NORTHERN

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GRDC GROWNOTES™

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

CANOLA

SECTION 8

NEMATODE MANAGEMENT

BACKGROUND | IMPACT OF CROP VARIETIES ON RLN MULTIPLICATION | MANAGEMENT OF RLN

Nematode management

8.1 Background

MORE INFORMATION

Managing root lesion nematodes: how important are crop and variety choice?

Root-lesion nematodes

Root-lesion nematodes (RLN) can have an impact on canola growth (Figure 1). However, following harvest, levels of the RLN *Pratylenchus neglectus* (*Pn*) have been found to decline rapidly, due to the release of isothiocyanates from the decomposing root tissue. Sulfur-deficient or stressed crops are more likely to host increasing nematode numbers during the season and have less effect on their decline at the end of the season. [1]

The hosting ability of canola is low–medium for *P. thornei* (*Pt*) and medium–high for *Pn*.

Testing soil is the only reliable way to determine whether RLN are present in a paddock. Before planting, soil tests can be carried out by PreDicta B (SARDI Diagnostic Services) through accredited agronomists to establish whether crops are at risk and whether alternative crop types or varieties should be grown. Growing-season tests can be carried out on affected plants and associated soil; contact local state departments of agriculture and PreDicta B. [2]

1 L. Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

2 GRDC (2015) Root-lesion nematodes. GRDC Tips and Tactics, February 2015, http://www.grdc.com.au/TT-RootLesionNematodes

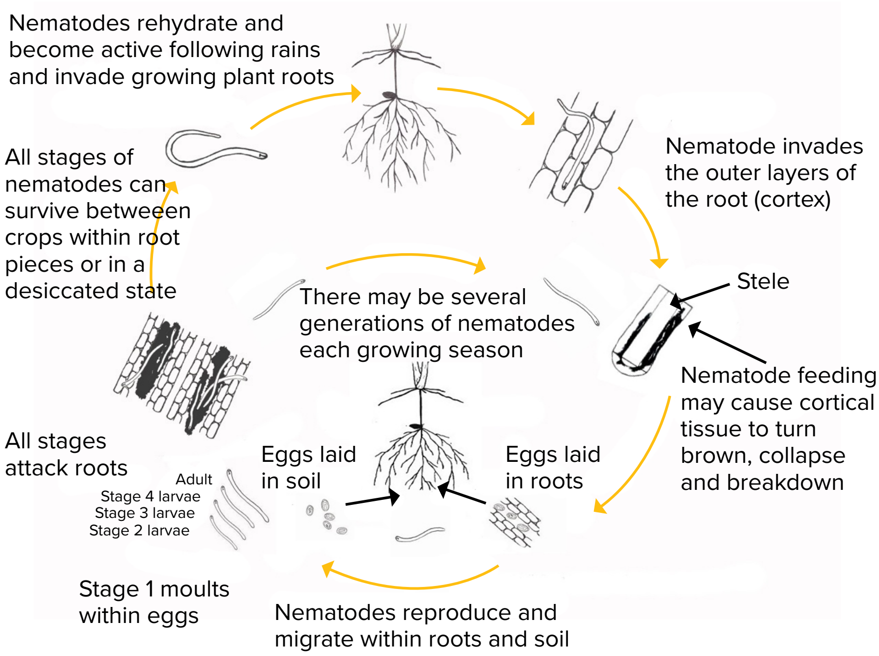

Figure 1: *Disease cycle of root-lesion nematode. Adapted from: GN Agrios (1997) Plant pathology, 5th edn.* [3]

Illustration: Kylie Fowler

IN FOCUS

8.2 Impact of crop varieties on RLN multiplication

8.2.1 Take-home messages

- Know your enemy—soil test to determine whether RLN are a problem, and which species are present.
- Select wheat varieties with high tolerance ratings to minimise yield losses in RLN infected paddocks.
- To manage RLN populations, it is important to increase the frequency of RLN-resistant crops in the rotation.
- Multiple resistant crops in a rotation will be necessary for long-term management of RLN populations.
- There are consistent varietal differences in *Pt* resistance within wheat and chickpea varieties.
- Avoid crops or varieties that allow the build-up of large populations of RLN in infected paddocks.
- Monitor the impact of your rotation. [4]

3 GRDC (2015) Root-lesion nematodes. GRDC Tips and Tactics, February 2015, http://www.grdc.com.au/TT-RootLesionNematodes

4 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

8.2.2 What are nematodes?

Nematodes (or roundworms) are one of the most abundant life forms on earth. They are adapted to nearly all environments. In cropping situations, they can range from beneficial to detrimental to plant health.

