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 0.4 to 1.1 t/ha for wheat and 0.5 to 1.8 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.

Several new wheat varieties have been released recently with improved tolerance to crown rot. No experimental field evidence is currently available to grain growers on the effect of crown rot on variety yields in WA. Hence, 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 pressure.

Trial Details

Property	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, Trojan, Westonia, Wyalkatchem, Yitpi 12 barley varieties – Bass, Baudin, Commander, Compass, Fathom, Flinders, Granger, Hindmarsh, La Trobe, Litmus, Mundah, Scope 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: 5.5	60-90cm: 5.7	90-120cm: 5.8
EC (dS/m)	0-30cm: 0.020	30-60cm: 0.019	60-90cm: 0.021	90-120cm: 0.025
PreDicta B DNA soil test for soilborne diseases	Below detection level for crown rot tests			
Sowing date	20/05/2015			
Seeding rate	75 kg/ha			
Paddock rotation	2012 wheat, 2013 wheat, 2014 lupin			
Fertiliser	20/05/2015: 80 kg/ha Macropro Plus 01/07/2015: 50 kg/ha urea			
Herbicides, Insecticides & Fungicides	20/05/2015: 1.5 L/ha Treflan, 2 L/ha Spray.Seed 250, 2.5 L/ha Boxer Gold 23/06/2015: 670 mL/ha Velocity 13/08/2015: 300 mL/ha Amistar Xtra			
Growing season rainfall	294mm (20 May to 30 October)			

Results

Grain yield for both barley and wheat were good, averaging 3.9 t/ha for wheat and 4.3 t/ha for barley in the uninoculated plots. All barley and wheat varieties had some level of yield reductions (Figure 1 and 2) in plots inoculated with crown rot and significant differences were evident between varieties. In the barley trials, Litmus, La Trobe and Hindmarsh had the lowest yield reductions from crown rot at less than 0.6 t/ha, with Litmus having significantly higher yields than any other variety in the presence of crown rot (Figure 1). Compass, Granger, and Scope were the most heavily impacted by crown rot losing over 1.4 t/ha yield to the disease. In the absence of the disease, grain yield of Litmus, the highest yielding variety under crown rot (inoculated), and Compass was not significantly different.

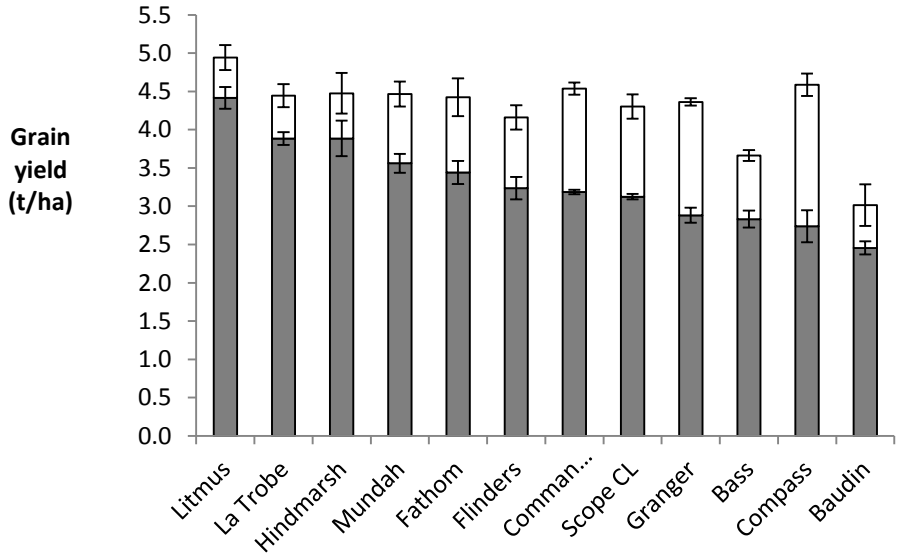

Figure 1: Grain yield for 12 barley varieties in nil (white bars) and *Fusarium pseudograminearum* inoculated (grey bars) plots at Wongan Hills in 2015. NVT crown rot resistance rankings are not available.

