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Varietal impact on final soil populations of *Pratylenchus thornei* – Macalister, Qld 2015

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Key findings

Cereal variety choice can have a large impact on *Pratylenchus thornei* (*Pt*) population build-up within paddocks, which can then affect how following crops and/or varieties perform in the rotation.

Significant differences were evident between varieties with an 8.9-fold difference in final *Pt* populations between the best (Commander⁽ᴾ⁾) and worst (Mitch⁽ᴾ⁾) entries.

Very susceptible varieties should be avoided in paddocks with known root lesion nematode (RLN) populations as they can increase the population to high risk levels in one season (e.g. 19.1-fold increase with Mitch⁽ᴾ⁾).

There was no significant difference between varieties in crown rot inoculum level that developed during the season based on postharvest PreDicta B® assessment.

Introduction

Repeated studies have demonstrated that the root lesion nematode, *Pratylenchus thornei* (*Pt*), is widespread across the northern region. At moderate to high populations it appears to interact with the expression of crown rot, which can exacerbate yield loss from both pathogens. While the relative yield of cereal type and variety in the presence of crown rot infection in the current season requires consideration, the potential consequences of these choices on *Pt* build-up for subsequent crops within the rotation should not be overlooked. Final *Pt* populations developed by 16 different winter cereal entries was determined after harvest at Macalister in southern Qld in 2015 to determine potential residual impacts on the differential build-up of *Pt* populations within a rotational sequence. This type of testing evaluates the relative resistance of each variety to *Pt* under field conditions.

Site details

Location:	**"Curraweena", Macalister, southern Qld**
Co-operator:	**Rob Taylor**
Sowing date:	**1 June 2015**
Starting N:	**126 mg/kg nitrate (0–60cm)**
Fertiliser:	**250 kg/ha urea and 40 kg/ha Granulock® 12Z at sowing**
PreDicta B®:	**5.5 *Pt*/g (medium risk), nil *Pn* and 1.8 log *Fusarium* DNA/g soil (medium risk) at sowing (0–30 cm)**
In-crop rainfall:	**121 mm**
Harvest date:	**2 November 2015**

Treatments

- A total of 16 winter cereal entries (one durum, two barley and 13 bread wheat; Figure 1).
- Added (plus) or no added (minus) crown rot at sowing using sterilised durum grain colonised by at least five different isolates of *Fusarium pseudograminearum* (*Fp*).
- All plots in the trial were cored (10 cores/plot at 0–15 cm on previous crop row) after harvest (November 2015) to determine final (Pf) *Pt* populations for each variety.
- *Pt* populations determined in all soil samples based on PreDicta B® analysis, a DNA-based test provided by the South Australian Research and Development Institute (SARDI). Levels of residual crown rot inoculum (log *Fusarium* DNA) were also determined from the same samples. Note: They were non-spiked (no added stubble) soil cores as collected on the previous crop row primarily for *Pt* analysis.
- *Pt* data transformed for analysis $ln(x + 1)$ to determine significance with back-transformed values for *Pt* presented in Figure 1.

Results

- This site had a medium *Pt* population (5.5 *Pt*/g soil) at sowing following a barley crop grown in 2013 and a faba bean crop in 2014.
- Adding *Fp* inoculum at sowing did not significantly affect final *Pt* numbers (P = 0.275) with no significant interaction evident in any of the entries.
- Significant differences were evident between varieties in final *Pt* populations developed in the top 15 cm of soil, which ranged from 11.8 *Pt*/g soil after the barley variety Commander up to 105.0 *Pt*/g soil after Mitch (Figure 1). This represents an 8.9-fold difference in final *Pt* populations between entries.

- Commander (barley) and Suntop (bread wheat) were the only entries that maintained final *Pt* populations at a medium risk level (2.0–15.0 *Pt*/g soil) at harvest.
- All other entries increased the final *Pt* population to within a high risk level (>15.0 *Pt*/g soil) for the following crop in 2016 (Figure 1).
- Both barley varieties and the durum variety Jandaroi were generally towards the mid to lower end of final *Pt* populations relative to the bread wheat entries.
- The two barley varieties appear to vary in their resistance to *Pt* with La Trobe leaving approximately double the *Pt* population of Commander.
- In barley, Commander increased the starting *Pt* population around 2.1-fold, while La Trobe had a 4.5-fold increase in *Pt* numbers over the 2015 season.
- In bread wheat there was between a 2.5-fold (Suntop) and 19.1-fold (Mitch) increase in the *Pt* population over the 2015 season.
- The one durum entry, Jandaroi, resulted in a 3.8-fold increase in the *Pt* population over the 2015 season.
- Crown rot risk is a sum of the DNA levels of all three *Fusarium* species known to cause crown rot expressed on a log scale where <0.6 is below detection, 0.6–1.4 is low, 1.4–2.0 is medium and >2.0 is high risk.
- All entries left low inoculum levels (0.5–1.8) in the uninoculated plots and high levels (2.0–3.0) in the inoculated plots, with no significant difference between entries.

