THE ADDITIVE YIELD IMPACT OF ROOT LESION NEMATODE AND CROWN ROT

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Key words

Wheat, barley, durum, *Pratylenchus thornei*, crown rot

GRDC codes

NGA00001: validation and integration of new technology through grower groups in north-west NSW and south-west Queensland grain growing zones

NGA00002: validation and integration of new technology through grower groups in north-east NSW grain growing zones

DAN00109: Management of Fusarium and other winter cereal diseases in the northern cropping zone

Take home messages

- Levels of *Pratylenchus thornei (Pt)* were found in ~40% of random crown rot (CR) trial sites conducted during 2007-2009
- Yield trends at sites with *Pt* present strongly supported current variety *Pt* ratings
- Results indicate an additive impact of losses due to both 'diseases' eg Bellaroi suffered a 24% yield loss due to CR alone, an 8% yield loss due to *Pt* alone but a yield loss of 38% when both factors occurred
- Variety selection appears more important for *Pt* management than for crown rot
- Poor variety choice in *Pt* situations reduced average yield by ~30%. This represented ~1/t/ha or $180/ha in net benefit (or cost)
- Clear benefits from identifying *Pt* risk paddocks and adjusting hygiene, variety and rotation choices

Background

NGA have been involved in 22 field trials since 2007, in collaboration with Steven Simpfendorfer I&I NSW, evaluating the impact of crown rot (CR) on a range of winter crops and varieties. Although this work has greatly improved our understanding of crown rot impact and variety tolerance, it also indicates we may be suffering more from another 'disease' that often goes unnoticed. Although the trials were not designed to focus on nematodes, a convincing trend was apparent after 2008 that indicated the root lesion nematode *Pratylenchus thornei (Pt)* may be having a wider and larger impact on actual yield than previously expected.

Nematode counts

Part of trial site characterisation was the testing of soil samples for background CR level as well as a range of other pathogens including nematodes. PreDicta B (DNA extraction) has been used on all samples with DEEDI also conducting 'manual' nematode counts on all samples from 2008 and 2009. The correlation between the two tests has been very good with both tests always indicating *Pt* presence at the same site (see Figure 1). One difference is that the DNA assessment is on the 0-15 cm soil fraction whilst the manual count is in layers from 0-90 cm. Deeper sampling may be useful at sites with prominent nematode 'bulges' at depth (see Figure 2).

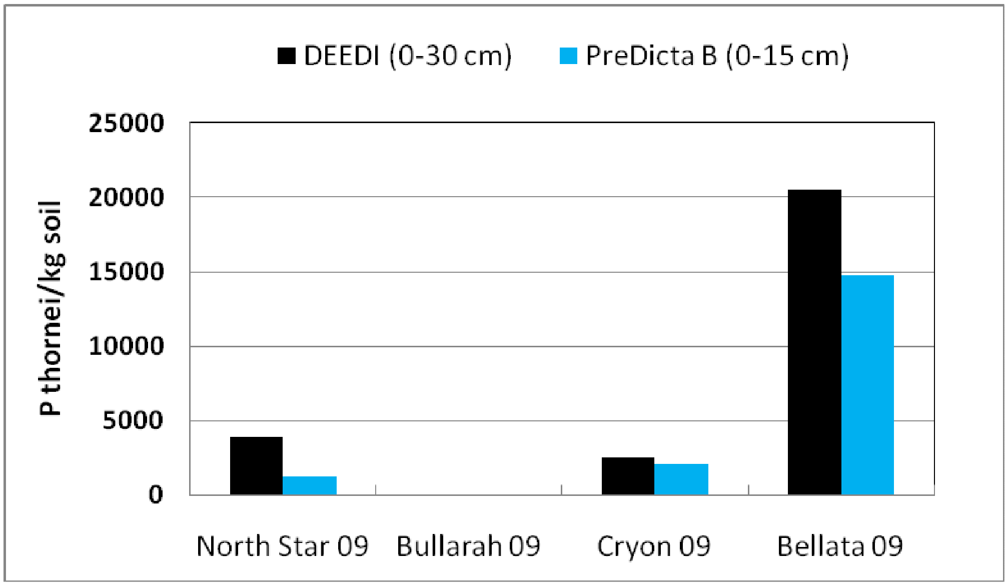

Figure 1. *Pt* assessments 2009: manual count v DNA extraction
NB soil sample depth differs between methods

