PLANT AND SOIL NEMATODES

PLANT-PARASITIC NEMATODES ON ALMONDS

The genus *Prunus* contains many important fruit and nut crops including apricots, peaches, plums, nectarines and cherries (commonly known as 'stone fruits') and almonds. Plant-parasitic nematodes reduce the yield of all these crops but this fact sheet summarises what is known about the nematode pests of almond (*Prunus dulcis*).

The Australian almond industry

In the year 2000, almonds were a relatively minor crop in Australia, as they were grown on about 3,500 ha of land. However, production has increased significantly in the last 25 years, as there are now more than 64,000 ha of almond orchards and about 22 million trees. Sunraysia and the northern mallee region of Victoria, the Riverina region in NSW, and the Riverland region of South Australia are the main areas where almonds are produced.

Nematode pests of almond

Three plant-parasitic nematodes are commonly found on almond. They all reduce the growth of trees while root-lesion nematode is a component of the replant problems which often occur when orchards are replanted.

Root-knot nematode (*Meloidogyne* spp.). Fifty years ago, root-knot nematode was the most important nematode pest in all countries where almonds were grown. Seedlings planted into heavily infested sites were stunted and produced little or no new growth while maturing trees in infested orchards showed symptoms typical of nutrient or water deficiencies and their vigour and yield declined. However, that situation changed with the introduction of Nemaguard, a rootstock that is resistant to *M. javanica*, *M. incognita* and *M. arenaria*, the three root-knot nematode species which attack almonds. In 2021, 76% of Australian almonds were grafted to Nemaguard and so root-knot nematode no longer causes major problems in the almond industry.

Root-lesion nematode (*Pratylenchus*). Four species of *Pratylenchus* (*P. penetrans*, *P. vulnus*, *P. coffeae* and *P. brachyurus*) are known to attack almonds but research is required to determine which of these species reach high population densities on almond in Australia, and whether they are causing yield losses. This endoparasitic nematode feeds on root cells, impairing root function and reducing the vigour of mature trees. Populations ranging from 500 to 3,300 lesion nematodes/200 mL soil have been recorded in diagnostic samples from almond orchards in Australia, which indicates that these nematodes are likely to be reducing yield in some orchards. However, lesion nematodes will cause even greater losses in future because when orchards age and are replanted, this nematode exacerbates the damage caused by the bacterial and fungal pathogens associated with replant problems.

Ring nematode. Many genera and species in the family Criconematidae feed on almond roots but the most widely distributed ring nematode species is *Mesocriconema xenoplax*. This slow-moving nematode is an ectoparasite and it feeds on the cortical cells of the root and on root tips. Studies on stone fruit and almonds in the USA have shown that when roots are damaged by *M. xenoplax*, the trees are predisposed to cold injury and various bacterial canker diseases. Ring nematodes occur in sandy soils in the Riverland/Sunraysia regions but surveys are required to identify the species present and determine whether they are likely to be reducing yields.

Other plant-parasitic nematodes

Dagger nematode (*Xiphinema*) and stubby root nematode (*Paratrichodorus*) are commonly found on almonds but there is little evidence to indicate they cause problems. Pin nematode (*Paratylenchus*) is also widespread, with a recent Spanish survey showing that the population density of some of the 12 species detected was often greater than 2,000 nematodes/200 mL soil (Clavero-Camacho et al. 2022). Limited surveys in Australia have shown high populations of pin nematode often occur in the Sunraysia and Riverina regions, and so research is required to identify the prevalent species and determine whether they are causing yield losses.

Nematode management

When plant-parasitic nematodes are present in an orchard and causing damage, an integrated pest management strategy is required in which all possible means are used in a compatible manner to reduce population densities of the target nematode to levels that do not cause economic damage. There are many potential control options available, but if the management program is to be sustainable in the long term, expensive and environmentally destructive fumigants and nematicides should only be applied as a last resort.

Biosecurity

One overseas pest that is a threat to the almond industry is the peach root-knot nematode (*M. floridensis*). It was initially found on peaches in Florida and was later detected on almonds in California (Westphal et al. 2019). This species is a concern because it can parasitise *Prunus* rootstocks such as Nemaguard which are resistant to the root-knot nematode species currently present in Australia. Thus, it is important that national biosecurity programs minimise the risk of introducing this nematode.

Biosecurity programs are also important at a farm level. Growers should reduce the risk of introducing nematodes from other areas by always using nematode-free planting material. They should also take steps to remove soil from incoming vehicles and machinery, and from the footwear worn by visitors.

Rootstocks

Nematode-resistant rootstocks are the most important nematode control option for almonds and the success of Nemaguard in minimising losses from root-knot in Australia and around the world is testimony to their effectiveness.

Many *Prunus* rootstocks have been introduced to Australia in the last 15 years and local studies with the three species of root-knot nematode which attack almonds have shown that Cadaman and Hansen 536 rootstocks are similar to Nemaguard in their capacity to prevent multiplication of these species. Results also showed that several other rootstocks are resistant to one or two *Meloidogyne* species. However, there is limited information on the performance of these newly introduced rootstocks in Australian growing environments (Almond Board of Australia, 2022) and so growers need to test them before using them extensively.

Only limited testing has been done on the resistance and tolerance of almond rootstocks to lesion and ring nematodes but the results obtained suggest that most rootstocks are susceptible to both groups of nematodes.

Other non-chemical practices

A nematode monitoring program is the most important component of an integrated nematode management program because the results provide the grower with information on the plant-parasitic nematodes present in an orchard and their population densities. If potentially damaging nematodes are present in high numbers, plants which are resistant to those species could be grown as a cover crop to reduce nematode numbers and improve soil health. Composts and other organic materials could also be applied to improve the soil's physical, chemical, and biological properties, and enhance its capacity to suppress the nematode pest. Finally, fertiliser inputs and irrigation practices should be optimised as this will improve the trees resilience and help them compensate for nematode damage.

Fumigation

When almonds are replanted, fumigants such as 1,3 dichloropropene (1,3D) and mixtures of 1,3D and chloropicrin provide temporary control of the nematodes and other soilborne pathogens which damage newly planted trees. However, as mentioned in Fact sheet PSN 006, fumigants are toxic to humans and kill a wide range of beneficial soil organisms, and so they may eventually be deregistered and not be available in future. Consequently, the almond industry needs to undertake research programs aimed at finding alternative methods of overcoming replant problems.

Literature cited and further reading

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Fact sheet PSN 066. Updated 26 May 2025

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