Are biological controls in your future?

Research has improved our ability to use biological controls to manage pests. Landscape managers and golf superintendents have more options than ever for pest control, and the next decade will undoubtedly bring new ones.

By: R. L. BRANDENBURG, PH.D., North Carolina State University

Biological control agents are often quite sensitive to environmental conditions and like their conventional counterparts may be less effective in providing acceptable control of soil insect pests.

With so much talk these days about the next millennium and predictions or changes we can expect, one can't help but wonder what awaits the Green Industry. Numerous changes will occur in the next few years and hopefully many of them will be technological advances that help us do our job better, more economically, and more efficiently. Most likely, however, many of these changes will be spawned by new or modified regulations that affect our industry.

Regulations on the turfgrass industry encompass many areas including labor and worker protection standards and, in some areas, noise regulations. Some of the most prevalent regulations, on both state and federal levels, involve pesticide use. These regulations have a dramatic impact on which pesticides we have available for us and how we use them. As a general rule, the regulation of a pesticide benefits us all, although sometimes many question how regulations are conceived.

In light of these regulations and consumer demand for pest management strategies other than conventional pesticides, biological control has gained popularity. During the past few years, research has improved our ability to use biological control to manage all types of pests. Some companies have sought to take advantage of new effective products and a growing market.

Bio-control of turfgrass insect pests

Since my expertise focuses on the management of insect pests of turfgrass, I will stick with that topic in this article. However, keep in mind that the concepts behind biological control are similar for other pests in other settings and the progress in developing similar products for other pest types has been successful and shows promise for the future.

Biological control in turfgrass is not a new concept. One of the earliest uses was the application of milky spore. These bacteria, *Bacillus popilliae*, were first used many years ago for control of Japanese beetle grubs. This was a naturally-occurring bacterial disease of the Japanese beetle white grub that could be grown in grubs in the laboratory and the spores harvested. These spores could then be packaged and sold as a biological control of this species of white grub.

Milky spore availability is limited, but has become more common.

While milky spore has been used for many years and many testimonials have been given as to its long-term suppression of grubs, its availability today is still quite limited. The product is also limited in that its greatest effectiveness, at least as shown by laboratory studies, is against the Japanese beetle grub, although some other species appear to have some susceptibility to this disease. While its use has declined, this is an example of an early biological control product successfully commercialized and used in the landscape industry.

More recently, the use of another bacteria, *Bacillus thuringiensis* (B.t.) has become more common in both agriculture and turfgrass management. There are various strains of B.t. and each strain varies in their effectiveness against different insects. In turfgrass, most strains are directed against

many of the various caterpillars that feed on turf. B.t. was first discovered in Japan in 1901 and has been researched extensively. The bacteria actually produce a protein crystal that is toxic. These bacteria must be ingested by the insect and the toxin attacks the gut lining. New technology has permitted the actual production and encapsulation of the toxic crystal to further improve the effectiveness of many products.

These products usually don't kill the insect immediately, and have short residual activity, a trait common to many biological control products, but feeding and damage usually decrease soon after treatment. This slower activity is frustrating to some landscape managers, but again it is important to understand that the key element, plant damage, does slow soon after application.

Endophytes reduce feeding

A somewhat different concept of "biological" control is the use of endophytes. Endophytes are fungi that reside within the turfgrass plant and can significantly reduce insect feeding. These endophytes are found in some commercial cool-season turfgrass varieties of perennial ryegrass, tall fescue, and fine fescue and will be indicated on the seed label. Endophytic cultivars reduce above-ground pests such as chinch bugs, green bugs, sod webworm and cutworms, but little effect is observed on below-ground soil pests.

