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SPECIAL REPORT:

INSECT CONTROL GUIDE

Attacking Insects Before They Attack Turf and Ornamentals

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ALA

JULY 1988
VOLUME 9, NUMBER 7

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ALA INSECT CONTROL GUIDE

DEPARTMENTS

COVER

This month's cover story examines the identification and control of insect pests in turf and ornamentals. This special section features a series of reports including information on biological control methods and building plant health. A gypsy moth larva is pictured on the cover.

ALA (USPS 657-470 ISSN 0744-0545) is published 12 times per year. One year subscription rates: $23.00 in the United States, $26.00 in Canada, and $72.00 in other foreign countries. One year foreign airmail rate: $172.00. Two year subscription rate: $31.00. Subscriptions and classified advertising should be addressed to the Cleveland office. Second class postage paid at Cleveland, Ohio and additional mailing offices. Postmaster: Return Form 3579 to ALA, 4012 Bridge Avenue, Cleveland, Ohio 44113.

INSIDE STORY

Insect populations have their ups and downs. If you look at one area one year, pest damage can be worse than a neighboring area. Then the next year, that same area may show no signs of the previous year's havoc.

Despite the comings and goings of these pests, entomologists generally agree that new species, not new insects, are what's plaguing turf and ornamentals and remains a constant challenge to researchers.

It's an exhaustive subject to tackle, but in this month's issue of *ALA* we're bringing you a special insect guide designed to help new LCOs better identify pests attacking turf and ornamentals, and perhaps to give a review to more knowledgeable LCOs. The guide begins on page 14.

In recent years, a number of industry researchers have concentrated on finding biological control methods as alternatives to insecticides. This research has actually been going on for decades, but just recently gained the spotlight because of an increased national interest in pesticide usage.

As a result, the use of insect parasitic nematodes appears to be on the verge of

breaking into the commercial industry for control of insect pests. These nematodes, which don't damage plants, have the ability to quickly control existing insect pests and to reproduce in great quantities within the doomed insect. They then have the ability to survive in the soil while searching out their next victim.

About a half dozen companies are currently marketing these nematodes in the United States and Canada, but mainly to the consumer. However, Biosys, a California-based research company, said it hopes to make its nematode product available to the commercial industry by 1990.

Still, with only limited success in biological control methods, leading entomologists continue their search for newer and more effective pesticides. In addition, more attention is being directed toward employee training, education and better identification of insect pests.

Although identification is now better than ever, according to researchers, there's still room for improvement. To accomplish this task, take advantage of local entomologists, county extension agents, university field days and association conferences. Once a pest is accurately identified, file the information away for future use. ■

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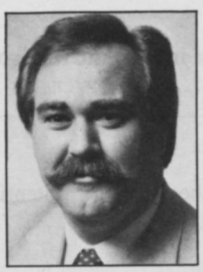

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Dr. John Street is an associate professor in the agronomy department at The Ohio State University. **Dr. William Meyer** is president of Pure-Seed Testing Inc., Hubbard, Oregon. **Des Rice** is president of The Weed Man Ltd., Mississauga, Ontario, Canada. **Dr. Al Turgeon** is professor and head of the department of agronomy, Pennsylvania State University. **Dr. Joseph Vargas** is professor of botany and plant pathology, Michigan State University, East Lansing, Michigan. **Dr. Patricia Vittum** is associate professor of entomology, University of Massachusetts, Waltham, Massachusetts.

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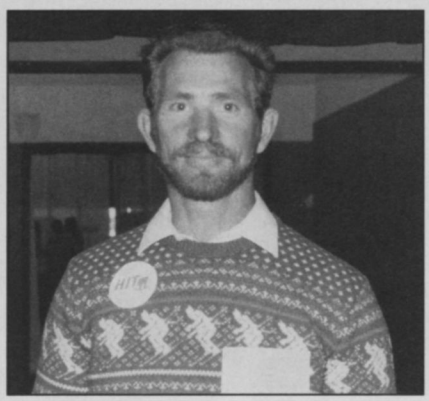
VIEWS ACROSS THE INDUSTRY

IS GROUND WATER CONTAMINATION A PROBLEM IN YOUR AREA?

"I think safe use of pesticides and insecticides is of major importance. Proper application techniques will curtail a lot of ground water contamination from pesticides. The industry is regulated such that proper application and mixed rates are a necessity, so I don't feel that it's a problem here. As long as our department of Health and Rehabilitative Services keeps tight control over applicators, then I think there won't be a problem." *Ben Marshall, Turf Care Inc., New Port Richey, Florida*



"In some areas it's a problem. I believe that more tests should be done. All the wells that we have are owned by the city, so I think it would be a matter of testing the water. I don't think that the amount of pesticides Daly City uses would be enough to cause problems, but if you consider that, along with private use, there's certainly a potential. Restrictions are much tighter on professionals than homeowners." *William Roser, Dept. of Parks and Recreation, Daly City, California*

"No it's not a real problem for us. We've had very few instances, that I'm aware of, of anybody questioning our use of pesticides. To prevent problems, applicators need to be prepared if something happens. They need to have the equipment available to keep it from leaching somewhere. There again too, particularly in Ohio, the lawn care industry uses a very minute portion of these chemicals as compared to the farmers." — *Shawn Purcell, Executive Lawn Care Inc., Columbus, Ohio* ■

CALENDAR

July 19-20
Athletic Facilities Maintenance Management Seminar, co-sponsored by the city of Lenoir, N.C. and Porter Brothers Inc., Mulberry Street Recreation Center, Lenoir, N.C. Contact: Professional Grounds Management Society, 12 Galloway Ave., Ste. 1E, Cockeysville, Md. 21030; 301/667-1833.

July 25-27
EXPO 88, Louisville, Ky. Contact: Mary Jane Reynolds, sales director, International Lawn Garden & Power Equipment Expo, P.O. Box 70465, Louisville, Ky. 40270; 800/558-8767.

July 26-28
1988 Midyear Dealer Conference (Roundup), Indianapolis, Ind. Contact: Lisa Scott, National Fertilizer Solutions Association, 10777 Sunset Office Dr., Ste. 10, St. Louis, Mo. 63127; 314/821-0340.

July 27-28
American Sod Producers Association, Summer Convention & Field Days, Sheraton Inner Harbor, Baltimore, Md. Contact: ASPA, 1855-A Hicks Road, Rolling Meadows, Ill. 60008; 312/705-9898.

Aug. 2
1988 Midwest Regional Turfgrass Field Day, co-sponsored by the Midwest Regional Turf Foundation, Purdue University Department of Agronomy and Cooperative Extension Service; Purdue University Agronomy Farm, West Lafayette, Ind. Contact: Jeff Lefton, 317/494-9737 or Clark Throssell, 317/494-4785.

Aug. 3
New Jersey Association of Nurserymen's Annual Summer Picnic, Rutgers University, New Brunswick, N.J. Contact: NJAN, Bldg. A, Ste. 3, 65 S. Main St., Pennington, N.J. 08534; 609/737-0890.

Aug. 12-15
1988 TAN-MISSLARK Regional Nursery and Garden Supply Show, Astrohall, Houston, Texas. Contact: TAN-MISSLARK, 7730 South IH-35, Austin, Texas 78745-6621; 512/280-5182.

Sept. 14-16
New Jersey Nursery & Landscape Show, sponsored by the New Jersey Association of Nurserymen, Atlantic City, N.J. Contact: New Jersey Association of Nurserymen, Bldg. A, Ste. 3, 65 S. Main St., Pennington, N.J. 08534; 609/737-0890.

Oct. 9-12
Florida Turfgrass Annual Conference and Show, Curtis Hixon Convention Center and the Hyatt Regency Hotel, Tampa, Fla. Contact: FTGA, 302 S. Graham Ave., Orlando, Fla.; 407/898-6721.

Oct. 22-24
Third Annual Landscape Exposition, Nashville Convention Center, Nashville, Tenn. Contact: Becky Lerew, show manager or Mary Sue Christoffers, sales manager at 203/853-0400; or write to Landscape Exposition, 50 Washington St., Norwalk, Conn. 06854.

Oct. 23-26
1988 Interior Plantscape Division Conference & Trade Show, Los Angeles Airport Hilton and Towers, Los Angeles, Calif. Contact: Martha Lindauer, Associated Landscape Contractors of America, 405 N. Washington St., Falls Church, Va. 22046; 703/241-4004.

Nov. 6-9
1988 International Irrigation Exposition & Technical Conference, Las Vegas, Nev. Contact: Mark Williams, Irrigation Association, 1911 N. Fort Myer Dr., Ste. 1009, Arlington, Va. 22209; 703/524-1200.

Nov. 7-10
9th Annual Professional Lawn Care Association of America Conference & Trade Show, Superdome, New Orleans, La. Contact: Doug Moody, PLCAA, 404/977-5222. ■

NEWS IN BRIEF

COMMERCIAL EQUIPMENT DESIGNER READY FOR ENCORE IN NEBRASKA

It's often said three times is a charm, and for Dick Tegtmeier it was. That's because after designing commercial lawn equipment for F.D. Kees and Exmark Manufacturing Co., Tegtmeier has started his own company and his own "Pro-Line" of equipment.

Ground breaking for the Encore Manufacturing Co., a 20,000-square-foot facility in Beatrice, Neb., was March 29. Completion is expected by midsummer, according to Tegtmeier.

In the meantime, a staff of four has completed prototypes for the company's flagship products — 36- and 48-inch commercial lawn mowers — and are working on prototypes for a power thatch, riding sulky and a grass catcher for large units. The staff is expected to expand to 11 in August.

Distributors, dealers and sales representatives in 32 states have made tentative commitments to handle Tegtmeier's products.

ENCORE
MANUFACTURING CO., INC.

Shipping is expected to begin in mid-September, he said. He expects to ship 150 products a month in the first year.

Tegtmeier remained purposely vague about his equipment's features, but claimed they were "somewhat innovative" in design and marketing.

Some special features revealed include: five-speed transmissions, high lift blades, easy grip handles made to fit the hand and blade drive linkages with adjustable yokes for fine-tuning of the belt tension.

Tegtmeier's success in the professional lawn maintenance business goes back to 1976 when he designed the first units for Kees. He then went on to become a co-founder of Exmark Manufacturing Company, responsible for early design there as well. Both Kees and Exmark are also located in Nebraska.

During its first year of business, the Encore line will be established throughout the U.S. and abroad, he said.

Encore representatives will have their new models on display at the Lawn and Garden Equipment Exposition in Louisville, Ky., July 25-27.

MULTIPURPOSE GROUNDS PRODUCT TO BE IMPORTED FROM W. GERMANY

A West German manufacturer of commercial groundskeeping equipment plans to make inroads into the United States through a Virginia Beach-based business firm.

Hako-Werke, a privately owned West German company, recently agreed to give Kyle International Ltd. of Virginia, exclusive rights to import its equipment into the country.

Hako's product line includes walk-behind, self-propelled verticle mowing machines; sickle bar mowers; driveway and sidewalk sweeping machines; and rotary mowers.

The multipurpose product is actually an all-in-one versatile product which can work as a rotary mower, verticutter, power sweeper or snow thrower, said Kristeen Schreiber of Kyle International. The Hako is similar to products offered by Gravely International and BCS Mosa in the United States.

Hako products should be in the United States in time for the Lawn and Garden Equipment Exposition in Louisville, Ky., July 25-27.

Hako landscaping equipment is popular in Germany and has had a positive initial response in the United States, Schreiber said. Kyle conducted a one-year market study here to examine the feasibility of sales and manufacturing of the Hako product line, before finalizing the agreement. The arrangement is Hako's first venture into the lawn maintenance field in the United States.

Kyle International is a business development firm and specializes in the importation of products from West German companies. Kyle representatives act as consultants for foreign companies interested in importing, set them up with facilities and distributors and then step out of the picture.

In this case, however, Kyle will remain involved with the Hako product line. In addition to setting up a distributor network for Hako, Kyle International will eventually build a warehouse in Virginia Beach where products can be shipped and small assembly work can be completed, Schreiber said.

Within three to five years, Hako has plans to establish a sister company in Virginia Beach.

CONNECTICUT POSTING LAW TO INCLUDE HOMEOWNERS

Following in the footsteps of nearly a dozen other states, Connecticut recently adopted a posting law for chemical applicators. However, in a departure from others, the Connecticut law includes homeowners among those who are required to post a sign in an area which has just been sprayed.

Regulations won't go into effect until October 1989.

Don Kiley, executive director of the Professional Pesticide Users of Connecticut (PPUC), said the law sets a precedent by including homeowners and anyone making an outdoor application of a pesticide.

"This is very important since it recognizes that unlicensed amateur applicators, such as homeowners and building super-

intendents, are major users of pesticides," Kiley said. "Up to now, these users of pesticides were totally unregulated."

The law, sponsored by both pesticide users and environmentalists, requires the posting of signs for all commercial and non-commercial applications for 24 hours after applications are made. The law doesn't cover agricultural applications.

A recent study investigating pesticide usage in Connecticut estimated that homeowners are responsible for 61 percent of the pesticides applied in the state, compared to an estimated 6 percent used by industrial, commercial and government applicators and about 33 percent used for agricultural purposes. As a result, Kiley said, industry users should not be singled out as the sole target for posting.

The bill also included the establishment of a registry for "chemically-sensitive" people through which they can request 24-hour prenotification of applications.

Kiley said those listed on the registry would be notified of a commercial pesticide application within 100 yards of an abutting property.

Kiley said the new law was particularly satisfying because it wasn't proposed and passed *by* the legislature *for* them, but was designed by industry representatives and consumer groups.

Another provision mandates funds for IPM cooperative extension activities.

OHIO PONDERS POSTING REGULATIONS FOR LCOs

Posting regulations for the Ohio lawn care industry may be written into the books as early as August, according to the Ohio Department of Agriculture.

Hearings were recently held by the department in Cleveland, Columbus, Cincinnati and Dayton to gather testimony from industry representatives and consumer groups. Jane Ruvolo, legislative liaison for the department, said there is a consensus among industry representatives and consumers that 24-hour posting regulations should be established.

A number of Ohio lawn care companies are voluntarily posting signs in treated areas. Ruvolo said a state law would bring the remaining applicators into line, and standardize the posting signs used by the applicators.

Other recommendations from the department include requiring licensed applicators to furnish customers with specific information on chemicals used on their lawns, dates of applications, notification of owners of abutting properties and placement of signs on lawns after they have been treated with pesticides.

Ruvolo said it was unusual for the department of agriculture to hold separate hearings on a legislative issue, but they decided to in this case since the issue extended far beyond the Columbus area. The main issue of contention at the four hearings was over the size of posting signs, and the length of time they should be posted.

