

Earthworm Control

INTRODUCTION

Earthworms unlike other pests do not directly damage the turf plants. The problem with earthworms is that their casts adversely affect the playing surface especially in the cooler, wetter periods of the year.

At this time of the year, the worm casts remain soft and result in the surface becoming smeared and often puggy due to surface sealing. Overall the playing surface for golfers is softer and of a poorer quality.



Endosulfan (Thiodan, Thionex)

Following its reassessment by ERMA, endosulfan has been deregistered in New Zealand and its use is prohibited. This means that **from January 16 2009, it is illegal for turf managers to apply existing stocks of endosulfan to their turf.** For clubs that still have stocks of endosulfan, they have **until January 2010** to dispose of all stocks of endosulfan in a safe and legal manner. It is illegal to use it or dump it.

Safe disposal means either:

- Contacting your Regional Council to confirm the disposal procedure. To date, Auckland, Waikato, Wellington, Canterbury and Otago Regional Councils have agreed to provide a free service for disposal.
- Employing the services of a professional chemical disposal company.

For more information refer to the ERMA website:

<http://www.ermanz.govt.nz/news-events/focus/endosulfan/index.html>

and the Ministry for the Environment website:

<http://www.mfe.govt.nz/issues/waste/special/agrichemicals/index.html> .

Turf managers should be aware that staff have now been employed to and are actively monitoring the requirements of the HSNO legislation.

FUTURE MANAGEMENT STRATEGIES FOR EARTHWORMS

With endosulfan now removed from the New Zealand market, strategies for suppressing earthworms will include a combination of the following methods.



Alternative Chemical Control

Interestingly, there are a range of pesticides that are known to be toxic to earthworms (refer to <http://www.oxfordcroquet.com/care/worms/index.asp>). However, the effectiveness of these products under New Zealand conditions is presently unknown. The main products identified include:

<i>2,4-D</i>	<i>acephate</i>	<i>captan</i>	<i>carbaryl</i>
<i>carbendazim</i>	<i>copper sulphate</i>	<i>cypermethrin</i>	<i>diazinon</i>
<i>malathion</i>	<i>phorate</i>	<i>thiophanate methyl</i>	

Research is required to determine the most effective agrichemical, rate and programme. The main chemical options available are summarised in Table 1.

Presently the only pesticide registered internationally for earthworm control is carbendazim. However, feedback from Sports Turf Research Institute advisors, indicate carbendazim produces variable and inconsistent results.

Given that in New Zealand we can still use Carbaryl (at least presently) NZSTI's preference is to use this product. This is to reduce potential issues associated with disease resistance that can occur with the repeated use of carbendazim or thiophanate methyl.

Table 1: Chemical Options for Controlling Earthworms

Product	Rate/ha	Comments
Carbaryl 500gai/L Acute oral LD ₅₀ 400mg/kg rats Acute dermalLD ₅₀ 500mg/kg rats	10-30L	<ul style="list-style-type: none"> ▪ Although there has been limited field use of carbaryl to date our experience has shown it to provide inconsistent or partial control of earthworms. ▪ Research³ has shown carbaryl to be less effective and provide a shorter duration of control than carbendazim. ▪ Best results are generally achieved with spring applications.

Product	Rate/ha	Comments
Carbendazim 500gai/L Acute oral LD ₅₀ 6400mg/kg rats Acute dermal LD ₅₀ >10000mg/kg rabbits	4 -8L	<ul style="list-style-type: none"> ▪ Product labels overseas (e.g. Scotts Turfclear) requires this to be applied every 3 months in at least 1000L of water/ha. ▪ Research² indicates that carbendazim, will suppress the amount of casting that occurs by approximately 35% for 3 months and thereafter the level of control will taper off with time.
Thiophanate methyl 400gai/L Acute oral LD ₅₀ 7500mg/kg rats Acute dermal LD ₅₀ >10000mg/kg rats	12.5L	<ul style="list-style-type: none"> ▪ For best results, these products should be applied in conjunction with light rain. ▪ Within Britain a <u>compatible wetting agent</u> is mixed with carbendazim, to improve penetration of the fungicide into the soil profile. ▪ Resistance to benzimidazole group of fungicides and in particular Benlate™ to Dollar spot and Fusarium is well documented on New Zealand⁴ turf facilities. Furthermore cross resistance within the benzimidazole group of fungicides is well documented. Repeated drenches of carbendazim will increase the risk of resistance to a range of fungi.