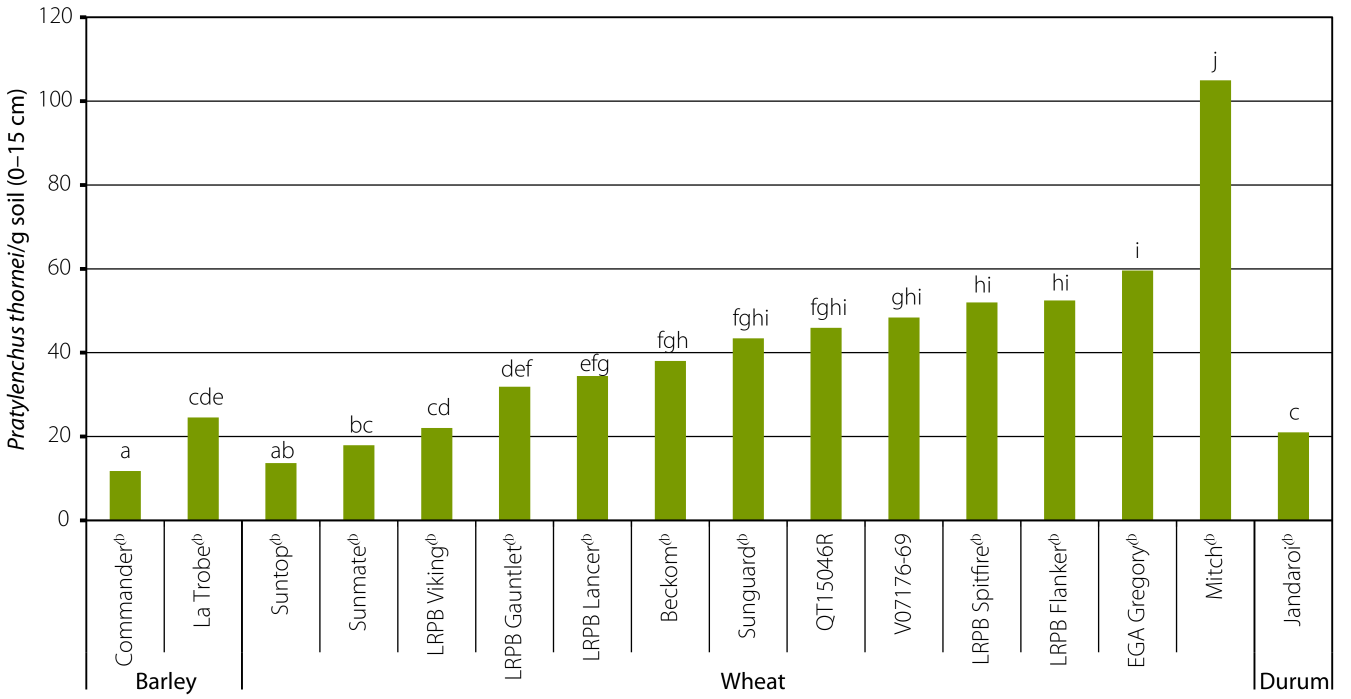

Figure 1. *Impact of selected barley, bread wheat and durum entries on final postharvest soil populations of the root lesion nematode, Pratylenchus thornei (Pt/g soil) – Macalister, Qld 2015*

Values within sites followed by the same letter are not significantly different (P = 0.05) based on transformed data (*ln*(x+1)). Back-transformed values are presented in the graph. Sowing *Pt* soil populations averaged across ranges was 5.5 *Pt*/g soil at Macalister in 2015 at 0–30 cm. Final *Pt* numbers postharvest due to drier soil conditions were collected from 0–15 cm at Macalister.

Conclusions

Cereal variety choice can significantly affect *Pt* population build-up within paddocks, with an 8.9-fold difference in final populations between the best and worst variety at this site in 2015. Starting *Pt* populations of below 2.0 *Pt*/g soil are considered low risk, populations between 2.0 and 15.0 *Pt*/g soil are considered medium risk and above 15.0 *Pt*/g soil are considered high risk for yield loss in intolerant crops or varieties in the northern region. This could have serious consequences for the production of following *Pt* intolerant crops and/or varieties within the rotation with all but two entries (Commander and Suntop)

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increasing the *Pt* population from a medium to a high risk level in one season or with one variety (Mitch) increasing the *Pt* population as high as 105.0 *Pt*/g soil at this site in 2015. Recent NSW DPI research has also demonstrated that significant yield loss still occurred in the moderately tolerant wheat variety EGA Gregory with high risk (>15.0 *Pt*/g soil) populations in the top 30 cm of soil at sowing. Very susceptible varieties should be avoided in paddocks with known RLN populations as they can dramatically increase the population to high risk levels in one season.

Although varieties appear to significantly differ in their yield in the presence of crown rot infection, differences in the levels of partial resistance, which limits the rate of spread of the crown rot fungus through the plant during the season, do not appear to result in significant variation in inoculum levels at harvest. Partial resistance does not actually prevent the plant from being infected, but rather slows the rate of fungal growth in the plant, arguably delaying expression of the disease that can translate into a yield and grain quality (reduced screenings) benefit. However, the crown rot fungus, while being a pathogen when the winter cereal plant is alive, is also an effective saprophyte once the plant matures and dies. This saprophytic colonisation of infected tillers late in the season as the crop matures is the likely reason why limited practical differences in residual inoculum levels are created between varieties and winter cereal crop types.

Further research across sites is required to confirm differences in resistance of barley and wheat varieties to *Pt* as this can have significant implications for the build-up of *Pt* populations within a paddock and hence following rotational choices. For instance, while it appears that Mitch has a useful level of tolerance to crown rot (average 0.54 t/ha higher yielding than EGA Gregory in 2015), its increased susceptibility to *Pt* resulted in it taking nematode populations from a medium risk level at sowing to an extremely high risk level by harvest at Macalister in 2015 (Figure 1). Hence, Mitch should only be considered for production in paddocks known to be free of *Pt* as its increased susceptibility to *Pt* is likely to override the yield gain in the presence of crown rot when considering the whole rotational sequence.

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