NORTHERN REGION

Root lesion nematode dominates in the north

Good rotation management and variety choice is the key for management of plant parasitic nematodes

KEY POINTS

- Well-managed rotations are vital. Avoid consecutive host crops to limit populations.
- Choose wheat varieties with high tolerance ratings to maximise yields in fields where root-lesion nematode (RLN) is present.
- Choose rotation crops with high resistance ratings, which result in fewer nematodes remaining in the soil to infect subsequent crops.
- Crop appearance of plant tops is an indicator of nematode attack, but testing farm soil is the best way to monitor RLN.
- Knowing which RLN species is present is vital for best management because each species can build up on different rotation crops.

Root lesion nematode (RLN, Pratylenchus thornei and Pratylenchus neglectus) feeds on roots, leading to declines of up 70 per cent in wheat and 20 per cent in chickpea.

In the northern region, RLN is found in northern NSW and Queensland. Reducing RLN populations can lead to higher yields in following susceptible crops.

Varieties are rated according to their tolerance and intolerance, and susceptibility and resistance to RLN. Intolerance means the crop yields poorly when attacked and susceptibility means nematode numbers increase. Some varieties are rated tolerant but susceptible.

Crops can differ in their susceptibility and tolerance of each species of nematode (see Tables 1, 2 and 3), so testing is essential to making the most appropriate crop choices.

About RLN plant parasitic nematodes

Pratylenchus are worm-like organisms less than one millimetre in length that feed in root tissues.

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

Several studies have shown that the extent of yield loss attributed to P. thornei and P. neglectus is directly related to the population density present at planting.

At the time of planting, damaging populations of RLN are found deep in the soil, high numbers can be found as far as 60 centimetres. RLN populations in surface soil may not give a full picture of the population density threatening crops. This needs to be considered when testing is done.

RLN has more than one generation per season and is able to migrate between and within the roots and soil. RLN survives during summer bare-fallow in a dehydrated state, becoming active once moisture is available. RLN can increase its population under susceptible summer crops.

These are plots in a crop rotation experiment on a P. thornei-infested site. The wheat on the left grew poorly as it was subject to high populations of P. thornei following susceptible crops of wheat (three years previous) and mung bean (15 months previous). The wheat on the right grew much better as it was subject to low populations of P. thornei following resistant crops of canary seed (three years previous) and sorghum (15 months previous).
**P. thornei**

*P. thornei* is the most common RLN in the northern grain region and is capable of causing crop damage and yield loss up to 70 per cent.

Many wheat, chickpea, faba bean, mung bean, black gram, soybean, navy bean and cowpea varieties are susceptible to *P. thornei*. All wheat will increase *P. thornei* populations, but some varieties less than others.

Barley, triticale, oats and maize varieties are moderately susceptible to *P. thornei*.

Most rotation crops are tolerant to RLN, even the susceptible crops, so while yield losses or crop damage are minimal, nematode populations could still be increasing in the soil.

Canary seed, linseed, grain sorghum, and forage sorghum (particularly the sweet sorghum types) are susceptible to *P. thornei*.

There are now moderately resistant varieties of wheat, but most varieties are susceptible. Tolerant wheats will continue to yield well when RLN is present (*Wheat Varieties for Queensland 2009* lists tolerance and resistance to RLN).

**P. neglectus**

*P. neglectus* is also found in the northern region and can cause substantial yield losses in wheat and chickpea, but it attacks different rotation crops to *P. thornei*.

Most wheat, chickpea, grain sorghum, and forage sorghum (particularly the sweet sorghum types) are susceptible to *P. neglectus*.

Oats, barley, canary seed, maize, and navy bean are moderately susceptible to *P. neglectus*.

Triticale, faba bean, linseed, sunflower, laabl, mung bean, black gram, soybean and cowpea make good break crops for *P. neglectus*.

There are now moderately resistant varieties of wheat, but most varieties are susceptible. Tolerant wheats will continue to yield well when RLN is present (*Wheat Varieties for Queensland 2009* lists tolerance and resistance to RLN).

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**The life cycle of root lesion nematode**

RLN is a migratory plant parasite. It migrates freely between roots and soil, providing the soil is moist. Its life cycle begins when juvenile and adult nematodes invade the new crop roots and feed and multiply as they move through the root. Individual eggs are laid within the root, from which juvenile nematodes hatch, grow to adults and lay eggs. There may be three to five cycles within the plant host each season. As plants and soil dry out, RLN enters a state of anhydrobiosis and can survive high soil temperatures and desiccation.

**FIGURE 1 ROOT LESION NEMATODE**

The symptoms

Above-ground symptoms of RLN attack can include:
- poor establishment;
- stunting;
- yellowing of lower leaves; and
- 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 RLN, the plants become less efficient in taking up water and nutrients and in 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 RLN damages 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. Primary and secondary roots may show a general browning and discolouration. Chickpea roots can show distinct dark-brown orange lesions at very early stages of infection and the lateral roots can be severely stunted and reduced in number.

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

Diagnosis is best confirmed with laboratory testing of soil and/or plants for the presence and population densities of the two species.

Management of RLN

Rotations and variety choice are central to the successful reduction of RLN populations in the soil. Only non-host crops or resistant varieties will minimise the build-up of RLN (Tables 1 and 2). Tolerant crops will suffer less damage, but if these varieties are susceptible, RLN numbers can still increase.

