New fungicides offer improved ascochyta blight control and yield benefit in field pea

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Key findings

- Early disease control is important for reducing initial AB infection levels in field pea crops with a yield potential above 1.5 t/ha.
- A late fungicide spray is important to control AB in spring when rainfall is conducive to disease spread and pod and seed infection.
- Early sowing into a high disease risk window with new fungicide actives evaluated in this project, were demonstrated to have improved yield benefits over later sowing in the 2017 season.

Why do the trial?

Fungicides play a key role in managing ascochyta blight (AB) in field pea (commonly referred to as blackspot), as there is no varietal resistance to disease. Recently, new fungicide actives have emerged in the market, offering superior disease control in field crops. However, they have not been tested for AB control in field pea. As part of continuing research, experimental field studies have been undertaken to evaluate the efficacy of new actives in disease control and yield benefits in low (Minnipa, upper Eyre Peninsula) and medium (Hart, Mid-North) rainfall zones in South Australia. The trials undertaken by SARDI are part of Southern Pulse Agronomy project (SPA) funded by the GRDC (DAV00150). The performance of two new actives constituting a) Bixafen (75g/L) in combination with Prothioconazole (150 g/L) trading as Aviator Xpro®, and b) Azoxystrobin (200g/L) in combination with Cyproconazole (80 g/L) trading as Amistar Xtra® were compared to, mancozeb (2 kg/ha), seed treatment P Pickle T®, fortnightly chlorothalonil treatment (complete disease control) and an untreated (nil) treatment.

How was it done?

Experimental field trials were conducted from 2015 to 2017. In 2015, trials compared new actives against the industry standard practice of a seed dressing plus two mancozeb sprays at 9 weeks after sowing (WAS) and early flowering. In 2016, trials included an earlier spray at 4 – 6 node, when disease was first sighted. In 2017, two times of sowing were included at Hart to produce high and low disease risk with fungicide treatments as per 2016. Minnipa was not sown in 2017, due to the late break to the season and extended dry conditions.

A number of fungicide treatments were tested over the three years however, only selected treatments have been presented in this report (Table 1). In 2015 and 2016, the trials were designed as Randomised Complete Block Design (RCBD), replicated three times at each site. In the sowing date experiment, treatments were arranged in a split plot design, with sowing date as whole plots and fungicide treatment applied to the split plots. PBA Coogee was used in 2015 and 2016 and PBA Oura in 2017, with sowing conducted at 55 plants/m^2.

To accelerate AB infection field pea stubble infested with AB was uniformly spread adjacent to seedlings at 1 to 2 nodes growth stage, in 2015 and 2016. In the sowing date trial (2017) the infested stubble was randomly spread in the trial prior to sowing and the forecasting model 'blackspot manager' was used to predict high and low disease risk sowing windows. Early sowing (April 27) was conducted in a high spore release window and delayed sowing (May 31) into a low risk window.

Disease severity was assessed as the percentage of plants covered by AB symptoms (purplish-black necrotic lesions on leaves) x frequency of infected plants per plot, at vegetative and flowering growth stages. Plots were machine harvested and grain yields recorded for each treatment at physiological maturity.

Results and discussion

Seasonal conditions

Low summer rainfall followed by high rainfall during the month of April led to a late release of AB spores in 2015, with all trials sown into medium or high risk disease situations. The subsequent wet winter favoured plant growth and disease progression, and AB infection was apparent at all sites.

In 2016, the growing season rainfall (GSR) was above long-term average at Minnipa and Hart. Total GSR of 356 mm and 268 mm was recorded at Hart and Minnipa respectively. The two trials were sown in late autumn into relatively dry seed bed conditions. This was followed by wet conditions in winter and a relatively cool spring that resulted in prolonged maturation of the crop, particularly at Hart.

The 2017 season started with a late break in most parts of the SA. Growing season rainfall (191 mm) and annual (330 mm) rainfall was well below the long-term annual average (400 mm) for Hart. Early AB disease infection and progression was low due to an extended dry period during the growing season and non-conducive environmental conditions. However, a high rainfall event occurred in late winter (August, 44 mm)/early spring (September, 24 mm) and may have favoured disease spread in the latter growing stages. Severe frost events occurred in the last week of August, which coincided with the critical development period of pod filling in the early sown crops.

Effect of fungicide treatments on disease severity

Disease onset occurred earlier in the low rainfall zone compared to the medium rainfall zone indicating the drivers of AB were different across the two environments, in both 2015 and 2016 (Table 1). Subsequently, results showed AB response to fungicide treatment changed depending on environmental conditions.

