Field pea - time of sowing and disease

Larn McMurray, Jenny Davidson, Mick Lines, Mark Bennie & John Nairn, SARDI

Key findings

- The field peas sown at Hart on the season break in 2009, were heavily infected with blackspot and grain yields were reduced by 30% (0.8 t/ha) compared with later sowing times.
- Sowing peas two to four weeks earlier (late May) than the conventional time (early – mid June) optimises production of Kaspa and the earlier, longer flowering line OZP0602.
- OZP0602 was generally higher yielding than Kaspa particularly in later sowing treatments.
- Yield loss from blackspot can be minimised if peas are sown after 60% of airborne spores have been released.
- The combination of P-Pickel T with two sprays of mancozeb was economic in some cases in the time of sowing trial at Hart in 2009, resulting in an average 7-14% yield gain in Kaspa and OZP0602.

Why do the trials?

To identify best sowing time and fungicides strategies in new pea varieties to maximise yields and to improve recommendations from the 'Blackspot Manager' disease risk prediction model in different regions by incorporating data from replicated trials.

How was it done?

Plot size	1.5m x 10m	**Fertiliser**	MAP @ 70 kg/ha with seed
Sowing date	TOS 1: 30th April 2009		
	TOS 2: 18th May 2009	**Row Spacing**	22.5 cm
	TOS 3: 4th June 2009		
Varieties	Alma (45 plants/m^2), Kaspa, OZP0602 & OZP0601 (55 plants/m^2)		
Trial design	Split plot with 3 replicates, blocked by sowing date. Variety by fungicide treatments randomised within blocks		

Fungicide	Seed *	Foliar
Nil	Apron	None
PPT + Mancozeb	Apron + PPT	Mancozeb @ 2 kg/ha – 9 node. June 24 (TOS1); July 23 (TOS2) & Aug 4 (TOS3)
Mancozeb @ 4-6 node & early flower	Apron	Mancozeb @ 2 kg/ha – 9 node & early flowering. June 11 & Aug 4 (TOS1); July 9 & Aug 26 (TOS2), July 23 & Sept 8 (TOS3)
Mancozeb @ 9 node & early flower	Apron	Mancozeb @ 2 kg/ha – 9 node & early flowering. June 24 & Aug 4 (TOS1); July 23 & Aug 26 (TOS2), Aug 4 & Sept 8 (TOS3)
PPT + Mancozeb @ 9 node & early flower	Apron + PPT	Mancozeb @ 2 kg/ha – 9 node & early flowering. June 24 & Aug 4 (TOS1); July 23 & Aug 26 (TOS2), Aug 4 & Sept 8 (TOS3)
Fortnightly	Apron + PPT	Chlorothalonil @ 2L/ha – May 29, June 4, 11 & 24, July 9 & 23, Aug 4 & 19, September 1, 18 & 30

* Apron® at 75ml/100kg seed for downy mildew control and PPT® at 200ml/100kg seed for blackspot control.

A similar trial was also conducted at Turretfield (high rainfall) and forms part of this SAGIT funded research. Results from this trial are also reported on in this article.

Results

Foliar disease and grain yield

High levels of early foliar disease (blackspot) infection occurred (Table 1) and significant and frequent rainfall events in spring favoured disease progression (Table 2). The field peas were severely affected by blackspot, especially at the earliest sowing time.

At Hart in 2009, the yield of all varieties in the earliest sowing period were 25-30% below the second two sowing periods due to severe blackspot (Table 1), clearly demonstrating the disease risk associated with early sowing (on the season break) of field peas. However, over the three years these trials have been run, the two earlier sowings have generally been equal or higher yielding than sowing in early June. Despite significant disease infection levels at Turretfield, the later sowing dates yielded similarly to the earlier sowing date as they were more adversely affected by the November heat wave than at Hart.

Table 1. Effect of sowing date and cultivar on blackspot disease severity and grain yield at two sites in SA 2009.