DOW CHEMICAL TEAMS WITH LCOs TO SPONSOR SPECIAL OLYMPICS

The Dow Chemical Company and the Professional Lawn Care Association of America are now official Bronze Medal Sponsors of the 1989 International Winter Special Olympics.

Dow recently made a contribution to the Special Olympics in the name of professional lawn care operators and the PLCAA. The winter games will be held in April of 1989 in the Lake Tahoe area.

Bronze medal status means the donation is in the range of $100,000 to $150,000.

The donation is intended to boost the industry's image among consumers, and create awareness of the PLCAA, according to Greg Nickerson of Bader, Rutter &Associates, the public relations firm representing Dow.

Special Olympics is the world's largest program of year-round sports training and competition for children and adults afflicted with mental retardation. Its programs reach more than one million athletes worldwide.

Lawn care companies who are members of PLCAA will be able to promote this sponsorship as long as its association to PLCAA is also mentioned. Nickerson said the sponsorship — the brainchild of Dow marketing managers — offers an excellent opportunity to provide positive exposure for the industry throughout the next year. Dow eventually would like to see lawn care companies involved with Special Olympics programs at the local and state levels.

HAWKEYE'S FORMOLENE BACK ON LINE IN IOWA

After an 18-month layoff, Formolene is back in production at the Hawkeye Chemical Company, Clinton, Iowa.

Hawkeye was forced to stop production of its product after an explosion occurred in its factory in 1986. Although the company was able to produce the product on a contractual basis in outlying plants, volume was far from what it used to be, according to Brian Lawrence of Hawkeye.

Formolene is a concentrated, slow-release, low-burn liquid fertilizer first introduced in 1978. The product is marketed in the United States and Canada.

Lawrence said it will be six to 12 months before Hawkeye will know whether it can regain its former market share. "There's been some competition in the interim. We'll just have to wait and see." ■

ALCA UPDATE

Members of the Associated Landscape Contractors of America are hoping a grass roots campaign can stop a congressional drive to increase the minimum wage.

ALCA members have joined the "Minimum Wage Coalition to Save Jobs" to help defeat proposed legislation which would increase the nation's minimum wage by more than 39 percent over the next three years. The coalition is a broad-based organization of business, public interest and community groups that are concerned about the impact of a higher minimum wage on the economy.

Martha Lindauer, director of communications at ALCA, said members have been busy writing letters and visiting their representatives to voice opposition to the bill.

Opposition stems from studies showing that an increase in minimum wage will ultimately result in an increase in unemployment. A report from the Minimum Wage Study Commission shows that a 39 percent increase would result in the loss of 312,000 to 936,000 jobs for teen-agers alone.

Although passage of a minimum wage increase would not have an immediate impact on the landscape industry, Lindauer said, the industry would feel the ripple effects of any wage increase. If wages are increased at one level, employees at higher pay levels will expect more. Most employees in the landscape industry are already paid more than the minimum wage.

The Senate and the House are still debating the bill, and a vote on the increase has not yet been scheduled.

In other news, ALCA's Interior Plantscape Division is jointly funding a research project with the National Aeronautics and Space Administration to study the ability of plants to reduce pollution levels in the office and home.

Previous NASA tests have shown that a few common plants are highly successful in reducing air pollutants found in the office and home environments.

As a result, 10 of the most common plants found in the everyday environment of offices and homes are being studied to determine their ability to remove formaldehyde, trichlorethylene and carbon monoxide — common indoor pollutants. The project will test each plant individually and in various combinations to discover its ability to remove each of the three pollutants.

The original NASA research showing plants' ability to remove large amounts of pollutants from the air stemmed from research for NASA's space program. NASA was trying to determine how the atmosphere of a spacecraft could be cleaned and made safe for travel.

The current research began in February and will run through January 1990. Among the plants to be tested are the: fig tree, peace lily, bamboo palm, aglaonema silver queen and corn cane English ivy.

ALCA has set a Sept. 1, 1988 deadline for those interested in entering the 19th Annual Associated Landscape Contractors of America Environmental Awards Program.

All commercial landscape firms who are members of ALCA and devote a major part of their business operation to exterior contracting, interior contracting and/or landscape maintenance are eligible to participate in the program.

It's designed to reward professionals who execute quality landscaping projects.

Complete information and entry forms can be obtained from ALCA, 405 N. Washington St., Falls Church, Va. 22046. 703/241-4004. ■

CLIPPINGS

Fit to eat. Five years ago when herb growers Jay and Pamela North of Paradise Farms in Summerland, Calif., sent samples of edible flowers to their wholesalers, the wholesalers laughed and asked, "What do you want us to do with *these?*" Back then, edible flowers were used by only a few of the most adventurous and creative chefs.

Today it's a different story. Edible flowers are widely used in fine restaurants throughout the country, as well as in Europe and Japan. Dishes featuring fresh herbs are routinely served, and diners are becoming more and more familiar with these advances in culinary arts.

According to President Jay North, his company's pesticide-free delicacies have enjoyed great popularity with home gourmets. "People want to enjoy at home the dishes prepared with fresh herbs, flowers and specialities that they enjoy in restaurants and read about in food publications," he said.

In response to the demand, Paradise Farms is now making available new herb packaging and point-of-purchase displays for supermarkets.

Herbs available in the company's new airtight containers include arugula, basil, chervil, chives, marjoram, mint, oregano, rosemary, tarragon, thyme and sage.

Also available is *Mes-a-Greens*, a ready-to-use gourmet salad mix of baby lettuces, herbs and edible flowers.

Specialty items include eposote, a favorite in New Mexican cuisine; Chinese mum leaves, which add zest to salads, stir-fry and Oriental stews; salad burnet, a lacy, fine herb with a cucumber flavor; and shiso, with a cinnamon-mint flavor, often used in sushi, Oriental sweet and sour sauces and stir-fry.

Safety catch. A recent consumer panel survey of *Better Homes and Gardens* magazine subscribers found that a majority of respondents didn't have a singular understanding of the word "safe" when it appears on plant food packaging.

When asked what the word "safe" on a package of plant food meant, 50 percent thought it meant the product was safe for plants. Forty percent thought it meant it was safe for people and pets. For 27 percent, it meant safe for the environment.

The product attribute that ranked most important to the respondents, according to the mean scores, was "keeps plants healthy and green." "Safe for plants," "convenient and easy to use" and "bigger, faster plant growth" were next in importance.

The survey also asked panelists to name the best plant food among three different types. Thirty-four percent chose controlled release, 30 percent liked continuous feeding and 30 percent named time release feeding as the best plant food type. ■

FINANCIAL CORNER

TAKE THE TIME TO SELECT A GOOD FINANCIAL ADVISER

Open any newspaper to the business section and you will find many advertisements telling you what to do with your finances. Financial advice comes from your friends, family, other media and so on. Who can you believe?

The selection of financial advisers who are right for you may take a lot of time and may be difficult. It will involve a lot of your personal judgment. Some general ideas of what to do and what not to do are presented next.

A good financial adviser will always score high in three qualities: ethics, experience and education. How can you recognize these qualities in a person?

Of the three qualities, the hardest to determine is ethics. If you are advised to do something that even you are not completely convinced is right legally, morally and ethically, do not even start. Once you think you have found a worthwhile activity, test the ethics of your potential financial adviser with questions such as the following:

How does your family feel about you being a financial planner, lawyer, etc.? What financial advice have you given them? What changes in the environment would make your rosy projections fall apart?

Think of other ways to reveal the core of that person's ethics. If you get hints or uncertain feelings about the person's descriptions or manner or hesitation to talk about doing the right thing, go to someone else.

You will want next to find out what experience your potential financial adviser has. Ask for his or her track record in several specific areas. If you get 10 years, ask for the most recent two or three years. If you get the last six months, ask for several years. You can weed out the person who is trying to rest on his or her laurels and is not actively doing worthwhile things today. You can also weed out the person who is in their apprenticeship period of trying out new areas. Do not have them learn at your expense by trying out something untested on you.

Make sure the record of experience relates to the areas in which you need advice. Ask for a list of clients in those areas. If you need certain tax advice, for example, and the accountant has recent experience mainly in auditing banks and credit unions, ask for the name of an accountant who specializes in your certain tax area.

Professionals only have enough time to keep up-to-date in certain areas, so find out what those areas of concentration are. What continuing education courses and seminars have they attended recently?

You don't want to make their pay the main criterion for selection. You should expect to pay good money for good advice. If it is an hourly rate, they are probably keeping track of the time anyway.

Always ask for detailed billing and examine the bill for evidence that the professional is making aggressive efforts to help you with your situation.

The preceding information was provided by Paul F. Rice of New London, Conn. He is the author of a series of financial publications. This column is designed to provide general information only.

IN SEARCH OF INSECT CONTROL IN TURF AND ORNAMENTALS

While insect pests in the landscape have more or less remained the same over the years, the methods of bringing them under control are constantly in a state of flux.

Researchers continually search for better insecticides to rid turf and ornamentals of damaging pests. In addition, a growing public sentiment toward biological control methods has had some research heading in a new direction — but only in the last three to five years with any significant results.

One biological control method in particular — insect parasitic nematodes — has received the most attention as an alternative to insecticides. Nematodes — microscopic in size — are most often associated as agents of disease in turf, however, researchers have had some success in controlling insects with bacteria-feeding nematode species.

Several companies are making the nematodes available in the United States and Canada for experimental purposes only, and at a great expense to LCOs.

Despite the cost, Ramon Georgis, director of application resource at Biosys, a California-based company, said nematodes are a "superb alternative" to insecticides for many reasons.

"First, it's not possible that an insect can build a resistance to the nematodes. Second, we found, especially in the Northeast, they (nematodes) have a very good persistance in the soil," he said.

The product is available to LCOs for testing and will not be commercially marketed on a widespread basis until 1990. In the meantime, Biosys markets its nematode product, Biosafe™, to consumers for $150 to $200 per acre, whereas insecticides average about $70 to $80 per acre, he said.

The nematodes are currently available in a dried formulation and must be refrigerated until use. However, with progress being made with liquid nematode formulations, the price should be equivalent to that of insecticides by 1990, Georgis said.

Biosys recently signed a research agreement with O.M. Scott & Sons to expand testing of the nematodes. The company is also working with ChemLawn Services Corp. and Chevron Chemical Company on nematode development.

The nematodes, which are only .02 inches long, can live outside the insect in only one stage known as the infective stage. *Neoaplectana* and *Heterorhabditis* nematodes are the two forms associated with biological control, and most testing has been conducted with *N. carpocapsae (S. feltiae)* and *H. heliothidis* species, Georgis said.

The infective stage, when the nematode is active and capable of invading an insect, is the stage of the nematode which is applied for insect control.

According to Georgis, nematodes work like this: A nematode is attracted to a target insect by carbon dioxide, insect excretory products or temperature gradients. The nematode then makes its way inside the insect through the insect's natural openings and cuticles. Once inside the insect's body cavity, it releases a bacteria, specifically associated with nematodes, that it has been storing in its gut.

The bacteria grow rapidly inside the doomed insect; while at the same time the nematodes feed on the bacteria. The insect dies within 24 to 48 hours and the nematodes continue to eat the bacteria until they sense the food supply is running out. They then burst out of the insect and into the soil.

As the nematodes feed on the multiplying bacteria and the dead host tissues, they reproduce at an enormous rate before leaving the insect. Depending on the temperature, the complete life cycle in most insects takes from 10 to 20 days. In some cases, reproduction doesn't occur and the nematodes never reach the stage to emerge from the insect.

In recent research, it was found that the nematodes were able to maintain a low population of grubs for almost two years after one spring application, according to Georgis.

Biosafe is currently available for use on turf and ornamentals, but is available only through mail-order catalogs. Biosafe is said to control a number of insects including Japanese beetles, sod webworms, cutworms, masked chafers, white grubs, wireworms, armyworms, mole crickets and billbugs.

"The problem holding back some people (from using nematodes) has been excessive costs," said Peter Heller, an entomologist at Penn State University. "I think you're going to see a popularity from the standpoint of safety. With some homeowners not wanting any pesticides put down and with posting and all the laws, I think it will eventually have a marketplace."

Heller and his associates have been working with biological control methods for about three years. Although he's had some positive results, he recently learned of some problems facing the use of nematodes — namely that other organisms can be feeding on the nematodes before they can do their job.

Despite the interest in nematodes and other biological control methods, their use remains small in comparison to the wide use of insecticides.

"Certainly people are interested in biological insecticides, and pesticide applicators are cognizant of the inherent risks with the use of synthetic poisons, but to this point in time I would say the use of strictly biological insecticides has been relatively limited," said Don Lewis, extension urban entomologist for Iowa State University.

This is a result of limited options for applicators in the Midwest, he said. Insecticidal soap for control of aphids and soft-body insects on ornamentals, and *Bacillus thuringiensis* biological insecticide for control of most leaf-feeding caterpillars are the main options for LCOs.

Researchers caution that minor advance ments in biological control methods does not signal a reduced need for insecticides.

"Biological controls are one of those things that keeps the population suppressed along with pesticides and other things," said Harry Niemczyk, an entomologist with The Ohio State University. "That's what pest management practices are all about

Elm leaf beetle egg cluster (above). Elm leaf beetle adult (right). Beetles resting after flight (below). Photos New York State Turfgrass Association

— integrating them altogether. And biological controls is just one of those things that you can integrate."

Regardless of whether a horticulturist, landscaper or turfgrass specialist is working to control pests in a customer's yard, an insect must be properly identified before it can be accurately removed from the environment.

Researchers across the country generally agree that landscape maintenance companies are committed to education and training in this area, but admit that misidentification can often be a problem.

"We get a lot of misidentification out there — one insect being mistaken for another. In some cases it results in the overapplication of pesticides," said Nick Christians, a horticulturist at Iowa State University. "In other words, a lot of times the lawn care person may misidentify it, and the person who owns the home will ask for an application."

Unwarranted pesticide applications generally don't cause further damage to the turf or ornamental, but may kill predatory insects that were working to keep the population of harmful insects in check, he said.

For an LCO unsure of the identity of a pest, samples can be submitted to local extension services for review. Once an expert makes a distinction, the LCO can then familiarize himself with the pest so he can better recognize it in the future.

"It's part of professionalism to know what you're talking about as you select plant materials and also as you maintain established plantings," Lewis said. "I guess I don't worry so much about misidentification as much as I worry about no identification.

We're slowly getting away from the era when pest controls were applied without the benefit of knowing first what you're dealing with. But we still have a long way to go."

Lewis readily admits that it's a difficult job to identify pests in both turf and ornamentals, particularly when each has a large number of potential pests.

