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Effect of chickpea Ascochyta on yield of current varieties and advanced breeding lines – Tamworth 2014

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Introduction

Ascochyta 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 improved resistance to Ascochyta 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 Ascochyta resistance were available to the chickpea industry. PBA HatTrick$^{\Phi}$ (2009) and PBA Boundary$^{\Phi}$ (2011) provided even better levels of resistance. Since 1999, field trials have been conducted to determine yield losses caused by Ascochyta in current varieties and advanced breeding lines. We report here on the 2014 trial Variety Management Package (VMP14) conducted at Tamworth.

Key findings

Under medium to high disease pressure, Ascochyta can be successfully and economically managed on susceptible varieties such as Kyabra$^{\Phi}$ and Jimbour$^{\Phi}$

However, Ascochyta management is easier and more cost effective on varieties with improved resistance e.g. PBA HatTrick$^{\Phi}$ and PBA Boundary$^{\Phi}$

The level of Ascochyta resistance in the advanced breeding lines CICA0912 and CICA1007 has been improved to the point that in a typical average to dry season neither will require fungicide applications.

Site and experimental details

Location:	**Tamworth Agricultural Institute, NSW DPI**
Sown:	**15 May 2014, standing cereal stubble, disc openers, 40 cm row spacing, plots 4 m × 10 m**
First inoculation:	**15 July, cocktail of 20 isolates, 233,000 spores/mL in 100 L/ha of water; 5.5 hr elapsed before rain started and whilst Ascochyta did develop, not all unprotected plants became infected**
Second inoculation:	**16 August, using same cocktail plus a highly aggressive isolate collected at Yallaroi on 24 July 2014, 833,000 spores/mL. It rained for 3.5 days, and every unprotected plant developed multiple Ascochyta infections**
Rainfall:	**From re-inoculation to desiccation (6 November), 94 mm on 16 rain days (8 days >1.0 mm); long term average for same period 141 mm on 20 rain days (15 days >1.0 mm)**

Treatments

Genotypes:	**Total of 10 being seven released varieties and three advanced breeding lines (Table 1)**
Fungicides:	**Three treatments being low disease (5 sprays 1.0 L/ha chlorothalonil – 720 g/L active); high disease (nil sprays), and VMP treatment with a reduced off-label rate of chlorothalonil**
Replicates:	**Four in a complete randomised block design**

Data for the VMP treatment are not presented here but we describe the fungicide strategies for each genotype as these reflect their Ascochyta rating:

- First VMP fungicide spray for Jimbour$^{\Phi}$, Kyabra$^{\Phi}$ and CICA1211 applied before the first Ascochyta inoculation.

- First VMP fungicide spray for PBA Monarch$^{\phi}$ and Genesis™ Kalkee applied 14 August after two infection events, when Jimbour$^{\phi}$, Kyabra$^{\phi}$ and CICA1211 were receiving their 2 second spray.
- First VMP fungicide spray for PBA Boundary$^{\phi}$, PBA HatTrick$^{\phi}$, Genesis3z 425 and CICA0912 applied on 12 September after four infection events, when Jimbour$^{\phi}$, Kyabra$^{\phi}$ and CICA1211 were getting their fourth spray.

Table 1. *Chickpea varieties and advanced breeding lines used in the Tamworth VMP14 trial and their current ratings for Ascochyta and Phytophthora*
(S – Susceptible, MS – Moderately Susceptible, R – Resistant, MR – Moderately Resistant)

Genotype	Ascochyta (AB)	Phytophthora (PRR)	Notes
Jimbour$^{\phi}$	S	MS/MR	Industry standard
Kyabra$^{\phi}$	S	MS	Drought tolerant
PBA Boundary$^{\phi}$	MR	S	High yield
PBA HatTrick$^{\phi}$	MR	MR	High yield, moderate AB & PRR
PBA Monarch$^{\phi}$	MS	VS	Medium/large seeded kabuli
Genesis™ Kalkee	MS/MR	VS	Large seeded kabuli
Genesis™ 425	R	S	Small seeded AB resist kabuli
CICA0912 desi	R	MR/R	Potential release, good AB and PRR
CICA1007 desi	R/MR	MR	Potential release, high yield
CICA1211 desi	S	MR	Potential release, high quality

Results

Conditions were not consistently favourable for Ascochyta development at Tamworth in 2014 and plants grew away from the disease between rain events. Nevertheless, unprotected (Nil) Kyabra$^{\phi}$ plots were severely affected by Ascochyta and produced no yield; unprotected Jimbour$^{\phi}$ yielded only 22% of Jimbour$^{\phi}$ protected with fungicides during the season (Table 2).

