C4 Disease Management, MRZ Mid North (Turretfield), South Australia

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Aim

To evaluate ascochyta blight (AB) response of new advanced varieties by comparing their susceptibility to commercial varieties

Treatments presented in Table 1.

Table 1: Site details

	Site details
Sowing date	15 June
AB Inoculation	All treatments were inoculated with AB spores at early seedling growth of 3 to 4 node growth stage
Treatments	Fortnightly fungicide application (Chlorothalonil @ 2L/ha) and Nil/unprotected
Row spacing	22.5
Plot size	10 m by 1.75 m
Fertilizer	MAP + Zn (2%) @ 90 kg/ha at sowing
Inoculum	Group N
Seed dressing	P-Pickel T (200 ml/100kg seed)
Plant density	Desi = 50 plants/m^2, Kabuli = 35 plants/m^2

Varieties Presented in Table 2.

Disease Assessment

Disease rating was conducted during early to mid-flowering using the following scoring system:

- % main stems broken per plot
- % stems with lesions per plot
- % side branches diseased per plot
- % leaves with lesions

All the scores were then averaged per plot to calculate a plant disease index (PDI).

Results

- The wet conditions in 2016 favoured the development and progression of ascochyta blight disease in chickpeas which allowed for maximum expression of the disease and assessment of varietal responses to treatment application.
- Application of fungicide had a significant effect on grain yield and percent disease index (PDI) over the control. A fortnightly foliar application with Chlorothalonil at a registered rate of 2 L/ha was effective in controlling disease severity and increasing grain yields across all varieties compared with untreated plots.
- Most of the fortnightly sprayed crops yielded on average 2 t/ha indicating that the fungicide had similar effect in controlling disease across varieties. PBA Slasher however, had the highest yield response (3.1 t/ha) from fortnightly fungicide application indicating a higher response from fungicide application.
- Under the favourable wet conditions of 2016, disease developed and spread rapidly in unprotected (Nil sprayed) crops causing significant and variable levels of AB foliar infection together with yield loss among the varieties (Table 2). This result indicated the existence of genetic variation in the level of resistance/susceptibility to AB pathogen among varieties.
- The yield loss in unprotected (Nil) plots ranged from 14 to 100 % and depended on the level of susceptibility of varieties/lines to AB pathogen.
- There was a direct relationship between the level of PDI rating and yield loss. Varieties and advanced breeding lines with higher PDI rating had high levels of foliar infection with incidences of complete necrosis (death) in some varieties leading to significant yield losses.

Table 2: Grain yield and ascochyta rating (plant disease index) of chickpea varieties at Turretfield, 2016.

	Grain yield (t/ha)				
Variety	**Fortnightly sprayed**	**Unsprayed**	**Yield loss (%)**	**Plant Disease Index (PDI) in Nil (unprotected) plots**	**AB Foliar disease Current (2016) rating#**
CICA1454	2.43	2.5	-3	22	*
CICA1551	2.31	1.98	14	28	*
CICA1541	2.69	1.81	33	35	*
CICA1156	2.52	1.77	30	38	*
CICA1552	2.60	1.72	34	36	*
Genesis™ 090	2.24	1.61	28	37	R to MS
PBA Slasher	3.10	1.60	48	51	R to MS
Neelam	2.86	1.46	49	57	R to MS
CICA1007	2.42	1.36	44	56	*
Ambar	2.82	1.26	55	70	R to MS
Genesis™ Kalkee	1.88	1.2	36	45	MS
CICA1442	2.91	1.11	62	58	MS
Almaz	1.94	1.01	48	63	MS
Genesis™ 079	2.56	0.87	66	57	R to S
CICA1352	2.06	0.63	69	65	*
PBA Maiden	2.27	0.60	74	74	MR to S
PBA Striker	2.74	0.28	90	81	MR to S
CICA1452	2.54	0.20	92	69	*
Sonali	2.69	0.14	95	79	S
PBA Monarch	2.27	0.11	95	87	MR to S
Howzat	2.49	0.04	98	100	S
CICA1007038	2.21	0.02	99	100	*
CICA1007077	2.24	0	100	100	*
CICA1007081	1.97	0	100	100	*

R= resistant, MR = moderately resistant, MS = moderately susceptible, S = Susceptible
*=Limited field evaluation
= Aschochyta Blight foliage current rating assessed from results from 2016 trials
-PDI Rated by Jenny Davidson and Sara Blake, SARDI Pathologist.

- Disease was highly aggressive in the advanced breeding lines CICA1007038, CICA1007077 and CICA1007081 causing complete foliar necrosis and a yield loss of 100 %.
- Commercial varieties previously rated as being moderately resistant to AB infection, PBA Maiden, PBA Striker and PBA Monarch showed significant and high levels of foliar infection together with corresponding high yield losses of greater than 90 %. The AB category for these varieties has now been amended to reflect 'susceptible' to AB infection.
- Varieties previously rated as being resistant to AB infection, Genesis™ 090, PBA Slasher, Neelam and Ambar showed only partial resistance to AB infection in the current trial. Consequently, the AB category for these varieties has been amended to reflect 'moderately susceptible' to AB infection.
- Compared to all varieties, the advanced breeding line CICA1454 had the lowest level of disease reaction in the untreated plots and the relative yields between unprotected (2.5 t/ha) and fortnightly sprayed plots (2.4 t/ha) were similar indicating a significant genetic resistance for AB pathogen in this variety.
- In the unprotected plots (Nil), advanced breeding lines, CICA1551 (1.98 t/ha), CICA1541 (1.81 t/ha), CICA1456 (1.77 t/ha) and CICA1552 (1.72 t/ha) showed lower disease reactions and slight yield increases over commercial varieties, Genesis™ 090 (1.61 t/ha) and PBA Slasher (1.6 t/ha). These new lines may have more robust levels of AB resistance and require further evaluation and development in collaboration with chickpea breeder, pulse breeding Australia.

Conclusion

- Environmental conditions of wet weather favoured AB disease development and allowed for evaluation of virulence of disease and susceptibility of different chickpea varieties/lines.
- The current trial established a change in susceptibility of AB pathogen in varieties previously rated as moderately resistant and resistant. This result indicates that there has been a change in virulence in the AB pathogen in chickpeas across SA. Consequently, this has resulted in all chickpea resistance ratings being revised to susceptible or moderately susceptible in the southern region.
- Application of fortnightly foliar sprays with Chlorothalonil at the registered rate of 2 L/ha ahead of rain effectively controlled AB pathogen and benefited yields similarly across all varieties irrespective of their AB category. A cost benefit analysis of this continuous protection was not carried out in the current trial and therefore the profitability of this strategy will require further evaluation.
- The current trial identified advanced breeding lines with improved level of AB resistance over the current commercial varieties such as Genesis™ 090 and PBA Slasher which are rated as being moderately resistant. These advanced breeding lines will be evaluated further and developed through our collaboration with Pulse Breeding Australia.
- Overall, chickpea production in the southern region will require close monitoring of disease together with adapting an integrated disease management strategy that incorporates agronomic practices including use of AB free seed, variety selection, use of thiram-based seed treatments and multiple foliar fungicides, maintaining adequate crop rotations with non-host crops and maintaining adequate distance from previous chickpea crops.