The RLN are a genus (*Pratylenchus*) of microscopic, plant-parasitic nematode that are soil-borne, ~0.5–0.75 mm in length and will feed and reproduce inside roots of susceptible crops or plants. Of the two common species of RLN in the northern grains region, *Pt* and *Pn*, the former is often described as the cereal and legume RLN. [5]

8.2.3 Why the focus on *P. thornei*?

- The species is widespread in the northern grains region. Surveys conducted within northern NSW and southern Queensland cropping areas consistently show *Pt* presence in ~60–70% of paddocks.
- The species frequently occurs at concerning levels; >2 *Pt*/g soil are found in ~30–40% of paddocks.
- Yield losses in wheat of up to 50% can occur when *Pt*-intolerant wheat varieties are grown in paddocks infested with *Pt*.
- Yield losses in chickpeas of up to 20% have also been measured in Department of Agriculture, Fisheries and Forestry Queensland (QDAF) trials.
- There is no easy solution to RLN infestation. Variety and crop rotation are the current major management tools.

Figure 2 is a simplified chart highlighting that the critical first step in the management of RLN is to test the soil and determine whether there is a problem to manage. Where RLN are present, growers should focus on planting tolerant wheat varieties and on increasing the number of resistant crops or varieties in the rotation. [6]

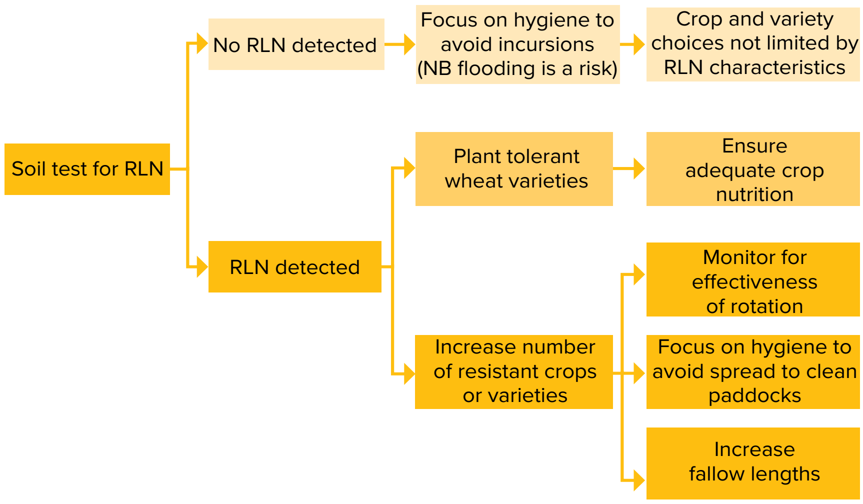

Figure 2: *Management flow chart for root-lesion nematode.*

5 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

6 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

8.2.4 Soil testing

The first step in the management of RLN is to test the soil and determine whether the problem is present. Testing of soil samples is most commonly conducted via DNA analysis (commercially available as the PreDicta B test from SARDI) with sampling to depths of 0–15 or 0–30 cm.

Vertical distribution of *Pt* in soil is variable. Some paddocks have relatively uniform populations down to 30 or 60 cm, some will have highest *Pt* counts in the 0–15 cm layer, whereas other paddocks will have *Pt* populations increasing at greater depths (e.g. 30–60 cm). Although detailed knowledge of the distribution may be of some value, most on-farm management decisions will be based on the presence or absence of *Pt*, with sampling at 0–15 or 0–30 cm depth providing that information. [7]

To organise testing and sending of soil samples, visit the PreDicta B website.

For testing and interpretation of results contact:
Rob Long, Crown Analytical Services
0437 996 678
crownanalytical@bigpond.com

MORE INFORMATION

Variety choice and crop rotation key to managing root lesion nematodes

Impact of crop varieties on RLN multiplication

Ground Cover Radio 121: Analysis underlines value of Predicta B for cropping decisions

8.3 Management of RLN

- Nematicides. There are no registered nematicides for RLN in broadacre cropping in Australia. Screening of candidates continues, but RLN are a very difficult target with populations frequently deep in the soil profile.
- Nutrition. Damage from RLN reduces the ability of cereal roots to access nutrients and soil moisture and can induce nutrient deficiencies. Under-fertilising is likely to exacerbate RLN yield impacts; however, over-fertilising is still unlikely to compensate for a poor variety choice.
- Variety choice and crop rotation. These are currently the most effective management tools for RLN. Note that the focus is on two different characteristics: *tolerance*, which is the ability of the variety to yield under RLN pressure; and *resistance*, which is the impact of the variety on the build-up of RLN populations. Varieties and crops often have different tolerance and resistance levels to *Pt* and *Pn*.
- Fallow. RLN populations will generally decrease during a 'clean' fallow, but the process is slow and expensive in lost 'potential' income. Additionally, long fallows may decrease levels of arbuscular mycorrhizal fungi (AMF) and create more cropping problems than they solve. [8]

