A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

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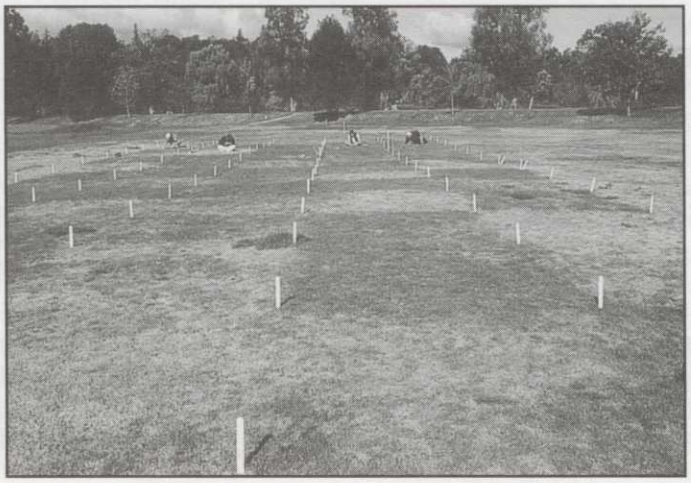
Dr. Patricia J. Vittum, University of Massachusetts

Turf managers in the 1990s have had to change the way they do business. The rising cost of labor has forced managers to develop highly efficient means to get the job done - for example, installing a computerized irrigation system or trimming trees to ease mowing patterns. Many people seem to perceive pesticides as unnecessary poisons and challenge pesticide applications, particularly on turfgrass. At the same time, golfers continue to demand faster and faster putting greens, perfect lies on all the fairways, and beautifully contoured landscapes. A turf manager cannot survive being a "jack of all trades" anymore, but instead must be a "master of all". That manager must use all the training and intuitional skills possible to provide the kinds of conditions expected. This article will focus on insect and insecticide issues, however many of the concepts mentioned here are also equally valid for weed, disease or nutrient management.

Scouting and Setting Tolerance Levels

Scouting an insect population has become more important for a number of reasons. Pesticide regulations are becoming increasingly restrictive, at the federal, state, and local level, and turf professionals must be able to document the need to apply insecticides. The days of "spray and pray" are gone, and rightfully so. Now a turf manager must know how to monitor insect activity - the appropriate technique, the right time to start looking, and where the trouble spots are likely to show up first.



Replicated plots for grub control at Stockbridge, MA. Photo by P. Vittum.

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Editor
Terry McIver
440-891-2709; 440-891-2675 (fax)
turfgrasstrends@advanstar.com

Production Manager
Karen Lenzen
218-723-9129; 218-723-9576 (fax)
klenzen@advanstar.com

Circulation Manager
Frank Christopherson
218-723-9271

Layout & Production
Bruce F. Shank, BioCOM
805-274-0321

Group Editor
Vern Henry

Group Publisher
John D. Payne
440-891-2786; 440-891-2675 (fax)
jpayne@advanstar.com

Corporate Office
7500 Old Oak Blvd.
Cleveland, OH 44130-3369

Editorial Office
7500 Old Oak Blvd.
Cleveland, OH 44130

Abstracts: 800-466-8443
Reprint: 440-891-2744
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Articles abound describing scouting techniques. The astute manager realizes scouting and setting tolerance levels are critical to any IPM program. Key pests are those which show up regularly and cause significant damage almost every year if left unmanaged. Key locations are those trouble spots where pest activity first becomes evident, providing an indication that pests are reaching a damaging stage. Often a golf course will have two or three "problem greens" - where a disease shows up as much as a week before it shows up anywhere else. Or there may be a fairway with a south facing slope that succumbs to insect activity a week earlier than other areas. These would be examples of key locations (Hellman 1995).

Scouting includes accurate identification of insect problems and an assessment of population levels. The trickier part is determining tolerance levels - how many grubs (or mole crickets or cutworms) can be tolerated before the golfer (or customer or owner) complains? These thresholds vary from site to site, and even within a golf course or condominium complex. However, guidelines can be established that enable a turf manager to determine when insecticide applications or other management strategies are NOT necessary. Furthermore, state regulatory agencies are under pressure from the federal government to regulate pesticides that have the potential to contaminate groundwater. Each state has been developing "best management practices" or other kinds of approaches, many of which mandate the implementation of IPM programs before any sensitive pesticides can be applied. Most of those strategies involve the establishment of tolerance levels and documentation that those levels have been (or will be) exceeded before a pesticide is used.