Sowing date	Foliar blackspot % plot severity					Grain yield (t/ha)				
	Alma	Kaspa	OZP 0601	OZP 0602	Mean	Alma	Kaspa	OZP 0601	OZP 0602	Mean
May-01	6.8	5.8	5.0	3.2	5.2	1.41	2.24	2.06	2.08	1.95
May-21	2.3	1.1	0.8	0.6	1.2	2.12	2.93	2.88	3.09	2.75
Jun-08	0.7	0.1	0.2	0.1	0.3	1.53	2.76	2.97	3.10	2.59
Average	3.3	2.4	2.0	1.3		1.69	2.64	2.64	2.75	
	lsd (P<0.05) = 1.7 (1.8 same sow date)					lsd (P<0.05) = 0.30 (0.15 same sow date)				
May-09	13.0	11.1	11.1	10.5	11.4	2.09	2.92	2.87	3.17	2.76
May-30	5.1	4.7	4.4	3.9	4.5	1.71	2.95	3.15	3.09	2.72
Jun-20	2.8	2.2	2.1	2.2	2.3	1.53	2.66	3.04	2.94	2.54
Average	7.0	6.0	5.8	5.5		1.78	2.84	3.02	3.06	
	lsd (P<0.05) = 1.3 (0.9 same sow date)					lsd (P<0.05) = 0.16 (0.11 same sow date)				

Table 2: Effect of sowing date and fungicide treatment on disease severity of field peas at Hart and Turretfield, SA, 2009.

Treatment	Foliar blackspot % plot severity					
	Turretfield (rated 24/9/2009)			Hart (rated 15/9/2009)		
	May-09	May-30	Jun-20	May-01	May-21	Jun-08
Nil	16.7	10.0	6.0	16.5	7.8	3.9
Mancozeb @ 4 node + early flowering	15.2	10.1	5.5	15.6	7.5	3.6
Mancozeb @ 9 node + early flowering	15.6	10.0	4.8	15.3	6.4	3.8
PPT + Mancozeb @ 9 node	15.7	9.0	4.0	15.8	7.7	3.5
PPT + Mancozeb @ 9 node + early flowering	15.8	9.0	4.7	14.5	6.0	3.0
Fortnightly chlorothalonil	9.0	3.3	1.1	4.4	1.7	0.6
LSD (P<0.05)	1.4 (1.4 same sow date)			1.1 (1.1 same sow date)		

Yield gains of 0 – 27% over the untreated plots were achieved, dependent upon sowing date and variety (Table 3). The line OZP0602 was higher yielding than Kaspa, particularly at the later sowing times of mid-May and early-June (Table 1). The benefit of OZP0602 over Kaspa was lost in the earliest sowing treatment at Hart under severe blackspot. Alma was lowest yielding particularly under high disease pressure. It had higher levels of foliar disease and therefore a greater yield gain from the fungicide treatments.

Yield gains in Kaspa and OZP0602 ranged from 7 - 14% and these varieties performed similarly in relation to disease infection level and response to foliar fungicide treatments in 2009. Fungicide applications found that the combination of P-Pickel T® seed treatment with two sprays of mancozeb (at 9 nodes and again at early flowering) were economic in some instances at Hart in 2009 (12% control). The fortnightly fungicide application produced significantly higher levels of disease control (71%) however, this treatment would generally be cost prohibitive.

Without the seed dressing, yield gains from two sprays of mancozeb, were generally less and more variable ranging from 0-14%. However timing of sprays relative to rainfall events and varietal flowering commencement appeared critical to yield response, such that fungicide sprays should be applied prior to significant rainfall events and earlier in OZP0602 than Kaspa, due to its earlier flowering date.

The above yields gains from the fungicides treatment strategies were still a lot less than those achieved by the fortnightly spraying treatment (19-65%) (Table 3). This treatment is uneconomical but does indicate that there are still yield gains to be made by controlling blackspot either through improved fungicides or increased genetic resistance.