MORE INFORMATION

GRDC Update Paper: Summer cropping options to manage root lesion nematodes

Resistance differences between winter crops

The primary method of managing RLN populations is to increase the number of resistant crops in the rotation. Knowledge of the species of RLN present is critical, because crops that are resistant to *Pt* may be susceptible to *Pn*. Canola is generally considered resistant or moderately resistant to *Pt*, along with sorghum, sunflowers, maize, canary seed, cotton and linseed. Wheat, barley, chickpeas, faba beans, mungbeans and soybeans are generally susceptible, although the level of susceptibility may vary between varieties. Field peas have been considered resistant; however, many newer varieties appear more susceptible. Figure 3 shows the mean *Pt* population remaining after a range of winter crops were grown near Weemelah in 2011. Crops were sown in individual trials to enable weed and pest control, and so

7 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

8 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

data cannot be directly compared; however, the data broadly indicate the magnitude of differences in *Pt* resistance between these crops. Assessment of the risk of buildup of *Pt* in different crops (or species susceptibility) shows canola has a low risk of nematode build up. Results shown in Table 1 indicate both low and high starting populations having reduced levels at the end of the season. [9]

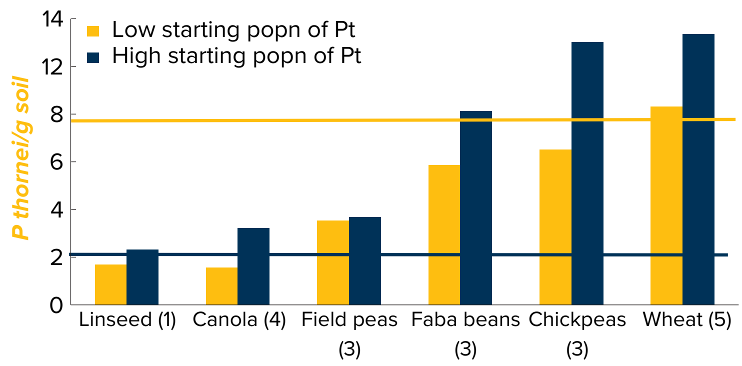

Figure 3: *Comparison of Pt populations remaining in March–April 2012 following different winter crop species near Weemelah 2011. Numbers of varieties within crops are in parentheses. The two horizontal lines indicate the respective 'low' and 'high' starting levels of Pt in March 2011. Soil sampling depth was 0–30 cm.*

Table 1: *Comparison of crops for risk of Pt buildup and the frequency of significant variety differences.* [10]

Crop	*Pt* buildup risk	Variety differences
Sorghum	Low	None observed
Cotton	Low	None observed
Sunflowers[A]	Low	None observed
Linseed[A]	Low	–
Canola[A]	Low to medium	None observed
Field peas[A]	Low to medium	Low
Durum wheat	Low to medium	Moderate
Barley	Low to medium	Moderate
Bread wheat	Low, medium to high	Large
Chickpeas	Medium to high	Moderate to large
Faba beans	Medium to high	Low
Mungbeans[A]	Medium to high?	Moderate to large?

AData from only one or two field trial locations for these crops
In crops with a range of buildup risk but a dominant category, the dominant category is in bold type

9 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

10 B Burton (2015) Impact of crop varieties on RLN multiplication. GRDC Update Papers, 1 March 2015, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Impact-of-crop-varieties-on-RLN-multiplication

Key points

- Test soil for nematodes and plan crop rotations that target the species identified.
- Resistant crops will reduce high root-lesion nematode populations but several consecutive resistant crops and fallow may be needed to reduce very high populations.
- Tolerant crops can produce good yields when root-lesion nematodes are present but try to select tolerant varieties with high levels of resistance to have the biggest impact. [11]

11 K Owen, T Clewett, J Sheedy, J Thompson (2016) Managing grain crops in nematode infested fields to minimise loss and optimise profit. GRDC Update Papers 2 March 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/03/Managing-grain-crops-in-nematode-infested-fields-to-minimise-loss-and-optimise-profit