Nematode pests of leguminous and oilseed crops in South Africa

By Dr Sonia Steenkamp, ARC – Grain Crops Institute, and Prof Driekie Fourie, North West University, Potchefstroom

During the past three decades, extensive nematological research has been conducted on especially soya beans and groundnuts. Limited information is available on the impact of nematode pests on other oilseed and leguminous crops, namely cowpeas, dry beans, lupins and sunflower. All of these crops are, however, parasitised by root-knot and lesion nematodes in particular, causing extensive damage and yield losses.

The peanut pod nematode is also known as an economically important nematode pest that causes qualitative damage to local groundnut crops. Various other nematode groups also infect oilseeds and leguminous crops, but generally do not occur as commonly as root-knot and lesion nematodes, and subsequently show lower damage potential.

Root-knot nematodes

Locally, *Meloidogyne incognita* and *M. javanica* are the two main root-knot nematode species that damage oilseeds and leguminous crops. They have a very wide host range and will, therefore, also infect and damage those crops planted in rotation. A root-knot nematode population in any given field will mostly consist of a mixed population of these two species, often also with one or two other species.

At present, an extensive survey is being conducted to identify root-knot nematode species and determine their abundance in local grain production areas. Such knowledge will enable more focused application methods to manage these pests.

Above-ground symptoms of root-knot nematode infestation include patches of poorly growing plants that may be stunted and/or wilted with yellowing leaves. These symptoms will often accompany yield loss manifestations such as smaller or only partially filled soya bean or dry bean pods.

Symptoms below ground are characterised by elongated to roundish, knot-like protuberances that form on roots, pegs and/or pods carried below ground (e.g. groundnut). Should producers suspect nematode infestation, it is crucial that they remove plants from the soil and check for such below-ground symptoms.

Galls formed by root-knot nematodes are often confused with *Rhizobium* nodules, but can be easily distinguished. *Rhizobium* nodules are easy to rub off the roots, while galls form an integral part of the root system that cannot be removed without damaging the root. The inside of a *Rhizobium* nodule is either whitish, greenish or pinkish in colour, depending on their developmental stage.

In cases of severe root-knot infestation in soya bean fields in the late 1990s in Mpumalanga, total destruction of the crop had been recorded. Yield losses ranging from 25 to 70% have also been recorded for the crop as a result of root-knot nematode infestation. Dry bean crop losses that ranged between 30 and 87% have been reported for a microplot trial.

Lesion nematodes

Lesion nematodes are usually the second most prevalent nematode pest infecting oilseeds and leguminous crops. Various species have been identified from oilseed and leguminous crops, with *Pratylenchus brachyurus* and *P. zeae* being the most abundant. This genus also has a wide host range.

Above-ground symptoms caused by lesion nematode infestations are similar to that of root-knot nematodes. Lesion nematodes cause distinct necrotic lesions on infected plant parts below ground, which can easily be confused with symptoms caused by other soil-borne pathogens.

Galls on soya bean roots caused by root-knot nematode infection. (Photograph by Philip Holtzhausen)

Pod nematodes

Although not a threat to crops other than groundnuts, this nematode pest needs to be mentioned because it has a huge impact on groundnut production in South Africa. Pod nematodes (*Ditylenchus africanus*) seem to be endemic to South Africa and has not yet been reported in other

parts of the world. They survive on crops other than groundnuts, as well as on weeds commonly found in groundnut fields, but cause damage only to groundnuts.

This nematode increases rapidly at the onset of pegging and the largest part of the population will occur in the pods at harvesting. They do feed on the roots, but to a lesser extent. For this reason, groundnut pod nematode infestations generally show no above-ground symptoms.

Below ground, the first symptoms appear at the connection point of the peg to the pod where the nematode primarily enters the pod. This causes weakening of the cells at this connection point, which causes the pods to break off when lifted. In severely infested fields a producer can lose 40 to 60% of his crop in this way.

The main effect of this nematode on groundnuts, however, is qualitative. Infected pods appear dark brown to blackish, sometimes with darker veins. Infected seeds are shrunken with dark brown to black micropyles, and flaccid testae showing darker vascular strands. Testae of infected seeds can easily be removed by gentle rubbing and reveals a distinct yellow discolouration on its inner layer.

Damage caused by the hull and the destruction of the seed testae by these nematodes, result in the occurrence of second-generation seedlings and germinated kernels even before harvest. The feeding of the nematodes near or in the vascular bundles of the seed testa also results in the unattractive appearance of infected seed.

These symptoms increase the percentage of unsound, blemished and soiled (UBS) kernels and are highly correlated with the number of nematodes present in the testae of the seeds. Consignments are often downgraded because of the higher UBS percentage caused by this nematode. For this reason, pod nematode infestations have substantial financial implications for producers.

Grading of groundnut consignments is specified by law and the supply and demand dictate the prices of each grade. The economic importance of pod nematode is determined by the loss of income from infected groundnut consignments, which in turn depends on current prices for each grading class.

Kernels infected with peanut pod nematodes have dark testae and veins (left), a germinating kernel (right) and infected pods with germinated kernels inside.
(Photograph by Johan Els, Agricultural Research Council – Grain Crops Institute, Potchefstroom)

Other nematodes

Although a wide range of other nematode groups infect groundnut locally, the testa nematode (*Aphelencoides arachidis*) also impact adversely on groundnut quality. So far, this nematode has been found in various groundnut pods from fields located in the Northern Cape and North West. The distribution of this nematode and another nematode that closely resembles the testa nematode morphologically is currently under investigation.

Management strategies

All these nematodes are difficult to control because of their wide host range and high reproductive potential. These characteristics enable them to quickly build up to large populations that cause substantial damage to crops.

Chemical control

Although still the most popular management strategy, nematicides are not always capable of sufficiently reducing nematode population densities, especially those that produce numerous generations during a single growth season. During the past few years, a strong movement has been initiated towards using more environmentally friendly products to reduce nematode population densities in crop fields.

Crop rotation

Crop rotation is generally not an effective strategy to reduce root-knot and lesion nematode populations, because of the wide host range of such pests. However, using a poor host or resistant cultivar within each crop cycle should be the main strategy to combat root-knot nematodes.

The effectiveness of this strategy in combating pod nematodes is limited, because of the ability of the pod nematode to survive on weeds and crops other than groundnuts. Its high reproductive potential and short lifecycle of seven days cause this nematode to build up to damaging populations, even if they are present in small numbers at the beginning of the growth season.

Host plant resistance

Rotation with poor hosts or resistant plants is one of the most effective management tools to manage nematodes. A limited number of root-knot nematode resistant cultivars are available for oilseed and leguminous crops in South Africa, while their host status for lesion nematodes must still be determined.

There are no resistant groundnut cultivars available against the pod nematode on the local market. Research is still needed to identify groundnut cultivars resistant to root-knot and lesion nematodes.

Sunflower cultivars tested so far are all susceptible to root-knot nematodes. Although four sunflower cultivars show resistance to a lesion nematode species, more cultivars should be tested. Most dry bean cultivars tested against root-knot nematodes proved to be susceptible. There is no information available in terms of dry bean resistance to lesion nematodes.

Research on the impact of these nematodes on the most important oilseed crops and the development of strategies to combat them should be pursued. This much needed research should provide producers with practical and cost-effective strategies to ensure sustainable crop production.