Chickpea variety specific ascochyta management

Martin Harries, Mark Seymour, **Stephanie Boyce** DAFWA

Key messages

- New varieties have improved ascochyta resistance, but still need careful management.
- Avoiding early infection is critical to managing ascochyta effectively.
- A two spray fungicide strategy will provide reliable control.

Aim

To develop variety specific management packages for ascochyta blight of chickpea.

Method

Plots of three chickpea varieties Howzat, Genesis 836 and PBA Striker with varying tolerance to the foliar disease of chickpeas A*scochyta rabiei*; were sown on May 2 at Yandanooka (South Mingenew). Plots were 10 metres long by 2 metres wide. Buffer plots of lupin were sown between each chickpea plot to stop the spread of disease between treatments.

Chickpea plots were inoculated with chickpea stubble (sourced from an ascochyta disease nursery at Medina) which had obvious ascochyta lesions. Three 10cm long sticks of diseased stubble were placed in the ground 2.0 metres in from each end of the plot. Half of the plots were inoculated early on June 2. 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 5, to simulate a late disease challenge.

Each of the resulting 6 treatments had a different foliar fungicide treatment; Nil (none), one application early in the season (June 2) one application late in the season (August 11), two applications (June 2 and August 11) and fortnightly application (control). The fungicide used was 1.0 L/ha Barrack® (chlorothalonil 720g/L) applied in 100 litres of water/ha.

Measurements included establishment counts, NDVI/green leaf area using a handheld green seeker, 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

The trial was sown into good moisture at on May 2 and rainfall through the growing season totalled 283mm, close to the long term average May-Oct rainfall of 310mm. There were 11 rain days in June (all after the first inoculation of ascochyta infected stubble), 6 in July, 2 in early August and a further 10 after the late introduction of disease on Aug 5. Hence it was a season of frequent rainfall events which would be expected to stimulate ascochyta infection.

Table 1. 2016 monthly rainfall (mm) from BOM Yandanooka weather station (8143)

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	*GSR
Yandanooka	25.2	0.0	41.2	63.8	50.6	70.4	77.4	55.8	17.0	12.4	-	-	283.2

*Growing season rainfall

Establishment and plant growth

While there was good soil moisture at sowing, the next good follow up rain did not occur until May 22, which contributed to lower than targeted plant establishment of 32 plants/m^2 (target 40-45 p/m^2). Despite the reduced plant establishment there were no statistical differences in the plant density between the varieties.

NDVI measurements were taken at four dates throughout the season: (23/6, 14/7, 28/7 and 5/8). At the earlier times of measurement the disease inoculation and fungicide spray regimes had not yet resulted in differences in green leaf area between plots and this was confirmed by the NDVI measurements. However by Aug 5 there was a significant reduction in NDVI readings which were related to the varying amounts of disease and necrosis within plots. There was more green area in the moderately tolerant variety PBA Striker plots compared to the other varieties (*P <0.001*) with the susceptible variety Howzat having the lowest green area. Plots in which infection had been introduced earlier had less green area than later infected plots. The plots sprayed with fungicides fortnightly had more green area than all the other fungicide regimes (*P < 0.001*).

Dry matter cuts taken at maturity, Oct 24, indicated that variety, spray regime and inoculation time all had significant effects on plant growth (Table 2). This followed the same pattern as NDVI and ascochyta ratings with Howzat having reduced biomass compared to the other varieties. There was less biomass from early infected plots compared to late infected plots and the fortnightly control treatment had more biomass than other fungicide treatments, whilst the nil fungicide plots produced the least biomass. None of the interactions were statistically significant.

Ascochyta ratings

Ratings for extent and severity of ascochyta disease were taken on August 5, the same day as the late infection plots had the diseased stubble placed in them. These ratings showed that the early infection and spray treatment resulted in significant differences in the amount of ascochyta within the plots. Howzat plots had more ascochyta in them than PBA Striker and Genesis 836 (*P <0.001*), and there was more disease in early infected plots compered to late infected plots (*P <0.001*), the nil fungicide treatment had the most disease infection and the control fortnightly spray the least (*P <0.001*). The interactions Variety*inoculation time, Variety*spray regime, Inoculation time*spray regime and variety*inoculation time*spray regime were all highly significant. A rating for ascochyta taken towards then end of the growing period on Oct 24 showed the same responses (Table 2).