Fertility

Earthworms are sensitive to acidic soil conditions particularly where the pH falls below pH 5.0. Regrettably the adoption of inappropriate fertiliser practises in the past on a number of golf clubs has aggravated problems with earthworms.

Key considerations are:

1. Have a full understanding of the grass type that you are growing and the implications that the required management programme for this grass type will have on earthworms. For example the higher pH required by ryegrass and its clump type growth habit means it is both more susceptible to earthworm activity and the short term damage from casting (smearing/smothering of the plant) is generally more severe.
2. The use of organic fertilisers (which act as a food source for earthworms) such as poultry manure, should be used sparingly and concentrated during the late spring – summer.
3. Lime should be used sparingly and its requirements based on soil testing. A common misnomer on turf is the necessity to raise the pH of the profile. For browntop the dominant grass on many golf courses, an acidic pH is recommended and any pH adjustment is primarily required within the surface 20mm to assist with infiltration and managing thatch.
4. Where required, acidic nitrogen sources (ammonium sulphate) are recommended during autumn – winter when earthworms are most active.

Surface Acidification

The primary goal (depending on the grass type grown) is to lower the pH within the surface 50 -75mm and thereby create an environment that is less conducive to earthworm activity. This will take time and consequently in the short term surface acidification is suggested as a means of suppressing surface casting. There are two main fertiliser options that can be considered for re-acidifying fairways and the like, namely iron sulphate or sulphur.

The following process is suggested:

- i. Soil test the fairways (0-25mm and 25 – 75mm deep samples) to assess your soil pH.
- ii. With iron sulphate:
 - a. Initially apply 25 – 40kg/ha in 700 – 900L of water in conjunction with rain during April when reliable rainfall is anticipated.
 - b. Follow up at 6-8 weekly intervals (May – August) using 10 – 15kg/ha of Iron sulphate.
- iii. Sulphur programmes are more risky and would typically involve 2 – 3 applications of wettable sulphur (for example: Kumulus DF 800gai) applied at 25kg/ha in 700-900L of water during April (with cool temperatures and reliable rainfall), June and August.

Caution:

Total annual sulphur rates of > 150kg Sulphur/ha (>187kg of an 80% sulphur formulation/ha/year) can be damaging to *Poa annua*. The use of sulphur on poor draining situations, particularly thatchy or sandy situations can increase the incidence/severity of Black layer. Applications of sulphur during hot or sunny conditions can result in burning/death of the turf.

Sanding

For sand facilities, research^{1,3} has shown that firstly:

- Heavy and regular applications (37.5mm/year) can suppress the severity of casting.
- In the absence of spraying for earthworms additional sanding is required to counter the effects of casting and maintain porosity (drainage) within the sand profile.

REFERENCES

1. Backman, P.A., Miltner, E.D., Stahnke, G.K., Cook, T. W (2002). *Worming your way out of a Turf Situation*. Green Section Record, July/August, pg 7-8.
2. Baker, S.W., Binns, P.J., Kirby, E.C. (1998). *Reduction in rates of earthworm casting on turf areas using carbendazim, carbaryl, gamma-HCH + thiophyrate methyl*. Journal of the Sports Turf Research Institute. Vol. 74, pg 25-39.
3. Gibbs, R.J. (2003). *Managing contamination of the sand carpet layer of slit drained sports fields*. Proceedings of the 2nd Sports Turf Conference and Trade Show. Pg 139-148.
4. Pennucci, A., Beever, R.E., & Laracy, E.P. (1990). *Dicarboximide – resistant strains of Microdocium nivale in New Zealand*. Australian Plant Pathology. Vol. 19.

If you have any further enquiries relating to this fact sheet, contact your local NZSTI agronomist, or NZSTI Head Office.

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