WESTERN
FEBRUARY 2016

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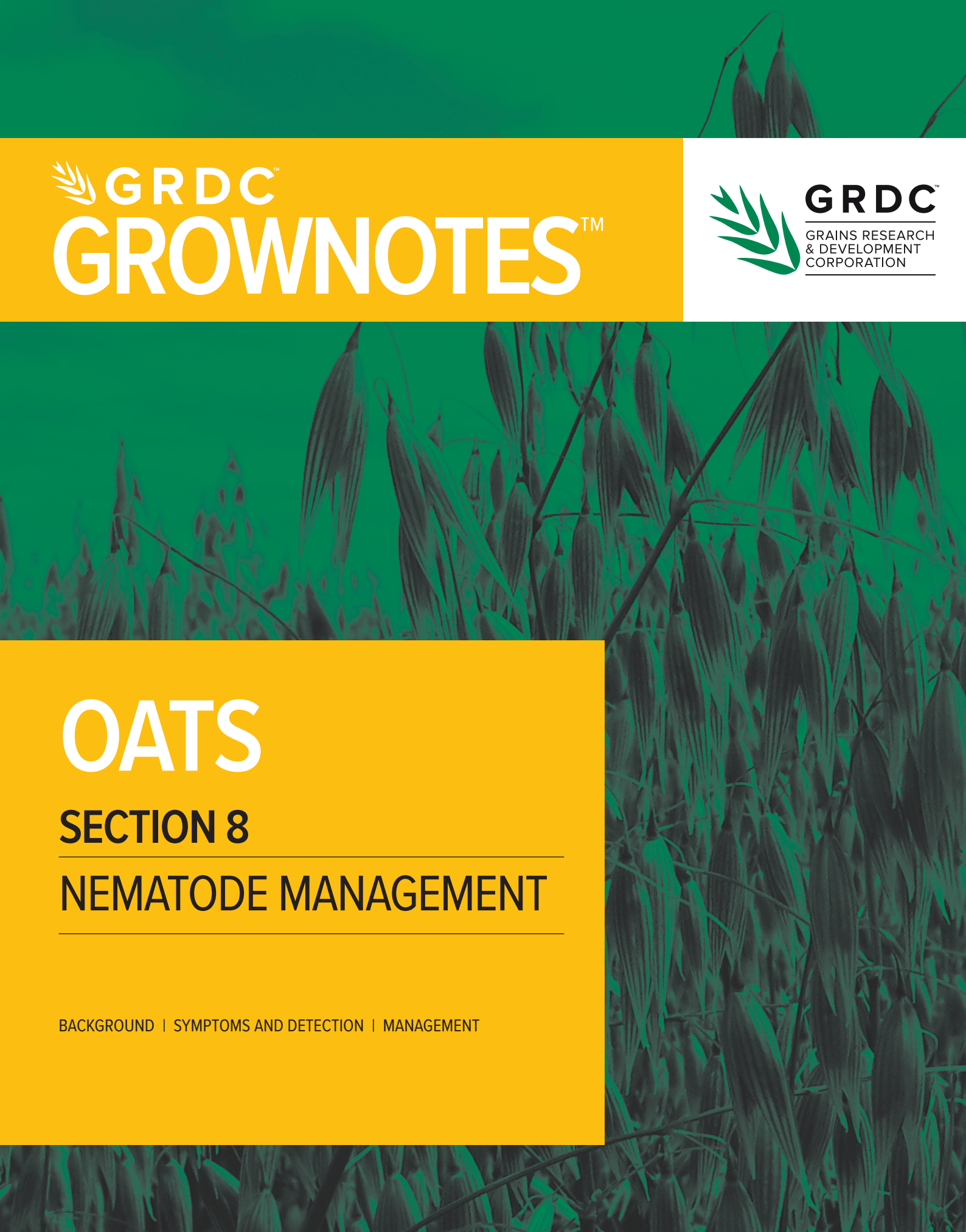

OATS

SECTION 8

NEMATODE MANAGEMENT

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SECTION 8

Nematode management

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Tips and Tactics
GRDC
ROOT-LESION NEMATODES
WESTERN REGION
FEBRUARY 2015
KEY POINTS
Management of root-lesion nematodes in winter crops
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Root-Lesion Nematodes, GRDC Tips and Tactics

Root-lesion nematodes (RLN; *Pratylenchus* spp.) are microscopic, worm-like animals that extract nutrients from plants, causing yield loss. [1]

Root-lesion nematodes are found over 5.74 million ha (or ~65%) of the cropping area of Western Australia (WA). Populations potentially limit yield in at least 40% of these infested paddocks.

