Nematodes

IN BOWLING GREENS - WHERE ARE WE AT NOW?

A reality check...

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It is important to realise that soil dwelling nematodes play an important role in the soil's biological system and that they are needed for both good soil and plant health. They are present in high numbers which may range from 3 to 10million/ m^2, mostly in the surface 150mm of soil[1]. There will be a range of nematode species present, feeding on fungi, bacteria, other nematodes and other food sources. Some can damage plants.

It is this latter group of nematodes that can cause problems on bowling greens. Managing nematodes and their effects on plant health on bowling greens is both very difficult and time consuming as you are often trying to manage two different greens on the same green!

BRIEF HISTORY OF NEMATODES ON BOWLING GREENS IN NZ

Managing nematode problems on bowling greens in NZ is not new and greenkeepers have been dealing with nematodes issues for the last 40+ years[2].

Nematode species

In the early days, spiral, root lesion or root knot nematode was the main species that troubled greenkeepers. Over the last decade, most of the damage has been caused by the Dagger (*Xiphenima* spp) nematode.

Interestingly, Dagger nematode is not considered a major problem in turf internationally or for that matter, on other crops. Consequently, we need to be cautious about extrapolating chemical control information from overseas especially if it doesn't specifically mention dagger nematodes.

Effectiveness of chemicals

Over this time a range of nematicides were used. Unfortunately, the results then and now were generally inconsistent and, when successful, only provided short-term relief - weeks to a few months only. In other words, they suppress rather than kill the nematode, and only *if* the chemical encounters the nematode.

One of the main reasons for this inconsistency is the generally high thatch levels present in bowling greens which causes many chemicals to be adsorbed onto the thatch and then broken down by microbes.

Another observation was that once use of nematicides commenced, greenkeepers were usually tied into using them on an ongoing or annual basis.

Observations

Over this period there have been many things learnt, including:

- Nematodes don't kill cotula or starweed. Instead, they damage and weaken the plants to the point that the plant cannot recover from the effects of heat stress, wear and poor vigour due to the damaged or minimal roots present.
- Cotula and starweed do not have an extensive fibrous root system like grass and as such any restrictions to root growth (e.g. compaction, thatch

Localised bare areas due to nematodes.

Browntop used to re-establish a nematode area, thriving whilst cotula struggles.

and layers in the soil profile) will have an impact on both root development and tolerance to nematodes. This is observed when grass is sown in the damaged areas and not affected by nematodes.

- Doubling the root system has often overcome a nematode problem – not because the nematode population has reduced, but rather because having a larger root mass for the same number of nematodes to feed on results in less damage or stress on the plant.
- The use of non-chemical alternatives (e.g. garlic, seaweed, phosphites) to help improve the plant's resistance by improving root development or increasing the soil microbe activity reduces the effects from nematodes, but similar to chemicals, the results have been variable.

WHERE TO FROM HERE FOR NEMATODE MANAGEMENT?

We know that nematodes are here to stay and there are no silver bullets for their control.

Chemical suppression going forward:

An unfortunate reality check – there are no reliable chemicals presently available!

Oxamyl (Vydate) and fenamiphos (Nemacur etc) were the main chemicals used. Oxamyl has not been available for several years and as of July 2023, fenamiphos will no longer be allowed to be used. Thus, as it stands there will no longer be any semi-reliable chemicals available for controlling nematodes.

There are some new chemistries, but at this stage they are likely to be unreliable against Dagger nematode:

- **Abamectin**
  This chemistry is not registered against Dagger nematode and present formulations are likely to be ineffective due to their limited mobility within the soil rootzone. They may have some effect against root knot nematode.
- **Fluopyram**
  This is actually a fungicide that has provided good results on controlling different nematodes overseas. However, in two BNZGA trials to date, NZSTI found this chemistry to be ineffective against Dagger nematodes. Based on overseas information this should provide some control against root knot though - and possibly other nematodes if identified as being present.

Based on the evidence to date, there will be no reliable chemistries available for greenkeepers to control our main nematode species, Dagger nematode. Consequently, greenkeepers will need to re-focus on their management practices to manage nematode issues.

MANAGEMENT – THE MAIN APPROACH GOING FORWARD AT THIS POINT

The key focus will need to be on promoting better plant health, especially a stronger root system.

Timing

Traditionally management of nematodes begins during spring as nematodes resume activity. Unfortunately, by the time such programmes begin, damage from nematodes is already starting and often the main period of root development has already passed. Moving forwards, more focus is required during autumn and winter to prepare the plants for the summer battle!

This effect is also seen where bulbils are sown into these bare areas over the late winter /early spring period. When the nematode activity starts in the spring, these maniototo seedlings only have 1-3 rootlets and are therefore easily damaged by the nematodes. The seedlings thus die, and the patches 'bare out again'. Repairing these areas in the autumn will give the young plants a much longer period of time to develop a better root system before the spring when nematode activity recommences.

