

Managing crown rot – fungicide seed treatment and variety resistance

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Key findings

- The Syngenta Australia fungicide seed treatment (working name, Tymirium) improved yields of durum wheat, bread wheat and barley in the presence of crown rot.
- Yield improvements were greatest for durum wheat (VS) – 24%-32% and lower for bread wheat (MS-S) – 4%-29% and barley (S) – 7%.
- New Elders Limited bread wheat lines EDGE-19-SA-0178 and EDGE-19-SA-1098 improved crown rot resistance and yielded well in the presence of crown rot when compared with Trojan.
- Tymirium seed treatment reduced crown rot incidence (% main stems with basal browning), severity of basal stem browning and white head expression in durum and bread wheats and severity of basal stem browning in barley.
- Fungicide seed treatment and bread wheat varieties with improved resistance to crown rot (even if combined) will not eliminate crown rot inoculum carryover in the season they are used. However, it is likely that both management options will assist in managing crown rot inoculum levels in the medium to long-term, particularly where they are used together and where breaks from cereal are included in the rotation.

Why do the trial?

Crown rot infected stubble can take three to four years to break down, making crown rot difficult to manage in current farming systems, particularly where durum wheat is part of the rotation. To date, fungicides registered for use in controlling crown rot have not been available and resistance levels in commercial wheat varieties have been limited. These management options are generally the simplest and most economic to implement and are particularly advantageous for managing crown rot.

At the start of 2020, there was an opportunity to work with Syngenta Australia to assess efficacy of a promising new fungicide seed treatment (Tymirium – working name) in the process of being evaluated for crown rot management. In addition to this, Elders Limited have advanced bread wheat lines with crown rot resistance levels which were assessed in these trials. This also provided the opportunity to assess the level of crown rot resistance of the new AGT durum variety Bitalli when compared with DBA Aurora. These opportunities were taken up to ensure any options for better managing crown rot would be made available to the South Australian Grains Industry in a timely manner.

How was it done?

Plot size	1.75 m x 10.0 m	Fertiliser	Seeding: DAP (18:20) Zn 1% + Impact @ 80 kg/ha
Seeding date	May 25, 2020		July 2: Easy N (42.5:0) @ 80 L/ha
Harvest date	November 26, 2020		August 5: Easy N (42.5:0) @ 50 L/ha
Location	Hart, SA		

Plot size	1.80 m x 12.0 m	Fertiliser	Seeding: DAP (18:20) @ 105 kg/ha
Seeding date	May 18, 2020		
Harvest date	December 19, 2020		<i>*In-season N application data not available for this site</i>
Location	Pinery, SA		

Trial layout was a split-plot design at Hart and a randomised block design at Pinery with treatments (Table 1) in three replicates at each site.

All plots were inoculated with crown rot by adding sterilised grain colonised with crown rot to treatments at sowing. The same seed sources were used for all treatments in both trials and the Tymirium fungicide was supplied and applied to seed by Gereon Schnippenkoetter (Syngenta Australia).

Table 1. Treatments applied at Hart and Pinery in 2020 to assess the efficacy of variety resistance and fungicide (Tymirium) seed treatment for managing crown rot expression and yield losses due to crown rot.

Entries	Crown rot resistance	Hart		Pinery	
		Tymirium ¹	Control	Tymirium ¹	Control
Bitalli	Very susceptible	✓	✓		
Aurora	Very susceptible	✓	✓	✓	✓
Scepter	Susceptible	✓	✓	✓	✓
Trojan	Moderately susceptible	✓	✓	✓	✓
Spartacus		✓	✓		
<i>Elders bread wheat lines bred for improved crown rot resistance</i>					
EDGE-19-SA-0178		✓	✓	✓	✓
EDGE-19-SA-1098		✓	✓	✓	✓
EDGE-SA-0944					✓
EDGE-SA-1071					✓
EDGE-SA-058					✓
EDGE-SA-054					✓

¹Fungicide seed treatment (applied to grain for these trials by Syngenta Limited). This product is in the process of being evaluated for crown rot management. Planned for release in 2023-2024.

Plant samples were collected at early grain fill for assessment of plant density, whitehead expression and browning on main stem bases. Plot yield was recorded, and grain quality assessed (grain quality results not yet available). Crown rot incidence (% of main stems with basal stem browning) and expression (extent of browning on main stems) was scored visually on a 0-5 scale:

0 = 0%	No yield loss
1 = 1-10%	Possibility of minor yield loss
2 = 10-25%	Possibility of some yield loss
3 = 25-50%	Probably some yield loss
4 = 50-75%	Significant yield loss likely
5 > 75%	High yield loss likely

Results and discussion

Trials established well and weeds, pests and other diseases were adequately controlled, except for Russian wheat aphid at Pinery. Although good rains around sowing allowed the trials to establish well, at both sites there were significant moisture stress periods across the season. Plant densities (data not presented) were not influenced by seed treatment and so plant density effects on crown rot expression and grain yield did not need to be considered during data interpretation. For simplicity, mainly Hart data is presented here, but Pinery data also support the general trends seen at Hart.

