New fungicides for controlling ascochyta in chickpea

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Key messages

- One or two well timed fungicide applications increased yield 10% and full control a further 15%.
- Newer fungicides were more effective at supressing ascochyta but this did not translate to increased yield.
- Further testing of new fungicides is required in more locations and seasons.

Aim

To investigate the efficacy of newly registered fungicides for control of ascochyta in chickpea.

Background

The occurrence of ascochyta *(Ascochyta rabiei)* in Western Australia in 1998 resulted in chickpea production area decreasing from a peak of around 70,000 hectares to a few thousand hectares. Plant breeding has produced varieties with increased resistance to this pathogen and new fungicides have been used extensively in Eastern Australia in the past few years. This trial aimed to test the effect of different fungicide management strategies in high and low ascochyta disease pressure situations within the WA environment. The aim is to develop robust ascochyta management practices.

Method

Chickpea, cultivar Striker was sown 15km east of Mingenew into dry soil on May 1 using a plot cone seeder. Plots were 10m long by 2m wide. Buffer plots of lupin were sown between each chickpea plot to stop the spread of ascochyta disease between treatments. P-Pickle T® fungicide was applied to all seed as per best practice ascochyta management.

Chickpea plots were inoculated with chickpea stubble which had obvious ascochyta lesions (sourced from previous ascochyta trials). Three 10cm long sticks of diseased stubble were placed in the ground 2.0m in from each end of each plot. Half of the plots were inoculated early, on June 26. This introduction of inoculum simulated an early occurrence of disease that may occur due to using infected seed or placing a chickpea crop too close to a crop from the previous session. A further introduction of ascochyta infected stubble was made to the remaining half of the plots on August 9, to simulate a late disease challenge. Three foliar fungicide products were applied; Aviator Xpro® (150g/L prothioconazole & 75g/L bixafen) @ 600mL/ha, Barrack® (chlorothalonil 720g/L) @ 1.5L/ha and Veritas® (Azoxystrobin 120g/L & Tebuconazole 200g/L) @ 1.0L/ha.

For each fungicide there were four application regimes: one application early in the season (June 26) one application late in the season (August 21), two applications (June 26 and August 21) and fortnightly application (control). Nil plots with no fungicide were also included with extra replications of this treatment. Measurements included establishment counts, NDVI/green leaf area, ascochyta ratings using a 0–9 rating scale (0 = No infection, 9 = most foliage dead or completely dead), biomass at maturity, seed yield and seed size.

Results

Seasonal conditions

A late start to the season and below average in-season rainfall were not conducive to the proliferation of ascochyta. Rainfall at the site was 260mm for the year and 208mm from sowing to maturity (Table 1). Growing season rainfall was well below the May-Oct long term average of 310mm. The first rains after planting occurred on May 27 and plants emerged in early June. There were 6 rain days between the introduction of inoculum (June 26) and the second (August 9). There were 8 rain days (33mm in total) from August 9 to September 30, at which time plants began to senesce.

Table 1. 2018 monthly rainfall (mm) from BOM Yandanooka station (8143).

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	GS
Mingenew	37	0	15	0	31	30	87	52	7				260	208

Rain days	4	0	3	0	3	8	9	9	3				39	32

Establishment

Plant density was measured on June 26 and the site average was 32 plants per square metre. As expected there was no effect across treatments, as they had not yet been applied. This indicates even establishment of a reasonable density over the site.

Table 2. Plant establishment, as of June 26 (p/m^2).

		Fungicide spray timings				
Fungicide	Inoculation time	1 early	1 late	2 (early and late)	Fortnightly	Unsprayed
Aviator	Early	32	33	36	35	*
	Late	31	27	31	32	*
Bravo	Early	32	29	33	33	*
	Late	30	31	30	32	*
Veritas	Early	33	33	33	31	*
	Late	30	34	33	33	*
Nil	Early	*	*	*	*	32
	Late	*	*	*	*	32
P inoculation time						NS
P Fungicide						NS
P Spray regime						NS

Growth and development

NDVI measurements taken on August 9 indicated no significant difference in green area between the early inoculated plots and those inoculated later, on August 9. Similarly there were no significant differences in NDVI due to the fungicide product or spray regime. At this time ascochyta was observed on plants close to the infection points but had not spread throughout the plots. Plants started flowering soon after this, from mid-August.

NDVI measurements taken on September 25 from the fortnightly applied fungicide treatments were significantly (*P* <0.001) greater, by 10%, compared to the nil fungicide treatments.

Plant biomass on September 29 of the late disease introduction treatments were significantly (*P* <0.05) greater, by 11%, than the early disease introduction treatments. Fortnightly fungicide application plots contained 8% more biomass than nil fungicide treatments, however this was not significant (Table 3).

Table 3. Plant biomass, as of June 26 (g/m^2).

