

Fungicide control of *Ascochyta rabiei* in chickpeas

This project was supported and funded by the GRDC.

SUMMARY

Ascochyta rabiei can be controlled in chickpeas using chlorothalonil (Bravo). The fungicide needs to be applied early (six weeks after sowing) and be applied, at a minimum, every three weeks after the first application. Kaniva chickpeas sprayed with Bravo applied at two litres per hectare, every three weeks, produced a clean sample, free of infected grain (premium priced grain).

Mancozeb (Dithane) was less effective in controlling *Ascochyta* compared to Bravo. Carbendazim (Bavistin) did not control *Ascochyta* in these trials.

At Rupanyup the most tolerant variety to *Ascochyta* was Kaniva (kabuli), followed by Sona (desi). Lasseter (desi) was not tolerant. At Hart the most tolerant variety was Heera, followed by Dooen (both desi) and then Bumper (kabuli). It should be noted that at both sites the only harvested grain came from the fungicide treated plots.

Kabuli and desi chickpeas form an integral part of cropping rotations on alkaline clay based soils in southern Australia. The *Ascochyta rabiei* outbreak in 1998 was devastating to most chickpea crops. The normal area sown to chickpeas in Victoria is some 140,000 ha, it is estimated that less than 20% of this area was sown to chickpeas in 1999 as a direct response to the *Ascochyta* outbreak in the previous year. It will be some years before reliable *Ascochyta* resistant chickpea varieties are released. Until then, there is an urgent need to determine whether an effective fungicide control program, in combination with other best management practices, is available for the control of *Ascochyta* in chickpeas.

METHOD

Two fungicide trial sites were established (Hart in SA and Rupanyup in Victoria). The fungicide program in the trial was exactly the same at both sites. The varieties were different between the two sites (Table 3.8). At both sites fungicide treatments were fully replicated in a randomised plot design. Fungicides used were 720 g/kg chlorothalonil (as Bravo®), 500g/L carbendazim (as Bavistin®) and 800 g/kg mancozeb (as Dithane®). Two of the treatments included a foliar application of ZnSol at the first spray application (Table 1). At Rupanyup control plots (no application of fungicide) were bordered on both sides by heavy intensity fungicide application of Bravo to stop the spread of *Ascochyta* into other treatments. At Hart all plots were bordered by faba beans to reduce the spread of infection. At both sites the intensity of infection was high but not dissimilar to the level of infection in commercial crops nearby. Chickpeas were infected with *Ascochyta* naturally.

Measurements included *Ascochyta* damage rating on the crop during the season, crop yield, seed infection levels on Kaniva chickpeas at Rupanyup, and MRL (minimum residue levels) for the Bravo treatments for Kaniva chickpeas at Rupanyup. Unfortunately the MRL data will not be available until after printing.

Table 3.8 Site treatment descriptions

	Rupanyup, Vic	Hart, SA
Varieties sown	Kaniva, Lasseter, Sona	Bumper, Dooen, Heera

Seed treatment	P-Pickel TSC	P-Pickel TSC
Date sown	20 June 1999	8 June 1999
Date fungicide application	17 August 7 September 30 September 19 October 4 November 23 November	22 July 10 August 21 August 20 September 12 October 3 November
Water application rate	100 L/ha	60 L/ha

Table 3.9 Fungicide treatments

No	Treatment	Rate / ha	Code	Application timing	Cost \$/ha
1	Control		Control		
2	Dithane	1.2 kg	Dith 1.2	6 WAS [^]	6.50
3	Dithane	2.4 kg	Dith 2.4	6 WAS	13.00
4	Bravo	1.0 L	Brav 1.0	6 WAS	21.50
5	Bravo	2.0 L	Brav 2.0	6 WAS	43.00
6	Bavistin	0.25 L	Ba 0.25	6 WAS	11.00
7	Bavistin	0.5 L	Ba 0.5	6 WAS	22.00
8	Dithane	1.2 kg	Dith 1.2x6	6 WAS + every 3 weeks	39.00
9	Dithane	2.4 kg	Dith 2.4x6	6 WAS + every 3 weeks	78.00
10	Bravo	1.0 L	Brav 1.0x6	6 WAS + every 3 weeks	129.00
11	Bravo	2.0 L	Brav 2.0x6	6 WAS + every 3 weeks	258.00
12	Bavistin	0.25 L	Ba 0.25x6	6 WAS + every 3 weeks	66.00
13	Bavistin	0.5 L	Ba 0.5x6	6 WAS + every 3 weeks	132.00
14	Dithane/Bavistin alternate*	1.2kg/0.25L	Dith/Ba	6 WAS + every 3 weeks	52.50
15	Bravo/Bavistin alternate*	1.0L/0.25L	Brav/Ba	6 WAS + every 3 weeks	97.50
16	ZnSol + Dithane/Bavistin#	1.2kg/0.25L	Zn-Dith/Ba	6 WAS + every 3 weeks	58.50
17	ZnSol + Bravo/Bavistin	1.0L/0.25L	Zn- Brav/Ba	6 WAS + every 3 weeks	103.50

