Beating the Ban (and Turfgrass Pests) With Research Into Environmentally-Friendly Products

Michael Brownbridge, Vineland Research & Innovation Centre and
Pam Charbonneau, Ontario Ministry of Agriculture, Food & Rural Affairs

April 22, 2009. Overnight, Ontario's Cosmetic Pesticides Ban removed over 250 products that had previously been used to control insects, weeds and diseases in the urban environment, leaving the general public and landscaping community with few proven pest management tools for lawns and home gardens.

OTS HIGHLIGHT
Presented February in Guelph, Ontario.

For lawn care companies, practices have had to change radically. With the ban, all the old quick fixes are gone, and more than ever the emphasis has to be on production of a healthy lawn as the first line of defence, and to shift from curative to preventative approaches. In the past, relatively inexpensive broad-spectrum, persistent insect and weed control products were often applied prophylactically, whether they were needed or not. In order to achieve good insect control today, effective new products are needed, combined with appropriate knowledge on how to use them.

The ban created a real urgency to develop alternative pest management tools, particularly biopesticides (based on naturally-occurring microorganisms, nematodes and plant-derived products) for the major pests that threaten Ontario lawns. Most biopesticides have a low risk profile and while the present focus is on the use of these materials by landscapers and lawn care specialists, it is likely that some may

be successfully transitioned for future use on amenity and sports turf, and in larger operations such as sod farms.

Target Pests

The main research targets include 'white grubs,' European chafer and Japanese beetle, and hairy chinch bug. European chafer is predominant in most of southern Ontario, while the Japanese beetle is a more recent arrival, now established in the Niagara Peninsula and spreading west, and may even be displacing European chafer as the dominant pest in some areas. Larvae of these insects preferentially feed on organic matter and the fibrous roots of turf grasses and damage usually becomes apparent in late summer/early fall or early spring. The hairy chinch bug feeds at the base of the grass stem rather than the roots. Damage primarily occurs when grasses are water-stressed and temperatures at their highest in late July/August, coinciding with adult feeding activity. Secondary pests such as leatherjackets and sod webworms appear to be increasingly common. These insects were likely kept in check by materials (now banned) previously used to control grubs.

Main. Chinch bug feeding damage on an Ontario lawn. **Adjacent Left.** Late stage European chafer (Rhizotrogus majalis) larva, a very hungry grass root feeder. **Adjacent Right.** A white grub infected and killed by the fungus Metarhizium anisopliae.

Encouraging results were obtained in summer/fall 2010 field trials where nematodes, fungi and two natural products have been tested against European chafer and chinch bug.

Natural Solutions For Insect Control

Both grubs and chinch bugs are often naturally-infected with fungi and nematodes. How can we use these beneficial organisms to our advantage and develop them into products that can be readily produced and applied? Research is focusing on these biocontrol agents and other natural products and ways of reliably and cost-effectively using them to control turf pests. The work is supported in part by organizations such as the Ontario Turfgrass Research Foundation, Landscape Ontario, Agriculture and Agrifood Canada through its AgriScience Research Cluster Program, the CUPRI Program, companies involved in the production and sale of biopesticides and private lawncare companies.

A number of approaches are being taken, including the search for and testing of novel strains of fungi and nematodes that may be better suited to work in Ontario's cooler soils. So far, several of these microbial biocontrol agents have been recovered from field-collected insects and are being tested in lab/greenhouse studies to allow those best suited to further investigation and development to be identified. Most of our work is presently focusing on existing control agents to provide users with options in the near term. Although some of these have been available for some time, considerable improvements are needed to devise robust use practices to enable their use in a novel environment and to develop 'best use' practices for their application, either alone or in combination with another control agent, in order to maximize control over a range of conditions in the most cost-effective manner. As living control agents, as with any other living organism, they have to be produced, formulated, stored, handled and applied correctly to maintain viability and achieve maximum efficacy.

Nematodes, fungi and two natural products have been tested against European chafer and chinch bug. Research still has some way to go, but encouraging results were obtained in field trials carried out in summer/fall 2010, where various products, formulations and application techniques were tested. The nematode *Heterorhabditis bacteriophora* (Hb) is currently recommended for chafer control in Canada; a second species, *Steinernema glaseri* is a new addition to the bio-arsenal for 2011. For both species, timing of application is critical to their successful use. Soil temperature (ideally around 12 to 15 degrees), insect age and location in the soil all influence efficacy. The fungus *Metarhizium anisopliae* is already registered in Canada for use against black vine weevil in nursery crops. We are assessing its potential utility for both chinch bug and chafer grubs

and its use together with nematodes. One of the plant-derived products included in our trials is an all-natural organic fertilizer which, in addition to other plant-derived ingredients, also contains neem seed cake. The product functions as a bio-fertilizer and a pre-emergent herbicide; the neem component may also have an impact against some insects, so this product could provide multiple benefits.

Results From Field Trials

Results of the lab and greenhouse trials against chafer grubs showed that they were susceptibile to the microbial biocontrol agents and clearly demonstrated the influence of temperature on performance. In the field trials, treatments were applied in late September when the grubs were older, harder to control and residing lower in the soil profile where they are more difficult to contact. Soil temperatures were also decreasing. All of these factors can result in reduced susceptibility to control agents; however despite the fact that this timing was not ideal, observed downward population trends in plots treated with the Hb nematode, *Metarhizium anisopliae* and biofertilizer were on par with or slightly better than those obtained with the standard insecticide, Merit. It is likely that efficacy can be improved considerably with better formulations, improved application techniques and better timing. Trials planned for 2011 will encompass some of these improvements and will include additional experimental products.

What about chinch bug? A similar suite of microbial and botanical products were included in tests against damaging natural infestations of the pest which were detected in late July/August 2010. Given the high temperatures and dry conditions experienced at that time, results were very encouraging. While results were not conclusive from a statistical standpoint due to uneven distribution of the chinch bug populations, the trials have provided us with some excellent lead candidates for testing in 2011. These include a *Metarhizium anisopliae* spray and the nematode *Steinernema carpocapsae*, particularly when used together with a botanical wetting agent. An essential oil product also provided excellent knock-down of the bugs and may be an ideal partner with a biological, the combination providing rapid knockdown and extended control.

The Final Word

The primary goal of the current project is to provide functional biopesticides to control chinch bugs and European chafer in lawn turf. Field trials have allowed effective candidate organisms to be identified for field validation studies. The project will, in the near term, deliver new pest control tools and techniques to homeowners, lawn care and turf professionals that successfully mitigate turf pests in a cost-effective and environmentally-benign manner. Applications of some of these technologies seem likely to extend into other turf sectors, particularly in high-traffic grassed areas such as recreational and sports fields as legislation and the general public drive change towards the use of sustainable 'green' products.


Researchers chasing chinch.

Acknowledgements. The support of the following individuals and funding agencies is gratefully acknowledged: Taro Saito, Paul Côté, Pat Schenck, Richard Reed, the Ontario Turfgrass Research Foundation, Landscape Ontario, the CUPRI Program, The Agriculture Adaptation Council, Canadian Ornamental Horticulture Research Cluster (AAFC).