"Identify them with great difficulty, and you learn to do it by practice. There is no one magic reference; there is no one magic computer program or textbook that will answer all your questions, so you need to develop over the years a library of resources and maintain contacts with your county extension offices and your land grant universities," Lewis said.

Some of the larger companies in the industry can afford to have their own educational staff, while most send their employees to turfgrass schools, university field days and association conventions. In addition, many companies are beginning to hire students from universities with a basic training in turfgrass science.

"A lot of the companies are supporting continual educational updates," Heller said. "It becomes more critical because if you don't know what you're dealing with, how can you make an accurate recommendation? I've been working with a lot of the companies and right now people are trying to do an excellent job."

Overall, most researchers agree that the industry hasn't seen many new insect pests. However, whether it be through increased identification, adverse economic conditions or the removal of certain insecticides from the market, insect numbers do go through periodic changes.

"There are never any new insects. They are what they are. There are new species being identified all the time, but there aren't any new insect pests in turfgrass," Niemczyk said. "We discover pests that we've forgotten about. People are still discovering the billbug."

"Insects have their ups and downs. On the average, by looking at a variety of situations through the years, it seems to me things are about the same as they have been," Lewis said. "As we pay attention to certain problems, it appears to us that they are slightly increasing through the years, but I wonder if that's not a result of paying more attention to those problems."

The industry has lost some insecticides, most notably chlorinated hydrocarbons for above-ground use, which may have had some effect on the changing insect populations, he said. But the products currently on the market are effective and safe when used according to label directions.

In some instances, just the right environmental conditions can cause an insect

(continued on page 18)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INSECT CONTROL
(continued from page 15)

population to change.

"The major grub species up until about two years ago were Japanese beetles. Now we're starting to see more of a mix of Japanese beetles and Northern masked chafers, and we're even starting to see a movement of Asiatic garden beetles in some areas," Heller said. "So as far as new species, we haven't seen that many new ones, we're just starting to see a change in population dynamics."

According to Christians, the closest example of a new insect is probably the greenbug aphid. It was basically new in the late 1970s, and has pretty much spread throughout the Midwest.

In addition, he said, he's seen increased damage by pests in the Midwest — particularly by the Bluegrass billbug and armyworm.

"In some cases, we had a year not too long ago, where we had a massive outbreak of armyworms. They moved up into our part of the country from the South. And if you get just the right environmental conditions, you may get a bad outbreak of those. Then you may not have those conditions again for several years," Christians said. "With the billbug, I'm not sure what the situation was."

Pest identification and insecticide selection are instrumental in eradicating insects, but landscape professionals must also be concerned with alkaline hydrolysis — a process by which pesticides can deactivate and decompose.

An insecticide may never reach its target if alkaline hydrolysis occurs, because it results in the premature breakdown of the insecticide, Lewis said. The breakdown generally occurs when the pH of the spray water reaches 7.7.

"If you have very high pH water, you should probably be using a buffering adjuvant. And with certain pesticides that are known to have a problem with alkaline hydrolysis, you should adjust your mixing and application schedule accordingly," he said.

Testing for alkaline hydrolysis under field conditions normally is impractical, according to Lewis. Instead, landscape professionals who fill their tanks from a variety of water sources should take that into consideration and check the water pH at each source.

As far as offering standard yearly applications of certain insecticides, most researchers don't condone the precautionary practice. They take the attitude if it isn't broken, why fix it? Of course any application depends on the area of the country and the seriousness of the problem.

"Advocating a standard spray program would be stupid. We should know there's a reason to put a pesticide down every time we put it down," Niemczyk said. "If there is a constantly recurring insect then the manager in that area is simply going to have to decide if it's necessary. There has to be a good reason to apply a pesticide."

Lewis said he leans toward the integrated pest management approach of monitoring identification and application as needed, but recognizes the practicality of scheduled or maintenance spray programs as long as the spray program is fine-tuned as changes in insect populations or pesticide choices occur.

"I'm kind of optimistic that down the line we're going to have a variety and a menagerie of pest control tricks that we haven't even imagined yet," he said. "Because of the interest in these kinds of things, there will always be a market for new ideas. I guess I don't see any in the short-term, but in the long-term I think there will be a lot of new things to come on the market."
— *Cindy Code* ■

The author is Editor of ALA *magazine.*

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CONTROLLING NORTHERN TURF INSECTS

Successful control of turf insects depends on following certain principles. First, an LCO must identify the pest accurately. Once he knows what he is dealing with, he must understand the basics of the life cycle and establish a feel for the "economic threshold" for the pest.

In particular, the LCO must know whether the pest is active in the soil or thatch or is a surface feeder. With this knowledge, he can put together a control program in which he can determine whether an insecticide is necessary, choose an appropriate insecticide and apply it when the insect is most susceptible to control. Understanding some of the basics of the insect's life cycle will also help the LCO to identify application techniques which will maximize the effectiveness of an insecticide.

IDENTIFYING TURF INSECTS. While identification of turf insects is often not stressed enough, an LCO must be able to make accurate identifications or be able to take specimens to a person trained in identification. Many large lawn care companies have support staff able to make the necessary identifications. However, any lawn care company would benefit by becoming familiar with the services available through the appropriate land grant college (state university) and county Cooperative Extension Service.

UNDERSTANDING LIFE CYCLES. Turf insects come in different shapes and sizes and are active in different parts of the turf environment. An LCO must know when a pest insect is in its damaging stage, and often must be able to predict whether that pest population will reach damaging numbers (economic threshold) during its development.

In other words, he must have an idea of how many insects it takes to cause a problem on the turf. He also must realize that this number will vary depending on how many stresses the turf faces. Conditions such as compaction, heavy traffic or drought will stress the turf and leave it less able to tolerate insect or disease stress.

Grub, third (ultimate) instar. (NYSTA)

In addition, it is crucial that the LCO work with the homeowner and explain that the most sensible approach does *not* necessarily involve eradicating the pest insects. While some homeowners seem to feel that the only good insect is a dead insect, it is generally impossible to completely eradicate a pest population from a lawn.

Efforts to remove 100 percent of the insects usually involve application of excessive amounts of insecticides which may seem to improve the situation in the short term, but may in fact lead to the destruction of many beneficial organisms in the lawn. The turf manager must convince the homeowner that the wisest approach is one of moderation — occasional applications of insecticide to keep the pests below damaging levels.

APPLICATION TECHNIQUES. Many seemingly minor adjustments in application techniques can have a dramatic effect on the effectiveness of an application. Perhaps the most crucial aspect in application is the use of water. For some kinds of insects, notably the root feeders, substantial applications of water immediately after application improve the level of control of the application. For other insects (generally the surface feeders), any procedure which will keep the material in the upper layers of the turf for an extended period of time will increase the level of control.

Note that certain insecticides move through the thatch more rapidly than others and might be better suited for use against root feeders. Conversely, some insecticides tend to be tied up in the thatch and thus might be more appropriate for use against surface feeders.

Many insecticides are subject to "alkaline hydrolysis." This means that those insecticides tend to break down more rapidly under alkaline conditions. Some city water systems are somewhat alkaline. If an LCO finds that applications made late in the day seem to be somewhat less effective than applications from the same tank mix made early in the day, there may be a problem with water alkalinity. Have the water pH tested. If it is greater than 7.7, an acidifying agent may be necessary to counteract the alkalinity of the water.

WHITE GRUBS. *Identification and life cycle.* White grubs are root feeders so they are generally found in the top two inches of the soil. Grubs are cream colored, C-shaped, with brown heads. They range in size from 1/8 inch to 1 inch long. There are several species in Northern turfgrasses, but most species have one generation per year. Eggs are laid in early summer and small grubs begin feeding by mid-summer. They grow rapidly and feed throughout the fall. They spend the winter as grubs deep in the soil and then return to feed again for a few weeks in the spring.

Damage. Damage occurs in early to mid-fall and again in late spring, as the large grubs feed most actively. Affected areas first appear as drought stressed areas, with a general yellowing of the turf. Heavy feeding results in a total destruction of the root system, so that the sod can be rolled back like a carpet. Often birds will feed on the large grubs, so bird feeding and searching (and peck holes) can be an indication of grub activity.

Control. Some grub species are susceptible to control by biological (non-chemical) agents. Current research is investigating the use of insect-eating nematodes as an alternative to standard insecticides. In some areas of the country, Japanese beetle grubs can be controlled by using *Bacillus popil-*

liae, the bacterium which causes "milky disease." Meanwhile, several standard insecticides give acceptable levels of control for most grub species.

The key to successful grub control is to time the application properly and to water in the application. There are two periods during which an application could be expected to be effective — April or August (or perhaps late July in the transition zone). The April application is made just as the large grubs are returning to the root zone to feed. While the grubs are much larger in April than they will be in August, the normal spring rains assist in keeping the grubs in contact with the insecticide. The August application is made as small larvae just begin to feed. The grubs are most susceptible to control at this time, but the drier conditions of August make watering absolutely crucial.

CHINCH BUGS. *Identification and Life Cycle.* Chinch bugs are true bugs with sucking mouthparts which are active in the thatch and upper foliage of the turfgrass. Adults are about 1/8 inch long and are black with relatively shiny white wings. They are like slightly elongated ovals. The immatures have the same basic body shape, but are smaller and lack wings. In addition, early stages may have a reddish or orange tinge.

Chinch bugs will complete one or two generations per year on cool season turfgrasses. The more northern locations, such as upstate New York or northern Michigan will experience a single generation, while warmer areas, such as southern Ohio, will encounter two generations per year. In either case, adult females lay eggs in the spring. Nymphs (immatures) emerge from these eggs and begin feeding immediately. Nymphs complete their development in four to six weeks during the summer, but take a bit longer in the spring. Adults find semi-protected areas (often tall grass or plant debris near buildings) to spend the winter.

Damage. Both adults and nymphs suck sap from the crown and stems of grass plants. Because chinch bugs tend to occur in clumps, the affected areas usually first appear as localized yellow areas, but in heavy infestation, these areas soon expand into large patches of dead turf. Damage usually is most severe in drought stressed lawns (sandy soils or very sunny areas), and is often confused with drought at first.

Control. Chinch bugs are quite susceptible to many insecticide applications and

Bluegrass billbug life stages.

usually can be controlled reasonably well. The reason some control attempts have not matched expectations is that a turf manager may fail to recognize chinch bugs as the cause of observed droughty conditions until the insects have exploded into very high numbers. Thus, early identification is the key to successful control of chinch bugs.

Many lawn care companies throughout the Midwest and Northeast are now making an insecticide application in late March or early April to lawns which have proven to be subject to chinch bug damage in previous years. While this may seem to be a bit too early based on the observed life cycle, the rationale is that the insecticide kills the adult females before they have a chance to lay eggs.

The more traditional approach is to apply an insecticide in June (or late May in warmer areas of the cool season turfgrass region), when the new nymphs are beginning to feed, but have not yet caused visible damage.

Either approach seems to work quite well and is preferable to a late summer application. By the late summer, chinch bug numbers are reaching their peak for the year and feeding activity will begin to decline at about the same time that high temperature and drought stress are relieved by the approaching autumn weather conditions.

SOD WEBWORMS. *Identification and Life Cycle.* There are several species of sod webworms (and other surface feeding caterpillars) which can cause damage to Northern turfgrasses. Adult sod webworms are small tan moths which fly haphazardly over turf areas during the summer months. The caterpillars may be green, brown or gray, but usually have dark spots scattered over the body. They range from 1/8 inch to 1 inch in length.

Sod webworms spend the winter as caterpillars in a self-woven sheath. They may feed briefly in the spring before pupating and emerging as adult moths in late spring or early summer. The number of generations per year varies with the species and location, but there will normally be one or two generations per year. Both the moths and caterpillars tend to be most active at night.

Damage. The caterpillars are the damaging stage of this insect — burrowing through the thatch, weaving plant debris and excrement into little tunnels and cutting off grass stems. They remain concealed in their burrows during the day and emerge at night to feed. They often cut off grass blades and pull them back into their burrows. Most sod webworms feed above the crown of the plant.

Control. Sod webworm generations often overlap so that there may be individuals in all stages of development at any one time. Fortunately, the caterpillars are relatively susceptible to control so an application at nearly any time during the summer will give some level of control.

Since webworms are most active during the evening and night, applications as late in the afternoon as possible will generally be more effective. Early morning applications are more subject to breakdown by sunlight or volatilization (evaporation).

A treated area should not be mowed for two or three days after application so the webworm will continue to feed on the treated area. Some turf managers water the area before application and then use granular formulations to keep the material in the thatch a bit longer. Keep in mind that this approach also leaves the insecticide in an

area where children and pets are more likely to encounter it.

BLUEGRASS BILLBUGS. *Identification and Life Cycle.* In spite of its name, the billbug is in fact a weevil (a beetle with a long snout). Adults are gray or black, about ¼ inch long, with a distinct long narrow snout. The larvae are white with brown head capsules. They are about ¼ inch long and have no legs.

Bluegrass billbugs overwinter as adults in semi-protected areas and begin to move to bluegrass areas in late spring. Females lay eggs in stems and young larvae emerge to feed in stems and crowns. By mid-summer, the larvae are feeding very actively and causing considerable damage in bluegrass turf. Larvae complete feeding by late summer, pupate and emerge as young adults to overwinter. There is only one generation per year.

Damage. Larvae initially feed inside stems and hollow them out. Larger larvae feed at the base of the stems and may completely destroy the tissue so that the stems can be pulled out by hand. Late stage larvae then migrate downward and feed to some degree on the roots. At this time, they produce a sawdust like excrement which can be used as a diagnostic feature.

Control. The key to control is proper and prompt identification of the problem. Most bluegrass billbug damage is sporadic and sometimes seems to appear in an area with little or no warning because many turf mangers are not accustomed to looking for it. Generally by the time damage is visible, it is too late to obtain any level of control with an insecticide.

The best time to treat for bluegrass billbug appears to be in late May or early June as the adults are moving into turf areas to lay eggs for the coming generation. Such an application serves a dual purpose, killing many of the egg-laying weevils and also killing most of the young larvae as they first emerge. Because the early activity is primarily in the thatch, applications should not be watered in.

CONCLUSIONS. Insect control on home lawns has become an increasing challenge, partly because of rising public concern about the use of insecticides in areas where the homeowner is perceived to be vulnerable to pesticide exposure. The lawn care industry is likely to encounter increased scrutiny of its actions during the coming years. Thus it is crucial that the LCO plan his insect control efforts carefully.