Model validation

The disease spore predictions made by Blackspot Manager (a WA Department of Agriculture model that predicts the timing of release of airborne spores of blackspot from pea stubble) were analysed against final disease severity for each time of sowing in the 2007 and 2008 fungicide trials (including data from a third trial at Minnipa). Early results indicate that blackspot stem lesions will exceed 5 nodes, and hence affect yield, if more than 40% of spores are still present after sowing (Figure 1). Extremely dry seasons, such as occurred at Minnipa in these two years, will not result in disease irrespective of spore loads.

Table 3: Effect of sowing date and fungicide treatment on grain yield of field peas at Hart and Turretfield, SA, 2009.

Hart		Grain yield (t/ha) in each fungicide treatment						
Time of sowing	**Variety**	**Nil**	**Mancozeb @ 6 node + EarlyFlower**	**Mancozeb @ 9 node + EarlyFlower**	**PPT plus mancozeb @ 9 node**	**PPT plus mancozeb @ 9 node + EarlyFlower**	**Fortnightly Chloro-thalonil**	**Mean**
30-Apr	Alma	1.18	1.44	1.28	1.30	1.35	1.94	1.41
	Kaspa	2.05	2.14	2.03	2.04	2.20	2.96	2.24
	OZP0601	1.73	2.01	1.98	1.77	2.03	2.86	2.06
	OZP0602	1.89	2.07	1.94	1.79	2.03	2.76	2.08
	Mean	1.71	1.91	1.81	1.73	1.90	2.63	1.95
18-May	Alma	1.82	1.98	1.95	1.95	2.31	2.72	2.12
	Kaspa	2.75	3.01	2.78	2.56	3.11	3.37	2.93
	OZP0601	2.82	2.70	2.52	2.83	2.84	3.57	2.88
	OZP0602	2.82	2.98	3.10	2.96	3.11	3.54	3.09
	Mean	2.55	2.67	2.59	2.57	2.84	3.30	2.75
4-Jun	Alma	1.44	1.61	1.58	1.35	1.51	1.72	1.53
	Kaspa	2.70	2.68	2.44	2.58	2.71	3.45	2.76
	OZP0601	2.84	2.72	3.11	2.72	2.86	3.54	2.97
	OZP0602	2.76	2.88	2.67	3.41	3.13	3.73	3.10
	Mean	2.43	2.47	2.45	2.51	2.55	3.11	2.59
LSD variety x TOS x fungicide = 0.43								

Turretfield		Grain yield (t/ha) in each fungicide treatment						
Time of sowing	**Variety**	**Nil**	**Mancozeb @ 4 node + EarlyFlower**	**Mancozeb @ 9 node + EarlyFlower**	**PPT plus mancozeb @ 9 node**	**PPT plus mancozeb @ 9 node + EarlyFlower**	**Fortnightly Chloro-thalonil**	**Mean**
11-May	Alma	1.87	2.11	2.01	2.15	2.00	2.39	2.09
	Kaspa	2.79	2.63	2.75	2.88	2.89	3.56	2.92
	OZP0601	2.71	2.94	2.72	2.60	2.72	3.54	2.87
	OZP0602	3.03	3.07	3.12	3.11	3.11	3.56	3.17
	Mean	2.60	2.69	2.65	2.68	2.68	3.26	2.76
1-Jun	Alma	1.64	1.83	1.65	1.66	1.77	1.69	1.71
	Kaspa	2.84	2.93	2.87	2.77	2.82	3.46	2.95
	OZP0601	3.02	3.15	3.00	3.03	3.26	3.42	3.14
	OZP0602	2.97	2.89	3.11	3.02	3.13	3.42	3.09
	Mean	2.62	2.70	2.66	2.62	2.74	3.00	2.72
19-Jun	Alma	1.42	1.53	1.56	1.45	1.59	1.65	1.53
	Kaspa	2.55	2.66	2.69	2.64	2.72	2.73	2.66
	OZP0601	2.91	2.95	3.06	3.00	3.01	3.31	3.04
	OZP0602	2.76	2.89	2.87	2.99	3.01	3.11	2.94
	Mean	2.41	2.51	2.55	2.52	2.58	2.70	2.54
LSD variety x TOS = 0.16								
LSD variety x fungicide = 0.15								
LSD TOS x fungicide = 0.17								
LSD variety x TOS x fungicide = ns								