* Dithane first application, 3 weeks later Bavistin, 3 weeks later Dithane etc

ZnSol and Dithane first application, 3 weeks later Bavistin, 3 weeks later Dithane etc

[^] 6 WAS = six weeks after sowing

RESULTS

The effectiveness of the fungicide in controlling the foliar affects of *Ascochyta* were very similar at both sites (Table 3.10). At Rupanyup a late assessment of *Ascochyta* infection was undertaken on the foliage and pods (Table 3.11).

Table 3.10 Foliage *Ascochyta* ratings*

No	Treatment	Rupanyup, Vic (23/9/99)			Hart, SA (14/10/99)		
		Kaniva	Lasseter	Sona	Bumper	Dooen	Heera
1	Control	6	7	6	9	6	8
2	Dith 1.2	5	6	5	9	7	8
3	Dith 2.4	5	6	5	9	8	8
4	Brav 1.0	4	5	5	8	7	7
5	Brav 2.0	4	5	4	7	5	6
6	Ba 0.25	6	7	6	9	7	8
7	Ba 0.5	6	6	6	9	8	8
8	Dith 1.2x6	5	6	5	7	6	6
9	Dith 2.4x6	5	6	5	6	5	5
10	Brav 1.0x6	4	6	5	4	3	4

11	Brav 2.0x6	4	5	4	3	2	3
12	Ba 0.25x6	5	7	6	9	7	7
13	Ba 0.5x6	6	6	6	9	8	8
14	Dith/Ba	5	6	6	8	6	7
15	Brav/Ba	5	5	5	7	5	5
16	Zn-Dith/Ba	5	6	5	8	6	7
17	Zn- Brav/Ba	4	5	5	6	5	5

Table 3.11 The effect of the fungicide in controlling the foliar affects of *Ascochyta* blight at Rupanyup measured before harvest.

N o	Treatment	3rd assessment (10/12/99)			Pod assessment (10/12/99)		
		Kaniva	Lasseter	Sona	Kaniva	Lasseter	Sona
1	Control	8	9	8	8	10	7
2	Dith 1.2	8	9	8	7	10	6
3	Dith 2.4	8	9	8	7	10	7
4	Brav 1.0	8	9	8	7	10	6
5	Brav 2.0	8	9	8	7	10	7
6	Ba 0.25	9	9	8	7	10	6
7	Ba 0.5	9	9	8	8	9	7
8	Dith 1.2x6	8	9	7	6	10	5
9	Dith 2.4x6	6	9	8	3	10	3
10	Brav 1.0x6	4	7	5	2	5	2
11	Brav 2.0x6	3	5	3	1	3	1
12	Ba 0.25x6	9	9	9	7	10	7
13	Ba 0.5x6	9	9	8	8	10	7
14	Dith/Ba	8	9	8	6	10	5
15	Brav/Ba	6	9	6	4	10	3
16	Zn-Dith/Ba	8	9	8	7	10	6
17	Zn- Brav/Ba	6	9	6	3	9	4

* *Ascochyta* ratings scale used

1 - no effect; 3 - some plants affected; 5 - 50% of plants affected and infection serious; 7 - all plants affected and infection serious; 9 - crop dead

Discussion of foliage assessment

Hart: Bravo applied at 2L/ha every three weeks was the most successful treatment in all varieties at suppressing *A. rabiei*. Control in Bumper was still not satisfactory with this treatment with at least 20% of foliage infected and 80% of stems with lesions resulting in 15% of broken stems.

Bravo, at 1L/ha and 2L/ha (six weeks then every three weeks) were the most effective treatments. There was no significant difference between the two Bravo applications at 1L/ha and 2L/ha.

Rupanyup:

Treatments at the first assessment were not significantly different. There was a low incidence of the disease at this growth stage, but most plants were healthy. The disease was prevalent in all varieties at the second assessment. Some plants in the Lasseter plots had 100% infection. Many plants had 50% infection regardless of fungicide treatment. In the Kaniva chickpeas, Dithane applied at 2.4kg/ha (six weeks after sowing) and all the Bravo treatments had significantly less infection than the control. In Sona, Dithane at 2.4kg/ha (six weeks after sowing) and Dithane 2.4kg/ha (six weeks after sowing then every three weeks) and all the

At the third assessment, the application of Bravo at 1L/ha and 2L/ha (six weeks after sowing then every three weeks) to Lasseter and Sona chickpeas were the only treatment to significantly reduce disease severity compared to the control. In the Kaniva plots the best treatment (lowest disease severity) was Bravo 2L/ha (six weeks after sowing then every three weeks). This reduced disease severity by 60% when compared to the control. Bravo 1L/ha (six weeks after sowing then every three weeks) reduced disease severity by 48% when compared to the control.