While many companies may find a set schedule of fertilizer, herbicide and insecticide applications to be very convenient, every lawn care establishment would be well-advised to be sure that each applicator can identify the major turf insect pests found in his region, understand a little bit about the life cycles of those pests and use that information to plan the most effective control strategies possible.

Such an understanding of the world of insects will reduce the number of "call backs" and will minimize the number of applications necessary, thereby reducing your costs.

Finally, as a frequently overlooked benefit, efficient use of pesticides normally will reduce the disruption of the beneficial organisms which operate in every lawn, unwittingly helping to maintain healthier turf. — *Patricia J. Vittum* ■

The author is an associate professor of entomology at the University of Massachusetts Suburban Experiment Station, Waltham, Massachusetts.

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WARM SEASON TURF INSECT PESTS

The variety of turfgrasses grown in the South is accompanied by a variety of insect turf pests. There is no doubt that turf insect pests are increasing in number and their damage becoming more severe in many parts of the Southeastern United States.

Many attribute this situation to loss of organochlorine insecticides such as chlordane, dieldrin and heptachlor. While this may be true in part, resistance to these compounds by certain insects in some areas was known even before their loss. The fact that Southern turf managers are growing better grass than ever (and insect pests are usually attracted to the best grass), and that new insect pests have migrated into many areas, are also probably factors.

SURFACE FEEDERS. *Sod webworm* species are numerous and varied throughout the South. In southern Florida, the tropical sod webworm may be a year-round pest. Most species in the South, however, complete two or three generations a season. Damage in most cases is greatest in July and August. Several common species overwinter as larvae, and begin feeding in the spring about the time of "green up" of warm season grasses. Sod webworms prefer Bermudagrasses, but may also attack other grasses. Chewing damage may appear as browned areas and is often mistaken for disease damage such as Dollar spot or *pythium.* Treat when larvae are present in the summer. Treatment to an infested area can also be delayed until two weeks after peak flights of sod webworm moths.

Fall armyworms are usually late summer and fall pests. Fall armyworms migrate in to the area from Mexico and farther south, but do not usually overwinter in the South except perhaps during mild winters.

There are several overlapping generations a season. The tender portions of grass blades are chewed, leaving midveins to quickly dehydrate and brown out. Well-maintained Bermudagrass lawns are preferred, and will usually recover quickly from damage. Fall armyworms, when present in large numbers on lawns, are as much "people pests" as grass pests. Treatments applied late or early in the day when fall armyworms are feeding on the turf surface are most effective.

THATCH DWELLERS. *Southern chinch bugs* damage turf by piercing plant tissue and extracting plant juice. Damage appears as yellowed spots that are confined to sunny areas.

Southern chinch bugs prefer most varieties of St. Augustine grass. Floratam, a chinch bug resistant variety, has also been subject recently to chinch bug damage in areas of southern Florida. The establishment of cold tolerant, but chinch bug susceptible, Raleigh St. Augustine grass in more northern areas of the southern Gulf states has introduced chinch bug damage to LCOs in some areas.

Chinch bugs overwinter as adults and begin to become active during warm days in March. There are three to five generations a season, with overlap during late summer. Treatments during late March to mid-April are directed to overwintered adults before females lay eggs. May treatments for nymphs are also usually effective. If chinch bugs are present from March through May, a single treatment is usually effective in preventing June/July damage. Areas may become reinfested later in the season if surrounded by chinch bug-infested, untreated turf or crops.

Two-lined spittlebug nymphs also damage turf by sucking out plant juice. Centipedegrass is very susceptible to attack, but damage has also been reported on other warm season turf grasses. Lawns with thick turf, thatch accumulation and high humidity are most susceptible to damage.

There are at least two spittlebug generations a year. Nymphs hatch in the spring from overwintered eggs and move deep into the turf. Each nymph surrounds itself with a mass of "spittle" and feeds head down. Damage first becomes noticeable in June or July, and appears as yellowed spots a few inches in diameter. In heavily infested lawns, larger yellowed areas several feet in diameter may appear. Spittle masses, although located deep in the turf, may give the area a "squishy" feeling when walked on. Adult spittlebugs seem to be attracted to Japanese hollies, and may move from these plants to susceptible, thick humid lawn areas to lay eggs.

Since spittlebugs are dependent upon humid conditions for development, thatch control may aid in disruption of their preferred environment. Controls are most effective if lawns are mowed and irrigated before treatment. Sprays should be applied in at least 10 gallons of water per 1,000 square feet.

SOIL INSECT PESTS. *Fire ants,* although surface "people pests" because of the worker ants' painful stings, may move in and out of colonies that extend several inches to several feet below the soil surface.

Fire ants can overwinter in any stage, but begin to establish new mounds in the spring. Winged reproductives fly and mate — usually after rains — and queens begin new colonies. Worker ants are most active on the soil surface before the dry hot periods of mid-summer and after fall rains begin. New mounds may remain hidden beneath thick turf.

Bait formulations are available that destroy the reproductive capacity of the queen. These baits work slowly, however, and in older colonies the large number of worker ants may remain active for several weeks. Baits that are broadcast on heavily infested areas from April to June eliminate smaller, newer colonies. However, larger mounds should be treated with a faster acting contact insecticide a week or two later in order to eliminate large numbers of worker ants.

If dry conditions exist, controls are more effective if the turf is irrigated the day before treatment. Applications should be made during the cooler periods of the day when worker ants are most active on and near the turf surface.

Mole crickets have become the South's most damaging insect pest in areas of the

Mole crickets on top of ground after soap flush.

Gulf States, Georgia and the Carolinas. Two pest mole cricket species damage turf by uprooting plants, allowing the grass to dry out and die. One of these species, the tawny mole cricket, also damages turf by feeding (chewing) all parts of grass plants. Hybrid Bermudas, Bahia and centipedegrasses are the most severely damaged.

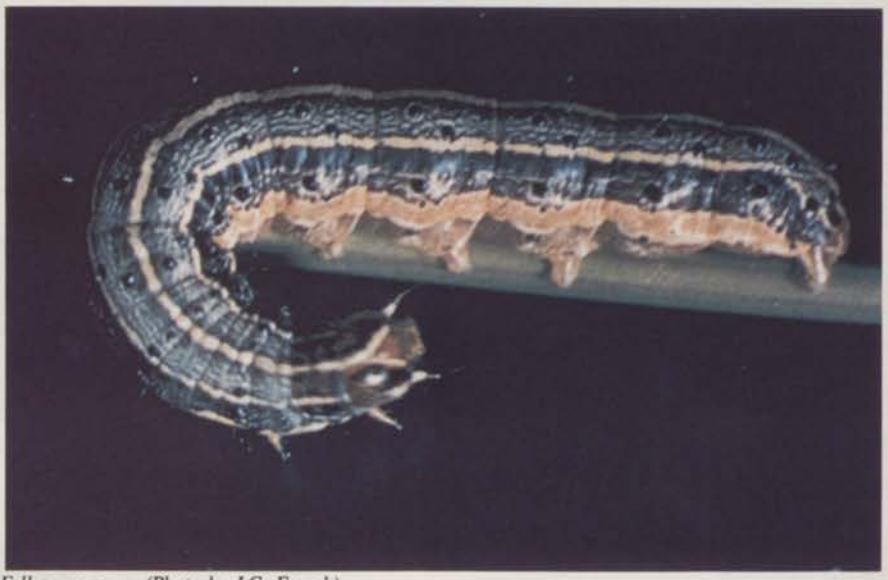
Mole crickets overwinter as adults or older nymphs. Tunneling activity increases in March, and spring mating flights occur. Eggs that are laid in the spring hatch from May to July, and nymphs feed and develop rapidly until cold weather. Dispersal flights occur in the fall.

Effective mole cricket control is heavily dependent upon proper timing of applications. Larger nymphs and adults are more difficult to control with insecticides. Therefore, the major emphasis of control efforts is placed on applications timed to control the smaller, younger nymphs.

One problem that lawn care professionals in the South have is that new accounts for mole cricket control often come in when the damage begins to show up in August or September. By this time, control efforts are difficult and seldom as successful as if started earlier. Another problem arises when customers whose lawns receive spring treatment do not understand that another treatment during the summer is usually necessary. This is where communication with customers and education about these pests is vital.

Mole crickets are most active near the soil surface at night and in moist soil. Therefore, applications made late in the day to lawns irrigated before treatment are most effective. Granular formulations and some sprays require irrigation after application.

Grub problems in lawns are increasing in many parts of the South. Generally, grub damage on lawns is most severe in the northern half of the Gulf States, northern Georgia, eastern Texas, Tennessee and parts of the Carolinas. Chafer beetles and May and June beetles are common throughout the area. Japanese beetles are reported in areas westward and south into northern Alabama.



Fall armyworm. (Photo by J.C. French).

White grubs in the soil.

Most pest species have one-year life cycles. The grubs that hatch during the summer overwinter in the soil. These grubs move up into the root zone during late March and early April. Shortly thereafter the grubs form pupae from which adults develop.

Successful grub treatments during spring usually require application in late March or early April. Applications made later are often unnecessary because pupae are already present. Warm season grasses will recover from moderate spring grub damage if maintained properly. Adults emerge generally in May and June. Eggs are laid in the soil, and new generation grubs of most species are present by mid-August.

Treatments directed to the younger grubs are most successful from August through September if soil moisture is adequate. During the last two droughts in the South, irrigation before treatment was required to move grubs near the surface where insecticide contact is made. These treatments also included the usual irrigation after application.

One problem LCOs encounter with summer/fall grub treatments is that warm season grasses that are irrigated and actively growing may remain green on top while grubs have chewed away the roots. Areas that feel "fluffy" or loose — regardless of surface appearance — should be sampled for grubs. Sometimes these are areas where spring damage was observed and reinfestation occurred.

CONCLUSION. Basic knowledge of warm season insect turf pests and of one's own situation, coupled with correct timing of applications and proper use of water, better enable Southern lawn care professionals to meet the challenge of insect pest control. Up-to-date information on availability of new technology and guidelines for control strategies is important. Communication with customers, relaying information about pests and proposed control procedures, is also vital. — *Patricia P. Cobb*

The author is an extension entomologist at Auburn University, Alabama.

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BUILDING ORNAMENTAL PLANT HEALTH

Although ornamentals are continually attracting arthropods, a pest situation doesn't arise until feeding pressures jeopardize the plant's aesthetic or functional value.

Unlike lawn insects, pests which attack trees and ornamentals can seem innumerable. More than 1,200 pest species are known to attack the more than 700 ornamental plant species in cultivation today. The common ornamental pests also represent practically every major insect order, plus many species of mite.

Some ornamental pests will attack several different plant species (non-specific) while others feed exclusively upon a single specie (host-specific). Whether plants be coniferous, broadleaf, shrub or tree, practically all woody ornamentals are subject to every form of attack the insect world can muster.

In general, pest damage to an ornamental results from either a destruction of plant foliage or the disruption of water and assimilants (sap flow) to all or part of the plant. Fortunately, not all pest activity will directly result in acute mortality of a woody plant. However, chronic exposure to pest pressures can exhaust root reserves and lower plant tolerance to disease and environmental stress, which could eventually prove fatal.

Pests can also act as vectors which transmit deadly plant disease — such as the infamous Dutch Elm Disease transmitted by the European and American Bark beetles. Under these scenarios, pest control can become quite crucial.

Many times the target pest can be observed feeding directly on the affected plant parts. However, other ornamental pests are almost microscopic in size while others can be concealed within plant parts or beneath the soil.

Therefore, in addition to the obvious presence of a pest type, applicators should always check for indirect evidence of other pests that might also be present. Oozing sap, girdled stems and branches, bulbous projections, malformed shoots, loose bark, webbing or shotholes could indicate pest presence. Never overlook any abnormal manifestations.

Yet another group of pests — casual feeders — have no specific host preference and migrate from plant to plant, making their detection and control difficult. Grasshoppers and leaf cutting bees are a good example.

APPROACHING ORNAMENTAL PESTS. Compared to turfgrass, woody ornamentals have a greater biomass, are more resilient and are generally more self-sufficient. As such, ornamentals can have a much higher biological tolerance to pest infestations. On the other hand, the high visibility and profile of ornamentals can result in a much lower threshold for the coincidental effects caused by pest activity.

While preserving plant health is paramount, applicators are often asked to deal with the pest infestations long before populations approach a true economic threshold. Although the industry tends to seek to curtail pesticide use, the ornamental applicator must sometimes tip the scale toward chemical control in order to satisfy a more acute consumer demand for aesthetics.

Frequently, the ornamental applicator is called to unleash a full barrage of insecticides due to little more than several drooping stems or a few specks on the foliage. Even the mere sight of a plant insect — be it beneficial or pest — has been known to trigger customer panic.

And because ornamentals can represent a sizeable investment — not to mention great sentimental value — applicators have been known to routinely spray trees and shrubs solely at the discretion of the customer, despite the absence of a target pest.

METHODS AND MATERIALS. The arsenal available to applicators for the control of plant pests is fairly diverse. Included are insecticides of virtually every class and mode of action. While a great many pests respond to broad-spectrum products, others can be resistant to all but a few. Insecticide regulations ultimately dictate the product pool from which an applicator can select.

Commonly used plant insecticides include, Di-syston, Meta-systox-R, dimethoate, diazinon, bendiocarb, Zolone, Orthene, malathion, carbaryl, resmethrin, pyrethroids, azinphosemthyl, methoxychlor, Dipel (BT), dormant oil and others.

The residual activity of insecticides is often a major consideration. Systemics (those absorbed and retained in plant fluids) are applied to either plant foliage or through roots to offer residual pest protection lasting up to 60 days. The residual activity of most other insecticides can vary, but all foliar insecticides are subject to degradation by exposure to sunlight or humidity, and can be removed by precipitation.

As residual activity of insecticides increases, applications are more apt to coincide with susceptible stages of a pest's life cycle. However, shorter-lived pesticides are effective when pest occurrence can be definitely predicted through monitoring efforts and a knowledge of the pest's bionomics (how pest activity arises from the life cycle).

Aside from selecting an effective pesticide, control failures are often due to poor targeting techniques. Insufficient insecticide dispersions often fail to reach pests on the underside of leaves, deep within dense foliage, inside webbing or within the folds of bark.

Spray equipment for ornamental work should have sufficient pressure to both disperse solutions and penetrate foliage. For tree spraying, higher volume rigs are required to assure the throw needed to reach the top and inner parts.

The addition of surfactants (spreader/stickers) is an often overlooked adjunct of effective spray applications. The waxy cuticle of some plant foliage can shed spray droplets unless the surface tension is broken by the surfactant. Besides spreading the solution over plant surfaces, surfactants decrease insecticide loss due to precipitation. Certain oils and surfactants can be phytotoxic to certain plants or non-compatible with certain pesticides. Therefore, only use them according to the manufacturer's label.