Encouraging and maintaining a deeper root system.

Shallow roots are the result of thatch, layering, compaction, and overwatering. Addressing these factors will promote a deeper root system.

As the thatch increases above 10-15mm, cotula and starweed roots tend to be increasingly confined to the thatch. Once the plant has shallow roots it is more prone to heat stress, poor vigour and damage from nematodes.

Thatch provides an ideal environment for nematodes as it holds water, thereby compromising plant health and enabling nematodes to 'swim' and contact the now shallow plant roots.

With clubs renovating less, thatch levels tend to be on the increase. Clubs that renovate most years, continue to have roots growing into the soil as there is less layering. Renovation stimulates new vigorous growth - especially of roots.

If thatch is an issue and the green has a nematode problem, resurfacing is an option. While it may reduce nematode numbers for a brief period, the main benefit of resurfacing is that the roots can grow back into the soil, which then improves plant health.

As well as resurfacing to remove thatch, grooving and coring are of benefit, as both practices stimulate new growth, root development, and introduce fresh soil into the green. These practices should be considered to promote a deeper root system.

Roots confined to thatch layer, being damaged by Dagger nematode.

Addressing other factors that reduce root development like compaction and overwatering will also benefit plant health.

Use of organic fertilisers at renovation

Adding organic fertiliser down the core holes on nematode affected areas in autumn and spring will provide the following benefits:

- It provides a steady source of nutrient over 3 – 6 months which will help support stronger root growth and plant recovery.
- It acts as a biostimulant for the microbes present in the soil, some of which may predate on the nematodes.

Seaweed

One of the main roles of seaweed is to help with new root initiation and encourage deeper root systems. Traditionally they have tended to be applied when damage has been seen and continued over the summer. A better option is to apply them at the time of the main root development in the autumn and spring BEFORE the soil temperatures warm up enough for the nematodes to become active.

Drenching the seaweed in and perhaps treating the known poor areas may give a better result than spraying the entire green.

Targeting the nematode.

Over the years a number of alternative products (such as garlic, sugar, Neem) have been used to stop the nematode from feeding or to 'kill' the nematode. The results have been based on laboratory trials, but their success has not always been reflected in the field. However, with no reliable chemicals presently available for Dagger nematode, perhaps it is an option to consider their use again.

To get the best results from these products, they should be used alongside other management strategies to encourage a deeper root system and healthy plant rather than using them on their own in isolation.

Starting applications earlier before damage is seen, treating individual patches rather than the whole green as well as making sure these products are thoroughly drenched in afterwards (to contact the nematodes) may provide better results than seen previously.

THE FUTURE

Sadly, as with most other things we deal with in turf, nematodes are no different -there are no silver bullets.

Dealing with a nematode problem on a green is one of the most difficult issues greenkeepers deal with and manage. The lack of 'reliable nematicides' means that going forward we will have to develop an integrated approach that focuses on the plant by promoting a deeper root system, improving plant health and minimizing summer related stresses to better allow the plant to tolerate the nematodes that are present. ●

References

1. M.Hodda 2000. Nematodes and Turfgrass. Proc Seminar on Pests, Diseases and Nematodes, 2000
2. D Howard,D Ormsby 2017. 40 years of Nematodes. NZTMJ Winter 2017

(LHS). Roots confined to thatchy surface due to lack of renovation and (RHS) deep root development with no obvious layers due to annual renovation.

Poor Risk Management CAN HAVE DISASTROUS Consequences in Turf

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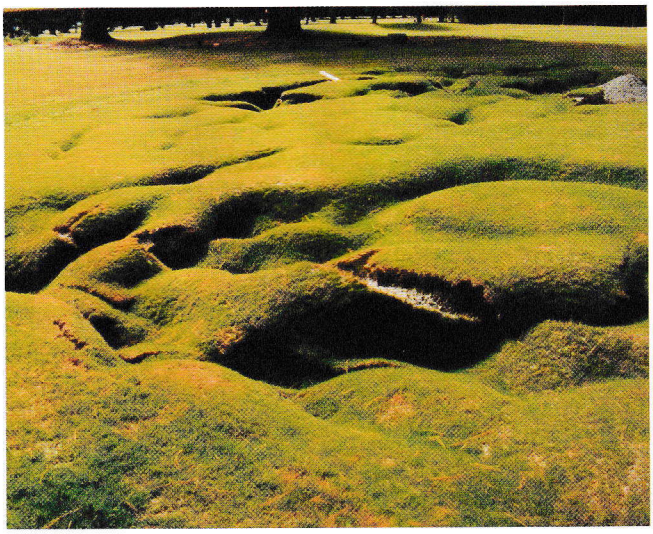

