PLANT AND SOIL NEMATODES

ROOT-LESION NEMATODES (*PRATYLENCHUS* SPP.): DAMAGING PESTS OF CEREALS AND OTHER GRAIN CROPS IN ALL GRAIN-GROWING REGIONS OF AUSTRALIA

The heavy losses caused by cereal cyst nematode in southern grain-growing regions of Australia were largely overcome when resistant cultivars were introduced in the 1980s and 90s. The grains industry then turned its attention to root-lesion nematode. This fact sheet summarises what has been learnt about this important pest in two quite different environments: the temperate, winter-dominant rainfall regions in the south and west, and the subtropical, summer-dominant rainfall region in the north.

Pratylenchus species, feeding habits, and symptoms

There are more than 100 *Pratylenchus* species worldwide, and about ten are known to cause damage in Australia. Details of the key features of these nematodes, their life cycle, and the damage they cause to various crops can be found in Fact sheet PSN 028. *Pratylenchus penetrans*, *P. crenatus*, *P. brachyurus*, and *P. quasitereoides* have been found on grain crops in Australia but this sheet focuses on *P. neglectus* and *P. thornei*, the most widespread and economically important species.

Nematodes in the genus *Pratylenchus* are considered migratory endoparasites because they retain their worm-like shape throughout their life cycle, migrate into roots, and feed on root tissue. The lesions and discoloration they cause results in loss of root function, and so infested plants are stressed for moisture when soil moisture is limiting, as often occurs in annual crops towards the end of the growing season, and in dry years.

Root-lesion nematodes complete their life cycle in 6-8 weeks, and as several generations may occur in one growing season, populations can increase markedly if the crop is a good host. In the absence of a host plant, the nematodes dehydrate and become anhydrobiotic, a state that allows them to survive hot, dry conditions near the soil surface or in the subsoil.

Detection of root-lesion nematodes

Growers wishing to check whether root-lesion nematodes are present on their farm can use a DNA-based diagnostic service known as PREDICTA®B. This test will indicate the number of root-lesion nematodes in a soil sample and the species present, and can also detect a wide range of other soilborne pathogens. Samples can also be forwarded to nematology laboratories in various states.

Susceptibility, resistance, and tolerance

When developing a management plan to minimise losses caused by root-lesion nematode, it is important to recognise that crops vary in their capacity to host various species of *Pratylenchus*. **Susceptible** crops and varieties are good hosts, which means they allow the nematode to multiply readily and increase in number. In contrast, **resistant** crops/varieties do not allow the nematode to reproduce, and so numbers will decline when these crops are grown.

Another important point to recognise is that crops also vary in their capacity to withstand the damage caused by root-lesion nematodes. **Tolerant** crops/varieties will yield well when sown in fields containing high nematode populations whereas **intolerant** crops/varieties yield poorly in such situations.

It is difficult to provide information on the susceptibility of various crops to *P. thornei* and *P. neglectus* because varieties of the same crop may differ in their reaction to one of the species and do not always react in the same way to the other species. Consequently, GRDC crop variety guides for a particular location or region should be consulted to find the resistance and tolerance status of a particular variety.

Root-lesion nematodes in southern and western grain-growing regions

P. neglectus, is the most widely distributed *Pratylenchus* species in southern NSW, Victoria, South Australia, and Western Australia, with surveys showing that 80-90% of cropping paddocks are infested. *P. thornei* also occurs but is not as widely distributed (5-30% of paddocks infested, depending on the region). Yield losses from these nematodes can be as high as 20%, with the extent of the loss dependent on factors such as the

species present, the nematode population density at sowing, the capacity of the crop tolerate damage caused by the nematode, and how conducive the season is to nematode damage.

Crop rotation has proved to be the best way of reducing populations of root-lesion nematode but is only effective when the grower knows the *Pratylenchus* species present in a paddock, and then selects the most appropriate crop to plant. Thus, when *P. neglectus* is present at high population densities, poor hosts such as faba beans and chickpea and are good options, whereas canola is the best option in paddocks with high numbers of *P. thornei*. However, individual cultivars of a crop can vary in their reaction to one of the species, and so when selecting a crop to reduce root-lesion nematode populations, it is important that growers obtain reliable varietal resistance information from relevant research agencies, or check the GRDC crop variety guides for a particular location or region.