(Counter-clockwise from top right) Winged aphid scales. Adult beetles boring tree. Egg mass of Elm Leaf beetle. Adult May beetles. Adult Elm Leaf beetle. Two-spotted mites.

PEST TYPES. Ornamental pests can be roughly classified as either *surface feeders* (foliage-consumers and piercing/sucking pests) or *boring insects*, which burrow into the bark, cambium, stems or shoots of a plant.

The *foliage-consumers* are among the most widespread and common ornamental pests encountered. The group is predominated by the Lepidopterous (moth) larvae, the larvae of certain wasps (sawflies) and several species of adult beetle (including weevils). Several species of fly and beetle larvae are also known to create twisting galleries (leaf mines) throughout the epidermal layer of leaves. Virtually all foliage-consumers have chewing mouthparts.

Foliage-consumers can partially or completely consume plant leaves or needles, or cause skeletonization of broadleaved plants by interveinal feeding. Also, many species within this group are characterized by the building of webs, tents, bags and shields. Substantial accumulation of frass (insect excrement) is not uncommon around feeding sites.

Most foliage-consumers have from one to seven generations per year and undergo complete metamorphosis. At least two life cycle stages — egg and larval — will typically occur on the host plant, however, the larvae of some species may migrate. Pupation of foliage-consumers will usually occur either on the plant itself or in debris and litter beneath or around the host. The adult insects within this group will typically swarm and greatly extend the insect's range of occurrence. Eggs are usually laid in close proximity to the larva's food source, but not in every case.

Because life cycle development is regulated by variable climatic conditions, predicting the activity of foliage-feeders from year to year can be difficult. If a particular species becomes a real local threat, government agencies will sometimes sponsor a monitoring program using light and pheromone (sex attractant) traps. Applicators should keep abreast of data with such programs.

Stomach or contact insecticides are typically used to control foliage-feeders, but systemics may also be effective, particularly for the smaller species. For the Lepidopterous species, the biological agent *Bacillus thuringiensis* is highly effective and extremely safe for non-target organisms. Non-chemical controls include physically pruning out congregational pests like the bag, tent and web makers. The early instars of larvae are most susceptible to pesticide applications, with lower rates often being sufficient for good control.

Whenever the swarming activity of adults can be predicted, plant damage can be averted by targeting young larvae directly following their emergence from the eggs (lag periods between oviposition and larval emergence should be determined for each specie of pest). For pests with overlapping genera-

(continued on page 32)

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(continued form page 29)

tions, the only option may be strictly a curative application on an as-needed basis.

Of most concern are the aphids, scale insects, mealybugs, whiteflies, spider mites and numerous other species in the orders Homoptera (planthoppers, leafhoppers, treehoppers) and Hemiptera (the true plant bugs).

Most piercing/sucking pests are visible to the naked eye, but mites must usually be observed against a light background (a sheet of white paper works well) or with a hand lens. Many members of this group can be observed on either the foliage or bark, and are often found on the underside of leaves.

While piecing/sucking pests can ultimately cause defoliation, their activity is most characterized by mottling or discoloration of foliage. Other signs to look for include copious amounts of sticky excreta, leaf molds, scales, powdery or waxy "deposits" or fine webbing.

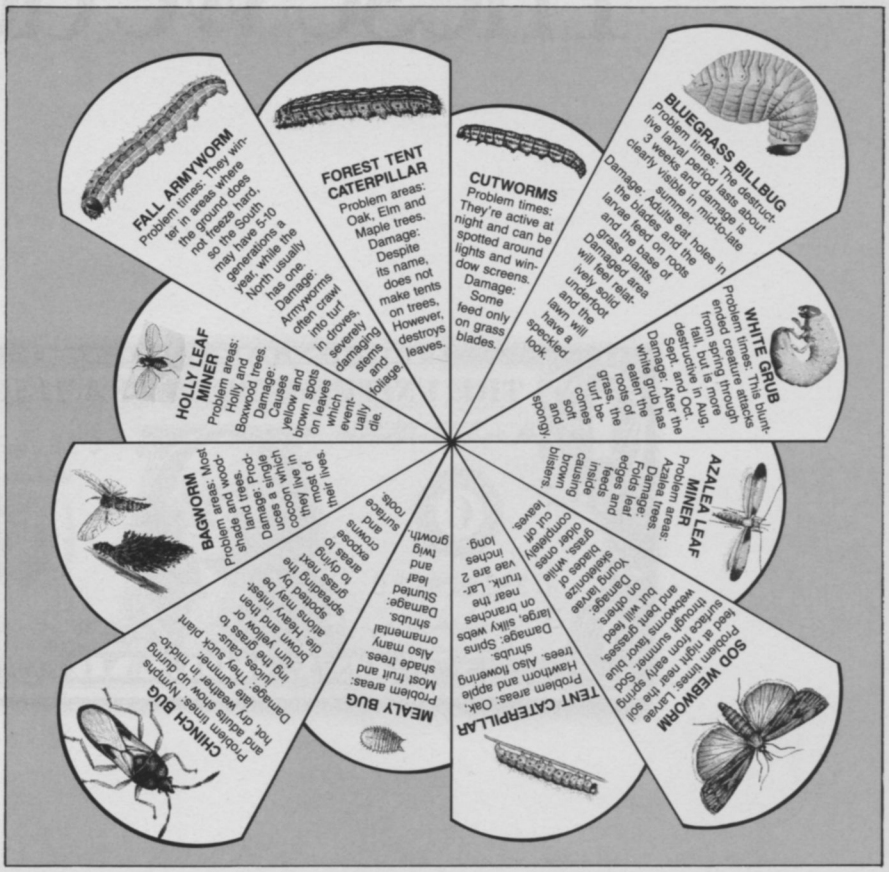
There are perhaps more positive control options for the piercing/sucking insects than for other groups of ornamental pests. Since most members of this group continually remain on the host plant, dormant oil applications in late winter or early spring can be effective in controlling the overwintering eggs and adults.

Systemic insecticides can be particularly effective for piercing/sucking pests because of their high ratio of sap intake to body weight. Contact insecticides can also be effective, however, the phenomenal reproduction rate of some species produces frequent insecticide resistance.

Boring insects constitute yet another group of pests that can cause major damage to woody ornamentals. Depending on the bore specie, twigs, stems, branches and trunk areas can become the site of boring activity. The most common offenders are the adult and larvae of beetles (Coleoptera), certain wasp (order Hymenoptra) larvae and moth larvae which commonly attack softer stem and tip tissues.

The tunneling activity of borers will to some degree interrupt movement of water and nutrients to consecutive areas of the plant. Besides physical disruption of plant assimilants, bore activity can often facilitate systemic plant diseases that are equally as hazardous to the plant. In addition, tip and shoot borers can effectively destroy plant meristematic tissue (growing points) to inhibit seasonal plant development.

Unless tunnels and galleries are sufficiently exposed, embedded borers might



Twelve of the most common insect pests found in turf and ornamentals.

be impervious to directed insecticide sprays. But systemic insecticides applied via the soil can be effective for some borer infestations, especially those affecting stems and tips.

Non-chemical control measures include extracting embedded borers with a wire probe or installing physical barriers prior to the expected influx of a bore specie.

Girdling occurs whenever certain insects (particularly adult beetles and sawfly larvae) strip away up to the full circumference of conducting tissue around stems, twigs and petioles. The complete necrosis of all plant foliage above the wound will usually result.

Some *root feeders* attacking ornamentals are often the same or similar to those which are found in turfgrass. Mostly ornamentals are attacked by the larvae of scarab beetles, weevils or ground beetles (wireworms). Most larger ornamental plants can tolerate a fair amount of root feeding due to their more massive root systems. However, young or smaller ornamentals may be quite susceptible, and root feeding activity can often predispose root rot or systemic disease.

CONCLUSION. For any ornamental, a proper balance of water, nutrients and cultural management imparts a resistance to pest activity. In fact, physically weak plants are notorious for attracting unusually high populations of plant pests — a part of the natural selection process. Hence, conscientious plant care is the first, and primary line of defense against pests.

Since many ornamental pests complete at least part of their life cycle under soil debris and litter, maintaining clean areas beneath and around ornamentals can greatly reduce future pest inoculum. Along these same lines, unabated weed growth can harbor a multitude of non-selective plant pests which use this cover as a staging ground for ornamental invasions.

While it's very possible that an insecticide application will control all susceptible pests on a plant, customers and applicators alike should recognize the distinct possibility of reinfestation. Therefore, callbacks are certain to plague any ornamental applicator who fails to grasp this most basic characteristic of the ornamental pests. — *Jim Ware* ■

The author is an agronomic consultant residing in Hobbs, New Mexico. He is a regular contributor to ALA *magazine.*

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TOOLS FOR IDENTIFYING ORNAMENTAL INSECT PESTS

Every lawn care company in America is involved with turf which is surrounded by ornamental plants such as trees and shrubs. These ornamentals will from time to time be plagued with problems, such as insects, disease or nutritional deficiencies. Often these pests or nutritional problems can be traced back to the effects of construction damage, poor drainage, water stress, etc.

Whatever the nature or cause of the stress placed on the trees and shrubs, these weakened plants are, as a result, much more susceptible to the detrimental effects of insects and disease.

Plant damage or decline recognition is the key diagnostic ingredient in perpetuating good plant health. Let's consider the main anatomical features of a plant, realizing the fact that insects can and often do attack any portion of a plant at varying times during the season. The anatomical features we will use to isolate pest damage will be leaf, stem/twig, trunk and root system.

The insects attacking ornamentals can at the same time be categorized into major feeding groups such as chewing insects beetles; chewing insects caterpillars/leaf miners; sucking insects, including mites; borers; and gall makers.

Let's take a closer look at these anatomical features and discuss what to look for when a particular plant is displaying signs of damage, poor color, wilted leaves, dying/dead branches and otherwise generally poor health.

LEAF DAMAGE. Many different kinds of insects attack the leaves of a plant. Generally speaking, if the edges of a leaf appear chewed, ragged or notched, this is the work of a caterpillar or beetle larva. Beetle adults will chew away leaf tissue from the center of the leaf, leaving holes in the leaf or leaving it skeletonized.

Many beetles and caterpillars are gregarious, which means they enjoy the closeness and fellowship of a good meal and will congregate "en-mass" to ravage your plant. Heavy uncontrolled pest populations may result in plant defoliation. Should a plant have to spend energy on refoliating two to three times in a single season, or for two to three years in a row, the plant may very well not make it through the next harsh winter.

Pest Examples: caterpillars/cankerworms, tent and forest tent caterpillars, gypsy moth, fall webworm, bagworm, tussock moth and sawfly (related to bees and wasps). Beetles/Japanese beetle, elm leaf beetle, willow and cottonwood leaf beetle.

Leaf stippling is another type of leaf damage. This is the yellow speckled discoloration on certain leaves caused by sucking insects or mites. Usually when turning such damaged leaves over, one will see the insects themselves or will see evidence of their previous presence. You will quickly find that the use of a 10x power hand lens will aid tremendously in detecting live critters too small for the naked eye.

Spider or eriophyid mites may be found on either the top or bottom side of the leaf. Most other stippling will be caused by insects feeding on the bottom side of the leaf. This stippling is simply the removal, by the pest, of the chlorophyll at that location. A heavy pest infestation may make the leaf totally devoid of chlorophyll and moisture, thus making it incapable of conducting photosynthesis and causing it to dry out. Such leaves will be quickly shed by the plant. Again as above, a weakened plant going into a cold harsh winter may never come out of dormancy.

Pest Examples: insects/scale insects, whitefly, mealy bug, aphids, lacebug and leaf hoppers. Mites/spider and eriophyid. (Very small cigar shaped mites with all eight legs stuck on one end.)

The formation of tunnels between upper and lower leaf surfaces is another type of leaf damage. Leaf miners are responsible for this damage. The adult fly or wasp lays its eggs between the leaf layers and after hatching, the larva will mine randomly until its life cycle is complete. It will then emerge as an adult leaving a tiny emergence hole in the leaf surface.

These insects are very difficult to control since the adults are not feeding on the leaves, just laying eggs. A heavy population will often cause premature leaf defoliation. Most often, by the time the damage is noticed, the insects have already completed their life cycle.

Pest Examples: holly leaf miners and yaupon leaf miners.

Black specks or tar spot on the undersurface of a leaf is the telltale sign of lacebug activity as described under leaf stippling above.

Pest Examples: lacebug of azalea, sycamore and pyracantha.

Shiny, sticky, clear droplets on a leaf surface is the sign of honeydew deposition. As these honeydew-producing insects feed, tiny droplets of this sticky sweet substance is exuded.

A black sooty mold (fungus) then begins to grow on this very nutrient rich substance, and shortly leaves, twigs, branches and even the trunk of the tree or shrub turn black. Obviously, the object is to control the insect before an abundance of honeydew is produced, thus preventing the development of the black sooty mold. It is pretty hard to convince the property owner that a black plant is "beautiful."

Pest Example: aphids, scale insects, mealybugs and whiteflies.

Cupped leaves are another type of leaf damage. The feeding of some insects causes a growth response from the plant which produces cupped, curled, twisted leaves. Upon opening these leaves, large colonies of insects may be observed. A single red tipped photinia terminal may have literally thousands of aphids on a total of four to six leaves.

Pest Examples: aphids, wooly aphids, psyllids. (Very small aphid-like sucking insects which jump and fly.)

Fleshy growths on the surface or under the surface of a leaf is the last type of leaf damage we'll consider for the sake of brevity. Gall making insects are responsible for these outgrowths. Upon cutting open such growths, with the aid of a hand lens, one

Leaf stippling to Holly leaves caused by mites (above). Caterpillar chewing damage on Oak (right).

often finds the immature insect feeding inside. The female insect lays the egg inside of the leaf tissue. The presence of the egg as well as the hatching and subsequent feeding of the immature insect will cause the plant response. The plant tries to wall off this foreign invader by building a fancy barricade which protects the plant from further damage, and protects the insect from outside harm while it is inside developing. Controlling gall makers is very difficult because of the thick woody-like protection the gall affords the insect within.
Pest Examples: wasps, phyllids and midges.

STEM AND TWIG DAMAGE. Many plants may exhibit wilted, dying or dead foliage, which may or may not hold onto the twig or branch. For proper diagnosis of stem damage, carefully inspect the leaves to rule out the attack of the aforementioned leaf feeding insects. Then begin to inspect the small twigs as well as larger branches which supply nourishment to the affected leaves. The judicial use of a sharp knife will enable the inspector to determine the junction between healthy and damaged wood.