Mancozeb applications reduced AB severity compared to the nil at Hart in 2015 and 2016, while there was no reduction in 2017. In contrast, AB severity was not reduced by this treatment at Minnipa where severity was initially higher. This may be due to the establishment of the disease prior to the first foliar applications 9 weeks after sowing.

Amistar Xtra® reduced disease infection levels at Hart in 2015, but not 2016 nor in either year at Minnipa. In 2017 at Hart, disease severity in Amistar Xtra® was lower than the nil treatment and similar to mancozeb and the two Aviator Xpro® treatments.

Aviator Xpro® sprayed at 6-8 WAS plus early flowering reduced disease severity over the nil at Hart and Minnipa in 2015, and Minnipa in 2016. The strategy of including an early spray of Aviator Xpro® at 4 WAS followed by a second application at 9 WAS and mancozeb at early flowering resulted in lower disease severity at both Hart and Minnipa, compared to the treatments other than fortnightly sprays of chlorothalonil, in 2016.

There was no fungicide interaction with sowing date in 2017, indicating the fungicide effect similar across sowing dates. The application of two Aviator Xpro® treatments showed similar disease control to the Amistar Xtra® treatment, compared to mancozeb and nil treatments.

Table 1. Ascochyta blight disease severity (% plot severity) assessed at between 9 and 13 node growth stage in field pea (PBA Coogee) under different fungicide treatments at Hart (Mid-North, SA) and Minnipa (upper Eyre Peninsula, SA), 2015 to 2017.

Year	Fungicide Treatment	Application Timing	Disease severity (%) Hart	Minnipa
2015	Nil		24	37
	P Pickle T®	Seed treatment	28	27
	Mancozeb	8 WAS + Early flowering	12	30
	Amistar Xtra®	8 WAS + Early flowering	6	30
	Aviator Xpro®	8 WAS + Early flowering	4	23
	Chlorothalonil	Fortnightly	9	18
		Lsd (*P*≤0.05) Fungicide x site	**8**	
2016	Nil		32	51
	P Pickle T®	Seed treatment	36	46
	Mancozeb	6 WAS + Early flowering	24	47
	Amistar Xtra®	6 WAS + Early flowering	33	49
	Aviator Xpro®	6 WAS + Early flowering	24	46
	Aviator Xpro® +	4 WAS, 9 WAS + mancozeb at early flowering	17	42
	Chlorothalonil	Fortnightly	14	25
		Lsd (*P*≤0.05) Fungicide x site	**7.8**	
2017	Nil		55	
	Mancozeb	Early disease + Early flowering	48	
	Amistar Xtra®	Early disease + Early flowering	42	
	Aviator Xpro®	Early disease + Early flowering	39	
	Aviator Xpro® +	Early disease + Early flowering + mancozeb	37	
	Chlorothalonil	Fortnightly	2	
		Lsd (*P*≤0.05) Fungicide	**8.1**	

NOTE: WAS = weeks after sowing. NB: # All treatments were treated with Apron® (350 g/L Matalaxyl-M) seed dressing to control downy mildew. Notably, in 2017, no trial was conducted at Minnipa due to the late break of the season. As some of the fungicide treatments in this research contain unregistered fungicides, application rates have been withheld. The research was carried out for experimental purposes only and the results within this document do not constitute a recommendation for that particular use by the author or author's organisation.

Effect of fungicide treatments on grain yield

The average site grain yield was 1.6 t/ha in 2015 for both Hart and Minnipa, while in 2016 Hart had higher yields (1.74 t/ha) than at Minnipa (1.30 t/ha) (Table 2). In 2017, the first time of sowing (27 April) yielded 3.1 t/ha with the second time of sowing (31st May) 2.3 t/ha (Table 3). Fungicide strategies in field pea are generally economic for yields above 1.5 t/ha.

Grain yields showed a similar fungicide treatment response across the two sites in 2015. In 2016, a fungicide treatment by site interaction was found for grain yield. Across all trials the highest yields were associated with Aviator Xpro®, Amistar Xtra® and fortnightly sprays of chlorothalonil, while mancozeb sprays did not significantly increase yield over nil treatments in any of the trials (Table 2).

