Yield loss of barley and wheat varieties to Fusarium Crown Rot

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Key Messages

- Yield loss to crown rot varied significantly among wheat and barley varieties ranging from 0 to 0.8 t/ha for wheat and 0.5 to 1.4 t/ha for barley.
- An understanding of the crown rot disease history of a paddock and choosing varieties with appropriate disease resistance ranking can improve crop yield substantially.

Aim

To evaluate the relative yield loss (tolerance) of commonly grown and newly released wheat and barley varieties to Fusarium crown rot.

Background

Fusarium crown rot, caused predominately by the stubble-borne fungus *Fusarium pseudograminearum*, is one of the major root and crown disease constraints on cereal production in Australia. In 2009 it was estimated to cost Australian grain growers $97 million annually in wheat and barley (Murray and Brennan, 2009, 2010). WA's losses to this disease were estimated at that time to be $7 million annually. In 2014, many growing regions in WA were impacted by crown rot, exacerbated by dry weather conditions during grain fill. For example, reports from Merredin indicated that crown rot affected 30-50% of wheat paddocks.

There is an on-going need to evaluate wheat and barley varieties to demonstrate to growers the economic benefits of adoption of varietal selection in paddocks with high crown rot disease pressure. Particularly as several new wheat varieties have been released recently with improved tolerance to crown rot. The field trials reported here is part of a three year series of Western region based trials to provide WA grain growers experimental field evidence of the effect of crown rot on variety yields in local environmental conditions.

Trial Details

Property	DAFWA Wongan Hills Research Station			
Plot size & replication	10m x 1.8m x 4 replications			
Trials & Treatments	Two trials – wheat and barley trial 12 wheat varieties – Calingiri, Cobra, Corack, Emu Rock, Harper, Justica, Mace, Magenta, Scepter, Trojan, Westonia, Wyalkatchem 12 barley varieties – Bass, Baudin, Compass, Fathom, Flinders, Granger, La Trobe, Litmus, Mundah, Rosalind, Scope, Spartacus Uninoculated and inoculated with *F. pseudograminearum* paired plots for each variety			
Soil type	Yellow brown sand			
Soil pH ($CaCl_2$)	0-30cm: 4.7	30-60cm: 5.8	60-90cm: 5.9	90-120cm: 5.8
EC (dS/m)	0-30cm: 0.033	30-60cm: 0.032	60-90cm: 0.027	90-120cm: 0.028
PreDicta B DNA soil test for soilborne diseases	Below detection level for crown rot tests			
Sowing date	01/06/2016			
Seeding rate	75 kg/ha			
Paddock rotation	2012 wheat, 2013 wheat, 2014 lupin, 2015 wheat			
Fertiliser	01/06/2016: 80 kg/ha Macropro Plus 11/07/2016: 60 L/ha Flexi-N 18/08/2016: 25 L/ha Flexi-N			
Herbicides, Insecticides & Fungicides	01/06/2016: 2 L/ha Spray.Seed 250, 2 L/ha Trifluralin, 1.2 kg/ha Terbuthylazine 06/07/2016: 800 mL/ha Velocity 15/08/2016: 250 mL/ha Alpha-cypermethrin			

Annual rainfall	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**YTD**
	66.2	0.0	149.2	77.6	46.0	57.0	80.8	63.6	34.8	17.0	-	-	592.2
	Growing season rainfall (April-October) 381.6mm												

Results

Grain yield for both barley and wheat were good, averaging 3 t/ha for wheat and 5.1 t/ha for barley in the uninoculated plots. No yield loss was sustained by Emu Rock, a wheat variety known for crown rot tolerance. All other barley and wheat varieties had reduced yield (Figure 1 and 2) in plots inoculated with crown rot and significant differences were evident between varieties. In the barley trial, Spartacus, La Trobe and Litmus had the lowest yield reductions from crown rot at less than 600 kg/ha, with Litmus having significantly higher yields apart from Compass, Rosalind, and La Trobe, than any other variety in the presence of crown rot (Figure 1). Bass, Scope, Granger, and Flinders were the most heavily impacted by crown rot losing over 1 t/ha yield to the disease. In the absence of the disease, grain yield of the highest yielding variety, Litmus, was not significantly different to Rosalind, Fathom, Compass, and Mundah.

