Impact of winter cereal crop choice and sowing date on final soil populations of *Pratylenchus thornei* – Tulloona 2015

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Key findings

- Winter cereal crop and variety choice can have a large impact on *Pratylenchus thornei* (*Pt*) population build-up within paddocks.
- Averaged across winter cereal entries, final *Pt* densities were 83% higher when sown in early May compared with early June.
- Final *Pt* populations were between 1.6 and 4.7 times higher in 14 of the 24 barley entries, the durum line 190873, and 12 of the 19 bread wheat entries when sown in early May compared with early June.
- The additional population build-up with early May sowing generally increased the risk level for yield loss in the following wheat crop from either low to medium, or medium to high compared to sowing in early June.
- Although earlier sowing can reduce yield loss associated with both crown rot (CR) and *Pt*, it does, however, appear to favour higher *Pt* population development in some winter cereal varieties, which could exacerbate negative consequences on following crops and/or varieties in the rotation.

Introduction

The root lesion nematode (RLN) *Pratylenchus thornei* (*Pt*) is widespread in cropping soils throughout northern NSW and southern Qld. Winter cereal varieties differ in their extent of yield loss from *Pt* (tolerance) and the numbers of nematodes that multiply in their root systems within a season (resistance). Resistance to *Pt* is an important consideration as it dictates a variety's effect on subsequent crops in the rotation. That is, more susceptible varieties allow greater *Pt* multiplication in their root systems over a season. The higher the resulting *Pt* population left in the soil, the greater the potential for a negative effect on the yield of subsequent crops.

Previous NSW DPI research has demonstrated that earlier sowing can reduce losses to crown rot, caused predominantly by *Fusarium pseudograminearum* (*Fp*), by bringing the grain-filling period forward to when temperatures are generally lower and less favourable to disease expression (Simpfendorfer et al. 2016). Sowing date is also an important consideration to maximise yield potential within a given season; delayed sowing dates are usually associated with significant yield penalties (Graham et al. 2016). However, in the northern grains region, sowing date and variety maturity need to be balanced against the risk of excessive early vegetative growth depleting soil moisture reserves before grain filling, and the risk of frost versus terminal heat stress during flowering and grain development.

Recent modelling research highlights that sowing date can also influence the multiplication of *Pt* through interactions with temperature differences created in the soil profile. Simulations showed that a late May sowing date in southern Qld limited *Pt* densities in the soil profile by allowing roots to develop in soil cooler than a late April, late June or late July sowing date (Thompson 2015).

The effect of two sowing dates on final *Pt* populations was examined in a range of durum, bread wheat and barley varieties near Tulloona in north-western NSW in 2015.

Site details

Location	'Myling', Tulloona
Co-operator	Jack and Julia Gooderham
Sowing dates	6 May and 4 June 2015
Fertiliser	90 kg/ha Urea and 70 kg/ha Granulock Z at sowing
Starting nitrogen (N)	137 kg N/ha to 120 cm

PAWC	~209 mm plant available soil water (0–120 cm)
Rainfall	The growing season rainfall was 150 mm
PreDicta B	2.5 *Pratylenchus thornei*/g soil (medium risk), nil *P. neglectus* and 2.0 log *Fusarium* DNA/g (medium crown rot risk) at sowing (0–30 cm)
Post-harvest soil sampling date	19–20 January 2016 with a bulk of 10 cores (0–30 cm) per plot

Treatments

Varieties (48)

- Twenty-four barley entries (Table 1)
- Five durum wheat entries (Table 1)
- Nineteen bread wheat entries (Table 1)

Pathogen treatment

Added or no added crown rot at sowing using sterilised durum grain colonised by at least five different isolates of *Fp* at a rate of 2.0 g/m of row at sowing.

Results

Averaged across entries (genotype) and sowing date, final *Pt* densities were 10% higher (4.3 *Pt*/g soil) in the no added CR treatment compared with the added CR treatment (3.9 *Pt*/g soil). However, there was no interaction between CR treatment and genotype or sowing date. Averaged across entries and CR treatment, final *Pt* densities were 83% higher (5.5 *Pt*/g soil) when sown on 6 May compared with 4 June (3.0 *Pt*/g soil). The interaction of sowing date with CR treatment was not significant but there was a significant interaction between genotype and time of sowing ($P = 0.061$).

There was a 10.8 fold difference in *Pt* densities between the lowest (Compass⟮D⟯, WI4896 and DBA Aurora⟮D⟯) and highest (Elmore CL Plus⟮D⟯) entry when sown on 6 May and a 9.6 fold difference in *Pt* densities between the lowest (WI4896 and DBA Aurora⟮D⟯) and highest (Elmore CL Plus⟮D⟯) entry when sown on 4 June (Table 1). There were significant differences between entries in each of the three winter cereal crop types at each sowing date with the most susceptible barley, durum and bread wheat entries being Gairdner⟮D⟯, Jandaroi⟮D⟯ and Elmore CL Plus⟮D⟯, respectively. Generally, there was lower variation in final *Pt* populations with the durum entries, which were on the lower end, than with barley and bread wheat varieties, which had a larger spread between entries.

Final *Pt* densities were significantly higher with the earlier sowing date (6 May) compared with delayed sowing (4 June) in 14 of the 24 barley entries, the durum line 190873, and 12 of the 19 bread wheat entries (Table 1). Final *Pt* populations were between 1.6 (LPB09-0358) and 4.7 times (LRPB Lancer⟮D⟯) higher when sown on 6 May compared with the delayed 4 June sowing date.