When mixed populations of *Pratylenchus* occur, a crop may increase populations of one species and reduce populations of the other, and so growers must monitor nematode populations and choose rotations that minimise the effects of the dominant species. However, whenever resistant break crops are included in the rotation, it is important to recognise that they may have to be grown for two years to decrease the nematode population.

Root-lesion nematodes in the northern grain region

Root-lesion nematodes are found in nearly 80% of paddocks in the northern region but *P. thornei* is considered more important than *P. neglectus* because it is more widespread and generally occurs at higher population densities. *P. thornei* is also more pathogenic, as intolerant varieties of wheat will begin to suffer yield losses when the nematode population density at sowing is only 2 nematodes/g soil. Populations of *P. neglectus* must be many times higher before significant damage will occur.

A diverse range of summer and winter crops are grown in the northern region but the broad host range of *P. thornei* and the limited number of resistant cultivars of the most profitable crops means that it is difficult for growers to develop a rotation program that will keep *P. thornei* populations to non-damaging levels. Grain sorghum, sunflower and oats are relatively poor hosts of *P. thornei* but when susceptible crops such as wheat, barley, chickpea and mungbean are grown, it is important to select tolerant cultivars. In wheat, for example, a tolerant cultivar will suffer no yield loss when planted in a field with a medium population density of *P. thornei* (i.e. 3-8 nematodes/g soil), whereas losses may be as high as 20% if an intolerant cultivar is chosen. An example of the tolerance effect can be seen in Fig. 1.

Fig. 1. Symptoms caused by root lesion nematode (*Pratylenchus thornei*) on wheat at a trial site on the Darling Downs, Queensland. The yield of variety Petrie has been markedly reduced (left) whereas variety EGA Wylie (right) is tolerant of nematode damage.

The management program being used to minimise losses from *P. thornei* in the northern grain region currently has three key components.

- Collect samples prior to planting to check the nematode population density. Retest the field at the end of a cropping sequence if a susceptible crop has been grown or flooding has occurred
- Choose a cultivar with the highest level of tolerance and resistance available, especially for wheat

- Grow two or more resistant crops consecutively to reduce population densities to less than 1 nematode/g soil

Further reading

Root-lesion nematode fact sheets relevant to the northern, southern, and western grain-growing regions are produced by GRDC and are regularly updated. They focus on strategies growers can use to reduce losses caused by the nematode.

The following publications provide details of some of the research that has been undertaken.

Owen K (2022) A triumph of tolerance: Managing the threat to wheat production by the root lesion nematode *Pratylenchus thornei* in the subtropical grain region of eastern Australia. In *Integrated Nematode Management: State-of-the-art and visions for the future* (Eds. RA Sikora et al.) CAB International, Wallingford, Chapter 2, 13-19.

Owen KJ, Clewett TG, Bell KL, Thompson JP (2014) Wheat biomass and yield increased when populations of root-lesion nematode (*Pratylenchus thornei*) were reduced through sequential rotation of partially resistant winter and summer crops. *Crop and Pasture Science* 65, 227-241.

Thompson JP, Clewett TG, Sheedy JG, Reen RA, O'Reilly MM, Bell KL (2010) Occurrence of root-lesion nematodes (*Pratylenchus thornei* and *P. neglectus*) and stunt nematode (*Merlinius brevidens*) in the northern grain region of Australia. *Australasian Plant Pathology* 39, 254-264

Vanstone VA, Hollaway GJ, Stirling GR (2008) Managing nematode pests in the southern and western regions of the Australian cereal industry: continuing progress in a challenging environment. *Australasian Plant Pathology* 37, 220-234.

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Author: Graham R Stirling, Plant and Soil Nematodes. **Contact details:** graham.stirling@biolcrop.com.au

Other nematology fact sheets in this series can be accessed at: https://www.appsnet.org/nematodes