The main species found in broadacre cropping in WA are *Pratylenchus neglectus*, *P. quasitereoides* (formerly known as *P. teres)*, *P. thornei* and *P. penetrans*.

The host range of RLN is broad and includes cereals, oilseeds, grain legumes and pastures, as well as many broadleaf and grass weeds.

Which nematode species are present will affect the suitability of the rotational options.

Oats in the western region are considered moderately susceptible to *P. neglectus,* and susceptible to *P. quasitereoides* and *P. penetrans.*

Management of RLN in winter crops includes:

- Observation and monitoring of above- and below-ground symptoms of plant disease followed by diagnosis of the cause(s) of any root disease are the first steps in implementing effective management. Although little can be done during the current cropping season to ameliorate nematode symptoms, the information will be crucial in planning effective rotations of crop species and varieties in following seasons.
- Well-managed rotations with resistant or non-host break-crops are vital. To limit RLN populations, avoid consecutive host crops (Table 1).
- Use a state department of agriculture Crop Variety Guide to choose varieties with high resistance ratings. These will result in fewer nematodes remaining in the soil to infect subsequent crops.
- Reducing RLN can lead to higher yields in following cereal crops.
- Healthy soils and good nutrition can partly alleviate RLN damage through good crop establishment, and healthier plants may recover more readily from infestation under more suitable growing conditions.
- Observe crop roots to monitor development of symptoms.
- Weeds can host parasitic nematodes within and between cropping sequences, so choice of pasture species and control of host weed species and crop volunteers is important (Table 2). [2]

[1] KJ Owen, J Sheedy, N Seymour (2013) Root lesion nematode in Queensland. Soil Quality Pty Ltd Fact Sheet

[2] GRDC (2015) Tips and Tactics Root-Lesion Nematodes Northern Region, http://www.grdc.com.au/TT-RootLesionNematodes

Table 1: Resistance of major crop broadacre species to Pratylenchus neglectus, P. quasitereoides and P. penetrans

Susceptible	Moderately susceptible	Resistant
P. neglectus		
Wheat	Canola	Field peas
Barley	Oats	Lupins
Chickpeas	Durum wheat	Faba beans
		Lentils
		Triticale
		Rye
		Safflower
		Narbon beans
***P. quasitereoides* (formerly *P. teres*)**		
Wheat	Canola	Field peas
Barley		Lupins
Oats		
P. penetrans		
Field peas	Barley	
Lupins	Canola	
Chickpeas		
Oats		
Durum wheat		
Wheat		
Triticale		
Faba beans		
Wild oats		
Wild radish		

Information for *P. quasitereoides* and *P. penetrans* is based on samples received by Agwest Plant Laboratories for diagnosis, combined with data from preliminary field and glasshouse trials.

Table 2: Resistance of pasture species to Pratylenchus neglectus

Cultivar	Species	Resistance rating
Tanjil lupin	*Lupinus angustifolius*	R
Charano yellow serradella	*Ornithopus compressus*	R
Flamenco sulla	*Hedysarum coronarium*	R
Yelbini yellow serradella	*Ornithopus compressus*	R
Margurita French serradella	*Ornithopus sativus*	R
Cadiz French serradella	*Ornithopus sativus*	MR
Santorini yellow serradella	*Ornithopus compressus*	MR
Erica French serradella	*Ornithopus sativus*	MR
Hykon rose clover	*Trifolium hirtum*	MS
Electra purple clover	*Trifolium purpureum*	MS
Sceptre lucerne	*Medicago sativa*	MS
Mauro biserrula	*Biserrula pelecinus*	S
Casbah biserrula	*Biserrula pelecinus*	S
Caprera crimson clover	*Trifolium incarnatum*	S
Cefalu arrowleaf clover	*Trifolium vesiculosum*	S
Sothis eastern star clover	*Trifolium dasyurum*	S
CFD27 bladder clover	*Trifolium spumosum*	S
2002ESP4 biserrula	*Biserrula pelecinus*	S

