PLANT AND SOIL NEMATODES

PLANT-PARASITIC AND FREE-LIVING NEMATODES IN SOILS UNDER PASTURE IN AUSTRALIA

Plant-parasitic nematodes damage grass and legume pastures in many countries, while free-living nematodes provide ecosystem services that help maintain the health of pasture soils. This fact sheet provides an overview of the research that has been undertaken on both groups of nematodes in Australian pastures.

Root-lesion nematode on medic-based pastures

Annual medics (*Medicago*) are an integral component of dryland farming systems in the winter rainfall regions of southern Australia. However, they are often grown on farms where *Pratylenchus neglectus* is causing problems on cereals such as wheat. Ballard et al (2006) showed that medics are an effective option for managing of *P. neglectus* because they inhibit multiplication of the nematode (i.e. they are moderately resistant). However, medics are also intolerant (i.e. they grow poorly in fields with high nematode populations) and so breeding programs are needed to improve their performance in such situations.

Plant-parasitic nematodes on white clover

White clover (*Trifolium repens*) is the major legume component of dairy pastures in temperate high rainfall regions and irrigated areas of Australia. Thirteen genera of plant-parasitic nematodes were detected in a survey by McLeish et al. (1997), and three of these genera are known to damage white clover. Clover cyst nematode (*Heterodera trifolii*), an important pest of white clover in many countries, was found at 77% of the surveyed sites and root-lesion nematode (*Pratylenchus*), which damages white clover in Europe and North America, was found at 92% of the sites. Root-knot nematode was also very common, particularly in northern NSW and southeast Queensland. Published records show that four *Meloidogyne* species have been found on white clover in that region but *M. trifoliophila* is probably the dominant species (Zahid et al. 2001). Based on the amount of damage observed in a pot test, *M. trifoliophila* is likely to be having a substantial impact on the growth of white clover.

As high population densities of the above species sometimes occur on white clover and several other plant-parasitic nematodes also occur, the dairy industry is probably suffering some losses from these pests.

Root-knot nematode on subterranean clover

Subterranean clover *(Trifolium subterraneum*) is the most important pasture legume in the southern temperate regions of Australia. Pung et al. (1988, 1992) found that root-knot nematode (*Meloidogyne arenaria*) was widespread on subterranean clover in the lower south-west of WA, that it was pathogenic at high inoculum levels, and was most likely to cause damage when environmental conditions in successive years were favourable for multiplication.

Ryegrass cyst nematode on perennial ryegrass

Ryegrass cyst nematode (*Heterodera mani*) is predominantly found in pastures and grasslands in Europe, California, and South Africa. It was recently found in Tasmania but research is required to determine whether it affects the yield of perennial ryegrass (Jain et al. 2022).

Plant-parasitic nematodes on pastures in summer- and winter-dominant rainfall zones

In a survey of pastures on commercial properties in the summer rainfall zone (the north-west slopes and northern tablelands of NSW) and winter rainfall zone (southeast South Australia and western Victoria) of eastern Australia, *Pratylenchus* was the most common plant-parasitic nematode in both zones. It was found in 67% and 29% of samples, respectively, with *P. neglectus* and *P. thornei* being the most common species (Stirling and Lodge, 2005). A later survey confirmed that the same species were relatively common on clover and grass pastures in southeast South Australia, and that morphotypes with affinities to *P. crenatus* and *P. penetrans* were also present (Riley et al. 2009).

Free-living nematodes on pastures in summer- and winter-dominant rainfall zones

In the study by Stirling and Lodge (2005), the biological status of pasture soils in two quite different environments was compared by assessing the free-living nematode community. Bacterial-feeding nematodes were found to be more common in the winter-dominant than the summer-dominant rainfall zone, and numbers tended to be highest when a legume (subterranean clover or lucerne) was a major component of the pasture rather than phalaris or perennial ryegrass. Fungivores were more common in the summer-dominant rainfall zone, indicating that detritus decomposition in this zone was largely being mediated by fungi. As bacterial-feeding nematodes mineralise more nutrients than fungal-feeders, the above results indicate that the level of biological nutrient cycling in the two zones was quite different. The results also showed that the soil food web was usually moderately or highly structured in both zones. However, soils under perennial ryegrass and phalaris in the winter-dominant rainfall zone had the highest structure index, as omnivores and predators that have a high colonizer-persister (c-p) index were more common in these soils.

These results show that the biological status of the soils differs markedly in the two rainfall zones and is also affected by the composition of the pasture sward. They also suggest that pasture soils are generally healthy, as they have high levels of total C and labile C, high numbers of free-living nematodes, high microbial activities, and few problems with plant-parasitic nematodes.

Soil health under crops and pastures

The nematode assemblages observed in the above study were quite different to the assemblages normally seen in cropped soils.

- Populations of root-lesion nematode were much lower on pastures than on cereal crops grown in the same region, and populations of the other plant-parasitic nematodes were also relatively low on pastures
- Populations of free-living nematodes were much higher than are usually seen in soils under agricultural and horticultural crops in Australia
- Plant-parasitic nematodes generally comprised less than 25% of the nematode community under pasture, whereas in many cropped soils, 50-80% of the nematodes are plant parasites.

These results suggest that mechanisms which regulate nematode populations are operating in pasture soils and they are helping to keep plant-parasitic nematodes under control. Once this is confirmed, research is required to identify the natural enemies responsible and understand why pasture soils are more nematode-suppressive than cropped soils.

Literature cited

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