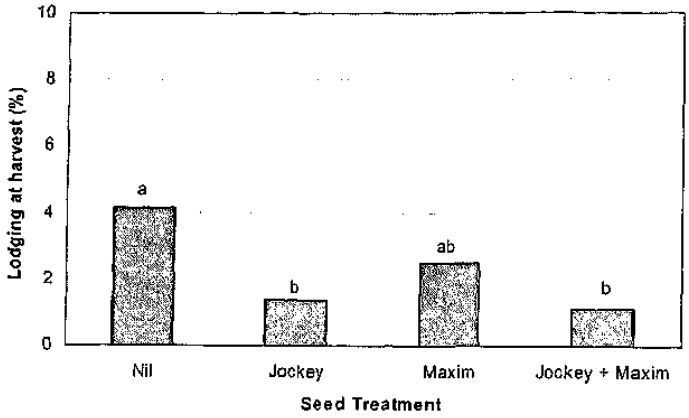

Figure 3: The effect of seed treatment on lodging at harvest of canola at Alectown 2004. Pooled data for ATR Stubby, AG Spectrum and AG Comet. Results with different letters are significantly different (P<0.05).

A significant grain yield response to Maxim® was recorded at Alectown for AG Spectrum (data not shown) and the pooled results from all 3 varieties (Figure 4). The Maxim® + Jockey® treatment gave no significant advantage over Maxim® alone. Maxim® provided a significant yield advantage of 13% for AG Spectrum and 10% for the pooled variety results. No seed treatment effects were observed on grain oil.

The grain yield response to Maxim® instead of Jockey® is confounding. Jockey® resulted in significantly less cotyledon blackleg disease and blackleg canker than Maxim®. Jockey® also significantly reduced lodging at harvest compared to the Nil seed treatment, while Maxim® did not. The only benefit from Maxim® on disease control occurred when it was mixed with Jockey® where it provided significantly better cotyledon blackleg disease control over Jockey® alone (Figure 1). However, this mix did not result in any significant yield benefits over Maxim® alone. One explanation may be that Maxim® controlled an aspect of disease that wasn't recorded in this trial, and that this has resulted in **a** significant yield increase.

An economic analysis of the benefit from Maxim® seed treatment indicates a benefit $10/ha to $35/ha (depending on the variety) after taking into account the product costs presented in Table 1. Under higher yielding conditions and higher disease pressure this benefit is likely to be more substantial.

Conclusion

Canola seed treatments responses were recorded at the Alectown site in 2004. No other responses from any of the seed treatments (nor their combinations) were recorded at the other sites.

The Cosmos® and Gaucho® seed treatments did not reduce earth mite leaf damage when they were present in large numbers at Red Bend. This reinforces the need for other control treatments to be used in combination with seed treatments

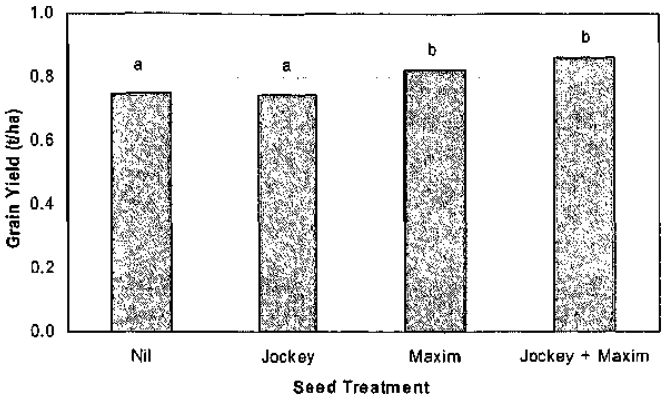

Figure 4: The effect of seed treatment on grain yield of canola at Alectown 2004. Pooled data for ATR Stubby, AG Spectrum and AG Comet. Results with different letters are significantly different (P<0.05).

when earth mite numbers are high or expected to be high.

Jockey® seed treatment provided significant control of cotyledon diseases and blackleg and reduced lodging at Alectown. Maxim© seed treatment when it was used in a mixture with Jockey®, significantly reduced cotyledon diseases compared to Jockey® alone. However, Maxim® and Maxim® + Jockey® resulted in a significant yield increase, not Jockey® alone. An explanation for this result maybe that Maxim® controlled an aspect of disease not measured in the Alectown trial, and that this was important and resulted in a yield response.

Canola fungicides can provide disease control and yield benefits in situations where disease pressure is heavy and/or variety resistance is low or moderate. These benefits are likely to be more substantial and profitable when seasonal conditions are more conducive to high disease pressure and high yield levels.

References

BASF (2004). Cosmos® Insecticidal Seed Treatment. Product Label.

Bayer CropScience. (2004a). Gaucho®. 600 Flowable Seed Dressing Insecticide. Product Label.

Bayer CropScience. (2004b). Jockey®. Systemic Seed Fungicide. Product Label.

Syngenta. (2004). Maxim® XL. Fungicide Seed Treatment. Product Label

McRae, F.J., McCaffery, D.W. and Mathews, P.W. (2005). Winter Crop Variety Sowing Guide 2005. NSW DPI.

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