More information

To hear Dr Sarah Collins, DAFWA discuss root lesion nematodes at the GRDC Agribusiness Crop Updates in 2014, visit https://www.youtube. com/watch?v=XjtdPy7f0ks

Cultivar	Species	Resistance rating
Coolamon subterranean clover	*Trifolium subterraneum*	S
Machete wheat	*Triticum aestivum*	S
Nitro Plus Persian clover	*Trifolium resupinatum*	S
Frontier balansa clover	*Trifolium michelianum*	S
Dalkeith subterranean clover	*Trifolium subterraneum*	S
Caliph barrel medic	*Medicago truncatula*	S
Urana subterranean clover	*Trifolium subterraneum*	S
Santiago burr medic	*Medicago polymorpha*	VS
Prima gland clover	*Trifolium glanduliferum*	VS

R - Resistant, MR - moderately resistant, MS - moderately susceptible, S - susceptible, VS - very susceptible

8.1 Background

Root-lesion nematodes use a syringe-like 'stylet' to extract nutrients from the roots of plants (Figure 1). Plant roots are damaged as RLN feed and reproduce inside the plant roots. *Pratylenchus thornei* and *P. neglectus* are the most common RLN species in Australia. These nematodes can be found deep in the soil profile (to 90 cm depth) and in a broad range of soil types, from heavy clays to sandy soils. [3] Oats are considered resistant to *P. thornei* and have intermediate susceptibility to *P. neglectus.*

New CSIRO research funded by the GRDC is examining how nematodes inflict damage by penetrating the outer layer of wheat roots and restricting their ability to transport water.

Figure 1: Microscope image of a root-lesion nematode. Notice the syringe-like 'stylet' at the head end, which is used for extracting nutrients from the plant root. This nematode is less than 1 mm long. (Photo: Sean Kelly, DAFWA)

[3] KJ Owen, J Sheedy, N Seymour (2013) Root lesion nematode in Queensland. Soil Quality Pty Ltd Fact Sheet.

8.2 Symptoms and detection

Root-lesion nematodes are microscopic organisms that occur in soil and plants. The most reliable way to confirm the presence of RLN is to have soil tested in a laboratory. Fee-for-service testing of soil offered by the PreDicta B root disease testing service of the South Australian Research and Development Institute (SARDI) can determine levels of *P. thornei*, *P. neglectus,* CCN and stem nematodes present. [4]

Similar results can be obtained by soil testing either by manual counting (under microscopes) or by DNA analysis (PreDicta B), with commercial sampling generally at depths of 0–10 cm. [5]

Signs of nematode infection in roots include dark lesions or poor root structure (Figure 2). The damaged roots are inefficient at taking up water and nutrients—particularly nitrogen (N), phosphorus (P) and zinc (Zn)—causing symptoms of nutrient deficiency and wilting in the plant shoots. Intolerant wheat varieties may appear stunted, with yellowing of lower leaves and poor tillering. These symptoms may not be present in other susceptible crops such as barley and chickpea.[6]

Figure 2: Oat plants with roots damaged by RLN. Note lack of root hairs and darkened areas. The shoots show phosphate deficiency, a result of damaged roots having poor uptake of nutrients. (Photo: Doug Sawkins)

[4] KJ Owen, J Sheedy, N Seymour (2013) Root lesion nematode in Queensland. Soil Quality Pty Ltd Fact Sheet.

[5] R Daniel (2013) Managing root-lesion nematodes: how important are crop and variety choice? Northern Grower Alliance/GRDC Update Paper, 16/07/2013.

[6] KJ Owen, J Sheedy, N Seymour (2013) Root lesion nematode in Queensland. Soil Quality Pty Ltd Fact Sheet.

8.2.1 What is seen in the paddock?

Above-ground symptoms are often indistinct and difficult to identify. The first signs are poor establishment, stunting, poor tillering of cereals, and plants possibly wilting despite moist soil. Nematodes are usually distributed unevenly across a paddock, resulting in irregular crop growth (Figure 3). Sometimes symptoms are confused with nutrient deficiency and they can be exacerbated by a lack of nutrients.

Figure 3: Above-ground symptoms of RLN, primarily in the form of moisture stress and nutrient deficiency. (Photo: Doug Sawkins)

When roots are damaged by RLN, the plants become less efficient at taking up water and nutrients, and less able to tolerate stresses such as drought or nutrient deficiencies. Depending on the extent of damage and the growing conditions, affected plants may partly recover if the rate of new root growth exceeds the rate at which nematodes damage the roots.

