

Golf & Sports Turf

A U S T R A L I A

A New Biological Control Agent for the Turf Industry



IPM IN THE TURF INDUSTRY

Integrated Pest Management in the turf industry has been talked about for a few years now, and most Turf Managers are sympathetic to the principles of IPM, and the general aim of reducing pesticide use. Sympathy is all very well, but we still need access to the biological and non-pesticide products that would allow the industry to reduce its dependence on pesticides. Well now it's happening, and Turf Managers need to keep up to date with the new products as they come out. It's easier with pesticides - each one has to be trialled extensively to prove it works before it can be registered in Australia, so the efficacy data is clear and available. Not only that, but new pesticides usually have an expensive advertising campaign to launch them onto the turf market. And when you use a new pesticide, you can fairly quickly sum up whether the product has worked or not.

The non-pesticide chemicals and biological control agents that you might "wish to integrate into your pest management program are harder to learn about, Because they don't need registration, there is usually little (or no) objective trial data to go through. This

has led in some cases to over-inflated claims of the efficacy of some products. And because the products are often marketed by smaller companies with little experience in the turf market, you may not be able to access information on the products - or you may not believe the information you do get, as the company may not have an established reputation in the turf industry. And let's be frank some of the products might be little better than coloured water in a fancy container.

One product that has been trialled, with extremely convincing results, is the Entomopathogenic Nematode for control of Coleoptera pests. In this case we can provide a useful summary - the nematodes work, and the product is available now. If that's all you want to know, go straight to the last section on cost and availability of the product.

ENTOMOPATHOGENIC NEMATODES

There are various types of nematodes - some feed on plants, and create problems for Turf Managers. Other types, however, are beneficial because they feed on fungal pathogens, or on plant-parasitic nematodes, or on insect pests such as cockchafers and weevils. These are the types we want to encourage.

The research to identify and breed up insect-killing nematodes has been the life's work of Dr. Robin Bedding, Chief Research Entomologist with the CSIRO in Canberra. Dr. Bedding began his work over 20 years ago, initially looking for a biological control for the Sirex wasp larvae that attack pine trees. He isolated an extremely patho-genic nematode that was able to find and kill the wasp larvae. This was the first step. The second step involved developing a breeding and nutrition program for the nematode, so that millions of them could be reared in a laboratory (or factory) for commercial sale and application. In the early days the growth medium for the nematodes consisted of a broth made from blended chicken guts. Fortunately, the growth medium is now a little less offensive, It has been estimated that Dr. Bedding's work has saved Australia over \$4 billion!

Dr. Bedding's work moved from Sirex wasps and pine trees to insect pests of other plants - berries, and cane fruit, and other horticultural crops. Several species of Entomopathogenic Nematodes (entomo = insect, pathogenic = killing) have now been researched, so a wide range of insect pests can be targeted.





action - rather than applying widespread preventative pesticide applications to try to hit Coleoptera larvae when they are young, the application of the nematodes can wait until the problem is evident (eg: by bird activity). In fact the nematodes are most effective on 3rd instar larvae. If you leave a pesticide application till that late, your control

In turf, the main two insect pest orders are the Coleoptera (the beetles and weevils, including all the cockchafers, the billbugs and Stem Weevils) and the Lepidoptera (the cutworm and armyworm group). The nematode species for controlling the Coleoptera group of pests is *Heterorhabditis bacteriophora* - (pronounced hetero-rab-ditis), This is characterised as a 'cruiser' nematode, as the 0.5mm long juvenile nematodes go cruising in search of fresh victims in the soil. The nematode detects and hones in on carbon dioxide emissions and movement of the target pest larva, and enters via the mouth, anus or spiracles of the grub. Once inside, the nematode releases a symbiotic bacteria (*Photobacterium*) which multiplies inside the now dead grub, and the nematode feeds off the bacteria. The nematode numbers increase, and within a few days millions of new juvenile nematodes are released in search of new Coleoptera larvae.