Stress Management

Much of turf management can be summarized as a form of stress management. Schumann et al. (1997) refer to IPM as "Intelligent Plant Management". In other words, providing the optimum growing conditions for turfgrass often allows it to outgrow damage caused by insects or to outcompete germinating weed seeds. So current turf management strategies emphasize providing ideal agronomic conditions. Some techniques that have been developed for production agriculture are being adapted for use in turf - for example, plant tissue analysis to determine fertility needs, precision applications of fertilizers (taking "spoon feeding" to another level), slow and quick release fertilizers meeting every imaginable need, pesticide formulation chemistry, amendments to alter soil profiles, new drainage designs to solve even the most challenging problems.

These techniques are not just "bells and whistles", but are critical pieces of an IPM program. Now one of the biggest unmet challenges is to convince golfers to allow their superintendents to raise the mowing height - but that is another topic unto itself!

New Pests and Problems

Recent surveys and reports indicate that the distribution of white grubs is changing in the Northeast. The European chafer is much more widespread than had previously been noted, and is found throughout much of eastern Massachusetts and eastern New York, as well as in Michigan and along the north shore of Ohio. This insect is more damaging than most other grub species, in part because it tolerates cooler soil temperatures and returns to the root zone to feed in the spring earlier than other species. It also remains in the root zone longer in the fall. In addition it is less vulnerable to insecticides than most other species, in part because it is a larger grub.

The oriental beetle is more widely distributed throughout New England than was previously believed. It is found throughout the Connecticut River valley and most of southeastern Massachusetts, as well as Rhode Island and Connecticut. Long Islanders have long known they had the pest to deal with, but now their neighbors to the north are discovering the challenges of dealing with oriental beetles.

There is some evidence that asiatic gar-

den beetle populations may be increasing in parts of the Northeast. One theory is that the species might be less vulnerable to imidacloprid (Merit™). WhenMerit™ is used, populations of many grub species are reduced significantly, but if asiatic garden beetles are less vulnerable, they could expand into areas where they could not compete previously. (Note that this is still a theory but certainly does provide one plausible explanation for the increase in asiatic garden beetles observed recently.)

New buffalograss cultivars have been developed for use in a variety of settings in the Great Plains and are being used in more fine turf settings. As buffalograss use increases, insect pests are becoming increasingly apparent. For example, there is a species of chinchbug that specializes on buffalograss that can cause significant damage. While buffalograss is very well adapted to conditions in the Central Plains, there are other turfgrass species and cultivars that are being used in areas well outside their natural range - for example, bentgrass in the Southeast, zoysiagrass in the Northeast. We can expect grasses in these situations to be under agronomic stresses and to sustain more insect damage than some of the better adapted grasses growing in the area.

While billbugs probably cannot be classified as "new" pests, they are perhaps the most misdiagnosed turf insect problem in many parts of the cool season turfgrass range. They do not usually cause visible damage on golf courses, but they are present in a variety of settings from golf course roughs and fairways to home lawns, athletic fields, and cemeteries. Unfortunately the damage caused by billbugs closely resembles drought stress and occurs when drought stress is most likely to occur (July and August in cool season turfgrass), so some turf managers assume their turf is succumbing to drought when, in fact, an insect might be the culprit. This is a perfect example of the value of monitoring - when drought conditions begin to develop, take a close look and determine whether anything else might be going on.

To add to the confusion, there are several species of billbugs that can occur in a given area. While the bluegrass billbug is the most common species throughout much of the cool season turf zone, there are other species that have similar life stages and cause similar damage. However, the life cycle for each varies a bit, and detailed information is lacking. Monitoring for adult activity in the spring, using pitfall traps, is an ideal way to establish the presence (or absence) of billbugs before it is too late to take action.

Turf and landscape managers may not have as sympathetic an ear "on the Hill" as lobbyists representing various environmental groups.

Pesticide Issues

Food Quality Protection Act. The federal government passed the Food Quality Protection Act (FQPA) unanimously in 1996. One of the driving forces in this act was to address the controversies which had been swirling around the Delaney Clause, a 1958 amendment to a federal law which greatly restricted (and generally prohibited) the use on processed food of any pesticide that had been shown to cause cancer in laboratory animals. The Delaney Clause used a "zero tolerance" approach which was workable in the 1950s, when laboratories could only detect chemicals at "parts per thouand" or occasionally "parts per million". However, laboratory detection techniques have improved tremendously and now laboratories can detect materials at "parts per trillion" or even smaller amounts. The language of the amendment, however, said if ANY of the material could be found (regardless of the dose that was necessary to generate an increased incidence of cancer in test animals), the residues on food crops would be greatly reduced or use would be prohibited outright.