In wheat, Emu Rock had the lowest yield loss of 0.36 t/ha (approximately half the total loss that occurred in Mace) from crown rot, and also had the highest yield in crown rot inoculated plots, significantly greater than Corack, Calingiri, Wyalkatchem and Justica. The varieties Justica, Wyalkatchem, Magenta, and Calingiri had over 0.9 kg/ha yield loss to the disease.

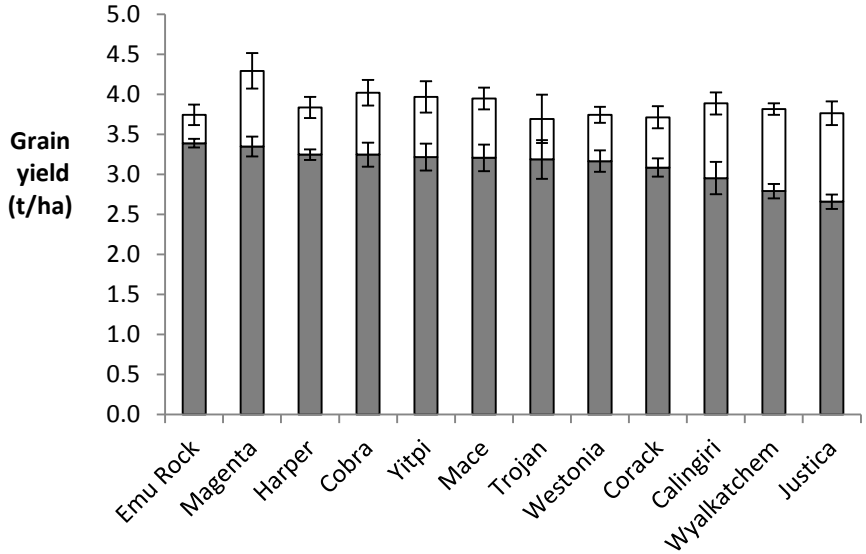

Figure 2: Grain yield for 12 wheat varieties in nil (white bars) and *Fusarium pseudograminearum* inoculated (grey bars) plots at Wongan Hills in 2015. NVT resistance rankings for Emu Rock and Trojan are moderately susceptible (MS), Magenta is MS to susceptible (MSS), and remaining varieties are susceptible to crown rot.

Comments

This is the second year of inoculated crown rot field experiments to evaluate yield loss in barley and wheat varieties in WA. As in 2014, 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). In both years, Emu Rock has had the lowest actual yield loss and has been the highest yielding in the presence of disease, while Justica was the lowest yielding in crown rot inoculated plots with the highest actual yield loss. For barley, Litmus, Hindmarsh and La Trobe have been the best performers under crown rot and Compass has had the largest yields loss to the disease in 2014 and 2015.

Yield losses for barley and wheat ranged substantially with the worst performers in barley losing over 1.4 t/ha and in wheat over 0.9 t/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 rankings have not yet been determined. This is the second year of these trials, and further testing next year will result in a final analysis of the three years' yield losses.

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 0.18 t/ha (not significant) and 0.3 t/ha (significant) more than Mace in 2015 and 2014, respectively. However, in the plots without crown rot, Mace out-yielded Emu Rock by 0.2 t/ha in both years (statistically significant in 2014).

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.

References

Murray, G.M. and Brennan, J.P. (2009). Estimating disease losses to the Australian wheat industry. *Australasian Plant Pathology* 38: 558-570.

Murray, G.M. and Brennan, J.P. (2010). Estimating disease losses to the Australian barley industry. *Australasian Plant Pathology* 39: 85-96.

Hüberli, D., Connor, M. and Gajda, K. (2015) Yield loss to Fusarium crown rot: is there a better choice among barley and wheat varieties? In: Australasian Plant Pathology Society Conference Handbook, 14 - 16 September, Fremantle, Western Australia. Download PDF conference paper, poster, and presentation: http://researchrepository.murdoch.edu.au/28457/

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