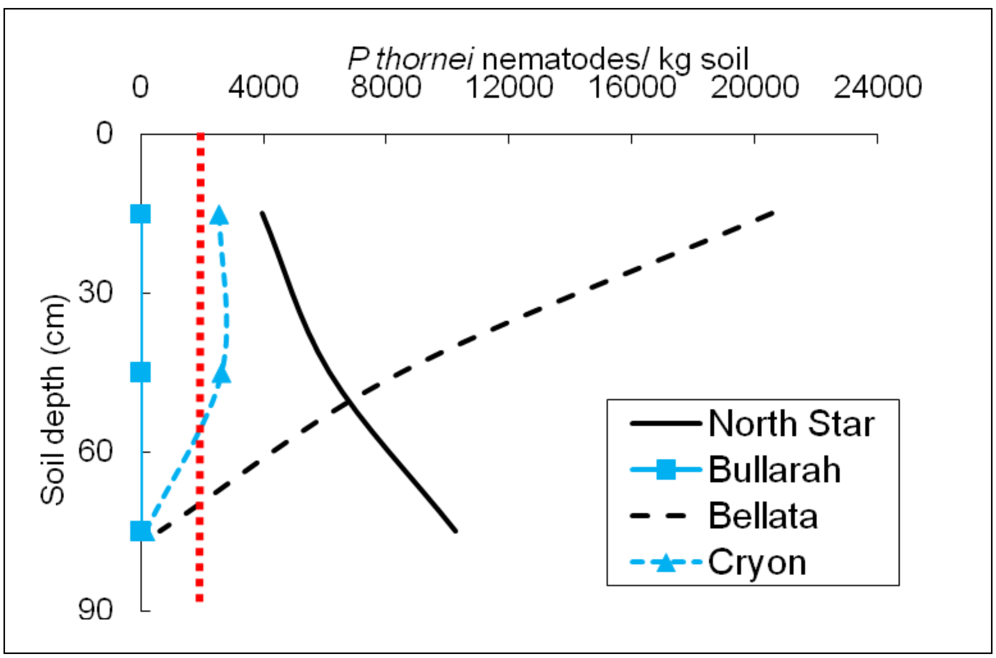

Figure 2. *Pt* assessments 2009: population profiles across sites
Vertical line = DEEDI threshold (~2000/kg) for yield loss in intolerant varieties

The yield impact of *Pt*

In all 18 trials in 2007 & 2008 a common series of 5 bread wheat varieties, 4 barley varieties and 1 durum were evaluated. Variety yield as a % of a 'standard' was calculated to investigate the performance across sites. EGA Wylie and Skiff were used as standards (EGA Wylie has the highest level of available tolerance in commercial wheat varieties but will still suffer yield loss in the presence of high *Pt* populations. There is little information available for barley).

Figure 3 shows the variety yield performance compared to EGA Wylie over the total of 18 trials. 11 trials had no *Pt* detected with 7 sites having *Pt* present (~40% of sites had *Pt*). 2007 was a high CR yield loss year with average bread wheat yield loss of ~25%. In contrast 2008 was a very low CR yield loss year with average bread wheat yield loss of only ~1%.

The four lines graphed show the yield performance of each variety as a % of EGA Wylie with:

1. 'no constraint' (no added CR, no *Pt* present)
2. 'CR alone' line (**added CR**, no *Pt* present)
3. '*Pt* alone' line (no added CR, ***Pt* present**)
4. 'CR + *Pt*' line (**added CR**, ***Pt* present**)

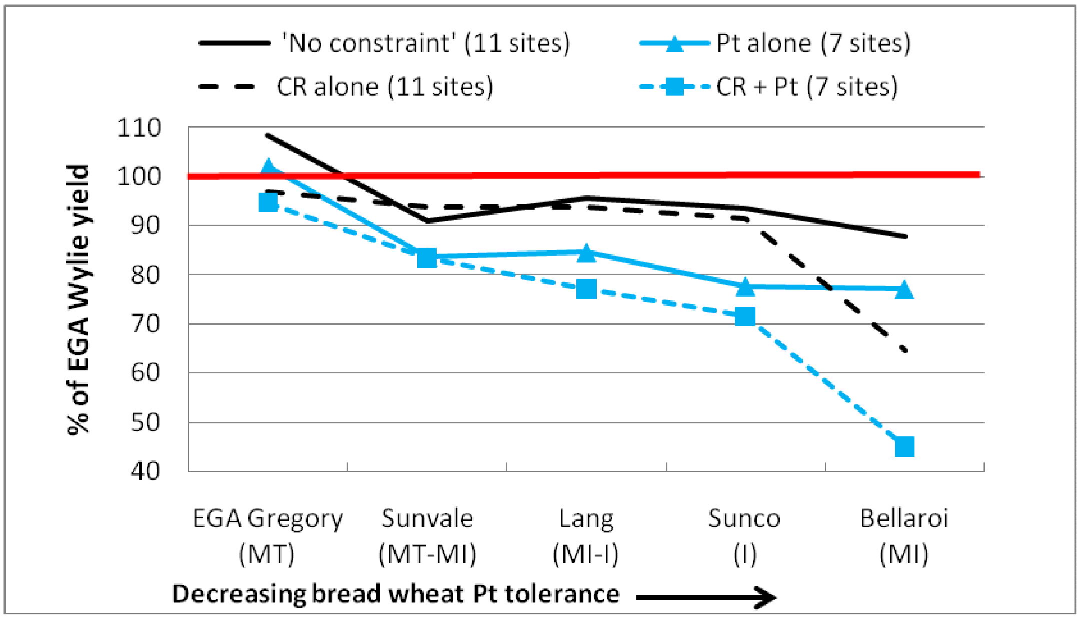

Figure 3. 2007 & 2008 wheat variety yield as a % of EGA Wylie

Letters indicate *Pt* tolerance rating eg MT moderately tolerant, MI moderately intolerant