Fungicide seed treatment

Tymirium seed treatment significantly reduced stem browning expression (Figure 1) and this was reflected in whitehead expression (Figure 2) and yields (Figure 3). Yield improvements ranged from 4% - 26% at Hart and from 13% - 32% at Pinery (Table 2), with the very susceptible durum wheat varieties having the greatest yield improvements. These magnitudes of yield improvement are consistent with those seen at an industry trial undertaken at Balaklava in 2020. The economics of using this seed treatment still needs clarification in trials with a range of crown rot inoculum levels, including a control with no crown rot present.

Numerous industry trials in New South Wales, Victoria and South Australia with the new seed treatment (Tymirium) developed by Syngenta, have indicated that it has efficacy against crown rot caused by *Fusarium pseudograminearum*. The trials run at Hart and Pinery in 2020 support this contention and once this seed treatment is registered and released (2023 to 2024), it will provide a powerful tool for managing yield losses due to crown rot. Importantly, Tymirium application to seed will allow durum wheat to be grown in paddocks with crown rot inoculum present (probably up to medium risk levels). This has the potential to increase the area sown to durum wheat and to decrease the length of the break between durum crops.

An incidence of 20% or more of plants with basal stem browning presents a significant risk of yield loss due to crown rot for a subsequent cereal crop. Even where the seed treatment was applied to the more resistant bread wheats, the incidence of crown rot was above 20% at both trial sites (data not presented). As the seed treatment also reduces the severity of expression of crown rot, it is still possible that it will reduce inoculum carryover, however, further research will be required to quantify effects of seed treatment on inoculum carryover.

Until the effects of the seed treatment on inoculum carryover is better understood, risk levels for crown rot should still be assessed (e.g. PREDICTA B® soil analysis) in paddocks being sown to susceptible cereals, particularly durum wheat.

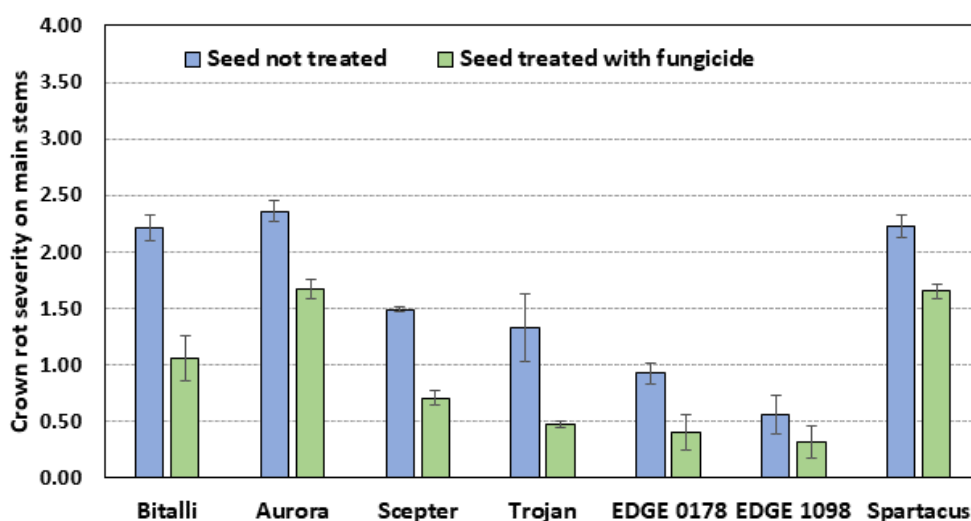


Figure 1. Effects of Tymirium seed treatment and varietal resistance on crown rot expression at Hart in 2020. A basal stem browning score of around 2.00 is often associated with some yield loss.