Fungicide	Inoculation time	1 early	1 late	2 (early and late)	Control	Nil	Av. Fung	Av. Inoc
Aviator	Early	640	626	769	692		717	685
	Late	748	829	673	758			755
Bravo	Early	646	648	762	791		736	
	Late	693	825	756	767			
Veritas	Early	681	675	711	619		716	
	Late	769	760	739	775			
Nil	Early					642	682	
	Late					723		
Av. Spray regime		696	727	735	734	682		
P inoculation time								<0.05
Lsd inoculation time								61
P Fungicide								NS
P Spray regime								NS

Ascochyta

Ascochyta developed slowly from the infection points and levels were reasonably low in most treatments. On August 8 there was a small but significant (*P* <0.05) difference in ascochyta levels between early and late disease inoculation. The average score of the plots with disease introduced on June 26 was 1 out of 9 while there was virtually no disease from the late inoculation. Fungicide application did reduce disease compared to unsprayed control (*P* <0.05), however the fungicide product and spray regime were not significant at this time.

By September 7 more ascochyta was observed from early vs late inoculation (*P* <0.05). At this time there was still very little disease in the late inoculation plots, 0.6 out of 9 averaged across all treatments.

Because there was little disease in the late inoculation treatments the data was analysed with early inoculation treatments only to obtain greater differentiation between other treatments. There was no disease in control plots, significantly less than other plots (*P* <0.001). The type of fungicide used affected disease level, Veritas® plots with less disease than the other products (*P* <0.05). Spray regime was significant; the fortnightly sprayed control had less disease than all others. The 2 spray strategy had less disease than 1 spray or no sprays and the 1 spray strategies less disease than the unsprayed nils. The fungicide by spray regime interaction was close to significant at 0.064; Veritas® gave good control across all spray strategies. Aviator Xpro® gave good control with the 1 spray late and 2 spray strategies. Barrack® gave reduced control with the one spray strategies (Table 4).

Table 4. Ascochyta rating from early inoculated plots, as of September 7.

Spray	Nil	1 spray early	1 spray late	2 sprays	Control	Average
None	2.5	*	*	*	*	2.5
Aviator	*	2.5	1.5	0.7	0.0	1.2
Bravo	*	2.2	2.3	1.3	0.0	1.5
Veritas	*	1.0	0.8	1.0	0.0	0.7
Average	2.5	1.9	1.6	1.0	0.0	1.5
Control						<.001
Lsd Control						0.43
Control.Fung						0.01
Lsd Control.Fung						0.47
Control.Spray						<.001
Lsd Control.Spray						0.54
Control.Fung.Spray						0.064
Lsd Control.Fung.Spray						0.54

Yield and seed quality

Average site yield was 1.4t/ha. There was no significant difference between yields at each time of disease inoculation or between the fungicide products used. There was a significant difference in yield between the fungicide spray strategies (*P* <0.001). The unsprayed plots and plots with 1 early spray yielded less than the 1 spray late or 2 spray regimes by around 120kg/ha (~10%). The fortnightly control spray regime yielded an additional 200kg/ha (~15%) (Table 5). This indicates that the early fungicide application was not as effective as the later application.

These results differ from previous results of similar trials where yields declined more due to early inoculation of ascochyta and consequently the early fungicide application timing was the most important. This may be a reflection of the seasonal conditions, in particular that there were few large rain events post introduction of disease, and also that unlike previous trials there were no very susceptible ascochyta varieties included. There was no effect of any treatment on seed size, data not presented.

Table 5. Machine harvested yield (kg/ha).

Fungicide	Inoculation time	1 early	1 late	2 (early and late)	Control	Nil	Av. Fung	Av. Inoc
Aviator	Early	1134	1378	1329	1682		1420	1388
	Late	1324	1533	1453	1523			1441
Bravo	Early	1169	1320	1339	1715		1401	
	Late	1360	1386	1343	1579			
Veritas	Early	1360	1415	1380	1614		1459	
	Late	1339	1419	1498	1643			
Nil	Early					1209	1269	
	Late					1328		
Av. Spray regime		1281	1409	1390	1626	1269		
P inoculation time								NS
P Fungicide								NS
P Spray regime								<0.001
Lsd Spray regime								107

Conclusions

Yields up to 1600kg/ha were impressive given the late start and sharp finish to the season.

Newer fungicides were more effective at supressing ascochyta but this did not translate to improved yield. In this trial the most important factor was the timing of the fungicide application, with the later application providing better control. Even with the application of two foliar fungicides about 15% of yield, or 200 kg/ha, was forgone due to disease.

More work needs to be done to refine the best management strategies with the newer fungicides in a wider range of environments and seasons.

Key words

Chickpea, Ascochyta, fungicide

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Striker is protected under the Plant Breeders Rights Act 1994.

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