The agricultural industry lobbied for a relaxation of the Delaney Clause while people representing various environmental groups lobbied for retention of the clause. The Food Quality Protection Act was the result of considerable debate and haggling.

In essence, it replaces the "zero tolerance" with language that allows use patterns with "virtually no chance of increased harm" from cancer or other unintended and undesirable side effects of pesticide use.

Under the auspices of FQPA, the government is reviewing the registrations of all pesticides during the next ten years, and reassessing their status. All possible methods of exposure are being quantified as accurately as possible - such things as unintended exposures from drift from agricultural applications, exposures in restaurants or hospitals, legal residues on food products, and applications to turf. Whenever there is insufficient information available, the government takes a conservative approach. For example, if a label permits four applications of a product per year, each at a rate of 2 to 4 pounds active ingredient per acre, the government assumes that four applications are made, each at the highest allowable rate.

All products that have a similar mode of action are being assessed together, and a "risk cup" analysis is conducted, determining the level of total exposure an average person should be able to tolerate (based on daily exposure for 70 years) with no increased probability of harm. While the intent of the law is good, the logistics are nightmarish. The bottom line for turf managers is that the government feels the "risk cup" for organophosphates and carbamates is already full or nearly full, and companies marketing such products will be deciding how to decrease the "exposures". Some of their options include reducing application rates or frequency, removing sites from the label, or voluntarily withdrawing their registrations.

Turf managers must target their information providing efforts at 80% of the people who are neither proponents or opponents of pesticides.

While it is still too early to tell just what will happen with the "risk cup" analyses, some people in the federal government and elsewhere believe that an unstated intent of FQPA is to eliminate many uses of the organophosphates and carbamates. If this happens, turf managers will have to make some major adjustments. Imagine maintaining turfgrass without chlorpyrifos (Dursban™) for cutworms and webworms, or acephate (Orthene™) for mole cricket baits, or isofenphos (Oftanol™) or bendiocarb (Turcam™) for grubs. And we would lose trichloron (Proxol™, Dylox™), one of the best spot treatment materials available.

So keep an eye on developments with FQPA. Several members of the House of Representatives Agriculture Committee have expressed concern that the EPA's interpretations of the wording have been much more conservative than they had intended and that further development in this direction could have grave impact on production agriculture. But turf and landscape managers might not have as sympathetic an ear "on the Hill" - where other lobbyists representing various environmental groups are equally adament that the conservative estimates should be continued or even expanded.

Public Perceptions of Pesticides. The "10 - 80 -10" rule seems to hold true for human attitudes toward pesticides - 10 percent of the population actively supports pesticide use, 10 percent adamently opposes their use in virtually any guise, and 80 percent falls somewhere in between. Those who oppose pesticides often articulate well and generate enough public support to convince legislators to pass legislation that restricts pesticide use based on public perception issues rather than data generated from laboratory and field tests. Human interest stories - for example, the plight of chemically sensitive individuals, exposure of migrant workers to pesticides, or the effect of pesticides on children - invariably catch the attention of the media.

In my opinion, much of the "negative" press that seems to surround pesticide issues stems from a lack of understanding of the total picture. Production agriculture in the United States depends on pesticide use to maintain the current level of productivity. Major changes in pesticide use patterns almost certainly would result in losses of yield and require that additional land be used for production agriculture. Much of the prime agricultural land is already being

used for agriculture, so that expansion would be into marginal land.

Turf managers must continue to search for ways to educate the public - their own golfing membership, neighbors, health officials in the local community, and state and federal legislators. If we can target our efforts at the 80% of the people who are somewhere in the middle, and can provide information that addresses some of the most frequently asked questions, perhaps we can make progress and convince people that pesticides, properly used, are a critical tool in turf management as well as production agriculture, and that our quality of life generally is enhanced by proper use of pesticides. At the same time, we must support aggressive enforcement of pesticide regulations, ensuring that those who fail for respect pesticides pay a heavy penalty.

Emphasis on Reducing Pesticide Use. As a result of new federal legislation and, in many cases, state regulations, many turf managers are looking for ways to reduce pesticide use, either by reducing the number of applications or the area treated or finding non-chemical alternatives. Some of the impetus for this "change" comes from the general public and their misunderstanding or mistrust of pesticides. Regardless of the source, new (or retooled) techniques and options have been developed recently that should be considered.

Global Positioning Systems and Other Precision Mapping. "Global Positioning Systems" take advantage of technology that was developed originally by the United States military. A radio-like device sends a signal to satellites overhead and senses the reflection of that signal. A computer chip then calculates the precise location based on the time it took the signal to travel to the satellite and bounce back and on the location of the satellites. While military versions are incredibly precise, commercial versions can pinpoint locations within a few feet.