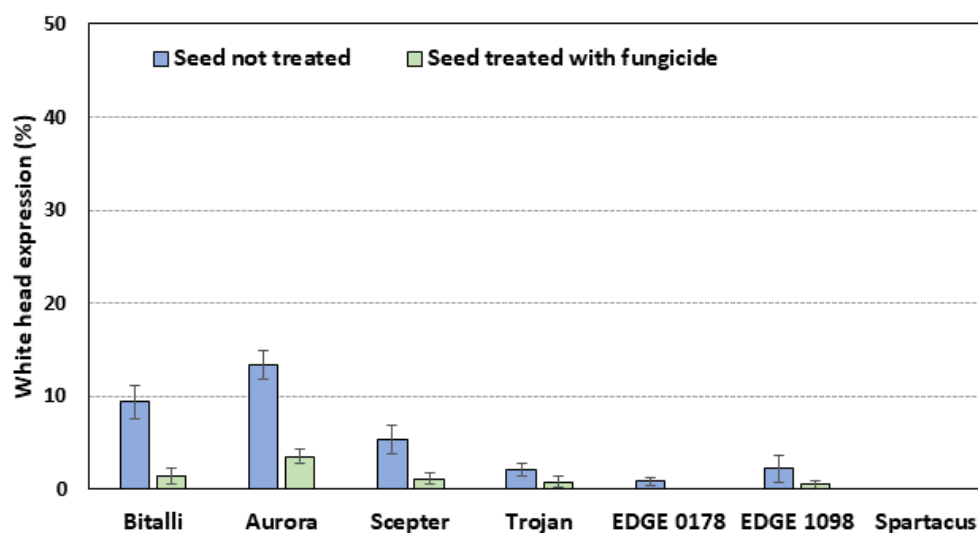


Figure 2. Effects of Tymirium seed treatment and varietal resistance on white head expression at Hart in 2020.

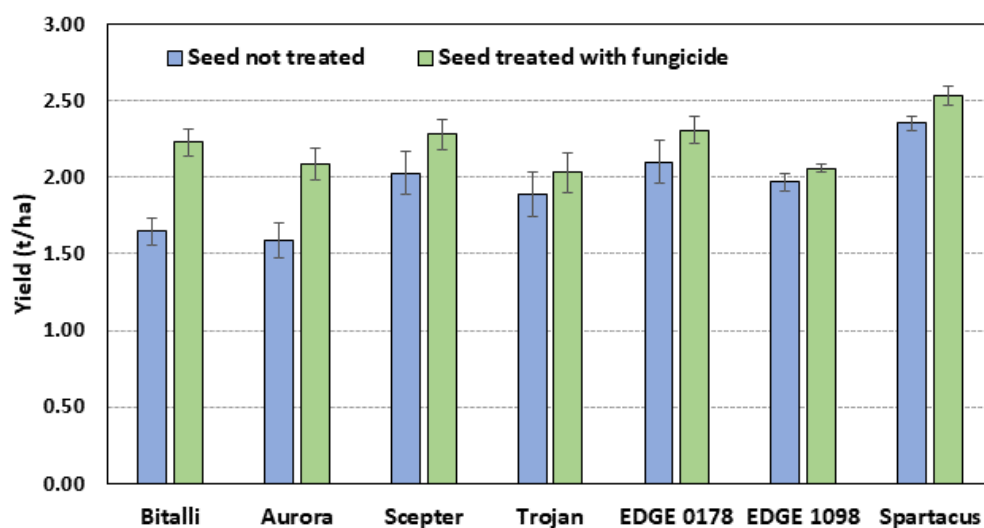


Figure 3. Effects of Tymirium seed treatment and varietal resistance on grain yield at Hart in 2020.

Table 2. Yield improvements (%) associated with application of Tymirium fungicide to seed of varieties with different resistances to crown rot, Hart 2020.

	Hart	Pinery
Bitalli	26	np ¹
Aurora	24	32
Scepter	11	18
Trojan	7	20
Spartacus	7	np
EDGE 0178	9	13
EDGE 1098	4	29

¹np was not present at Pinery.

Resistance to crown rot

All results discussed below are for treatments in the presence of crown rot and the absence of Tymirium seed treatment and no data are presented for Pinery findings.

The Elders lines EDGE-19-SA-0178 and EDGE-19-SA-1098 had lower crown rot expression than Trojan (MS) at both Hart (Figure 1) and Pinery. These lines had yields similar to, or better than Scepter and Trojan at Hart (Figure 3) and better than Trojan at Pinery.

EDGE SA 1071, assessed only at Pinery, had lower crown rot expression than Trojan but also had lower yields than Trojan, EDGE-19-SA-0178 and EDGE-19-SA-1098. Three other lines assessed only at Pinery had greater crown rot expression than Scepter (S) but had reasonable yields when compared with Trojan.

The Elders bread wheat lines EDGE-19-SA-0178 and EDGE-19-SA-1098 demonstrated that, compared with current commercial bread wheat varieties, they have improved resistance to crown rot combined with competitive yields in the presence of crown rot. If these lines are released commercially, they will be useful alternatives to current varieties, particularly if they also have good grain quality and yield well in seasons where crown rot does not express.

Basal stem browning on Bitalli and Aurora was present at similar levels at Hart in 2020 (Figure 1). This suggests that Bitalli is as susceptible to crown rot as Aurora.

Acknowledgements

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Photo: Researcher Marg Evans, SARDI demonstrating crop sampling techniques to a group of early career farmers at Hart.