Project Title: Northern Agribusiness Trial Extension Network Cultivar Crown Rot Tolerance 2012

GRDC Project No: CRA 00001

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Objectives:

- Assess the relative disease incidence and yield performance of pre-release varieties for Crown Rot tolerance.
- Provide feedback to GRDC and co-operating wheat breeding companies (AGT, Longreach and Heritage Seeds) regarding disease incidence and resultant yield performance of their submitted cultivars.
- Gather data to validate the potential use of a Crown Rot tolerance ranking system to be introduced as an industry standard.

Background:

- Traditionally Crown Rot resistance ratings have been based on whitehead assessments. Whilst whiteheads are one method of assessment they are strongly influenced by environmental factors and do not necessarily give a true reflection of its relative ability to perform in the field in the presence of known levels of inoculum.
- By engaging with commercial seed companies, namely AGT, Longreach Plant Breeders (plus Pacific Seeds by association) and Heritage Seeds, our proposal was to use this assessment method across a number of suitable sites over a number of years in northern NSW to "road-test" a number of their elite cultivars before they are released to the market. This objective data will assist these seed companies to reliably select and promote the most suitable cultivars for a region. Similarly it should give consultants and growers more confidence to choose cultivars with a documented history of performance in the presence of Crown Rot.
- AGT, Longreach and Heritage Seeds gave financial support for these trials.

Methodology

- The trial was conducted over three locations in Northern NSW, Bellata, Rowena and Mungindi to give a regional spread of soil type and climate. The sites were selected with the understanding they had low background levels of Crown Rot inoculum based on rotation and historical management.
- Five existing varieties were chosen as industry standard varieties in the trial. These were Gregory, Bellaroi, Strzelecki, Sunco and Wylie. These varieties provided a base to compare the pre-release varieties. Three companies, namely AGT, Longreach and Heritage Seeds each submitted varieties that they were advanced in their development and so long as they continue to meet market standards are expected to be released in the near future.

  The 14 pre-release varieties were

AGT:	Suntop, Sunguard, Sun651A, Sun643A, QT14381
Longreach:	Crusader, Spitfire, Dart, Impala, LPB07-0548,
Heritage Seeds:	SMBW12-086, SMBW10-0168, SMBW11-0107, SMBW11-073

- Crown Rot inoculum was prepared by growing the fungus (*Fusarium pseudograminearum*, mixture of 5 isolates) on sterilised White French Millet seed and adding it to the seed furrow of the inoculated plots at a rate of 2g/m row. This assessment method was devised by Dr Simpfendorfer to test the field tolerance of cultivars +/- known levels of added inoculum on selected clean sites. This was replicated four times per trial site in a randomised complete block design.
- Each of these plots were measured based on emergence, percentage biomass, NDVI, whitehead count, disease incidence and severity (basal browning assessment), grain yield and grain quality.

Results

There was a statistically significant inoculum x variety response at all sites. In other words, the added inoculum significantly increased the disease pressure. Disease pressure was highest at Rowena (-CR 10.9, +CR 30.9) > Weemelah (-CR 5.7, +CR 16.3) > Bellata (-CR 4.7, +CR 8.8). The order of ranking for disease (Crown Rot Index) matched the resistance ratings with the exception of Impala.

Despite the high levels of disease incidence and severity (Crown Rot Index), the only varieties that showed statistically significant Yield Loss as a result of Crown Rot were Bellaroi at all sites, Strzelecki at all sites, Gregory at Bellata, Dart at Rowena and SUN651A at Weemelah.

Yield Loss was tempered by the amount of stored soil moisture that the plants accessed during grain fill. Soil moisture profiles were full at planting following the widespread summer rains and flooding. Despite a lack of in-crop rain after July and extensive surface cracking, the cooler spring temperatures and deep soil moisture enabled these crops to fill grain without producing whiteheads and yield loss. This was the case throughout the district in 2012, where Crown Rot losses in bread wheat were severe on red ridges and sodic clay soils, yet surprisingly absent on the well drained vertosol soils. Bellaroi durum suffered significant yield losses due to Crown Rot in our trials and across the district.

The addition of Crown Rot inoculum significantly increased the screenings, reduced test weight and increased protein (as a result of decreased yield) in Bellaroi. Otherwise there were no significant grain quality issues in any of the bread wheats.

Implications

- The breeders and associated seed marketing companies (AGT, Longreach/Pacific Seeds, and Heritage Seeds) have closely scrutinised the data for their relevant varieties. This data will help make decisions regarding the commercial viability of those varieties submitted.

- These trials continue to re-affirm an industry requirement for a Crown Rot tolerance rating system to be run in tandem with the current Crown Rot resistance ratings. Resistance ratings provide valuable information regarding disease expression and % Yield Loss, but do not take into account the ability of a variety to perform in the presence of known levels of crown rot. Growers and Advisors would benefit greatly from knowing how a variety will perform, relative to its competitors, under Low, Medium or High crown rot pressure.

Recommendations

- Keep striving to establish a Crown Rot tolerance rating system.
- New varieties need to add some level of differentiation to the market to be successful. If they do not show a statistically significant improvement to one or more of the top six priorities as outlined in the Introduction, they are unlikely to be commercially successful.
- All companies to release a new variety should be encouraged to submit seed to be objectively tested for Crown Rot for at least 3 years prior to being released into northern NSW / southern Qld.

Extension & Field Days

- Site inspection at "Lochearn" Bellata with GRDC Board members, 4th July 2012
- Site inspection at "Lochearn" Bellata with Longreach (Adrian McNair) 7th September 2012
- Several site inspections at "Lochearn" Bellata with Longreach (Lindsay O'Brien) September 2012
- Site inspection at "Lochearn" Bellata with GRDC Northern Panel members, 10th September 2012
- Penagcon Field Day at "Lochearn" Bellata 18th September 2012. Approximately 85 attendees, mostly growers.
- NGA Field Day. Inspected all trials at "Lochearn" Bellata. 2nd October 2012.
- Several site inspections at "Lochearn" Bellata with Longreach (Lindsay O'Brien)
- "2012 – A Mixed Bag- winter crop review" meeting at Moree Services Club, 12th December 2012, discussing Crown Rot, Grain Protein and Root Lesion Nematodes. Organised by Crown Analytical Services in conjunction with NSW DPI.
- Penagcon grower meeting (54 growers attended), Bellata Golf Club. Presentation of preliminary data. 2nd February 2013.
- GRDC Update presentations, Coonabarabran 27th February 2013
- GRDC Update presentations, Goondiwindi 5th March 2013