Key points:

1. The difference between **'no constraint' and 'CR alone' indicates relative CR tolerance** eg Bellaroi showed the largest fall, followed by EGA Gregory
2. The difference between **'no constraint' and '*Pt* alone' indicates relative *Pt* tolerance**. All varieties fell compared to EGA Wylie with most impact on Lang, Sunco and Bellaroi
3. The 'CR + *Pt*' line shows the performance when both constraints were present. This data suggests an additive effect of variety CR loss PLUS *Pt* impact
4. **Generally an equal or larger apparent impact on variety yield from *Pt* tolerance compared to CR tolerance**

Over these two years, varieties such as Lang and Sunco performed well when CR was added in the absence of *Pt* (~90-95% of EGA Wylie yield). **However when CR was added and *Pt* were present they 'lost' an additional 15-20% yield (~70-80% of EGA Wylie yield).**

Barley varieties are generally considered to have increased levels of *Pt* tolerance. Comparison of barley performance over the same trials is seen in Figure 4.

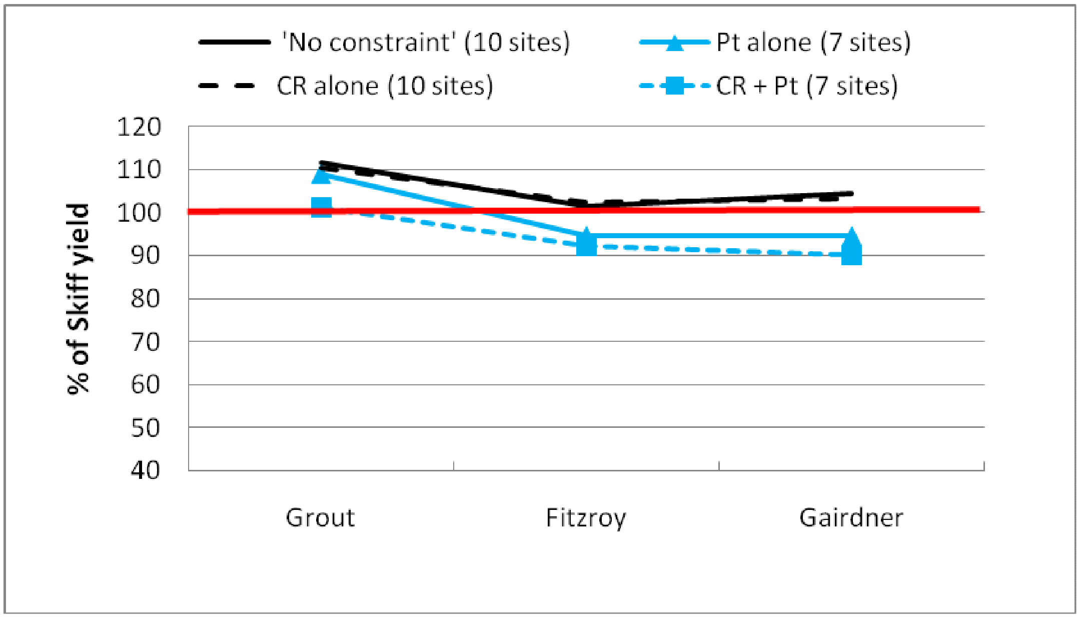

Figure 4. 2007 & 2008 barley variety yield as a % of Skiff

Key points:

1. Negligible apparent difference in variety CR tolerance
2. No indication of dramatic differences in variety *Pt* tolerance but with Skiff results suggesting it may have slightly increased tolerance than other varieties evaluated

Figure 5 shows the variety yield performance compared to EGA Wylie for all varieties evaluated in both 2008 and 2009. There were no *Pt* detected at 6 sites, with 5 sites having *Pt* present (NB site selection biased to *Pt* presence in 2009). 2008 was a very low CR yield loss year with average bread wheat yield loss of ~1% with low to moderate CR losses in 2009 with an average bread wheat yield loss of ~8%.