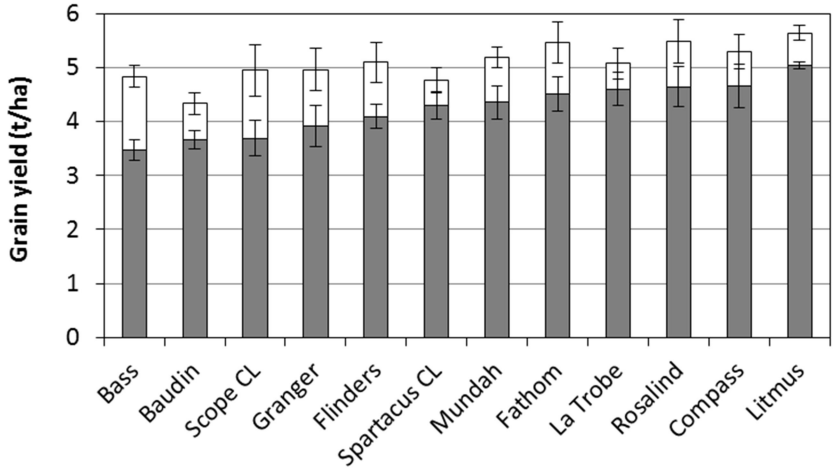

Figure 1: Grain yield for 12 barley varieties in nil (white bars) and *Fusarium pseudograminearum* inoculated (grey bars) plots at Wongan Hills in 2016. NVT crown rot resistance rankings are not available.

In wheat, Emu Rock had no yield loss while Mace, Justica, and Magenta had over 500 kg/ha yield loss to crown rot. Scepter had the highest yield in crown rot inoculated plots which was significantly different to the remaining varieties except Calingiri, Magenta, Emu Rock, and Cobra.

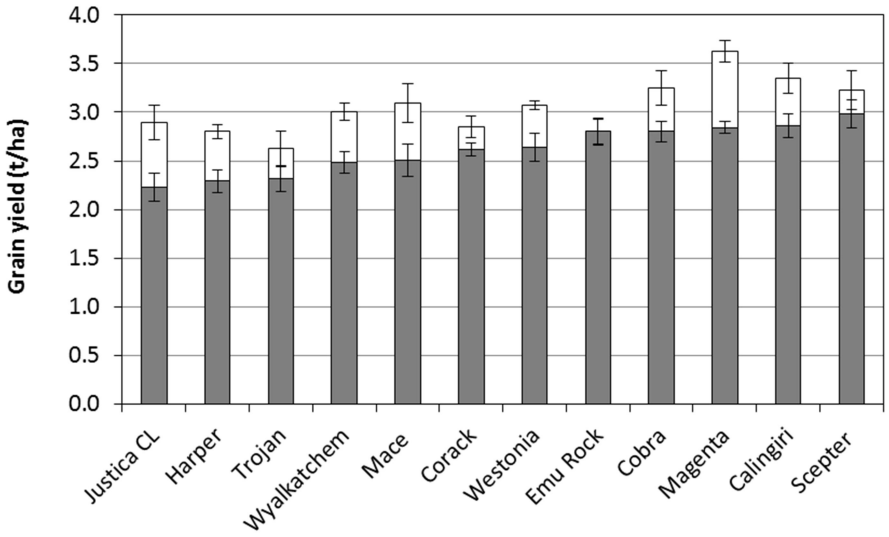

Figure 2: Grain yield for 12 wheat varieties in nil (white bars) and *Fusarium pseudograminearum* inoculated (grey bars) plots at Wongan Hills in 2016. NVT resistance rankings for Emu Rock and Trojan are moderately susceptible (MS), Magenta is MS to susceptible (MSS), and remaining varieties are susceptible to crown rot, except for Scepter for which NVT crown rot resistance rankings are not available.

Comments

This is the third and final year of inoculated crown rot field experiments to evaluate yield loss in barley and wheat varieties in WA. As in the previous two years, with the exception of Emu Rock in 2016, all varieties of barley or wheat were found to be affected by the disease and all had some level of yield reduction, however, significant differences between varieties were evident (see Huberli *et al*. (2015) for 2014 results, and Huberli (2016) for 2015 results). In all years, Emu Rock has had the lowest actual yield loss and has been the highest yielding in the presence of disease with the exception of 2016 where Scepter was the highest yielding. Justica was the lowest yielding in crown rot inoculated plots with the highest actual yield loss in 2014 and 2015, while Magenta suffered the highest yield loss in 2016. For barley, Litmus and La Trobe have been the best performers under crown rot pressure and Compass has had the largest yields loss to the disease in 2014 and 2015, and Bass in 2016.

Yield losses in 2016 for barley and wheat ranged substantially with the worst performers in barley losing over 1 t/ha and in wheat over 500 kg/ha to the disease. For wheat, the resistance rankings have been determined through the NVT screening system, and all varieties with high yield losses in 2015, except Magenta, are susceptible. For barley, resistance ranking have not yet been determined. As this is now the final year of trials a final analysis of the three years' yield losses will be completed and presented at Research Updates 2017.

The results show that variety choice under high crown rot disease pressure can have an impact on yield. For example, with added crown rot inoculum, Emu Rock yielded 294 kg/ha (statistically significant) more than Mace in 2016. However, in the plots without crown rot, Mace out-yielded Emu Rock by 295 kg/ha in 2016 (statistically significant).

These preliminary results indicate that understanding the crown rot disease history of a paddock and choosing varieties with appropriate disease resistance ranking can improve crop yield substantially. It is important to understand that in a year with good rainfall and no or very low level of disease expression (white heads), inoculum levels can build up substantially on tight cereal rotation paddocks.

References

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