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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 8

NEMATODE MANAGEMENT

BACKGROUND | SYMPTOMS AND DETECTION | VARIETAL RESISTANCE OR TOLERANCE | RLN DAMAGE | MANAGEMENT OF NEMATODES

Nematode management

Key messages

- Root-lesion nematodes (RLNs) are found over 5.74 million ha or 65% of the cropping area of Western Australia.
- In WA, P. neglectus is the main species of RLN, with P.quasitereoides the next most prevalent.
- All RLN species cause root damage and yield losses, particularly in cereals. Root-lesion nematodes have a wide range of hosts, including cereals and grassy weeds, pulses, pasture, and forage legumes and oilseeds.
- The life cycle of RLN begins after the opening rains in autumn in WA.
- RLNs are worm-like organisms less than 1 mm in length, and cannot be seen with the naked eye.
- Rotations of resistant crop species can effectively keep RLNs to a minimum.
- Faba beans are resistant to Pratylenchus neglectus.
- Weeds can host parasitic nematodes, so control of host weed species and crop volunteers is important.

8.1 Background

Root-lesion nematode (RLN) is a microscopic, worm-like organism <1 mm in length that feeds in root tissues (Photo 1).

They are migratory endoparasites, meaning they enter roots to feed and lay eggs but may live for some time in soil, feeding on the exterior of the roots or travelling between roots and plants. [1]

In Western Australia (WA), *P. neglectus* is the main species of RLN, with *P. quasitereoides* (originally described as *P.teres)* [2] the next most prevalent, and *P. thornei* rarely occurring. [3]

Faba bean is resistant to *P. neglectus* but susceptible to *P. penetrans*. [4] There are variable reports about the response of faba beans to *P. thornei*, but in terms of usefulness as a break crop for *Pt*, the crop is generally rated as 'susceptible'.

Intensive cropping of susceptible species, particularly wheat, will lead to an increase in RLN levels. Crop rotation with resistant crop species is the key to reducing RLN and the damage caused by this pest.

1 GRDC (2015) Tips and tactics: root-lesion nematodes, Western Region, www.grdc.com.au/TT-RootLesionNematodes

2 GRDC (2015) Tips and tactics: root-lesion nematodes, Western Region, www.grdc.com.au/TT-RootLesionNematodes

3 Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course.

4 GRDC (2015) Tips and tactics: root-lesion nematodes, Western Region, www.grdc.com.au/TT-RootLesionNematodes

Photo 1: *Microscope image of a root-lesion nematode. Notice the syringe-like stylet at the head end; it is used for extracting nutrients from the plant root. The nematode is <1 mm long.*

Photo: Sean Kelly, Department of Agriculture and Food, Western Australia

8.1.1 The life cycle of RLN

Root-lesion nematodes are migratory plant-parasitic nematodes, and will migrate freely between roots and soil if the soil is moist. In WA, the life cycle of RLN begins after the opening rains in autumn.

Juvenile and adult nematodes rehydrate, become active and invade plant roots, where they feed and multiply as they move through the root (Figure 1). Individual eggs are laid within the root, from which juvenile nematodes hatch and grow to adults, which in turn lay more eggs. They develop from egg to adult in 40–45 days (~6 weeks) depending on soil temperature and the host (Figure 1). There may be 3–5 life cycles within the plant host each season.

As plants and soil dry out in late spring, RLN enter a dehydrated state called anhydrobiosis and can survive high soil temperatures and desiccation over summer. As the nematodes feed and multiply, lesions and/or sections of brown discoloration are formed on the plant root. Other symptoms include a reduction in the number and size of lateral roots and root hairs. [5]

5 GRDC (2015) Tips and tactics: root-lesion nematodes, Western Region, www.grdc.com.au/TT-RootLesionNematodes

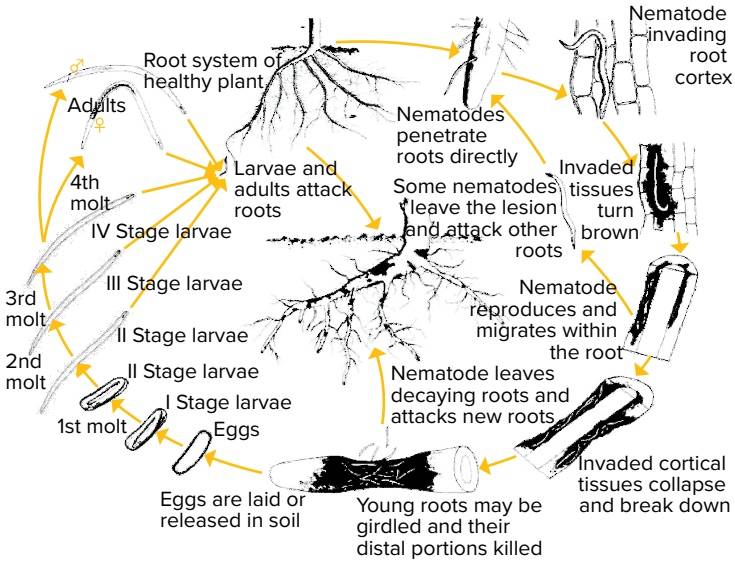

Figure 1: *Life cycle of root-lesion nematode.*

Source: GRDC (2009) Plant parasitic nematodes. Fact sheet

8.2 Symptoms and detection

Root-lesion nematodes cannot be seen with the naked eye in the soil or in plants. The most reliable way to confirm the presence of RLN is to test farm soil. Nematodes are extracted from the soil for identification and determination of their population size. Look out for telltale signs of nematode infection in the roots and symptoms in the plant shoots, and if seen, submit soil and root samples for nematode assessment.

