Effect of chickpea Ascochyta blight on the yield of current varieties and advanced breeding lines – Tamworth 2015

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Introduction

Ascochyta blight (AB, *Phoma rabiei* previously called *Ascochyta rabiei*) first caused widespread damage to chickpeas in eastern Australia in 1998. At the time, all Australian chickpea varieties were susceptible, some highly so. Following the 1998 epidemic, efforts to develop chickpea varieties with resistance to AB were increased, aided by considerable support from GRDC.

Howzat$^{\phi}$, released in 2002, had better resistance than Amethyst but it was not until 2005 when Flipper$^{\phi}$ and Yorker$^{\phi}$ were released that substantial gains in AB resistance were available to the chickpea industry. PBA HatTrick$^{\phi}$ (2009) and PBA Boundary$^{\phi}$ (2011) provided even better levels of AB resistance. Since 1999, field trials have been conducted to determine yield losses from AB in current chickpea varieties and advanced breeding lines. We report here on the 2015 trial.

Key findings

Under extreme disease pressure, Ascochyta blight can be successfully and economically managed on susceptible varieties such as Kyabra$^{\phi}$.

However, Ascochyta blight management is easier and more cost effective on varieties with improved resistance such as PBA HatTrick$^{\phi}$ and PBA Boundary$^{\phi}$.

The 2015 Ascochyta trial, confirmed the next variety planned for release (CICA0912) has an improved level of resistance to Ascochyta blight.

Site details

Location:	**Tamworth Agricultural Institute, Tamworth**
Sown:	**18–19 May 2014, standing cereal stubble, tyne openers, 40 cm row spacing, plots 4 m × 10 m**
Ascochyta inoculation:	**16 June, during a rainfall event, a cocktail of 20 isolates collected from commercial crops (1999–2014), 1,066,666 spores/mL in 200 L/ha water. It rained for four days, and every unprotected plant had multiple AB infections**
Rainfall:	**From inoculation to desiccation (1 December), 341 mm on 46 rain days (32 days >1.0 mm); long-term average for same period 141 mm on 20 rain days (15 days >1.0 mm)**

Treatments

Genotype (10): Six released varieties and four advanced PBA breeding lines (Table 2)

Fungicide (3): Low disease (seven sprays 1.0 L/ha chlorothalonil – 720 g/L active); High disease (nil sprays); Variety management package (VMP) treatment with a low, off-label rate of chlorothalonil

All fungicides applied before rain. Table 1 summarises the number of rain days, rainfall and application dates for the low disease sprays.

Replicates: Four

Data for the VMP treatment are not presented here, but we describe the strategies for each genotype as these reflect their AB rating. The genotypes were grouped as susceptible (S), moderately susceptible (MS), moderately resistant (MR) and resistant (R). Timing the first VMP spray was based on these groupings. The first group S VMP spray for Kyabra$^{\phi}$ was applied before inoculation. The first group MS VMP spray for Genesis Kalkee™, PBA Monarch$^{\phi}$, CICA1302 and CICA1303 was applied after three infection events (six rain days, 67 mm rain post inoculation); for group MR VMP spray (PBA HatTrick$^{\phi}$ and PBA Boundary$^{\phi}$, CICA1007) and R (CICA0912, Genesis 425™) the first spray occurred after four infection events (14 rain days, 79 mm rain post inoculation).

The trial was split across two experiments: one on red soil, one on heavy black soil. The latter had waterlogging problems that affected AB resistance (data not presented) so results are presented only for the red soil.

Results

The early and heavy rate of inoculation, combined with extremely favourable conditions, resulted in high levels of AB development, so much so that unprotected susceptible varieties were dead by the end of July and even unprotected PBA HatTrick had severe damage (stem breakage).

The key findings of VMP15 (Table 2) were:

- Under extreme disease pressure, AB can be successfully managed on susceptible varieties by frequently applying registered rates of chlorothalonil.
- Well managed Kyabra yielded 1862 kg/ha with a gross margin (GM) of $954/ha.
- Under extreme disease pressure, unsprayed PBA HatTrick yielded only 417 kg/ha (GM $4/ha).
- The new line CICA0912 performed well, yielding 1568 kg/ha (GM $844/ha) with no foliar fungicide application.

The PBA HatTrick performance in VMP15 was both a surprise and a disappointment. In all previous VMP trials at Tamworth, unsprayed (nil treatment) PBA HatTrick has produced substantial and profitable yields. For example in the 2010 trial, VMP10, it produced 1707 kg/ha (Table 3), which was a year that also had above average rain in June/July that persisted throughout the season, so was in fact more conducive to AB development than 2015 (although 2015 had more rain days in June/July than 2010).

Both VMP15 and VMP10 were in seasons that favoured AB development and so provide a strong evaluation of current varieties and advanced breeding lines. A number of the key findings of VMP10 were similar to VMP15:

- Under extreme disease pressure, AB can be successfully managed on susceptible varieties with registered rates of chlorothalonil.
- Well managed Jimbour yielded nearly 3 t/ha with a GM of $750/ha.
- Varieties and advanced breeding lines with improved resistance to AB were the most profitable.
- However, the two VMP experiments differed in that:
  - In 2010 PBA Boundary performed exceptionally well, yielding over 2 t/ha without applying any foliar fungicide, a minimal yield loss (4%), whereas in 2015 AB reduced yield by 53%.
  - Under extreme disease pressure in 2010, unsprayed PBA HatTrick still gave a profitable yield, but in 2015 the unsprayed PBA HatTrick yield was much lower and not profitable.