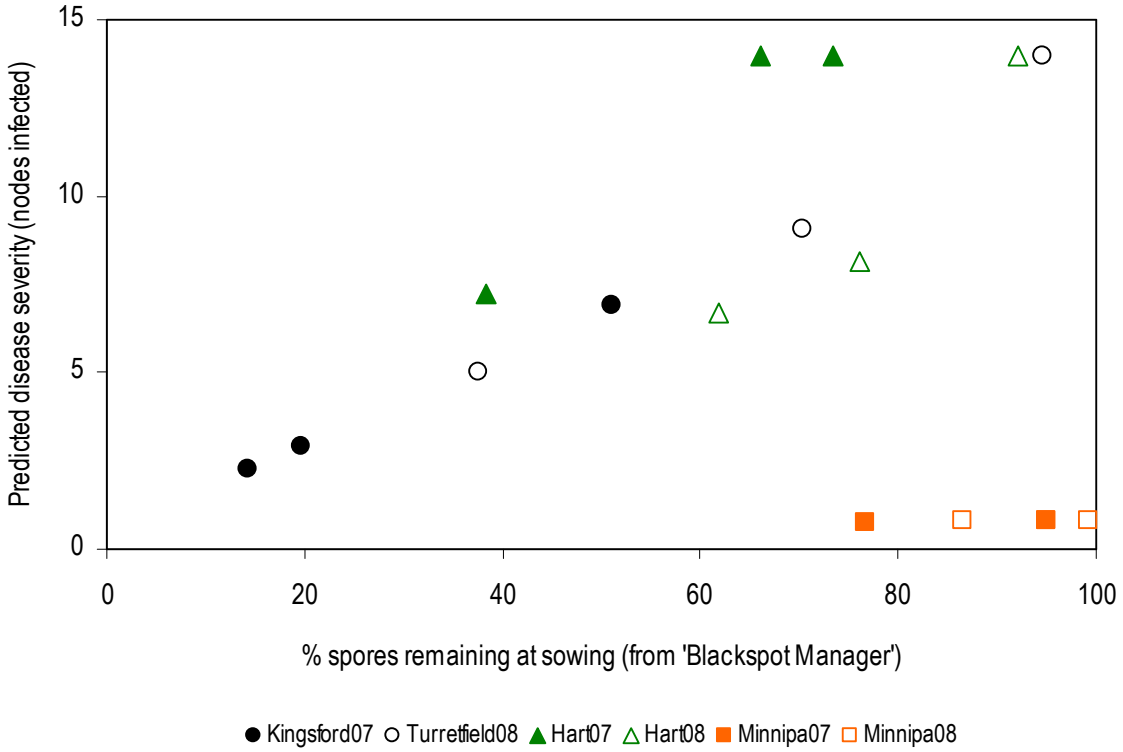

Figure1: Relationship between percent spores remaining at sowing and disease severity

Summary

These pea management trials have been conducted during shorter drier seasons and yield has been optimised by planting Kaspa and the early and longer flowering cultivar OZP0602 at an earlier date (late May) than the conventional time of early June. Combined with strategic fungicides the losses due to blackspot were minimised at this mid sowing date. Sowing at the break of the season (early May) exposed the crops to maximum blackspot risk with yield losses of 30% in 2009. Economic fungicides with greater efficacy than mancozeb are required before peas can be sown at the earliest period.

Early sowing of field pea is often essential for economic yields in dry years in low rainfall environments, however frost, weed and blackspot risks must be known and best practice management strategies implemented where possible.

Acknowledgements

SA Grains Industry Trust (SAGIT) for kindly funding this research and GRDC for providing funding of additional measurements.