Other mapping techniques, such as aerial photography using infrared-sensitive film and "Geographical Information Systems", can be used to identify soil types and conditions (drainage patterns, localized dry spots, diseased turf). Computer-generated maps can be developed that indicate nutritional needs (based on leaf tissue analysis) or insect trouble spots (based on scouting the area and marking areas with heaviest populations).

The technology now exists to incorporate the information from these maps with the Global Positioning System, and set up a locating sensor on a spray rig. As the operator drives the rig, the computer determines where an application is needed and the GPS determines when the rig is at the designated location and turns on the sprayer only at those locations. This technology is being used in production agriculture and was demonstrated at turf trade shows this winter. Some readers might view this approach as a loss of control for the turf manager, but it does have potential in the turf market. If the information provided to the system is accurate, it will provide an outstanding means to minimize pesticide or fertilizer applications. Of course if the input is inaccurate, the results will be less than pleasing.

At the same time, we must support aggressive enforcement of pesticide regulations, ensuring that those who fail to respect pesticides pay a heavy penalty.

Sub-surface Applications. There are several ways a turf manager can apply insecticides beneath the surface of the turf, including high pressure liquid injection and slicing. The slicing approach can be used to drop granules into a slit (not unlike a slicer-seeder) or liquids at very low pressures. The technology has been refined over the past five years, and is used widely for the application of fipronil (Chipco Choice™) and other materials against mole crickets in the Southeast. Field research has also documented that the approach works very well against white grubs, but it has not been as widely embraced by the industry.

As turf managers come under increasing pressure to reduce pesticide use or exposure, sub-surface applications may become more popular. Our field trials indicate that sub-surface applications reduce surface exposures at least 50 percent in many cases (at least in cool season grasses) and greatly reduce the risk of unintended drift. Meanwhile when targeting white grubs and using sub-surface application technology, some active ingredients can be applied at less than

the labelled rate without a loss in efficacy. While some of the "new" insecticides are highly effective against grubs and do not need to be applied below the surface, the technology still provides benefits that should not be overlooked.

Emphasis on non-chemical approaches. There are several cultural or biological control alternatives that are available for use in turfgrass, including such things as endophytic cultivars, entomopathogenic nematodes, and various strains of *Bacillus thuringiensis*. All of these have been addressed in some detail in previous articles in ***TurfGrass Trends***, and will not be discussed here. However, turf managers should note that manufacturers of the various biological control agents continue to refine their production and formulation techniques, and the reliability of these products should continue to improve with time.

New Insecticide Chemistry

Merit™ - While imidacloprid (Merit™) can no longer be considered a "new" compound, its appearance on the turf market has changed many aspects of turf management. This material is much slower acting and longer lasting than any turf insecticides we have had since the mid 1970s, when chlordane was available for use against white grubs. Many turf managers apply Merit™ in the spring (for black turfgrass ataenius or other spring-active insects) and expect season long-control, including white grubs that appear the following August. Such a use pattern sometimes results in less emphasis on monitoring insect activity, and some turf managers have encountered unpleasant surprises - for example, an unusual insect problem that gets established because a turf manager has let down his or her guard and has not been scouting regularly. In any case, Merit™ has become a mainstay for many turf managers, and has many favorable characteristics, including lower toxicity to humans than some of the "standard" insecticides that have been used over the years.

Mach 2™ - Halofenozide (Mach 2™) is another exciting new compound, with a very different mode of action. This material is a "molt accelerating compound", and induces an immature insect to molt before it has sufficient reserves to survive the process. The molt is aborted midstream and the insect does not survive. One of the attractions of the material is that it is much less toxic to humans and other vertebrates because vertebrates don't molt! While the compound received federal registration in late summer 1997, it is still awaiting registration in some states (as of May 1998).

The material should be applied before the target insect has reached intermediate larval stages, and can be applied at the time eggs are being laid. The company (RohMid™, which was formed solely to market the product) indicates white grub treatments can be made as early as June, but our field data suggest July and early August applications are preferable. Other researchers have documented that Mach 2™ can be effective against black cutworms, especially when the cutworms are small at the time of application.

Turf management has changed drastically in the past several years, with increased expectations and different tools. While some traditional insecticides may become less appropriate or less available, other options are being developed. The successful turf manager will have to make a conscious effort to stay informed abou;t the changes as they occur, and to implement the new strategies as they become available.

Dr. Patricia J. Vittum is associate professor in the Department of Entomology, University of Massachusetts, Amherst, MA

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