Table 1. *VMP15 dates in 2015, number of rain days (>1 mm rain), mm of rain and number of 1 L/ha chlorothalonil applications; trial sown 18–19 May and inoculated 16 June*

Date	Rain days (number)	Rainfall (mm)	1 L spray
28–31 May	4	31	
12 Jun			Ist All genotypes
16–19 Jun	4	61	
22 Jun	1	1	
30 Jun–01 Jul	2	4	
9 Jul			2nd All genotypes
10–17 Jul	8	12	
21 Jul			3rd All genotypes
24–27 Jul	4	13	
21 Aug			4th All genotypes
23–24 Aug	2	40	
1 Sep			5th All genotypes
3 Sep	1	11	
4 Sep	1	6	
16 Sep	1	4	
11 Oct			6th All genotypes
14 Oct	1	16	
22 Oct	1	18	
23 Oct	1	12	
26 Oct	1	10	7th All genotypes

The following factors in VMP15 could have contributed to the nil PBA HatTrick treatment having a poorer yield than in earlier VMP trials:

- Parts of VMP15 were waterlogged during June/July. Past experience and commercial cropping has shown that any stress, including waterlogging, is known to compromise the moderate resistance of PBA HatTrick to AB.
- Interaction between herbicide damage and AB resistance – VMP15 sustained minor herbicide injury in August. This could have also compromised the moderate resistance of PBA HatTrick to AB.
- Change in the pathogen. The isolates used in VMP10 were collected from crops in 2008 and 2009 compared with the isolates used in VMP15, which were collected from 1999 to 2014. Recently collected isolates have shown a higher level of aggressiveness on PBA HatTrick. See Chickpea Ascochyta: latest research on variability and implications for management from the GRDC for further information.

Table 2. *Number and rate/ha of chlorothalonil sprays, cost of application, grain yield, and gross margin (GM) for seven desi and three kabuli chickpea varieties on red soil in the Tamworth VMP15 trial. (GMs also take into account other production costs estimated at $300/ha; chickpea price desi $730/t; kabuli $1000/t) Yield P<0.001, LSD 417 kg/ha; GM P<0.001, LSD $354/ha*

Variety and treatment	No. sprays	Cost ($/ha)	Yield (kg/ha)	GM ($/ha)
CICA0912 1.0 L	7	105	1853	984
Genesis425 1.0 L	7	105	1875	1470
CICA1007 1.0 L	7	105	1846	982
PBA Boundary 1.0 L	7	105	1755	876
PBA Monarch 1.0 L	7	105	1274	869
PBA HatTrick 1.0 L	7	105	1722	852
CICA1302 1.0 L	7	105	1864	954
CICA1303 1.0 L	7	105	1949	1018
Kyabra 1.0 L	7	105	1862	954
Genesis Kalkee 1.0 L	7	105	1659	1254
CICA0912 nil	0	0	1568	844
Genesis425 nil	0	0	1144	844
CICA1007 nil	0	0	1083	491
PBA Boundary nil	0	0	1233	600
PBA Monarch nil	0	0	887	587
PBA HatTrick nil	0	0	417	4
CICA1302 nil	0	0	0	–300
CICA1303 nil	0	0	0	–300
Kyabra nil	0	0	0	–300
Genesis Kalkee nil	0	0	1589	1289

Table 3. *Number and rate/ha of chlorothalonil sprays, cost of application, grain yield, and gross margin (GM) for four desi chickpea varieties in the Tamworth VMP10 trial. (GMs also take into account other production costs estimated at $300/ha; chickpea price $450/t)*

Variety and treatment	No. sprays	Cost ($/ha)	Yield (kg/ha)	GM ($/ha)
Jimbour 1.0 L	14	294	2988	750
*Kyabra 1.0 L	14	294	2549	553
PBA HatTrick 1.0 L	14	294	2604	578
PBA Boundary 1.0 L	14	294	2410	491
Jimbour nil	0	0	0	–300
Kyabra nil	0	0	0	–300
PBA HatTrick nil	0	0	1707	468
PBA Boundary nil	0	0	2320	744
*Kyabra$^{\Phi}$ 1.0 L one of the four reps was severely affected by waterlogging which (i) compromised AB control and (ii) impacted on yield.				

Summary

Under extreme disease pressure, AB can be successfully and economically managed on susceptible varieties such as Kyabra$^{\Phi}$ and Jimbour$^{\Phi}$. However, AB management is easier and more cost effective on varieties with improved resistance e.g PBA Boundary. VMP15 confirmed that the next variety planned for release (CICA0912) has improved AB resistance.

Acknowledgements

This research was made possible by the significant contributions of growers through both trial co-operation, field access and the support of the GRDC; the authors most gratefully thank them and the GRDC. The research was funded by NSW DPI and GRDC under project DAN00176: Northern NSW integrated disease management. Thanks also to Woods Grains, Goondiwindi and Glenn Coughran, Beefwood, Moree for planting material for trials and to chemical companies who provided products for research purposes and trial management.