To gain the full picture requires examining what is going on under the ground. Primary and secondary roots of cereals will show a general browning and discoloration and there will be fewer, shorter laterals branching from the main roots.

The root cortex (or outer root layer) is damaged and it may disintegrate.

Diagnosis is difficult and can be confirmed only with laboratory testing. This is essential if identification is sought to species level as all RLN species cause identical symptoms. The PreDicta BTM soil test (SARDI Diagnostic Services) is a useful tool for several nematode species and is available through accredited agronomists. [7] In-crop testing can also be a useful tool by sending whole plants with roots and soil to the Agwest Labs.

Contact information:
Agwest Plant Laboratories
+61 (0)8 9368 3721
Email Agwest Plant Laboratories

[7] GRDC (2015) Tips and Tactics Root-Lesion Nematodes Northern Region, http://www.grdc.com.au/TT-RootLesionNematodes

8.3 Management

The most important management tool is using rotations that effectively reduce RLN populations. In heavily infested paddocks, resistant break-crops should be grown for 1 or 2 years to decrease the population. Resistant varieties should be selected for the following years using a current Crop Variety Guide (Figure 4).

Adequate nutrition (especially N, P and Zn) help crops to compensate for the loss of root function caused by RLN, although this does not necessarily lead to lower nematode reproduction. In field trials in areas infested with *P. neglectus*, yield losses for intolerant wheat ranged from 12% to 33% when minimal levels of P were applied, but losses were reduced to only 5% with a high rate of P (50 kg/ha).

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.

Wild oats, barley grass, brome grass and wild radish are susceptible to *P. neglectus*.

Several pasture species and varieties are suitable in rotations to reduce RLN when targeted to the species in your paddock (Table 1), but weeds must be managed because they can strongly influence nematode populations at the end of the pasture phase.

Manage volunteer susceptible crop plants, because they can harbour nematodes.

Nematodes cannot move great distances unaided. However, they can be spread through surface water, and in soil adhering to vehicles and farm machinery. In uninfested areas, good hygiene should be practised. They can also be spread in dust when they are dehydrated over summer.[8]

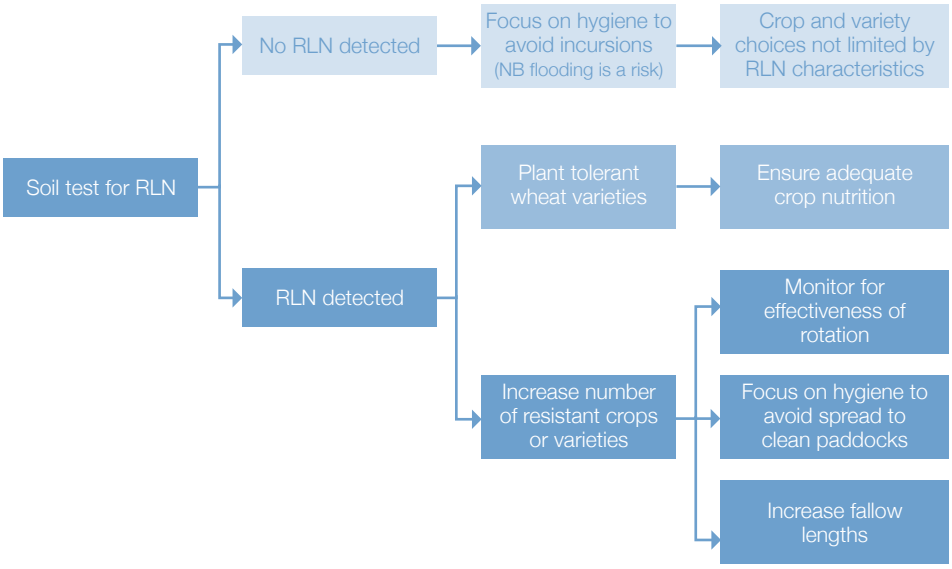

Figure 4: Root-lesion nematode management flowchart.

[8] GRDC (2015) Tips and Tactics Root-Lesion Nematodes Northern Region, http://www.grdc.com.au/TT-RootLesionNematodes