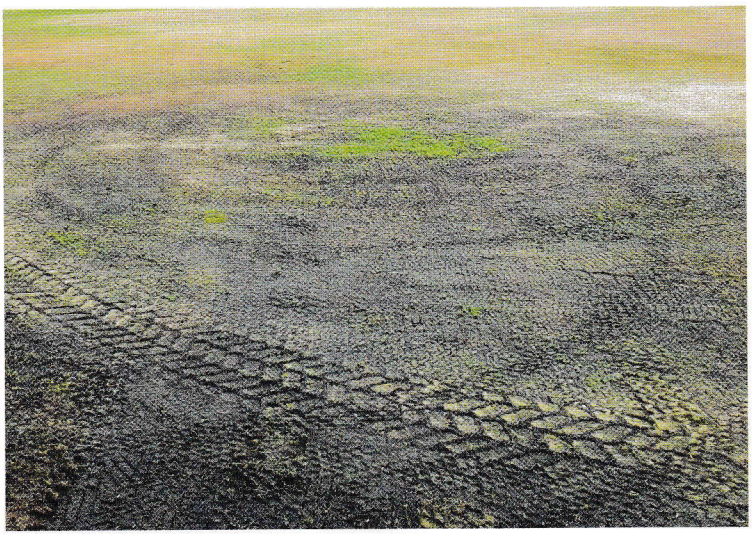

OOPS!!!!

In turf, it's easy to get caught out by being 'rushed into making mistakes' either by trying to beat the weather, or the next sporting event, the Friday syndrome, or addressing a concern raised by management. Unfortunately, in turf if you get it wrong the damage is often long lasting!

Simply stated, grass is going to take 3 – 5 months to regrow.

These situations that are sadly too common, can be avoided if turf managers took a more risk-based approach to the management of their turf facility.

So, what is risk management? In short, before undertaking a management activity such as spraying, renovation etc, ask yourself and answer the following questions:

- What is the desired outcome of this management practise?
- What could go wrong?
- How do I manage the identified risks?

To illustrate this process, let's consider the following turf management tasks that are common to all turf disciplines and potentially pose a significant risk either to the turf and/or the 'users'.

SITUATION ONE:

MIXING SEVERAL CHEMICALS TOGETHER

Several agrichemicals or mixtures of agrichemicals, fertilisers and/or other products are tank mixed and applied together.

Why would you mix several chemicals together?

To save time or money as fewer spraying events are required.

What can go wrong?

1. Are the chemicals actually compatible?
   If not, they often produce sediment, gels etc that must then be cleaned from the sprayer.
   In other words, how much time have you saved now?
2. Depending on the formulations of the different chemicals being mixed, the likelihood especially when mixing different groups of products (fungicides, herbicides, insecticides etc) is the 'brew' gets hotter and the turf is at an increased risk of damage.

   Example: In one situation I recall, Lorsban and Axall as they were then known - both emulsifiable concentrates, were mixed. The result was akin to spraying glyphosate, with 16 greens experiencing severe cover loss and recovery took close to a year.

   Imagine the ramifications of this in terms of:
   - Turf managers and clubs reputation.
   - Income for the club.
   - Members reaction.
   - Time that substandard surfaces must be put up with.
3. Sometimes (and often more commonly than realised) products with different target locations are mixed together, i.e. root and foliar absorbed. This will never work, and the result is often a poor outcome.

When tank mixing goes wrong, how much time or money have you actually saved? You will have probably created more work and sleepless nights for yourself!

How do I manage this risk?

1. The safest option is to apply the different products as separate applications. However, the issue of getting this done when you are time poor is not addressed.
2. Experience

   Do YOU have personal experience of mixing these products, both in terms of the products compatibility (jar test) and the likelihood of damage to the turf?
   Alternatively, if you don't have your own personal experience make sure that you are consulting RELIABLE sources as to the compatibility of the products. **However, beware!** Talk is cheap and getting it wrong can have severe consequences for **YOU!**
3. Correct mixing order – WALES
   - W =wettable powders and dispersible formulations
   - A = Agitate
   - L = Liquid formulations (flowables and suspension concentrates)
   - E = Emulsifiable concentrates
   - S = Surfactants, other
4. If the 'mixture' is something you are likely to use regularly in your management programme, trial this mixture first on a small area and if it's successful, then it can be extended to the full turf area. True - it takes time, but this is better than 'trialling it on the entire turf area' and suffering long term widespread damage if something goes wrong!
5. Timing
   If after all these actions, you proceed with spraying a 'brew,' remember that the more products in any given spraying mixture, the 'hotter' it is likely to be.
   Consequently, ensure the turf is in good health and not under stress. Always spray when overhead conditions are suitable i.e. overcast. Additionally, all the products in the 'brew' must have the same target location, i.e. foliar or root absorbed. Not both!