For Kaniva and Sona, treatments 9, 10 and 11 were all significantly different to the control with less disease, but still resulted in pod damage on some plant. For all the varieties Bravo 2L/ha was the best treatment resulting in the lowest level of pod damage (70% less disease compared to the control). Bravo at 1L/ha (six weeks after sowing then every three weeks) was only effective in Kaniva.

Chickpea yields were significantly different between treatments (Table 3.12).

No	Treatment	Rupanyup, Vic kg/ha			Hart, SA kg/ha		
		Kaniva	Lasseter	Sona	Bumper	Dooen	Heera
1	Control	13	0	37	0	9	0
2	Dith 1.2	67	0	27	0	17	9
3	Dith 2.4	0	0	27	0	9	9
4	Brav 1.0	30	0	63	0	5	0
5	Brav 2.0	147	0	137	0	43	26
6	Ba 0.25	0	0	0	0	9	3
7	Ba 0.5	0	0	50	0	0	0
8	Dith 1.2x6	220	0	303	0	43	38
9	Dith 2.4x6	460	0	490	29	63	111
10	Brav 1.0x6	893	0	703	257	263	345
11	Brav 2.0x6	1383	1090	1113	520	674	790
12	Ba 0.25x6	0	0	0	0	9	19
13	Ba 0.5x6	0	0	93	0	0	0
14	Dith/Ba	50	0	243	0	31	21
15	Brav/Ba	450	0	703	21	133	87
16	Zn-Dith/Ba	160	0	287	0	17	0
17	Zn- Brav/Ba	790	0	517	24	87	137
Significant diff.							
Variety		P<0.001 LSD=62			P<0.001 LSD=27		
Fungicide		P<0.001 LSD=14			P<0.01 LSD=65		

Grain quality

Grain quality was assessed for the harvested Kaniva chickpeas at Rupanyup (Table 3.13). Grain quality was assessed as the percentage grain with discolouration on a weight basis. NACMA export standards are a maximum 1% by weight of discoloured seed. Depending on market supply down grading of grain will occur with levels of infection above this level.

Table 3.13 Kaniva grain quality assessment

No	Treatment	Discoloured grain (% w/w)
9	Dith 2.4x6	3.1
10	Brav 1.0x6	2.2
11	Brav 2.0x6	0.5
15	Brav/Ba	3.2

INTERPRETATION

The results between the Rupanyup and Hart sites were very similar. The only successful fungicide application, to ensure an economic yield, was Bravo applied six weeks after sowing and then every 3 weeks, at either the 1.0 or 2.0 L/ha rate. The 2.0L rate performed significantly better compared to the 1.0L rate of Bravo. Even at the 2.0L rate there was still infection on the leaf material and pods, which resulted in seed abortion.

Dithane did not control *Ascochyta* sufficiently well and Bavistin had no control. The addition of ZnSol as a foliar spray with the first spray application did not improve control (zinc regularly applied to paddock).

The other consideration is grain quality. Discoloured grain is downgraded to a lower price (Table 3.14). At the moment there is a shortage of good kabuli type chickpeas and the grain price for large clean kabuli chickpeas is at a premium for the domestic market. Good clean 9mm sized chickpeas are priced between \$1000 and \$1200 per tonne (8mm at \$900 and \$1100/tonne). Grain will be down graded if there is more than 1% by weight of discoloured grain in the sample. A poor sample with discoloured grain could only be worth \$700/tonne. At the Rupanyup site only the Bravo at 2.0L applied at 6 weeks and then every three weeks ensured a good clean grain sample. Even though some of the other fungicide mixes controlled *Ascochyta* to the extent that there was a harvested yield the sample of grain harvested had a relatively high level of discoloured grain, and would incur a price penalty.

Table 3.14 Grain size and quality and relative prices for kabuli chickpeas

Grain size mm	Market	% discoloured grain	\$/tonne
9	Domestic	<0.5	1100
8	Domestic	<0.5	1000
7	Domestic	<0.5	800
9	Premium Export	0.5 - 1.0	1000
8	Premium Export	0.5 - 1.0	850
7	Premium Export	0.5 - 1.0	650
All grades		1.0 – 3.0	Deduct \$100/t
All grades		> 3.0	Sale by sample, expect a minimum deduction of \$200/t

No treatment provided total control and we do not regard six applications of Bravo at 2.0L/ha to be excessive. 1999 was a relatively dry year and it is unlikely that we saw the full potential of an *Ascochyta* outbreak. The infection at the Rupanyup site appeared to spread most quickly in September.