Table 1. Final *Pratylenchus thornei* soil populations (*Pt*/g soil; 0–30 cm) produced by 24 barley, 5 durum and 1 bread wheat entry on two sowing dates – Tulloona 2015.

Crop	Entry	6 May		4 June	
Barley	Compassⓓ	1.9	a-j	1.4	a-d
	WI4896	1.9	a-j	1.1	a
	Urambieⓓ	2.5	c-p	1.2	ab
	SY Rattlerⓓ	2.8	e-s	1.9	a-i
	WI4897	3.0	f-u	1.2	ab
	Oxfordⓓ	3.4	i-x	2.5	c-o
	NRB121156	3.6	k-z	1.3	a-c
	Commanderⓓ	3.9	l-A	2.8	e-t
	Fathomⓓ	4.0	m-A	3.4	i-x
	La Trobeⓓ	4.0	m-B	4.1	n-C
	GrangeR	4.1	n-D	2.0	a-k
	Spartacus CLⓓ	4.3	o-E	2.0	a-k
	Admiralⓓ	4.6	q-I	2.6	d-r
	Schooner	4.7	r-J	1.7	a-g
	Shepherdⓓ	4.9	t-L	2.8	e-t
	Scope CLⓓ	5.6	x-O	4.9	s-K
	Hindmarshⓓ	5.7	x-O	3.0	f-u
	Navigatorⓓ	6.1	y-Q	2.2	a-l
	Bassⓓ	6.2	A-R	2.2	b-m
	Westminsterⓓ	7.0	C-S	3.2	h-v
	Flindersⓓ	7.9	K-U	3.5	j-y
	Fairviewⓓ	8.2	K-U	4.4	o-F
	Rosalindⓓ	8.7	N-U	2.6	d-q
	Gairdnerⓓ	10.8	S-U	6.1	z-Q

Crop	Entry	6 May		4 June	
Durum	DBA Auroraⓓ	1.9	a-j	1.1	a
	DBA Lillaroiⓓ	2.3	b-n	2.9	f-t
	Caparoiⓓ	2.8	e-s	1.5	a-e
	190873	3.9	l-A	2.1	a-k
	Jandaroiⓓ	4.6	q-H	3.2	h-w
Bread wheat	Beckomⓓ	4.0	m-A	2.3	b-m
	LRPB Spitfireⓓ	4.3	o-E	4.6	p-G
	Suntopⓓ	5.0	t-M	1.7	a-h
	Sunguardⓓ	5.1	u-M	4.1	n-C
	Kioraⓓ	5.4	v-N	2.7	e-r
	LRPB Vikingⓓ	5.6	w-O	4.5	p-G
	QT15046R	6.0	y-P	3.4	i-x
	LRPB Flankerⓓ	6.8	B-S	2.3	b-n
	EGA Gregoryⓓ	6.8	B-S	3.6	j-z
	EGA Eaglehawkⓓ	7.2	E-S	6.0	y-Q
	Suntimeⓓ	7.4	F-S	5.9	y-P
	LRPB Lancerⓓ	7.5	F-T	1.6	a-f
	Livingstonⓓ	7.7	G-T	3.1	g-v
	Sunlambⓓ	9.5	P-U	7.0	D-S
	Condoⓓ	9.9	Q-U	3.9	l-A
	LPB09-0358	12.1	T-V	7.8	J-U
	LRPB Dartⓓ	12.7	UV	4.6	r-I
	Mitchⓓ	19.2	VW	9.3	O-U
	Elmore CL Plusⓓ	20.7	W	10.1	R-U

Values followed by the same letter are not significantly different ($P = 0.061$) based on transformed data ($\ln(x + 1)$). Back-transformed values are presented in the table.

Conclusions

Cereal crop and variety choice can significantly affect *Pt* build-up within paddocks, with a 10.8 and 9.6 fold difference in populations between the best and worst variety at this site in 2015 when sown in early May or early June, respectively. In the northern grains region, 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 is considered high risk for yield loss in intolerant crops or varieties.

Final *Pt* populations were 1.6–4.7 times higher in 14 of the 24 barley entries, in the durum line 190873, and in 12 of the 19 bread wheat entries, when sown in early May compared with sowing in early June. This generally increased the risk for the next crop from a low to a medium level. However, with the two most susceptible bread wheat varieties Mitchⓓ and Elmore CL Plusⓓ, earlier sowing increased the risk from a medium to high level for the next crop.

Over the past five years there has been a considerable change in grower practice in the northern grains region to sow their winter cereal crops in early May rather than late May or June. This has been primarily driven by the desire to maximise yield potential and use autumn soil moisture for planting. Earlier sowing can also reduce yield loss associated with the dominant soil-borne pathogens in the region: crown rot and *Pt*. However, this trend towards earlier sowing appears to favour higher *Pt* population development with some winter cereal varieties which might exacerbate the negative consequences on following crops and/or varieties in the rotation.

References

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Acknowledgements

This research is part of the projects *National crown rot epidemiology and management program* (DAN00175) and *Variety Specific Agronomy Packages for southern, central and northern NSW* (DAN00167) with joint investment by NSW DPI and GRDC. Thanks to Jack and Julia Gooderham for providing the trial site and Jim Perfrement, Mick Dal Santo and Stephen Morphett (NSW DPI) for sowing, maintaining and harvesting the trial. Thanks to Robyn Shapland, Jason McCulloch, Rachael Bannister, Carla Lombardo, Patrick Mortell and Chrystal Fensbo (NSW DPI) for collecting post-harvest PreDicta B soil samples. Root lesion nematode levels were determined using the DNA-based soil test service PreDicta B provided by the South Australian Research and Development Institute.