Evidence of girdling around a twig or branch terminal would indicate an attack of a twig girdler. The girdled branch most often falls to the ground while others may be left attached, but will be flagging (dying) awaiting the next wind to break them off. Inspection of the clipped end of the

Beetle larva chewing damage to Elm leaf.

fallen twig will reveal very smooth and deliberate chewing resembling a knife cut encircling the twig.
Pest Examples: twig girdler. (Adult beetles most often are involved.)

Evidence of bark splitting just at the point where branch terminal flagging occurs usually suggests egg implantation. Once the flagged terminal drops to the ground, the egg hatches and immature insects burrow into the ground to complete their life cycle. This damage is very difficult to control because the adult doesn't feed much.
Pest Example: cicada (17-year locust.)

Small or large holes in branches often indicate borer activity. Using a knife to probe the hole and subsequent tunnels, may produce the immature stage of either a beetle or caterpillar. Usually borer activity in small branches will cause flagging of foliage, indicating it is usually too late to save the branch. Usually trees or shrubs which are under stress as mentioned earlier will be much more susceptible to borer damage. Keep plants as healthy as possible. Spray preventatively before borers enter the plant.

Pest Examples: elm bark beetle, ash borer, branch and twig borers and shothole borer.

Hollowed out branch terminals is another plant damage symptom. The damage causes flagging of the foliage about the time the insect is winding up its life cycle and about to emerge as an adult. The best time to control these pests is to spray susceptible plants in early spring in order to prevent insect entrance into the terminal.
Pest Example: pine tip moth and European pine shoot moth.

Sap oozing from various places on a branch or terminal is evidence of borers. There are some insects which live under the sap covering and feed in the cambium layer of the plant. The best control is physical removal.
Pest Example: pitch mass moth of pine.

In the South, pine tree terminals are often plagued with mealybugs living beneath sap globules at the base of needles. Taxus is another plant attacked. The tiny insects are easily controlled, but if not controlled will turn the foliage, branches and trunk black with the feeding-honeydew-sooty mold cycle.
Pest Example: mealybug.

Large woody growths on stems are the work of gall makers. Sometimes the gall may cause the distal portion of the twig or branch above the gall to flag and die. Wasps, midges, psyllids, aphids and others are responsible.
Pest Examples: Eastern spruce gall aphid and wool sowers gall.

TRUNK/STEM DAMAGE. In weakened trees and shrubs, beetles and borers will attack the trunk or stems of the plants. The feeding of insects in the cambium layer of the plant breaks the vascular vessel linkup between roots and leaves. If this feeding damage is extensive, to include trunk girdling, then large portions or even the entire canopies are left without water and nutrient/gas exchange capability. The tree/shrub then

quickly dies. The symptoms of beetle/borer presence or beetle/borer damage is quite obvious.

Sawdust particles caught on upper edges of bark will pinpoint their location and inform one as to population density.

Pest Examples: pine bark beetle, lilac borer and cottonwood borer.

Sap oozing from holes or borer galleries is still another trunk damage symptom. The sap flow, if it is great enough, will often repel some boring insects. Of course, if the tree is in a weakened state, it will often not have enough sap pressure or turgor pressure to keep the leaves inflated and wilt will result. Insects feeding within this sap or resin flow are protected from pesticides, making control quite difficult.

Pest Examples: peach tree borer, lesser peach tree borer and shothole borer.

Dry holes present in the trunk many times are the result of adult borer emergence. Sometimes an empty pupal case will be stuck in the hole to support this claim. Once a borer is at work inside the plant feeding, it is quite difficult to control. Some systemic insecticides may be of use for cambial feeders. For heartwood feeders, a topical surface residual spray will often prevent borer entrance.

Pest Examples: ash borer, carpenterworm and dogwood borer.

Bulges and meandering tunnels beneath the thin bark of the white birch tree provides the habitat for one Midwestern insect borer. Being a cambial feeder, some control using a systemic insecticide may be obtained.

Pest Example: bronze birch borer.

Loose bark with tunneling and sawdust beneath, represents the last trunk damage symptom we'll consider. As insects feed beneath the bark in the cambium layer, they'll cause that portion of the cambium to die. The bark then begins to loosen as the vascular tissue beneath dries out from the insect damage.

Pest Examples: pine beetles and elm bark beetle.

ROOT SYSTEM DAMAGE. Roots which are severed, chewed in two or nicked will eventually display wilting or flagging in the upper canopy of the plant. When all other above-ground anatomical features of the plant have been inspected to rule out any of the previously mentioned insects and damage, then an inspection of the root system may be justified. Of course a plant or two will have to be sacrificed.

Carefully dig the plant up, sifting through the soil as it is gently washed away from the roots. Insects may be discovered while washing the roots or actually found attached to individual roots. Chewing insects cause the majority of insect related root problems. A soil drench of any number of insecticides should provide control.

Pest Examples: larval stage of several beetle grubs, black vine weevil and strawberry rootworm.

This presentation of insect diagnostic tools will hopefully enable the reader to now have a working knowledge of some of the steps with which to approach the diagnosis of insect pests on ornamental plants. — *William P. Eubank* ■

The author is a full-time tree and landscape consultant with William P. Eubank Consulting, Houston, Texas. He's also a registered professional entomologist providing a lawn and ornamental consulting service for companies.

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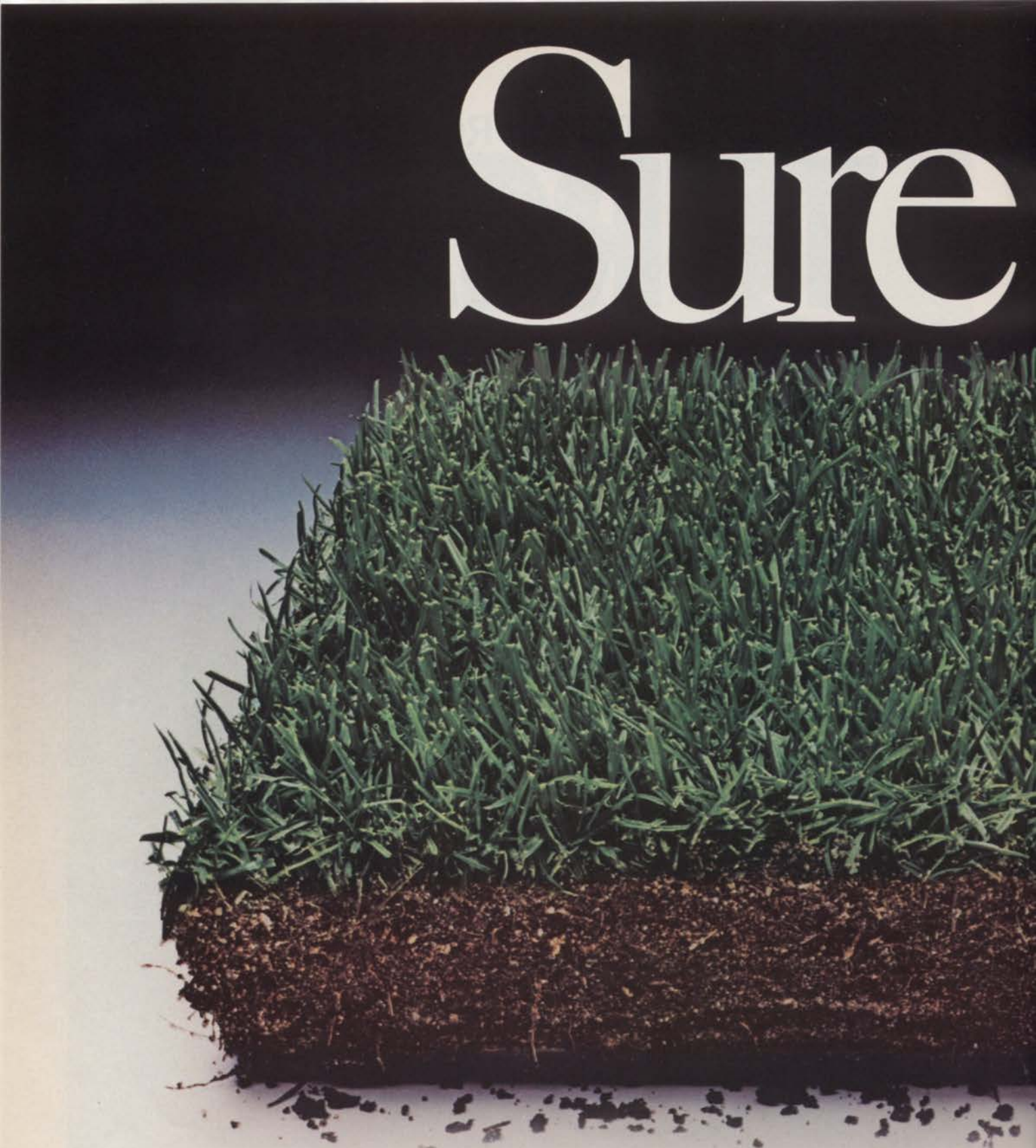

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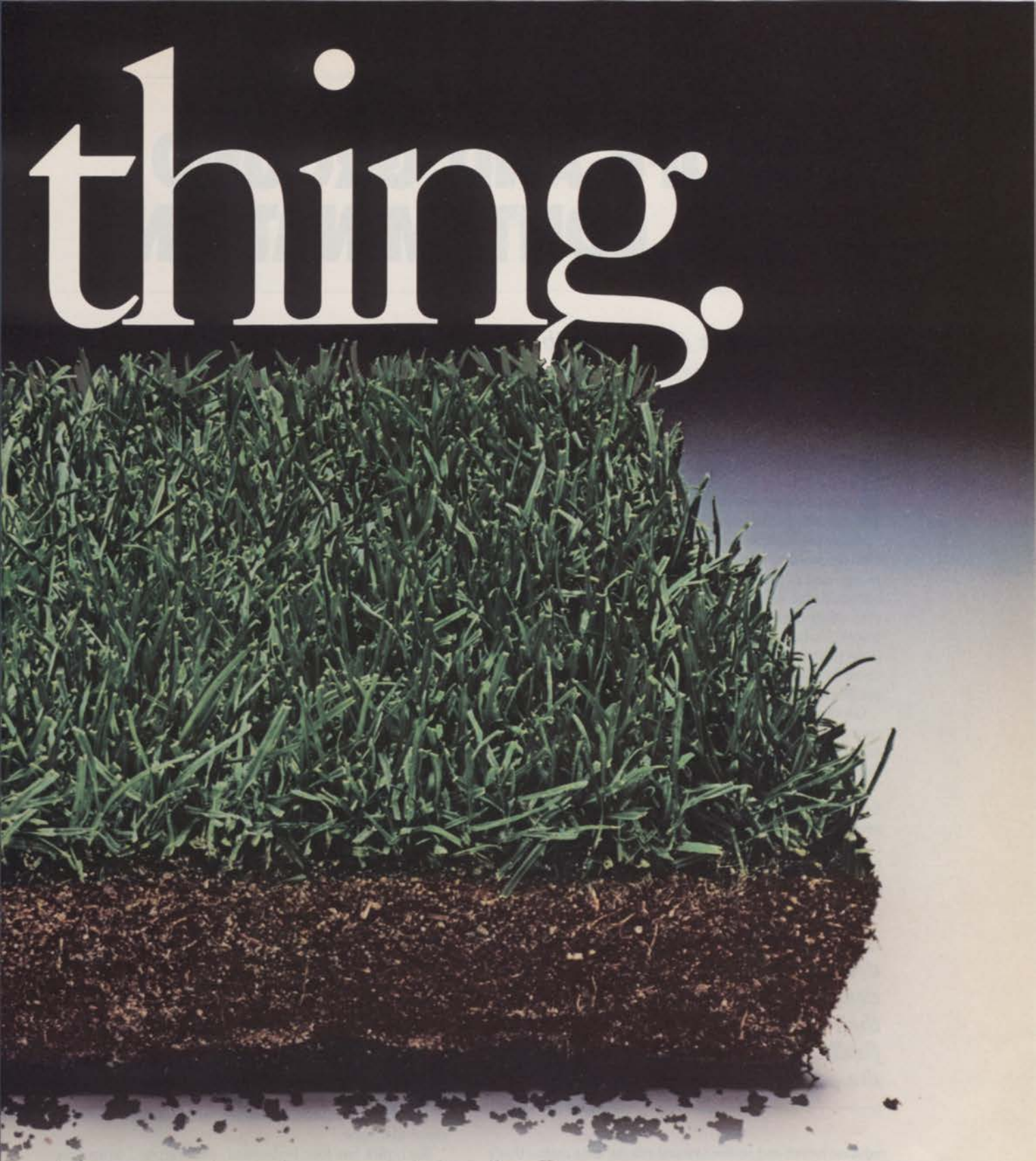

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RUNOFF AND GROUND WATER CONTAMINATION

Concern about possible runoff and ground water contamination resulting from lawn care chemicals has recently prompted a number of new studies.

If lawn care products are applied according to label directions there shouldn't be a problem with runoff or ground water contamination, right? Unfortunately this isn't always the case. Though label directions include disposal methods for pesticides and their containers in an effort to avoid possible environmental hazards, it's become recognized in recent years that when some chemicals are introduced to the turf itself, they have more of a tendency than other chemicals to filter down and reach the water below. Variables like a sandy soil type and shallow water table contribute to the problem in some locales. Researchers have also found that heavy irrigation and use of very soluble fertilizer sources in late fall encourage the problem.

Ground water in the United States accounts for 96 percent of freshwater available for use. Half of the population, and 95 percent of those living in rural areas, rely on it for drinking water supplies.

It is not presently known how much of that water suffers from contamination due to pesticide applications. However, several states have now identified their own ground water contamination problems — some of which may have resulted from the use of agricultural chemicals, including materials applied on lawns. Since contaminants are known to cause adverse health and environmental effects, it's a matter that's not taken lightly.

Sullivan recommends that LCOs develop an educational program to demonstrate irrigation techniques to their customers. An important finding in his studies has shown that the public tends to over-irrigate.

Runoff and ground water contamination have been under study the past decade by a number of university researchers. But they're not the only ones playing detective. State organizations and federal legislators have also taken the matter into consideration. In the past few months, the EPA has initiated its first-ever nationwide study for pesticides in both private and community drinking water wells. Officials say the two-year study will help them establish future regulations regarding agricultural chemicals, including some targeted for turf use.

It may seem strange, but studies on runoff and ground water contamination have not been undertaken by universities throughout the country. With its sandy soil and frequently shallow water table, it seems that the state of Florida has an environment that would lead to such problems. However, T.E. Freeman, professor of turfgrass pathology, University of Florida, explained that though this state is always cognizant of a potential problem, it hasn't had the uproar that's been prevalent in the North.