Table 2. ascochyta ratings (0-9) and dry biomass (g/m^2) taken on 24 Oct.

		Howzat		Genesis 836		PBA Striker	
Inoculation time	**Fungicide**	**Asco rating**	**Biomass**	**Asco rating**	**Biomass**	**Asco rating**	**Biomass**
Early Inoculation	Control	0.5	364	0.0	310	0.3	365
	Early & late	5.2	149	0.7	391	1.2	386
	Early	6.0	144	1.3	237	1.8	345
	Late	6.7	92	0.8	319	1.8	292
	Nil	7.3	53	2.0	177	2.7	154
Late Inoculation	Control	0.7	417	0.0	461	0.0	405
	Early & late	1.5	295	0.2	294	1.0	326
	Early	3.2	217	0.5	355	1.2	422
	Late	2.7	295	0.5	388	0.5	397
	Nil	5.3	211	1.2	266	1.3	264
F prob var						< .001	< .001
Lsd var						0.3	41
F prob inoc time						< .001	< .001
Lsd inoc time						0.3	34
F prob spray regime						< .001	< .001
Lsd spray regime						0.4	54

Yield and grain quality

Yields were quite low considering the favourable season, site mean was 700kg/ha although this was reduced heavily by the disease that was introduced within the treatments (Table 3). The control treatments averaged across both disease inoculation dates yielded 800, 754 and 878kg/ha for Howzat, Genesis 836 and PBA Striker respectively. Yield was impacted by the treatments in the same way as NDVI, biomass and ascochyta. Howzat, the variety with least resistance to ascochyta suffered large yield losses with early disease introduction; in fact it was difficult to ensure control plots remained disease free even with fortnightly fungicide application. For the more resistant varieties, Genesis 836 and PBA Striker yield declined when fungicides were not applied. When disease was introduced later the treatments responses were less consistent. Yield of Howzat still declined when it had no fungicides applied and the yield of Genesis 836 and PBA Striker declined under some spray regimes but the nils of these varieties yielded well showing their genetic tolerance to the disease (Figure 1). As would be expected the relationships between ascochyta disease to growth and yield were stronger when the level of disease was high (Figure 2).

Seed weight was affected by variety, with Genesis 836 producing the lightest seed (18.3 g/100seed) followed by Howzat (21.6 g/100 seed and PBA Striker (22.8 g/100 seed). Spray regime also affected seed weight with control seed heaviest and nil fungicide treatment seed the lightest. Seed from early ascochyta infection was lighter than the later infection - but this was not significant (Table 3).

Table 3. Seed yield (kg/ha) and yield as a percentage of the control treatments (%).

		Howzat			Genesis 836			PBA Striker		
Inoculation time	**Fungicide**	**Yield**	**% yield of control**	**100 seed wt.**	**Yield**	**% yield of control**	**100 seed wt.**	**Yield**	**% yield of control**	**100 seed wt.**
Early Inoculation	Control	734	100	22.6	774	100	19.2	899	100	23.3
	Early & late	448	61	21.4	899	116	18.1	791	88	22.2
	Early	255	35	20.2	714	92	17.7	667	74	22.5
	Late	301	41	21.4	710	92	18.8	788	88	22.7
	Nil	246	34	21.1	639	83	18.1	651	72	22.5
Late Inoculation	Control	867	100	21.7	735	100	19.1	858	100	23.9
	Early & late	872	101	22.2	815	111	18.4	899	105	23.2
	Early	523	60	21.4	713	97	18.2	683	80	22.0
	Late	829	96	22.7	632	86	17.3	752	88	22.1
	Nil	393	45	21.7	824	112	18.3	957	112	23.2
F prob var								<.001	<.001	<.001
Lsd var								27.5	9.8	0.43
F prob inoc time								<.001	<.001	ns
Lsd inoc time								22.5	8.1	
F prob spray regime								< 001	<.001	<.001
Lsd spray regime								35.5	12.7	0.56

