Information Sheet

8. PESTS

8.2.1 Nematodes

Background

Nematodes are the most abundant multicellular organisms on earth and occur everywhere. They are microscopic, worm-like organisms that infect plants, humans and insects. The nematodes that occur in the soil, associated with cane roots can be divided into two groups: the free living (good) nematodes and plant parasitic (bad) nematodes. Free-living nematodes contribute to nutrient recycling as they feed on bacteria, fungi, decaying organic matter and other nematodes in the soil. Through their feeding, digestion and excretion process, minerals and nutrients are recycled back into the soil. In direct contrast, many species of plant-parasitic nematodes feed on the roots of sugarcane. They occur in all soils throughout the cane growing areas of South Africa and can cause serious damage to the roots of sugarcane, particularly in sandy soils. This results in a reduction in yield of the affected crop as well as a reduction in the number of high yielding ratoons from one planting.

In South Africa, damage to sugarcane by nematodes was first suspected in the 1940s. However, it was only in the 1950s that conclusive evidence was found to support this. Investigations into growth failure in Zululand, using a variety of treatments including soil fumigation with nematicides, fertilisers, soil amendments, fungicides and insecticides, found the greatest response from soil fumigation. Examination of the roots of control plots revealed the presence of the root-knot nematodes *Meloidogyne javanica* and *Meloidogyne incognita*. Since then, numerous surveys and studies have been conducted to ascertain the extent and occurrence of nematodes. Thus far, 90 species of 29 genera have been recorded from the soil and/or roots of sugarcane.

Occurrence

Many different nematode genera are found in sugarcane fields in South Africa. Six genera are particularly widespread in the soil - namely *Pratylenchus, Helicotylenchus, Meloidogyne, Paratrichodorus, Xiphinema* and *Scutellonema* and three genera, *Pratylenchus, Helicotylenchus* and *Meloiodgyne* are more widespread in the roots. Other genera such as *Tylenchorhynchus, Criconematids* and *Longidorus* are also found, but occur less frequently and may be localised to certain areas.

The composition of a nematode community is dependent on a large number of factors such as soil type, variety, altitude, previous cropping history and agronomical factors. It has been shown that *Pratylenchus* is more commonly associated with soils with a low pH. *Meloidogyne* is more common in sandier soils and *Xiphinema* is found in higher numbers in soil that has been in monoculture and undisturbed for long periods. *Hemicycliophora* is found in wetter soils, usually in irrigated areas or near river-beds.

Figure 1. Sugarcane roots infected with *Meloidogyne*.

Identification

Nematodes are microscopic and cannot be seen with the naked eye. They are therefore only visible under a microscope. The plant-parasitic (damaging) nematodes are identified by the presence of a stylet ("syringe" like device) on their heads which they use to puncture root cells and extract nutrients. Identification of these nematodes into different types is based on various morphological features e.g. length of body, size and shape of head and tail, swimming movements, position of sexual organs, type of banding patterns etc. and is performed by a microscopist trained in such identification.

In order to determine whether nematodes are present in a field, soil and root samples are collected. Nematodes are then extracted from these samples, identified to genus level and counted using a microscope. These nematode counts provide the basis for recommendations given to growers on whether to use a nematicide or not.

Biology

Nematodes typically have six life stages consisting of the egg stage, four larval (or juvenile) stages and an adult stage. The length of the life-cycle varies for each nematode genus and species and can range from 3-4 weeks for *Meloidogyne* species to 16-36 weeks for some *Xiphinema* species. This is however affected by the type of crop, age of crop, soil type and length and type of season. The nematodes in the larval stages are the ones that move and feed on plant tissues. Each female nematode typically produces ~ 500 eggs which in turn can give rise to new offspring one month later.

Damage

Nematodes feed on both the sett and shoot roots of sugarcane. Feeding (mainly by the endoparasitic nematodes, *Meloidogyne* and *Pratylenchus*) on the sett roots of newly germinating sugarcane results in a reduction in the number of new tillers. This results in uneven germination which leads to competition between differently sized shoots and ultimately to a reduction in stalk number. Feeding (mainly by the ectoparasitic nematodes, *Xiphinema* and *Paratrichodorus*) on the newly forming shoot roots results in less uptake of water by the plant which in turn results in reduced stalk elongation and eventually shorter stalks.

Symptoms of nematode damage

Symptoms are not always easy to see and can often be confused with those of nutritional or moisture stress. Typical above-ground symptoms can include chlorosis, stunting of internodes, wilting (particularly during periods of high transpiration and/or water stress), patchy growth, spiky leaves, reduced tillering and thin stalks. Below-ground symptoms can include root galls (swollen area near the tips of primary roots, particularly when infected by species of *Meloidogyne*), root lesions (occurring as red, brown spots on the root tips, most commonly associated with species of *Pratylenchus*), stubby roots (short, stubby and swollen, absence of many lateral roots, usually from being fed upon by species of *Paratrichodorus*), surface necrosis (superficial discolouration, from the feeding of several migratory ectoparasitic nematodes). Other generalised root symptoms are the overall reduction of root mass, sparse root system, reduced root length, less development of secondary roots.

Effect on yield

Nematodes have been shown to reduce yield by 7.6% per annum, equivalent to 1.6 million tons of sugarcane lost which is equivalent to a R450 million loss in revenue per annum.

Control

Once nematodes are present in a field, it is nearly impossible to eradicate them. The best way to cultivate that field is to manage the nematode problem. The variety of recommended solutions available to sugarcane farmers include: the use of chemical nematicides, planting tolerant cultivars, planting during the cooler months (when nematode activity is reduced), applying organic amendments in the furrow at planting and growing suitable green manure crops between sugarcane cycles. These are discussed in more detail in *SASRI Information Sheet 8.2.2: Nematode Management*.

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