

Crown rot tolerance in new wheat cultivars – is there enough to base varietal decisions on?

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GRDC code

CRA004: Crown rot tolerance of commercial cultivars

DAN00175: National crown rot epidemiology and management program

Take home messages

In 7 trials over 3 years (2012-2014), recently released varieties demonstrated improved yield performance in the presence of Crown Rot relative to EGA Gregory (D), Sunguard (D) (+17%), Suntop (D) (+16%), LRPB Lancer (D) (+15%), Spitfire (D) (+12%).

Growers should consider alternatives to EGA Gregory (D) unless they have confirmed their paddock has a LOW Crown Rot risk.

Crown Rot tolerance, whilst important, should not necessarily be the most critical factor to choose a variety, nor should it be the first line of defence to combat the disease.

Growers/Advisors should determine the level of Crown Rot Risk for every paddock so they can choose the optimal variety to plant.

Introduction

Whilst Crown Rot is the biggest pathological robber of wheat yield in Australia, estimated at over \$100 million per annum (*Murray and Brennan, 2009*), it isn't necessarily the number one criteria for choosing a variety. Various, well documented cultural and rotational management practices can be employed to minimise crop losses from Crown Rot. Growers who have a well established farming system using crop rotation, inter-row sowing, timely weed control, strategic crop nutrition and canopy management with an acute awareness of their soil capability often do not have a problem with Crown Rot.

Selecting the most suitable, and therefore profitable, wheat variety must be based on a number of objective criteria. The relative weighting of each of these criteria will vary for each grower and advisor. Traits such as Stem Rust resistance, Yield (in the absence of CR), Quality classification (APH, AH, APW...), Grain protein performance and Root Lesion Nematode Resistance/Tolerance arguably should all be given higher priority than Crown Rot Resistance/Tolerance when selecting a variety in the northern cropping region.

Crown Rot Tolerance v Resistance

It is important to distinguish between Crown Rot tolerance and resistance. Tolerance is the ability of a variety to yield in the presence of a known amount of inoculum. Resistance is the ability of the plant to limit the incidence and/or build up of the disease. Resistance is often expressed as the level of basal browning and/or % whiteheads. As disease incidence increases so too does the % yield loss due to Crown Rot, but it does not take into account the inherent yield ability of the variety. That

missing piece of information prompted NSW DPI to pioneer a technique and conduct numerous trials since 2004, followed by Northern Grower Alliance (NGA) in 2007 and 2008 and Crown Analytical Services (CAS, 2010-2014), comparing the relative yields of varieties with and without added Crown Rot inoculum to assess Crown Rot tolerance for current and future varieties.

Commercial testing by CAS since 2008 has consistently shown approximately 40% of all paddocks in the northern cropping region have Moderate to High Crown Rot inoculum levels. Therefore growers and advisors who manage that 40% need to choose their varieties very carefully.

Yields relative to Gregory

The last three dry springs in northern NSW (2012-2014) have provided an excellent opportunity to assess Crown Rot tolerance. Each variety had either added or no added Crown Rot inoculum as millet (or durum) grain colonised by *Fusarium pseudograminearum* at a rate of 2g/metre row into the seed furrow at planting. Background disease levels for Crown Rot and Root Lesion Nematodes were assessed using Predicta B®.

Table 1: Summary of yield responses to added Crown Rot inoculum relative to EGA Gregory from 7 trials (2012-2014).

Variety	No Added CR	Added CR
Sunguard (MS#)	103% (7*)	117% (7)
Sunco (MS)	97% (5)	101% (5)
Spitfire (MS)	102% (7)	112% (7)
Lancer (MS-S)	101% (7)	115% (7)
Mitch (MS)	104% (7)	110% (7)
Suntop (MS-S)	108% (7)	116% (7)
EGA Gregory (S)	100% (7)	100% (7)
EGA Bellaroi (VS)	82% (7)	61% (7)

CAS data for 2012 (Bellata, Weemelah, Rowena) 2013 (Bellata, Weemelah) and NSW DPI data for 2014 (Garah and Tamworth). Caparoi was used instead of Bellaroi at Garah and Tamworth)

*denotes number of trials

denotes CR resistance rating

Note: Viking, Gauntlet and Sunmate were only assessed on two trials in 2014 and more testing is required.