Aboveground symptoms of RLN attack on all crops can include:

- poor establishment
- stunting
- yellowing of lower leaves
- poor tillering

Symptoms can be confused with nutrient deficiency and may be exacerbated by a lack of nutrients. Infected plants may wilt prematurely in dry periods and at the end of the season.

When roots are damaged by RLNs, the plants become less efficient at taking up water and nutrients and tolerating stresses such as drought or nutrient deficiencies. Affected plants may partly recover if the rate of new root growth exceeds the rate at which RLNs damage the roots. However, recovery will depend on the extent of root damage, the growing conditions, and whether sufficient fertiliser is applied.

An examination of washed plant roots may provide some information, but symptoms can be difficult to see and roots may be difficult to remove from heavy clay soils.

The root cortex (or outer root layer) may be damaged and may disintegrate. Diagnosis is best confirmed with laboratory testing of soil and/or plants for the presence and population densities of RLNs. [6]

MORE INFORMATION

DAFWA (2014) How to diagnose root lesion nematode. Video.

S Collins et al. (2013) *Pratylenchus teres*: WA's home grown root lesion nematode (RLN) and its unique impacts on broadacre crops. GRDC.

GRDC (2010) Plant parasitic nematodes, Southern and Western Region. Fact sheet.

S Collins et al. (2014) Root lesion nematode has a picnic in 2013, DAFWA.

6 GRDC (2009) Root lesion nematode dominates in the north. Northern Region. Fact sheet, http://www.grdc.com.au/uploads/documents/GRDC_NematodesFS_North_4pp.pdf

8.3 Varietal resistance or tolerance

Resistance: nematode multiplication

- Resistant crops do not allow RLNs to reproduce and increase in number in their roots.
- Susceptible crops allow RLNs to reproduce so that their numbers increase. Moderately susceptible crops allow increases in nematode populations, but at a slower rate.

Tolerance: crop response

- Tolerant varieties or crops yield well when sown in fields containing large populations of nematodes.
- Intolerant varieties or crops yield poorly when sown in fields containing large populations of nematodes (Table 1).

Table 1: *Resistance and tolerance of pulses to Pratylenchus spp.*

	Pratylenchus neglectus		***Pratylenchus thornei***	
	Resistance	**Tolerance**	**Resistance**	**Tolerance**
Chickpeas	S–MR	MI–T	VS–R	MI–T
Faba beans	R	-	MR	MI
Field peas	R	-	R	T
Lentils	R	T	R	MT
Vetch:				
Blanchefleur	MR	T	S	I–MI
Languedoc	MR	T	MS	I–MI
Morava	MR	T	MS	I–MI

S, susceptible; R, resistant; I, intolerant; T, tolerant; M, moderately; V, very. Chickpea varieties have a range of resistances and tolerances to Pratylenchus species.

8.4 RLN damage

Numbers of RLN build up steadily under susceptible crops, causing a decrease in yields over several years. Yield losses >50% can occur in some wheat varieties, and up to 20% in some chickpea varieties. The amount of damage caused will depend on:

- the numbers of nematodes in the soil at sowing
- the tolerance of the variety of the crop being grown
- the environmental conditions

Damage from RLN results in brown root lesions, but these can be difficult to see or can be caused by other organisms. Root systems are often compromised by reduced branching, reduced quantities of root hairs and an inability to penetrate deeply into the soil profile. RLNs create an inefficient root system that reduces the ability of the plant to access nutrition and soil water. [7]

7 GRDC (2013) Managing root lesion nematodes: how important are crop and variety choice? GRDC update papers, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/07/Managing-root-lesion-nematodes-how-important-are-crop-and-variety-choice

8.5 Management of nematodes

Rotations and variety choice are key to the successful reduction of RLN populations in the soil. Only non-host crops or resistant varieties will minimise the build-up of RLNs. Tolerant crops will suffer less damage, but if these varieties are susceptible, RLN numbers can still increase. Faba beans can assist with managing *P. neglectus* due to its resistance.

Weeds can play an important role in the increase or persistence of nematodes in cropping soils. Thus, poor control of susceptible weeds compromises the use of crop rotations for RLN management. [8]

As different species of RLN can be hosted on different crops, it is important to identify which species are present. Testing services are available around Australia, and growers are advised to contact their local department of agriculture for advice on specific issues for their area.

Testing for RLN

1. *Test your farm.* If RLN infestation is suspected, growers are advised to check the crop roots. Carefully dig up and wash the soil from the roots of an infected plant. This can reveal evidence of infestation in the roots, which warrants laboratory analysis. Testing services are available at DDLS at DPIRD.
2. PreDicta B. A DNA-based soil-analysis service is available that is delivered by accredited agronomists and can detect *P. neglectus*, *P. thornei* and *P. quasitereoides*.

8 GRDC (2015) Tips and tactics: root lesion nematodes, Western Region. Fact sheet, www.grdc.com.au/TT-RootLesionNematodes