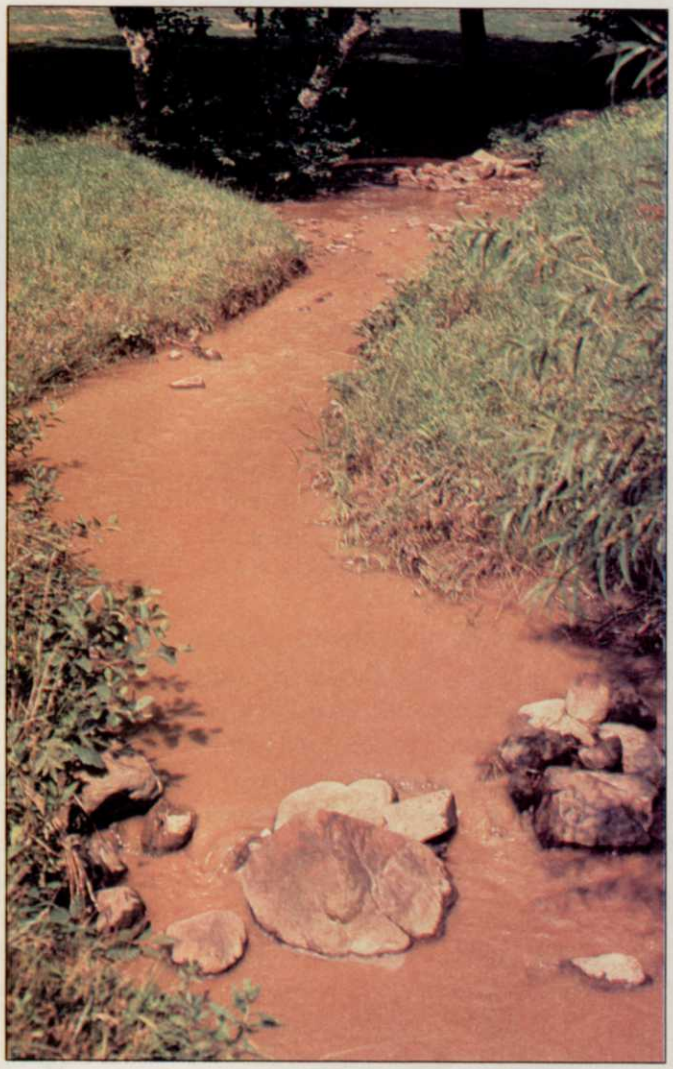
Nematodes, pathogens

Two types of biological control that have received a lot of commercial attention in recent years include entomyogenous nematodes and fungal pathogens such as *Beauveria bassiana*. Fungal pathogens are quite common in nature and their commercial use has been limited our ability to produce large quantities of a high quality product for a reasonable price. Now, however, at least two companies are producing a *B. bassiana* product and one company, Troy Bioscience, has a product labelled for turf use. Many above and below ground pests are listed on the label and a lot of independent testing is underway on this product. Like many biological materials that are very sensitive to the environment, the ultimate level of control obtained will likely depend upon environmental conditions which favor its performance.

The production of various entomogenous nematode products has been limited in the past two years. Problems with production, shelf life, formulations, and the consistency of results seem to plague this approach to pest management. The concept of using such nematodes is still a good one. The nematodes themselves don't actually kill the insects, but rather death is caused by a bacteria the nematodes introduce when they invade the insects' body. Several companies are aggressively pursuing the development of new strains and formulations of nematodes that may serve us quite well in the near future.

Oils, spinosads

Natural products, while not true biological controls, have also received attention of late. One of the original products, azadirachtin, the oil from the neem tree, acts as a growth regulator that disrupts normal insect development. It has been marketed under a number of trade names including Azactin® and Turplex®. A more recent addition of a natural type of product is the insecticide Dow Agroscience called Conserve SC®. This is the first insecticide in the spinosad family which is derived from a naturally-occurring soil organism. This product has a novel mode of action and works by ingestion or contact against caterpillars. Conserve must be applied against small worms and is being used commercially with good success.



Conventional pesticides pose little threat to our environment, when used properly in the landscape; however, in combination with soil erosion can cause negative environmental consequences.

Technological advances are enabling scientists to synthetically produce the active ingredient in many of these natural controls found in nature. In addition, bio-technology is allowing genetic engineering to be used as a tool to genetically incorporate some toxins directly into the turf plant. The future of pest management in turfgrass never looked brighter or more exciting. **LM**

Brandenburg is a turfgrass entomologist at North Carolina State University.