This data is consistent with that of NSW DPI (S Simpfendorfer) who in 2013 found that when averaged across 11 sites under high Crown Rot pressure (Added CR), Suntop was 0.42 t/ha, LRPB Lancer 0.51 t/ha, Sunguard 0.61 t/ha and LRPB Spitfire 0.63 t/ha higher yielding than EGA Gregory.

Crown Rot tolerance data coupled with the resistance ratings provides growers and advisors with information to select varieties based on yield as well as its ability to combat the disease. Tolerance data helps to discriminate yield performance within the resistance ratings. Sunco for instance is rated MS, yet most varieties with a MS-S rating will outperform Sunco in terms of yield, even in the presence of the disease.

Determine the level of Crown Rot Risk for each Paddock

Inoculum level, whilst critical, is only one of numerous factors that determine the Crown Rot Risk of a paddock. The following should all be considered and **measured** where possible.

- Inoculum level in stubble (measured by CR Index or Predicta B®).
- Amount of stubble and therefore potential volume of inoculum
- Root Lesion Nematode numbers (interaction with CR)
- Starting Soil Water (can be measured in mm or %PAWC)
- Soil Nitrate levels
- Factors that affect soil hydraulic conductivity and water supply during grain fill
 - Soil clay% (particle size analysis)
 - Soil bulk density
 - Soil sodicity
 - Soil EC
- Time of sowing and maximum daily temperatures during grain fill
- In crop rain (especially prior to or during grain fill).....overrides all the above

There are commercial tests available for determining levels of Crown Rot inoculum, CAS still provide a stubble testing service and Predicta B® is a DNA diagnostic soil test. (see the adjoining paper by Dr Steven Simpfendorfer *“Update on dedicated sampling strategy to improve the accuracy of PredictaB soil testing to identify Crown Rot risk”*.)

Once measured, growers and advisors could use their own relative rating system to assess whether their Paddock should be rated as a High, Moderate, Low or Very Low Crown Rot risk. **A full appreciation of Crown Rot risk is more than just measuring inoculum levels.**

If concluded the Crown Rot Risk is VERY LOW: All bread wheats and even Durum are possible.

If LOW: Susceptible bread wheat varieties such as EGA Gregory[®] are possible. Durum is a risk.

If MODERATE: Bread wheats such as Suntop[®], Spitfire[®], LRPB Lancer[®] should be preferred to EGA Gregory[®]. Definitely do not sow Durum.

If HIGH: Yield loss is likely even for the tolerant varieties. Consider not planting bread wheat and consider a non-host crop such as chickpea, faba bean, canola or sorghum. Most definitely **do not** sow Durum.

Conclusions

In the commercial world of End Point Royalties, new wheat varieties need to demonstrate value to the grower to survive in the market. Those varieties that are most successful in the northern cropping region have favourable grain quality features and the ability to yield in the presence of a number of perils..... of which Crown Rot is an important one.

Assess all aspects that determine Crown Rot risk, of which inoculum is one. Growers should consider alternatives to EGA Gregory[®] unless they know they are planting into a paddock with LOW Crown Rot risk. A range of current new varieties have demonstrated significant yield improvement over EGA Gregory[®] in the presence of Crown Rot.

However, Crown Rot management is more than just choosing the right variety. Significant losses will still occur with these new varieties if subjected to high infection levels and high evaporative demand

during grain fill. Variety selection **is not** a sole solution to crown rot. Rather an integrated approach to management needs to be taken, within which variety resistance/tolerance is one component.

These GRDC funded trials run by NSW DPI and CAS (and NGA in previous years) are an extremely valuable tool to assess varietal field performance in the presence of crown rot infection across a range of seasons and sites.

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