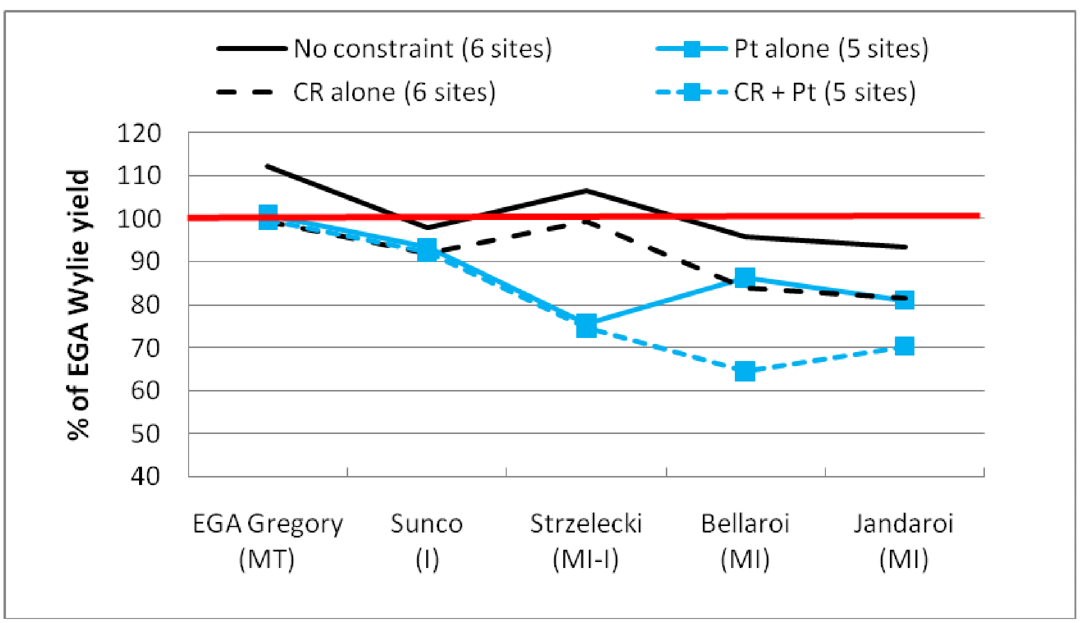

Figure 5. 2008 & 2009 wheat variety yield as a % of EGA Wylie (NB lower CR yield loss seasons)

Key points:

1. Over these two years varietal CR tolerance differences were less reflected in actual yield
2. Very concerning yield performance of Strzelecki, Bellaroi and Jandaroi at sites with both *Pt* presence and CR added
3. **Equal or larger apparent impact on variety yield from *Pt* tolerance than due to CR**

Summary

CR impact and variety choice

It is clear there are differences in level of CR tolerance between bread wheat varieties. However the relationship between CR tolerance rating and actual yield has been very poor ie inherent yield potential and local adaptation has been more important than CR rating.

The performance of EGA Gregory is a good example. Under CR pressure, EGA Gregory will certainly show more disease symptoms than Sunco but has still significantly outyielded Sunco in 10 of 22 trials. There was no situation when Sunco significantly outyielded EGA Gregory. EGA Gregory is NOT better than Sunco for CR tolerance but is a higher yielding, widely adapted option. This demonstrates the relatively small progress and the difficulty of breeding for CR tolerance. **Bread wheat variety choice cannot be your major CR management tool.**

***Pt* impact and variety choice**

The pattern of yield results obtained at sites with *Pt* presence, strongly supports the published variety *Pt* ratings. There appears to be a much stronger relationship between *Pt* rating and final yield under *Pt* pressure than exists for CR. In addition the level of apparent yield impact has been equal to or greater than losses from CR over the 3 seasons evaluated. **Bread wheat variety choice on the basis of *Pt* rating appears a very useful tool in *Pt* management and is likely to strongly impact actual yield and economic results.**

The performance of Strzelecki is a good example. Over the last 2 years at sites without *Pt*, it averaged 6% higher yield than EGA Wylie. However at sites with *Pt* present, it has averaged 24% lower yielding. The absolute loss has equaled ~1 t/ha. A poor variety choice when *Pt* are present could be costing the grower more than $180/ha.

Conclusions

It should be stressed that these trials were designed to evaluate the impact of CR on variety yield and quality. However with the large sample size, they strongly suggest that *Pt* are also having a very large impact on yield performance. Random site selection in the first 2 years revealed ~40% of paddocks having *Pt* presence. Survey work conducted by Dr John Thompson and his team (DEEDI), suggest frequency of *Pt* occurrence may be even higher. It may be a co-incidence but the four northern varieties with the highest *Pt* tolerance rating are EGA Wylie, EGA Gregory, Baxter and Sunvale. These are also amongst the most widely adopted and successful varieties in many parts of the north.

Although *Pt* is another issue we need to consider, it at least appears to be one where we can achieve some financial gains by knowledge of paddock status, by sensible varietal choice and by the adoption of rotations to assist in reducing nematode populations.

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