Unlike the classic biological controls (eg: Calicivirus or Myxomatosis in rabbits, rust in blackberries, etc) the Entomopathogenic Nematode species Dr. Bedding has employed are very rapid in their action, but unfortunately shortlived in their residual activity. Being so lethal and quick, the nematodes can potentially kill off all the target pest larvae, which leaves none for the next generation. When all larvae have been destroyed, the nematodes themselves will die. This is the trade-off with this particular biological control organism - it is quick, very lethal, and has a wide host range, but on the negative side, there is probably no carryover for the following year, so if the pest comes back you have to buy more nematodes and re-treat the area.

OTHER POSITIVES

Of course there are other points on the positive side - the nematodes are harmless to off-target insect species (many of which are beneficial in the thatch layer), and to birds, wildlife and humans. No safety equipment is required during mixing or application.

Another benefit is the rapid curative

will be compromised (as the grubs are so big) and the potential for bird kill is high.

There are other species of Entomopathogenic Nematode for other pests. The nematode species *Steinernema carpocapsae* is recommended for the Lepidopterous pests such as cutworm, and two other *Steinernema* species can be used for Mole Crickets.

HOW DO YOU APPLY THE NEMATODES?

The Entomopathogenic Nematodes are being marketed by Mr. Michael O'Dea, of Greenem Biological Control in Melbourne. Michael is a commercial gerbera grower, and has been successfully using the nematodes to control insect pests in his gerbera greenhouses. Greenem markets the nematode species separately, as Greenem Turf 1 (for cockchafers and other Coleopterous insects) and Greenem Turf 2 (mainly for the Lepidopterous insect pests).

Following identification of the insect pest and a discussion on the correct nematode product to use, Greenem will deliver a living culture of nematodes ready for use. The nematodes can be seen easily with a hand lens, swimming around the container. The product should be used as soon as possible - it is best applied late in the day, as the nematodes are sensitive to UV light and dessication. A pre-irrigation would help, and a high volume application (greater than 800 litres/ha) is required, with continuous agitation of the mix. This can be achieved using large nozzles on a boom spray, and the nematodes should survive a spray pressure up to 500 kPa. Water injection equipment has been tried, but the pressure was too high and killed the nematodes. Once applied, irrigation should follow up to help move the nematodes into the thatch and soil.

HOW EFFECTIVE ARE THEY?

Although several Turf Managers have used the nematodes with good success, the most compelling evidence comes from the trial work conducted by Dr. Bedding with David Nickson, Superintendent at Peninsula Golf and Country Club, near



Melbourne. After hearing about Dr. Bedding's work, David travelled to Canberra to talk to him and organise a trial on an outbreak of African Black Beetle (*Heteronychus arator*) at Peninsula.

The trial commenced in February, 1999. Four days after application of the nematodes, there was already a substantial death rate of the pest (around 66%). By Day 14, the death rate averaged 95%, compared to the control plots where the beetle larvae were still healthy and active. Later sampling failed to find any surviving larvae in the plots treated with either the standard rate or half the standard rate.

COST AND RATES

The standard rate of application is 500,000 nematodes per square metre, which can be achieved using one container per 250 square metres (at a cost of \$40 per 250 square metres, or \$1,600 per hectare). The Peninsula trial showed just as good a result at half that rate, so the potential is there for future rate trials to determine if lower rates can give similar levels of control.

CONCLUSION

Although the proliferation of new products over the past couple of years creates a headache for a busy Turf Manager, we should be grateful that at last we can do something about IPM and reducing pesticide use, rather than just talk about it.

The recent release of Biogreen (the *Metarhizium* fungus released for the biological control of Red Headed Cockchafers) and *Trichoderma* (for suppression of fungal diseases) are important steps forward, and the release of the Greenem Turf products is another major milestone. It's now up to the industry to put these products to use, and enhance our reputation as proactive and environmentally aware land managers.

For further information on the products, contact Michael O'Dea of Greenem on (03) 9756 6997, or email greenem@netlink.com.au, or visit the web site www.greenem.com.au.

For further information on entomopathogenic nematodes in turf, the web site run by Randy Gaugler at Rutgers University is worth a Look, at www.rci.rutgers.edu/gaugler/nemalab