In 2017, the three spray application strategy of Aviator Xpro® at early disease sighting, early flowering and a late spray of mancozeb at mid-flowering produced yields similar to fortnightly chlorothalonil (Table 2). In contrast, this response was not found in 2016, where fortnightly chlorothalonil had higher yields than the three spray strategy. This may be due to the number of chlorothalonil sprays being applied in seasons with more favourable and wetter finishing conditions. Although 2017 was generally drier, a substantial amount of rain fell in late winter/early spring and the late spray of mancozeb in the

Aviator Xpro® treatment was beneficial in controlling the spread of AB, resulting in yield increases in early sown crops, similar to the fortnightly chlorothalonil treatment. Grain yields increased by up to 20% from the use of new actives over the current industry standard in the early sown plots at Hart, in 2017 (Table 3). In the later sowing there was no yield response to fungicides. This result shows that significant yield penalties can occur if field pea crops are sown later or in high disease risk situations, such as early sowing, where fungicides are not applied.

Table 2. Average grain yields (t/ha) of field pea (PBA Coogee) sown with different fungicide treatments at Hart (Mid-North, SA) and Minnipa (Eyre Peninsula, SA) in 2015 and 2016.

Year	Fungicide Treatment	Application Timing	Grain yield (t/ha) Hart & Minnipa	
2015	Nil		1.55	
	P Pickle T®	Seed treatment	1.47	
	Mancozeb	8 WAS and Early flowering	1.47	
	Amistar Xtra®	8 WAS and Early flowering	1.77	
	Aviator Xpro®	8 WAS and Early flowering	1.79	
	Chlorothalonil	Fortnightly	1.73	
			Lsd ($P\leq0.05$) $_{Fungicide}$ = 0.16	
			Hart	**Minnipa**
2016	Nil		1.49	0.95
	P Pickle T®	Seed treatment	1.33	1.05
	Mancozeb	6 WAS + Early flowering	1.54	1.19
	Amistar Xtra®	6 WAS + Early flowering	1.84	1.32
	Aviator Xpro®	6 WAS + Early flowering	1.93	1.4
	Aviator Xpro® + Mancozeb	4 WAS, 9 WAS + Early flowering	1.65	1.58
	Chlorothalonil	Fortnightly	2.67	1.67
			Lsd ($P\leq0.05$) $_{Fungicide\ X\ Site}$ = 0.34	

Table 3. Average grain yields (t/ha) of field pea (PBA Oura) at different sowing dates under varying AB disease risk levels and different fungicide treatments at Hart (Mid-North, SA), in 2017.

	Grain yield (t/ha)		Grain weights (g/100 seed)	
Fungicide Treatment	**27-Apr**	**31-May**	**27-Apr**	**31-May**
Chlorothalonil	3.53^{a}	2.29^{a}	22.99^{a}	22.11^{a}
Aviator Xpro® & Mancozeb	3.42^{a}	2.19^{a}	22.15^{b}	22.51^{a}
Aviator Xpro®	3.22^{b}	2.33^{a}	22.00^{b}	22.46^{a}
Amistar Xtra®	3.04^{b}	2.37^{a}	21.21^{c}	22.57^{a}
Mancozeb	2.76^{c}	2.31^{a}	20.87^{cd}	22.57^{a}
Nil	2.66^{c}	2.28^{a}	20.65^{d}	22.35^{a}
Lsd ($P\leq0.05$) Fungicide x Sowing	**0.19**	**0.19**	**0.47**	**0.47**

NB: Seed dressing of P Pickle T® was used at sowing in all treatments except nil treatment

Frost damage impacted the grain quality of early sown crops, whereby more seeds had a shrivelled and discoloured appearance on the seed coat (Figure 1). This shows the importance of paddock selection when early sowing in order to avoid frost event during critical growth and development periods. Growers may need to adjust the sowing window of early sown crops depending on history of frost events on farm.

TOS 1 (April, 27) – Seed coat damage (shrivelled) and discolouration

TOS 2 (May, 31) – Seed coat damage (shrivelled) and discolouration

Figure 1. Frost damage expressed as shrivelled and discoloured seed coat in field pea (PBA Oura) sown at different sowing dates under varying AB disease risk levels and different fungicide treatments at Hart (Mid-North, SA) in 2017.

Implications for growers

Early disease control with new fungicide actives is important for reducing initial AB infection levels. In addition, a late fungicide spray is important to control AB in spring when rainfall is conducive to disease spread and pod and seed infection.

In environments with yield potentials above 1.5 t/ha, new fungicides showed improved disease control and a yield benefit of 15-20% over the current industry standard. Early sowing into a high disease risk window with these improved new fungicide actives was demonstrated to have improved yield benefits over later sowing in the 2017 season. However, the results need to be interpreted with caution as disease pressure was low and progression was reduced by below average rainfall in 2017. The susceptibility of early sown field pea to frost events will also require consideration.

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