Controlling parasitic nematodes. Where to from here?

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Introduction

Plant parasitic nematodes are common pests of turfgrasses. Their impacts seem to increase in sandy soil profiles which are commonly used in turfgrass situations. There are many nematode species which can affect turfgrasses. The following table lists some of the most common plant parasitic nematodes and some of their characteristics.

Most common plant parasitic nematodes

Common name	Sting	Ring	Stubby Root	Lance	Root-knot	Spiral
Scientific name (most common)	*Belonolaimus*	*Criconemoides*	*Paratrichodorus*	*Hoplolaimus*	*Meloidogyne*	*Helicotylenchus*
Type	Ectoparasitic	Ectoparasitic	Ectoparasitic	Endoparasitic	Endoparasitic	Ectoparasitic
Thresholds[1]	50	750	200	500	2000	2000
Grasses affected[2]	Buffalo Couch Bent Zoysia	Couch Bent Fescue Zoysia Buffalo	Couch Bent	Couch Bent Buffalo Zoysia	Couch Bent Tall fescue Rye grass Zoysia Buffalo	All
Symptoms[2]	"Stubby root" and knob like appearance of the root tips.	Stunting and thinning of turf. Stunted roots with brown lesions.	Similar symptoms to sting nematodes	Stunting of top growth. Swelling of roots and feeding areas. Increased fungal diseases.	Yellowing and stunting of top growth, swelling of roots, knots or galls present in roots. Wilting of top growth.	Thin stand which is difficult to maintain. Curtailment of growth of new plants in rhizomes or stolons.

[1] – provided by Nuturf

[2] – from http://www.poulengerusa.com/Neamatode_informaiton.htm

Once nematodes have become established in a turf area they cannot be eradicated, but the damage they cause can be minimized. Nematode numbers can build up rapidly in sandy warm moist soils and it is in these situations where good nematode management plan need to be implemented in advance.

Nematodes can be broadly divided into two groups. Those that remain in the soil while feeding on roots are called ectoparasites. Those that enter the plant are called endoparasites. Products with contact action will perform better on ectoparasites while systemic products will generally be better on endoparasites. This must be considered in assessing the value of some of the treatment products detailed later.

Nematode sample collection and testing.

The previous table shows some of the currently used thresholds to determine action thresholds for results from analysed soil samples. These should only be used as a guide as the level at which turf damage starts to occur can be affected by factors such as general root health. Monitoring of nematode levels and root health are important components of a nematode management plan. Appropriate laboratories should be contacted to get details on correct sampling procedures.

Current products

Fenamiphos (until recently sold as Nemacur and now available as Electricur) has been the only nematicide registered for use in turfgrass situations. At the moment some concern occurs over the future availability of fenamiphos. In April 2003 the APVMA released a "Fenamiphos Scope Document". This document raises concern over non-target effects of fenamiphos in turf situations (duck and fish kills). To date no recommendations have been released by the APVMA with regard to the future of fenamiphos registration. Fenamiphos registrations were withdrawn in the USA in 2007.

Apart from being a nematicide fenamiphos also has general insecticide activity. For many years fenamiphos was used for the control of turfgrass pests like African Black beetle as well as nematode control. In the 1990s it became apparent that fenamiphos was not as effective in some situations as it had been in the past. Investigation determined that enhanced biodegradation of fenamiphos was occurring at some locations (Beehag, 1995).

The organophosphate cadusafos (sold under the trade name Rugby) has been researched in Australia since 1994 (Kaapro, 1994) and used by turfgrass managers since 1996 under an APVMA permit for nematode control.

Maximising turfgrass root growth

With turfgrass roots being the primary point of attack by nematodes the use of management strategies to maximize root growth will assist in the turf surviving through periods of increased nematode pressure.

There are several points which turfgrass managers should consider to optimize the growth of turfgrass root systems;

Irrigation – Deep and infrequent irrigation results in greater root biomass and longer root systems, this can be further aided by allowing the surface to dry between irrigations. With cool season grasses like *Poa* and bentgrass frequent irrigation may be required during the summer due to the shallow root system.

Syringing – During days of high summer temperatures syringing to cool the turf canopy can assist reducing the rate at which turfgrass uses stored carbohydrates for respiration. The carbohydrates are generally depleted from reserves in the root systems. The greatest benefit from syringing occurs when this is combined with the use of fans as this then maximizes the cooling effect.

Nutrition – The implementation of balanced nutrition programmes will promote better general turf health, which will assist the turf with managing nematode attack. Bentgrass root production is greatest in the spring at this time adequate supply of elements which are important in root growth include potassium and phosphorus while excess nitrogen stimulates shoot growth instead. Couchgrass roots growth is maximum when soil temperatures are 24-29^{o}C and advantage must be made of this time to maximize root growth.

Mowing heights – Any increase in mowing heights and decrease in the frequency of mowing will reduce overall stress on turf and assist the turf manage periods of nematode increased nematode pressure. The use of rolling as a substitute to mowing could be one option to be considered.

Biostimulants – The use of various biostimulants (humic substances, sea weed extracts, amino acids, sugars/carbohydrates etc) may have some benefit for turfgrasses with depleted root systems. While performance is research trials has not always shown consistent benefits, there seems to be enough evidence than in some situations they may help. But they are only supplemental to good agronomic practices.

Managing root diseases – Nematodes and root fungal pathogens have similar impacts on turfgrass (depleted root systems which have reduced water and nutrient uptake). So the management of both should be undertaken to reduce the combined detrimental effects on turfgrass roots.

Use of growth regulators – some evidence has suggested that the use of growth regulators to control leaf and shoot growth will increase root growth. In situations where *Poa annua* is being managed the suppression of seed heads will reduce decline of root systems at that time.

The Future

Bacillus firmus is a bacteria which is commercially available in the USA (trade name Nortica) for turfgrass managers to assist in the management of nematodes. *B. firmus* forms a protective coating on the outside of roots which protects the roots from nematode attack. In addition there is some direct effect on nematode eggs.

Abamectin is an insecticide currently waiting registration in Australia for nematode control in turf. The formulation which has been developed is a unique formulation for nematode management. Abamectin fixes tightly in the soil and a specific formulation is required which with irrigation will move into the root zone.

A range of “alternative” products for nematode control in turf are used in the USA without consistent results in limited research trials. These include;

- Thyme oil
- Furfural
- Mixtures of soybean meal, urea, and processed shrimp or crab shells
- Ground sesame
- Fungus called *Myrothecium verrucaria*

Conclusion

Nematodes are another management issue for turfgrass managers which must be considered in their overall turfgrass management strategies. For those with more damaging species like sting nematodes the management problem are more difficult. No apparent “silver bullet” is on the horizon for the management of turfgrass nematodes. Turfgrass managers must continue to implement good agronomic practices to minimize stress on the turf and to maximize the general health of turfgrass swards and especially the root systems. Some new products are on the horizon which will offer some help.

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