As different species of RLN can host on different crops, it is important to identify which one is present. Testing services are available around Australia and growers are advised to contact their local agricultural department.

Regular testing has illustrated that there are crop varieties with tolerance to *P. thornei*. It is recommended that varieties be chosen to minimise crop loss. In cases of heavy infestation with *P. thornei*, non-affected crops such as sorghum (grain and forage), cotton, millets (but not white french millet), panicum, sunflower, lablab, pigeonpea, canary seed, durum wheat and linseed can be grown in rotation.

For *P. neglectus*, mung bean, black gram, soybean, cowpea, lablab triticale, linseed, and faba bean can be grown.

Adequate nutrition (especially nitrogen, phosphorus and zinc) normally allows plants to better tolerate plant parasitic nematodes, although this does not necessarily lead to lower nematode reproduction.

RLN appears to be spread in soil moved by surface water, vehicles and farm machinery. Good hygiene, by removing adherent soil from farm machinery, should be adopted to avoid infesting clean paddocks.

**TESTING**

Growing season tests can be carried out on affected plants and associated soil through state departments.

Soil tests can be carried out before planting to help establish whether crops are at risk or alternative crop types or varieties should be grown.

<table>
<thead>
<tr>
<th>TABLE 1 CROPS SUSCEPTIBLE TO <em>P. THORNEI</em> AND <em>P. NEGLECTUS</em> IN THE NORTHERN REGION</th>
<th>P. thornei</th>
<th>P. neglectus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Wheat</td>
<td></td>
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<tr>
<td>Chickpea</td>
<td>Chickpea</td>
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<tr>
<td>Faba bean</td>
<td>Grain sorghum</td>
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<tr>
<td>Mung bean and black gram</td>
<td>Forage sorghum (especially sweet sorghum types)</td>
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<td>Soybean</td>
<td></td>
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<td>Navy bean</td>
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<td>Cowpea</td>
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<tr>
<th>TABLE 2 CROPS RESISTANT TO <em>P. THORNEI</em> AND <em>P. NEGLECTUS</em> IN THE NORTHERN REGION</th>
<th>P. thornei</th>
<th>P. neglectus</th>
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</thead>
<tbody>
<tr>
<td>Canary seed</td>
<td>Faba bean</td>
<td></td>
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<tr>
<td>Linseed</td>
<td>Linseed</td>
<td></td>
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<td>Durum wheat</td>
<td>Triticale</td>
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<tr>
<td>Grain sorghum</td>
<td>Sunflower</td>
<td></td>
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<tr>
<td>Forage sorghum</td>
<td>Mung bean and black gram</td>
<td></td>
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<td>Millet (excluding white french millet)</td>
<td>Cowpea</td>
<td></td>
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<tr>
<td>Panicum</td>
<td>Lablab</td>
<td></td>
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<tr>
<td>Sunflower</td>
<td>Soybean</td>
<td></td>
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<tr>
<td>Lablab</td>
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<tr>
<td>Pigeon pea</td>
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<tr>
<td>Cotton</td>
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</table>
**Frequently asked questions**

**Q. Can I spray for RLN?**

Nematicides provide significant improvements in grain yield when applied to the soil in plots infested with RLN, but are no longer used commercially in Australia. They are not recommended because of their cost and inherent mammalian toxicity, and also because rotational crops are available for RLN management. If they were used commercially, it is likely their efficacy would be poor, particularly in situations where RLN occurs at depth.

No nematicides are currently registered for use on broadacre crops in Australia.

**Q: What other nematode species are found in the northern region?**

The stunt nematode (*Merlinius brevidens*) is found widely in the northern region. In lighter, textured soils stubby root nematode (*Paratrichodorus sp.*) and root-knot nematode (*Meloidogyne sp.*) have been found on cereals and grain legumes. Other RLN occurring away from traditional wheat areas are *P. zeae* on maize and sugarcane and *P. brachyurus* on peanuts. There have been isolated reports of cereal cyst nematode (CCN – *Heterodera avenae*) near Tamworth and Dubbo on lighter-textured soils and friable black soils. If growers suspect CCN they should contact a local agronomist.

**Q: Does timing of sowing help?**

There is limited information on the effect of time of sowing on the yield loss to intolerant crops in the presence of RLN. Trials in the northern region have shown later-sown wheat crops can be more severely affected than those sown early.

**Useful resources:**

- **Dr John Thompson**, senior principal soil microbiologist, Queensland Primary Industries and Fisheries 07 4639 8806 Email john.thompson@deedi.qld.gov.au
- **Test your farm** – a microscope-based identification and counting service for nematodes found on grain farms in the northern region provided by Queensland Primary Industries and Fisheries.
  - Contact your local agronomist or John Thompson (as above), or QPIF Call Centre 13 25 23
- **Wheat Varieties for Queensland 2009, PR09-4200**
- **PreDicta B** – a DNA-based soil analysis service delivered by accredited agronomists that can detect *P. neglectus*, *P. thornei* and CCN. Contact your local agronomist or to locate your nearest supplier, email your contact details and location to predictab@sa.gov.au
- **Growing season tests can be carried out on affected plants and associated soil through state departments**

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