JAR TESTS

The jar test involves:

- Add 600mls of water and a teaspoon of each product that you are planning to mix into a litre container.
- Leave for 15 minutes and watch for:
  - Change in temperature – does the container get hotter?
  - Does any form of precipitation occur? This is evident when the mix turns to a jelly, or when granules or sludge is present.
  - Obvious layers occur in the mixture.

Jar test showing signs of incompatibility - stratification, colour changes, gelling etc.

SITUATION TWO:

WEED CONTROL

Spraying for weeds is a routine practise on turf. When weeds become widespread or spraying occurs at times of sub-optimal growth for recovery, problems inevitably occur.

What can go wrong?

1. Spraying is 'too effective' and when completed at the wrong time of the year can result in bare areas that can last for several months after spraying.
   Ask yourself: What is worse? The weed or the resulting bare area after spraying?
2. The pressure to spray at the wrong time of the year endangers the turf plant:
   - For example, Hyvar X (Uragan) on winter leaf maniototo.
   - Triclopyr especially on *Poa annua* during winter or summer. During summer it can make Anthracnose disease worse.

Managing this risk

1. Is there enough weed to justify spraying immediately or can it be deferred to a safer time?
   Bowls is a classic example of this when weeds (normally hydrocotyle) are minimal (say less than 0.2% of the turf cover which is 2.68m² in total) yet to start the season, spraying is often undertaken. This results in the bare patch syndrome illustrated below well into December (half of the playing season) or worse.
2. Spraying for weeds should always be undertaken when the turf plant and weed are actively growing. Ideally spraying will be completed prior to renovation so any recovery (re-seeding, plugging etc) can be undertaken when the turf area surfaces are already damaged.
3. In some situations, and hydrocotyle is probably the best example, there is no good time to remove large patches. Disruption to play is in this instance largely inevitable. A better approach in this instance is multiple herbicide applications, using lighter rates, which initially thins rather than eliminating the weed, thereby reducing disruption to play and allowing grass to re-establish within the weed patch.

SITUATION THREE:

REINSTATING BARE AREAS

For a variety of reasons, regardless of the turf discipline, we lose turf cover. The objective is to reinstate the turf cover as quickly as possible.

What can go wrong?

Too often recovery is slower or poorer than desired as a result of:

1. Poor seed/soil contact. This occurs when the seed is not adequately buried or is buried too deeply.
2. The seeds are too widely spaced e.g. in core holes at 50 – 100mm apart or dethatch/sowing lines that are 30 -50mm apart. It will take an unnecessarily long time for grass to spread over these large areas and reinstate a complete cover.
3. Poor irrigation technique leading to poor strikes – seeds are germinating in the surface 5mm (approx.) which dries quickly even during autumn.
4. Grow-in technique. They may only be small areas but the requirements to 'grow in' a small 300mm diameter patch from seed is the same as establishing a golf green, sportsfield or similar.

Managing this risk

1. The best approach is to plug or turf out problem areas as it provides an instant result and in the members eyes the problem disappears immediately.
2. If sowing seed, it all starts with a good seedbed.
   - Ensure that the seed is adequately buried within the profile.
   - Use the correct sowing rate. More seed doesn't result in better or even faster recovery. Often the intense competition from heavy sowing rates slows establishment or results in the seedlings dying.
   - The sowing technique should result in seedlings that are closely spaced together so that the 'bare area' fills in quickly.
   - If reseeding into an established turf, 'pepper' the bare area with very closely spaced holes, 10-15mm apart and to a depth of 10-12mm so that the seedlings establish close to each other.
3. Initial establishment – simply stated: irrigation. The seedlings are germinating/establishing in the very surface of the profile. As you would with a new green, these areas need to be watered frequently and kept constantly moist until germination is completed.
4. Grow-in – although the areas involved are often small, you are still dealing with seedlings and the same grow-in approach is required as occurs when establishing larger areas such as sportsfields.
   - Fertiliser. This needs to be applied frequently to the resown area(s) at approximately twice the normal maintenance rate until full cover is achieved. Hand work and spot fertilising is required.
   - Re-seeding. Avoid the "hope syndrome". Examine the seedling density approximately 10 – 14 days after re-seeding a bare area. If weak areas remain, re-seed now, not 3 – 4 months later.

No turf manager wants to find themselves in the situation where they have suffered significant cover loss. A strategy to reduce this danger of cover loss or damage is to adopt a good and sensible risk management strategy. In other words, work backwards from the intended result and identify what can go wrong - then determine how you can manage or mitigate the identified risks. ●