His department has done much work on the fate of pesticides in soil, but no studies directly related to turf.

David Kopec, professor of plant sciences, University of Arizona, reported that Arizona is affected by ground water laws, but the department focuses most of its research on water conservation.

Most of the noise seems to be coming from the East. Michael Sullivan, associate professor of plant science, University of Rhode Island, attributes this to the fact that there's more commercial lawn care in this region.

"If you look at the total service area, you've generally got a lot more lawns and commercial maintenance here than you do in the Midwest or Southwest," he said.

RUNOFF RESEARCH. Scott Harrison, graduate research assistant, agronomy department, Penn State University, described the school's elaborate runoff research facilities where work has been in progress for three years.

Penn State has 12 sloped plots (about 1,300 square feet each) with individual irrigation systems and a collection apparatus that measures the amount of runoff in both rate and total volume. The system also subsamples runoff throughout the irrigation process and analyzes it for fertilizers and pesticides used on the turf.

The plots were established in 1985 and have been operating since that time.

Each plot has four lysimeters, underground collection basins that pick up water passing through the soil. Though the site is designed to study runoff, it also has some capability of looking at potential ground water movement.

Harrison said that each season, a fairly typical lawn care program is practiced. This includes treating the turf with about two to four pounds of nitrogen per year, and applications of a preemergence annual grass herbicide. An insecticide and broadleaf postemergence herbicide are also applied at the site. The water collected is then analyzed for those materials as well as nitrogen, phosphorus and potas—

sium — the three basic components of many turf fertilizers.

Researchers were interested in comparing runoff rate and volume on plots that had been "established" through different methods. At the Penn State site, half of the plots were established with Kentucky bluegrass sod, which is typically used to establish turf when laying sod in the North. Other plots were seeded — some with a high quality perennial mixture recommended by the agronomy department, and others with a commonly used contractor's mix containing annual ryegrass.

Since the site is based on a fine-textured soil, a great deal of runoff would normally be expected. Though it's too early to draw conclusions, researchers have clearly observed that high quality sod produces much less runoff, in terms of volume and rate, than even well-managed, high quality seeded areas.

The researchers found that during the first year of the study there was about 15 times more runoff coming off of the seeded plots than the sod. The sodded plots, Harrison said, essentially did not runoff.

The following year, the seeded plots had developed and matured and ran off less. By 1987, there was between three to five times the runoff volume and rate from the seeded plots as from the sodded plots.

In that entire period, little runoff came from the sod, Harrison said. In the study, six inches of water was applied to the turf to simulate severe storm conditions. Findings showed that only about 15 percent of that liquid ran off of even the poorest quality plot.

Researchers were surprised to find so little runoff and are now trying to comprehend some of the physical characteristics of the plots, and the surface itself, to determine why they're getting the response they are.

Harrison said a fair amount of bad press centering around the use of turf fertilizers and pesticides, and its potential contribution to ground water and surface contamination, lead to his research.

At this point in time, there are few studies on runoff and Penn State may be as far along as anybody with their work. It's a long-term commitment since they're locked into a seasonal schedule, Harrison explained.

"It's not the kind of thing that you can find out in a year," he said. "I don't know that there will be any real conclusion scheduled only because there are so many current lawn care chemical tools that we could introduce into the study and monitor for potential movement."

TO LEACH OR NOT TO LEACH. Sullivan studies percolate contamination — vertical movement of pesticides down into the sand and gravel above the ground water. Most of southern New England, down into Long Island, N.Y., has very coarse and permeable soil where it's far more likely that contamination will occur because of infiltration rather than runoff, he said.

Earlier in the year, Sullivan and colleague Arthur Gold completed work on the volume of nitrogen they saw lost from commercial home lawn applications.

Nitrogen, the element required in a nitrogen fertilizer in the largest quantity, is easily lost through leaching when irrigated. Any nitrogen fertilizer must be converted to inorganic nitrogen — nitrate (NO_3) or ammonium (NH_3) — before it can be used by the turf. In the study, Sullivan and Gold measured both forms.

According to Sullivan, an average loss was anywhere from 0 percent to 4 percent of the total applied material. When good watering practices were followed, it was about 3 percent to 4 percent. The rate went up to approximately 14 percent with over-irrigation.

The material measured was found in sand and gravel beneath the root zone. Because this area is clean, it basically doesn't retain anything, Sullivan said. Losses eventually end up in the region's fairly shallow ground water.

Sullivan and Gold will continue this work by comparing the findings to homeowner applications.

Sullivan recommends that LCOs develop an educational program to demonstrate irrigation techniques to their customers. An important finding in his studies has shown that the public tends to over-irrigate — a major cause of nitrogen loss from the site, he said.

The form of nitrogen that's used can also make a big difference, he said. Studies indicate that water-soluble, readily available products can cause problems. The water-soluble source, ammonium nitrate, can result in higher loss than either urea formaldehyde, a slowly soluble source, or Milorganite, a slow-release product. Increased amounts of nitrogen tend to increase the amount of loss from the system,

PESTICIDE SURVEY

The U.S EPA's two-year nationwide survey for pesticides in private and community drinking water wells got under way three months ago. Among the many agricultural chemicals and byproducts it will be testing for include the following, which are (or have been) associated with lawn care.

FUNGICIDES	HERBICIDES	INSECTICIDES	NEMATICIDES
Carboxin*	Atrazine*	*Aldrin*	*EDB**
Chloroneb	Bentazon*	Carbaryl*	Ethoprop
Chlorothalonil*	Bromacil*	*Chlordane-alpha**	Fenamiphos*
Etridiazole	Dalapon*	*Chlordane-gamma**	*1,2-Dichloropropane**
Fenarimol	DCPA	Diazinon*	
Triademefon	Dicamba*	Dichlorvos	**OTHER**
	Diphenamid*	*Dieldrin**	Nitrates/Nitrites*
	Diuron*	*Dinoseb**	
	EPTC	*Endrin**	
	Pronamide*	*Endrin aldehyde*	
	Simazine*	*4,4'DDT*	
	2,4-D*	*Heptachlor**	
	*2,4,5-T**	*Heptachlor epoxide**	
	*2,4,5-TP**	Methomyl*	
		Methoxychlor	
		Trifluralin*	

** Priority pesticides which have a high potential for leaching into ground water. For information on health advisories, contact the Safe Drinking Water toll-free hotline, 1-800-426-4791, Monday to Friday 8:30 a.m. to 4:30 p.m. E.S.T. (In Washington, D.C., call 382-5533).*

The chemicals that appear in italic have been canceled by the EPA and are not legal for use in commercial lawn care. However, that are still being studied as a result of past use or misuse.

but not nearly as dramatically as over-irrigation, Sullivan said.

Though mainly researching nitrogen, Sullivan has obtained a "small amount" of funding for pesticide work, he said.

Also recently completed is a study on the leaching of dicamba and 2,4-D from home lawns. Here conclusions were made that much of the loss of chemicals was due to microbial activities.

Sullivan explained that with repeated applications of these postemergence herbicides, microbes are capable of using the material as an energy source. In turn, the microbial population increases and the soil's ability to detoxify the product also grows. With good moisture conditions, residual control is virtually eliminated in the soil, he said.

Sullivan's work was prompted by public concern about ecology which resulted from rapid expansion of the industry. "The lawn care industry is very obvious in its growth," he said. "A lot of people are buying, but a lot of people are questioning it too."

He also feels that the studies evolved out of the industry's own concern for its health and well-being. "The research is needed by the industry to show that they are paying some attention to their consequences. Questions are being asked of the industry by the public. I think it (the work) serves both masters," he said.

GROUND WATER CONTAMINATION. Martin Petrovic, associate professor of turfgrass science, Cornell University, has researched late fall fertilization for ground water contamination potential. Over the past three years, he's looked at a number of different nitrogen sources.

Petrovic reported that when sulfur-coated urea was used, anywhere from 28 percent to 41 percent — depending on site — was lost as nitrate during the late fall and early spring. The material eventually ends up in the ground water, he said.

Meanwhile, the slow release sources Nitroform, Milorganite and an experimental resin-coated urea didn't leach at all. Petrovic therefore recommends that in areas such as Long Island, N.Y., where concerns about ground water contamination exist because of a conducive environment, LCOs should avoid applying very soluble sources in late fall.

Last September, the department began a follow-up study to examine a standard "season-long program" with 13 common nitrogen sources. The study is in its initial stages and will run for another two years. No findings are available yet.

Petrovic works primarily with nitrates but is also beginning work on pesticide movement and the fate of a season-long group of products. Eight chemicals that are of highest concern on the EPA's list of pesticides, because they're likely to leach into ground water, will initially be studied. This includes 2,4-D, dicamba, DCPA, carbaryl, chlorothalonil, fenamiphos, methomyl and trifluralin.

Like Sullivan, Petrovic has found it difficult to obtain state funding for pesticide studies. Typically, funding has been granted for work dealing with nitrogen loss. Petrovic believes that pesticide loss is an area which is gaining more interest, however, and expects funding to follow shortly.

David Baker, professor of biology and director of the Water Quality Laboratory, Heidelberg College, runs a ground water testing program that focuses primarily on rural private wells. Through the support of the state of Ohio, the lab has launched three projects in the area of ground water contamination. One study is a statewide nitrate testing program.

Baker said 7,500 hundred private wells across Ohio have already been tested. Seventy-eight percent of the wells sampled showed no trace of nitrate contamination. Only about 2.8 percent exceeded the federal EPA Safe Drinking Water Standard of 10 micrograms per liter (mg/L).

According to the survey, if the nitrate + nitrite-nitrogen concentration in a sample is less than .50 mg/L, the well water is not contaminated by nitrates. Concentrations between .50 mg/L and 5 mg/L shows some degree of nitrate contamination, but does not exceed the safe drinking water standard. Levels between 5 mg/L and 10 mg/L mean significant contamination is evident, but the water still meets the standard. Water is considered unsafe for infants under six months of age if the concentration exceeds 10 mg/L.

An EPA study of rural water supplies conducted by Cornell University reveals some insight into the status of ground water supplies nationwide (Francis, et. al., 1984). In its study, the EPA found that 2.7 percent of the wells tested exceeded the safe drinking water standard. North Central states showed the highest contamination levels where 5.8 percent exceeded 10 mg/L. The Northeast had the lowest levels with only .3 exceeding the standard.

Baker has also just completed sampling 260 private wells for pesticides. Here the lab was testing mainly for a corn/soybean herbicide. The wells were selected primarily because they had high nitrates, which in other states has meant a propensity for pesticide contamination.

Approximately 10 percent of the wells studied did show some trace levels of common herbicides, Baker said. But the levels exceeded the EPA's health guidance levels in only three wells. Shallow wells, which may have been dug as opposed to drilled, are much more likely to have problems.

In the study, researchers found high levels of contamination where there was potential for direct surface runoff from fields into wells. It seems likely that in areas where *turf* pesticides are used, the contamination shouldn't be as much of a problem since residents typicallly draw from municipal water supplies with deep ground water sources. Nevertheless, the EPA has just kicked off its own survey of pesticide contamination in domestic and community wells in the United States. Several of the chemicals on its list have (or once had) some use in and around the home landscape.

Since 1985, the EPA has been verifying reports from different states on the presence of pesticides in their ground water. This information is limited because it has only pertained to specific pesticides and geographic areas.

EPA'S UNDERTAKING. Since 1985, the EPA has been verifying reports from different states on the presence of pesticides in their ground water. This information is limited because it has only pertained to *specific* pesticides and geographical areas. In the past, the EPA believed that properly applied pesticides wouldn't enter the ground water. National findings which proved otherwise, however, have convinced the agency to investigate the situation.

Last April, the EPA introduced a two-year nationwide survey of both community and domestic wells, which will help determine what types of pesticides are present in ground water.

According to officials, the information the EPA obtains will also help them establish future regulations. (See chart identifying lawn care chemicals included in study. Note that some pesticides listed were canceled for turf use several years ago.)

Matt Lorber, agricultural engineer with the Hazard Evaluation Division of the Office of Pesticide Programs, explained that the EPA has assigned some chemicals a priority notation based on their potential for leaching into ground water. There are also about 10 products that were assigned the notation due to "high known toxicity."

— *Julie November* ■

The author is Assistant Editor of ALA magazine.

IS PESTICIDE RUNOFF FROM TURF INCREASING ?

The recent dramatic increase in the customer base of professional lawn care companies suggests that the nutrient and pesticide load of suburban-urban watersheds is undoubtedly increasing.

The Pennsylvania Turfgrass Council has actively supported the development, construction and maintenance of the runoff facilities at Penn State University. The interdepartmental research project was initiated early in 1982 via planning and organizational meetings of principals involved from the departments of agronomy, agricultural engineering, entomology, horticulture and plant pathology.

Development and construction of the physical facilities involved the complete renovation of an abandoned soil erosion research area, fabrication of collection and subsampling equipment, instrumentation and data logger linkage with computer access and establishment of turfed slopes (some seeded, some sodded) to which the application of nutrients and pesticides could be made.

By late 1985, the facility was completed and since that time, much of the research conducted has emphasized the hydrological characterization of each sloped plot.

A researcher pumps out water from the underground lysimeter so he can analyze the liquid.

GROUND WATER CONCERNS. The quantity and quality of our water resources has been identified locally, statewide and nationally as having a very high societal priority. Consequently, the public's concern becomes very politicized which frequently leads to the establishment of various water policies, access and use restrictions and land and water use regulations through zoning and ordinances.

Approximately 80 percent of the nation's water is supplied by underground aquifers. This high dependence requires the maintenance of ground water supply. However, as our population increases and demand and land development continues to decrease ground water recharge capacity, alternative sources of water are needed.

It has been suggested that because of the high percentage of runoff, surfaces which are located in urban and suburban environments that recharge from these areas might make a considerable contribution to our need for a safe and potable water supply. Collection, storage and treatment of storm water runoff has been attempted on a limited scale in some metropolitan areas. However, recent studies suggest that water quality tends to decline as urbanization increases.

Decreased water quality has been associated with the movement of undesirable particles deposited on impervious surfaces (i.e. highways, parking lots, rooftops, etc.). A parallel concern has been expressed relative to the quality of water emanating from landscaped surfaces that have received nutrient and pesticide applications.