The results of these two trial sites will be encouraging to growers who are planning to grow chickpeas in 2000. At current prices only kabuli chickpeas appear to be worth growing due to the cost of fungicide application. The gross margin for desi chickpeas at an expected price of \$350/tonne is marginal if the crop was required to be sprayed six times with Bravo at 2.0L (\$258/ha for the fungicide alone).

COMMERCIAL PRACTICE

The level of *Ascochyta* inoculum (fungal spores) is very high throughout the areas where chickpeas have been grown in the last decade. Growers planning to grow chickpeas in 2000 must be prepared to treat their crops with fungicide to ensure a harvest. It is not known if there was any commercial crop of chickpeas that yielded well that was not sprayed with fungicides in 1999. The trial results in 1999 demonstrated good control with Bravo at 2.0L applied every three weeks. An alternative strategy, which needs to be investigated, is whether a lower rate of application applied every two weeks could also be successful. 1999 was a reasonably dry season and disease pressure will be higher in a wet year.

BEST MANAGEMENT PRACTICES FOR GROWING CHICKPEAS IN 2000 ARE:

Budget - do your budgets carefully and ensure it is still worth growing chickpeas if six or more applications of Bravo are included. The only option is to grow kabuli type chickpeas because of price and possible higher level of tolerance in Kaniva chickpeas.

Paddock selection - no chickpea residues from previous chickpea crops and preferably no chickpeas in an adjacent paddock in the previous year. Select paddocks you know you can get on to in wet conditions to apply the fungicide

Clean seed - try to use clean seed (there is no totally *Ascochyta* free seed available). Avoid high-risk varieties like Lasseter.

Treat seed - with P-Pickle T SC (thiabendazole and thiram)

Sow late - as late as possible. In the Wimmera do not sow until at least July. There is a risk with late sowing if the season does not finish with late rains, but the disease appears to be much less virulent once temperatures get above 18°C.

No double sowing - avoid sowing headlands to reduce double sowing which reduces efficacy of fungicide coverage.

Zinc nutrition - ensure the paddock has had a good zinc history, otherwise include it as a foliar spray.

Apply fungicides early - apply the first application of Bravo at six weeks after sowing.

Apply fungicide regularly - apply Bravo at least every two or three weeks or in front of every significant rainfall event. The disease is spread by rain and it is therefore important to try and apply the fungicide prior to rain.

Coverage – good cover of application is essential. Boom application at high water rates is better than an application by airplane.

Table 3.15 Notes on the fungicides used in the trial

Active	Trade name	Group ¹	Notes
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consituant			
chlorothalonil	Bravo, Rover	Y	protectant only, broad spectrum, no systemic activity
mancozeb	Dithane, Mancozeb, Manzate	Y	protectant only, broad spectrum, no systemic activity
carbendazim	Bavistin, Spin Flo	A	broad spectrum, systemic fungicide. Moves from point of application to tips of plants. Single mode of action (resistance problem)

[†] Group Y- multi-site activity; Group A - Benzimidazole

GROWER EXPERIENCE

A local Rupanyup farmer grew a very successful crop of kabuli chickpeas in 1999. The crop was grown on a self-mulching Wimmera clay soil. Kabuli chickpeas were sown on 25 June (seed treated with P-Pickle T SC). Two year old (1997) seed was used (pre Ascochyta outbreak). All fungicide applications were applied by boom with a water volume of 93 L/ha. A sticker was used with the first application but because of high cost was not used again. To avoid leaf burn no grass sprays were used during the season.

Table 3.16 Rupanyup farmer application details

Spray date	Product / rate	Rainfall after each spray
6 Aug	Dithane 1kg	7/8 - 15mm, 12/8 - 8mm, 13/8 - 4mm, 14/8 - 3mm
24 Aug	Dithane 1kg	24/8 - 5mm, 25/8 - 9mm, 26/8 - 47mm, 3/9 - 7mm, 4/9 - 14mm
8 Sep	Bravo 1L	16/9 - 2mm
28 Sep	Dithane 1.3kg	30/9 - 5mm, 9/10 - 1mm, 10/10 - 11mm, 11/10 - 21mm
13 Oct	Dithane 1kg	14/10 - 3mm, 15/10 - 4mm
25 Oct	Bravo 1L	26/10 - 2mm, 30/10 - 3mm
4 Nov	Dithane 1kg	5/11 - 11mm, 6/11 - 5mm, 13/11 - 39mm
18 Nov	Dithane 1.2kg	3/12 - 10mm
Yield: 2.38 t/ha, 70% of sample at 8mm (priced at \$1050/t), clean grain		

The grower used Silo weather maps to determine when rain fronts were coming through and sprayed just prior to rain. He increased the fungicide rate when he thought a rainfall front was coming through. The chickpeas remained clean and Ascochyta free throughout the season.

In 2000 the grower will sow his chickpeas later (early July).