In spite of treating all planting seed with the fungicide metalaxyl (and thiram), Phytophthora root rot (PRR), developed following 39 mm of rain on 18–20 August and 18 mm on 25–26 Sep in 2014. By harvest, PRR had become quite severe in some areas of the trial; accordingly, %PRR infection was used as a covariate in the yield analyses. The covariate adjusted yields for label rate (1.0 L/ha) and nil fungicide treatments only are presented and covariate adjusted yields were also used to calculate gross margins (GM)(Table 2).

Key yield findings of VMP14

- Under moderate to high disease pressure, Ascochyta can be successfully managed on susceptible (S) and moderately resistant (MR) varieties with registered rates of chlorothalonil.
- Under these same conditions the Ascochyta resistance of two PBA breeding lines (CICA912 and CICA1007) was robust and application of chlorothalonil did not significantly improve yield.

Susceptible varieties

- Chlorothalonil significantly increased yield of all susceptible varieties.
- Good management of Ascochyta with fungicides in the S variety Kyabra$^{\phi}$ produced a yield of 2.4 t/ha with a GM of $669/ha compared to zero yield and a GM of minus $377/ha where the disease was not controlled

- CICA1211 was the surprise of the trial, with an unsprayed yield 86% of the sprayed. CICA1211 was rated Susceptible in PBA screening nurseries under very high Ascochyta pressure. In this drier than average season, CICA1211 handled Ascochyta much better than the other S entries, Jimbour$^{\Phi}$ and Kyabra$^{\Phi}$.

Findings for MR and R/MR varieties:

- PBA HatTrick$^{\Phi}$'s improved resistance was confirmed with the unsprayed yielding 76% of the sprayed, although the difference was significant. The difference between GMs (sprayed $630/ha; unsprayed $492/ha) was also significant.
- Unsprayed PBA Boundary$^{\Phi}$ yielded 88% of sprayed PBA Boundary$^{\Phi}$ with a GM of $637/ha.
- The 2013 released kabuli, PBA Monarch$^{\Phi}$ performed well, with an unsprayed yield 74% of the sprayed.
- The potential desi release, CICA0912, performed exceptionally well with no significant yield difference (P<0.001) between five sprays of chlorothalonil (2183 kg/ha) and none (2132 kg/ha).
- There was also no difference (P<0.001) in yield of the desi line CICA1007 between five (2340 kg/ha) and none (2343 kg/ha).

***Table 2**. Number and rate/ha of chlorothalonil sprays, cost of spraying, grain yield, and gross margin (GM) for ten chickpea genotypes – Tamworth 2014*

Variety and treatment	No.sprays	Spray cost ($/ha)	Yield (kg/ha)	GM $/ha*
Kyabra$^{\Phi}$ 1.0L	5	105	2385	669
Jimbour$^{\Phi}$ 1.0L	5	105	2180	575
Genesis™Kalkee 1.0L	5	105	1971	681
PBA Monarch$^{\Phi}$ 1.0L	5	105	2205	810
PBA HatTrick$^{\Phi}$ 1.0L	5	105	2301	630
Genesis™425 1.0L	5	105	2143	775
CICA1211 1.0L	5	105	2244	605
PBA Boundary$^{\Phi}$ 1.0L	5	105	2351	653
CICA912 1.0L	5	105	2183	577
CICA1007 1.0L	5	105	2340	649
Kyabra$^{\Phi}$ Nil	0	0	0	-377
Jimbour$^{\Phi}$ Nil	0	0	501	-76
Genesis™Kalkee Nil	0	0	1461	504
PBA Monarch$^{\Phi}$ Nil	0	0	1625	594
PBA HatTrick$^{\Phi}$ Nil	0	0	1761	492
Genesis™425 Nil	0	0	1878	732
CICA1211 Nil	0	0	1936	571
PBA Boundary$^{\Phi}$ Nil	0	0	2080	637
CICA912 Nil	0	0	2132	659
CICA1007 Nil	0	0	2343	754
L.S.D. (*P*=0.05)			275	133

**GMs also take into account other production costs estimated at $300/ha; chickpea price desi: $450/t, kabuli: $550/t*

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