PLANT AND SOIL NEMATODES

NEMATODE PESTS OF SWEETPOTATO: ROOT-KNOT NEMATODE AND RENIFORM NEMATODE

Root-knot nematode

Sweetpotatoes are grown in tropical and subtropical regions of Australia where three 'warm-climate species of root-knot nematode (*Meloidogyne javanica*, *M. incognita* and *M. arenaria*) are widely distributed. Collectively, these species cause heavy losses, largely because they damage the marketable product (storage roots). Second-stage juveniles invade these roots and grow to maturity within the roots, causing longitudinal cracking, uneven protuberances on the root surface and necrotic lesions within root tissue. Commonly, 5-20% of the marketable product is discarded due to nematode damage but yield losses in some fields may be as high as 75%.

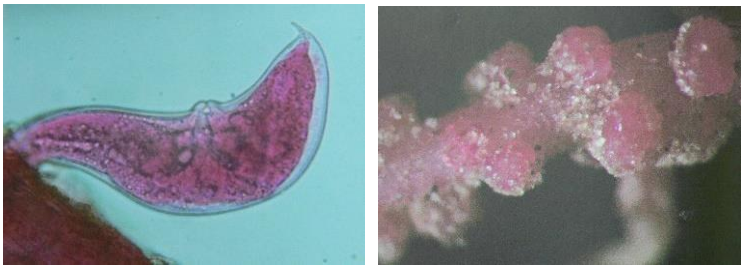
Symptoms caused by root-knot nematode on sweetpotato. Longitudinal cracking and pimples on the surface of a storage root, and internal lesions, each containing several nematode females and egg masses

Root-knot nematode is a ubiquitous problem on sweetpotato in Australia for several reasons.

- The climates where sweetpotatoes are grown are ideal for nematode multiplication. Nematodes develop and reproduce throughout the year because mean maximum temperatures range from 21 to 30°C.
- Crops are sometimes grown for 7-9 months, so there is time for the nematode to complete as many as six life cycles between planting and harvest
- The nematode has a wide host range and many common weeds are hosts. Examples include the morning glory family (*Ipomea* spp.), the pigweeds (*Amaranthus* spp.), nutsedge (*Cyperus rotundus*), fat hen (*Chenopodium album*) and the nightshades (*Solanum* spp.).
- The major soil types (sands and well-structured clay soils of volcanic origin) are ideally suited to root-knot nematode
- Widely grown sweetpotato cultivars such as Orleans and Beauregard are highly susceptible

Reniform nematode

Reniform nematode (*Rotylenchulus reniformis*) is a tropical nematode that is restricted to Queensland, the Northern Territory, and northern parts of WA. It differs from root-knot nematode in that the immature female rather than the second-stage juvenile enters the root and establishes a feeding site. Also, most of the female's body remains outside the root, with the posterior part swelling so that the mature female becomes kidney-shaped (hence the name reniform, which means shaped like a kidney). Each female lays 40-100 eggs which are deposited in a gelatinous matrix on the root surface. The life cycle is very short and is sometimes completed in less than three weeks.



Kidney-shaped female of reniform nematode, and egg masses on the root surface (from Clark et al. 2013)

Currently, reniform nematode is not widely distributed on sweetpotato in Australia, with detections mainly limited to a few farms around Rockhampton and Bundaberg. Although it is the most important nematode pest of

sweetpotato in some countries, problems caused by reniform nematode are difficult to diagnose because distinctive symptoms are not produced. Affected plants tend to be yellow and stunted and are prone to wilting, while the root system is reduced in size and the roots may be discoloured and necrotic. Storage roots may be cracked, reduced in size or delayed in development, but unlike root-knot nematode, reniform nematode is never found within damaged storage roots.

Nematode management practices

When a susceptible sweetpotato crop is harvested, root-knot nematode populations are usually relatively high (>1500 nematodes/100 g soil) and so numbers must be markedly reduced before the next crop is planted. This is generally done in two ways. First, volunteer plants that grow from small roots left behind at harvest are eliminated, as they carryover the nematode to the next crop. Most growers do this with tillage and herbicides, but another alternative is to erect an electric fence and use domesticated pigs to consume the volunteers. Second, a forage sorghum rotation crop is grown for at least six months, as many cultivars are resistant to the three common *Meloidogyne* species.

Although the above practices are effective, root-knot nematode populations are rarely reduced below the damage threshold, which may be less than 1 nematode/200 g soil. Pre-plant counts of 10-40 nematodes/200g soil are relatively common in sweetpotato fields, and so growers either plant a nematode-resistant cultivar such as Bellevue or apply a nematicide. Several nematicides (1,3 dichloropropene + chloropicrin, metham sodium, fluensulphone, fluazaindolizine and oxamyl) are currently registered for use and growers planting susceptible varieties would choose one of them.

Reniform nematode is more difficult to control for two reasons. First, the nematode becomes metabolically inactive in dry conditions and this enables it to survive in soil for protracted periods of time. Second, it can be found at depths of more than 1 metre, which means that when soil is treated with the nematicides listed above, reinvasion can occur from layers deep in the soil profile.

Research on non-chemical management of reniform nematode has not been undertaken in Australia, but overseas work suggests that resistant rotation crops are one of the most effective methods of reducing populations of the nematode. Crops such as corn, sorghum, sugarcane, oats, peanuts, and certain varieties of soybean are relatively resistant to the nematode and should be included in the rotation. Where a field has both root-knot and reniform nematode, research must be done to find the most suitable rotation crops but the best options are probably forage sorghum, peanut, and root-knot resistant soybean varieties.

No sweetpotato cultivars have been found that are resistant to reniform nematode. However, some cultivars yield reasonably well in the presence of reniform nematode, while Beauregard is usually not subject to the cracking caused by this nematode.

Because reniform nematode does not occur on most sweetpotato farms, growers should see it as a biosecurity threat and take steps to prevent its introduction. This means ensuring that clean planting material is always used and that all machinery brought onto the farm is disinfested.

Sustainable nematode management

Recent research has shown that controlled traffic, early bed formation, effective weed and volunteer control, minimum tillage, cover cropping, retention of cover crop residues as mulch, and organic amendments can be integrated into the sweetpotato farming system to not only reduce pest nematode populations but also improve the physical, chemical, and biological health of the soil (Stirling 2021). Growers interested in developing a more sustainable production system should set up on-farm trials to assess these practices, learn from the results and then integrate some or all of them into their farming system.

Literature cited

Stirling GR (2021) Modifying a productive sweet potato farming system in Australia to improve soil health and reduce losses from root-knot nematode. In *Integrated Nematode Management: State-of-the-art and visions for the future* (Eds. RA Sikora et al.) CAB International, Wallingford, Chapter 51, 368-373.

Clark CA et al. (2013) Compendium of Sweetpotato Diseases, Pests, and Disorders. 2nd edition. APS Press.

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