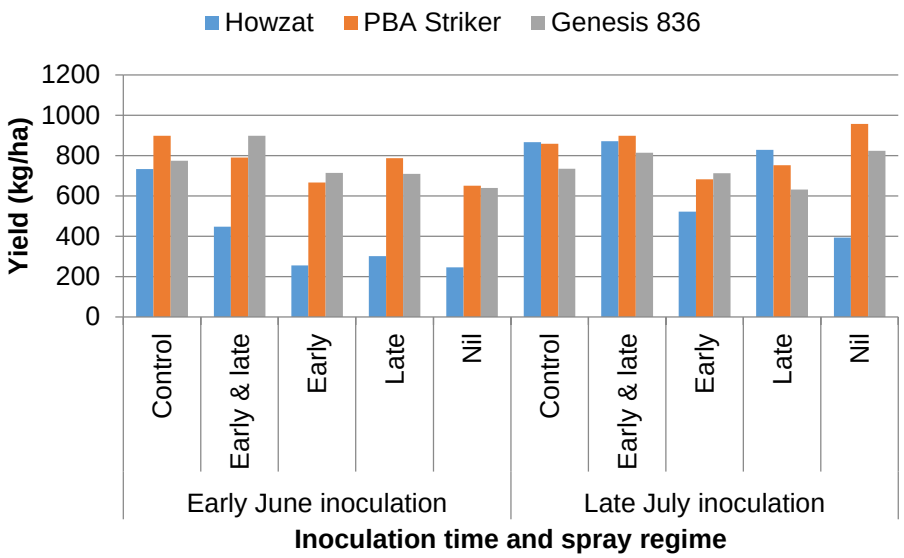

Figure 1. Yield of three chickpea varieties as affected by timing of ascochyta infection and fungicide spray regime.

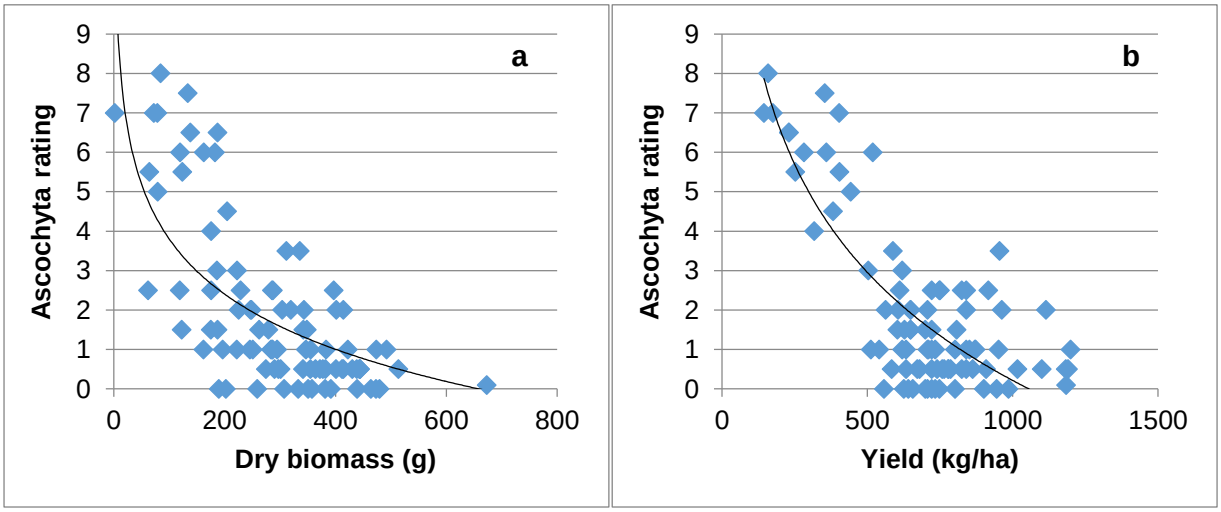

Figure 2 (a). Relationship between ascochyta infection and plant biomass. (b) relationship between ascochyta infection and yield.

Conclusions

The trial demonstrates that new chickpea varieties have a greater tolerance to ascochyta than older varieties; nevertheless diligent management of ascochyta to stop early infection is critical. This includes ensuring seed is disease free and treated with fungicide to stop early infection and that chickpeas are not sown close to last years chickpea stubble.

Both Genesis 836 and PBA Striker showed greater tolerance of the disease than Howzat however a two spray fungicide spray regime is still recommended to ensure yield is maintained and disease is kept at levels that will not build up in future crops. This should be more achievable now compared to 15 years ago when ascochyta first occurred because fungicides are now routinely applied to other crops and as such farmers have increased application capacity.

Key words

Chickpea, ascochyta, fungicide, variety

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