The recent dramatic increase in the customer base of professional lawn care companies suggests that the nutrient and pesticide load of suburban-urban watersheds is

undoubtedly increasing. Furthermore, it has been estimated that only 25 to 30 percent of the potential customer base for professional lawn care has been realized. It is therefore safe to assume that management inputs to landscape ecosystems will increase substantially in the near future. The effects of farm management on environmental quality have received considerable attention over the past several years. Water quality has been that aspect of the environment that has received the bulk of the research attention with respect to nutrient and pesticide pollution. Decreases in water quality have been documented as a result of fertilizer and pesticide use on agriculture lands.

Most of the work conducted over the past 25 years pertaining to the pesticide content of surface water draining from agricultural fields has been reviewed by Pionke and Chesters and R.D. Wauchope. In cases where water quality has declined due to nutrient and/or pesticide movement in water or eroded sediment, the use of grassed buffer strips between treated fields and receiving bodies of water has significantly reduced the problem.

These studies only provide indirect evidence of the impact that grassed areas have on water quality. Many of the compounds discussed in Wauchope's review are commonly used in urban-suburban landscape management. Recently (1982), a water resources monograph, Urban Stormwater Hydrology edited by D.F. Kibler, was published by the American Geophysical Union. With this monograph, considerable information was made available concerning the hydrology and engineering aspects of managing urban-suburban watersheds. Considerable computer modeling has been achieved, however, water quality data is almost entirely limited to that concerning the quality of water moving from impervious surfaces. The quality of water flowing from landscaped portions of the watershed is not known and is necessary for a complete understanding of the hydrological status of the system.

GREATEST PESTICIDE LOSSES. A number of studies have indicated that the greatest losses of pesticides result from storms that occur soon after applications are made. (Smith, et al. and White, et. al.) Since home lawns that are professionally cared for receive four or five applications per year, the potential for runoff loss is greater than areas receiving fewer applications per year. Also all pesticide treatments are surface applied because soil incorporation is not possible (except during establishment).

It is possible that substantial pesticide loading of urban-suburban watersheds has already occurred and, with the projected growth in the professional lawn care industry, the quantity of pesticides used will increase. Environmentalists' apprehension about the application of 2,4-D has increased pressure for governmental regulation of the use of this important pesticide.

Moreover, turf fertilization has been implicated as a contributor to the presence of nitrates in ground water. For many urban-suburban situations, storm water collection systems are inadequate, under designed or non-existent. Little is known about the quality of runoff water moving from landscaped surfaces, particularly from developments where a large percentage of the homeowners utilize nutrients and pesticides in the management of their individual landscapes.

Determination of the movement of these materials within the urban-suburban watershed and their effects on water quality are critically needed. It may be that improved landscape quality through the use of appropriate levels of nutrients and pesticides can result in the enhancement of the quality of water emanating from the site. The buffering capacity of the sod is directly related to plant density and thatch which is improved through proper fertilization and pest management. The question of whether there is a point of diminishing return needs to be answered.

PRELIMINARY RESULTS. The slopes have been hydrologically characterized. Seeded slopes have 10 to 12 times more runoff than sodded slopes during peak flow when irrigation is applied at a rate of six inches per hour. The lapse time from irrigation initiation to moment of runoff is four to five times shorter for seeded versus sodded plots. More runoff occurs in the fall of the year regardless of the method of establishment.

The infiltration rate of sodded slopes is approximately three times the rate of seeded slopes. The structure of the soil surface of seed slopes was adversely effected by the compacting action of raindrops and irrigation during establishment. The surface of the soil on sodded plots was protected immediately on the day of establishment; and structure, no doubt, has improved each day thereafter.

Analyses of nitrogen, phosphorus and potassium in lysimeter and runoff water has revealed low levels in all samples. When corrected for rate of flow, none of the samples have exceeded 10 ppm for any nutrient. Forty-eight hours after the application of nutrients and pesticides, irrigation is applied unless a runoff producing natural event occurs prior to that time. — *T.L. Watschke, G. Hamilton and S. Harrison* ■

Watschke is an agronomist from Penn State University, University Park, Pennsylvania. Hamilton is a senior research aide at the landscape management research center, Penn State. Harrison is a graduate student working on the project with Watschke.

ACKNOWLEDGEMENT

Partial funding for this research has been made available through a contract with the United States Geological Survey of the Department of the Interior.

VAN FOSSEN RESIGNS FROM CHEMLAWN

Van Fossen

Goldthwaite

Michael E. Shannon has been named president of ChemLawn Services Corp., Columbus, Ohio, replacing L. Jack Van Fossen, who is resigning to pursue personal interests. Both changes were effective July 1.

Also resigning is Mary Jane Goldthwaite, 41, ChemLawn's chief administrative officer. Her resignation took effect July 1 as well.

ChemLawn is a wholly owned subsidiary of Ecolab Inc. of St. Paul, Minn.

Van Fossen, 50, will continue his association with ChemLawn as a management consultant. He had been with ChemLawn since 1974 when the company was still a family-controlled business.

After fighting off a leveraged buy out attempt by Waste Management in early 1987, ChemLawn was acquired by Ecolab in April of that year.

At the time of the approximately $370 million acquisition, Ecolab Chairman, President and Chairman of the Board P.M. Grieve said the deal was the fulfillment of Ecolab's long-standing desire to enter the residential services market.

Grieve said then that Ecolab had no plans to replace ChemLawn's existing management with Ecolab executives. However, in the event that such events did take place, ChemLawn's board of directors had established a "golden parachute" for its top executives which would ensure lump sum payments based on an individual's salary.

Van Fossen said that he and Grieve had agreed that he would stay on through a transition period following Ecolab's acquisition of ChemLawn. One year later, they decided it was an appropriate time for a change to be made.

Van Fossen said that things had gone well during the first year of the acquisition.

He added that he would pursue other business interests, but would not remain in the lawn care industry other than in his capacity as a consultant to ChemLawn.

"I would remain in the industry only in some relationship with ChemLawn. My loyalties remain there," he said.

The lawn care industry has changed dramatically since Van Fossen first started with ChemLawn in 1974.

"It's interesting. Back then, people in the United States were not heavily involved in lawn care and weren't offered the availability of services they have now," he said. "It's been an educational process, and I think ChemLawn has tried to provide a leadership role in making it a professional industry and answering consumer needs."

Shannon, who also serves as Ecolab's executive vice president and chief financial and administrative officer, will continue to hold those responsibilities as well as that of ChemLawn president. He will maintain offices in St. Paul and in Columbus.

Goldthwaite, who had been with ChemLawn for nearly eight years, recently decided July 1 would be an opportune time to leave, according to Steve Hardymon, ChemLawn's director of public and environmental affairs.

"She's done a terrific job for us; she just decided to go do something else," he said.

PEOPLE

ChemLawn Services Corporation, a subsidiary of Ecolab Inc., has named **Gene C. Wilson** executive vice president/operations. Wilson's duties will include management of the company's field operations, sales and marketing activities.

Prior to joining ChemLawn, Wilson was employed with Pizza Hut Inc. as zone vice president of the Eastern United States. There he oversaw more than 2,700 company franchise locations. Prior to that, Wilson was employed by General Foods in finance and operations management.

Scott Stuckey has been appointed advertising and sales promotion manager for OMC Lincoln.

He was formerly public information supervisor for Lincoln Electric System, where he was responsible for marketing communications and public relations.

Steve Karrasch has been named manager of marketing information at Lawn-Boy. He previously held a similar position at Outboard Marine Corporation.

At Lawn-Boy, Karrasch will be responsible for market research and analysis, coordinating marketing reporting requirements with its parent company, Outboard Marine Corporation, and serving as the company representative on the OPEI Marketing Services Committee.

Stuckey

Karrasch

The O.M. Scott & Sons Company has promoted **Doug Smith** to executive technical representative for Scotts Professional Turf Division.

Smith's sales territory includes western and southwestern Ohio, the northwestern border of Kentucky and the southeast tip of Indiana.

Corinne Akahoshi has been promoted to assistant manager, market research for the Power Equipment Division of American Honda Motor Co. Inc.

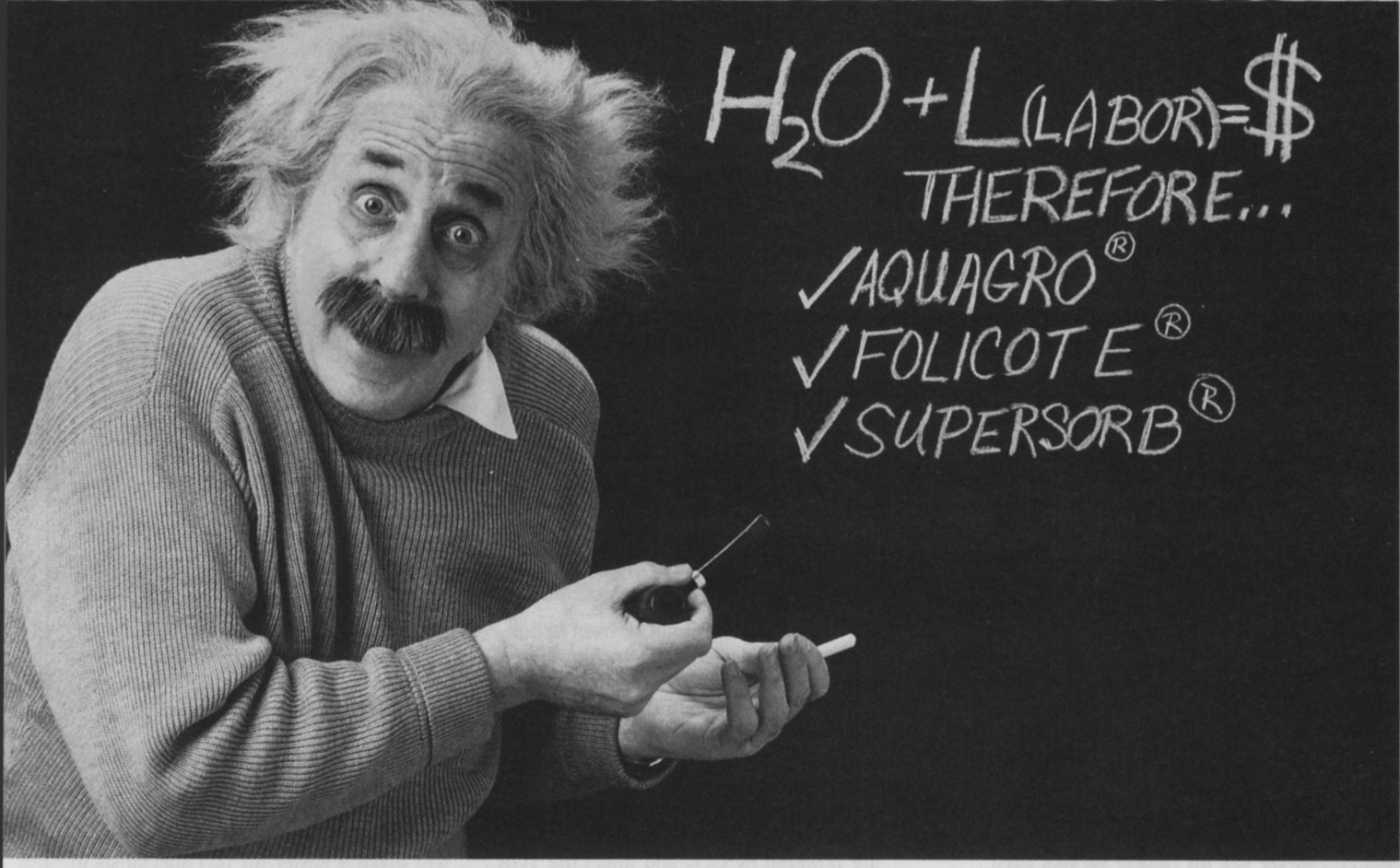
In her new position, Akahoshi is responsible for market research, consumer research, market analysis and related activities. She is also the Honda representative to various power equipment industry organizations.

Akahoshi joined Honda Power Equipment's market research department in 1986. Prior to that, she worked in the automotive industry.

Larry G. Vetter has been named commercial sales director at Ringer Corporation. His duties will include overseeing the further development of the company's commercial products division and sales to golf courses, landscapers, lawn services and other grounds maintenance operations.

Prior to joining Ringer, Vetter spent 10 years at the Northrup King Company of Minneapolis, where he helped develop its Medalist Turf Products Division.

KT Enterprises has promoted **Douglas Sevachko** to director of safety and quality control. In the position, he will monitor the quality levels of the landscape maintenance, installation, construction, application and irrigation departments. ■



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PRODUCTS

Riverdale Chemical Company has received EPA registration for Par 3™ Weed Killer, a three-way postemergent selective broadleaf herbicide containing the amines of MCPA, Mecoprop and Dichlorprop.

Par 3 controls dandelions, chickweed, plantain, oxalis, spurge and many other broadleaf weeds.

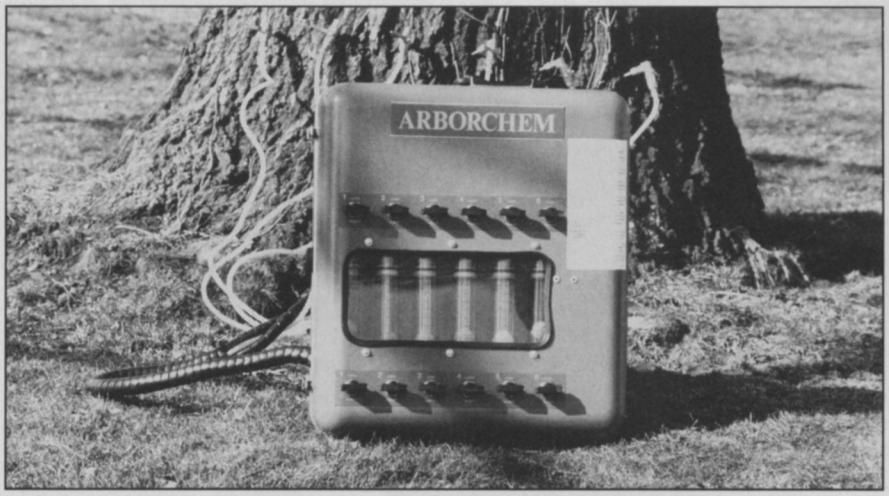
The product can be used on both cool and some warm climate grasses.

Circle 101 on reader service card

A package for the applicator's personal protection in the handling of pesticides has been developed by **The Broyhill Company.** The safety kit features a handy poly safety container for holding first aid needs, and is attached easily to any sprayer unit.

The kit includes one pair of goggles, a poly container, Dacriose eye wash, dust mask (non-toxic particle mask), Tyvek repellent suit, Takosan skin cream (repels chemicals that come in contact with the skin), a copy of the NEB Guide (laundering pesticide contaminated clothing) and an optional respirator.

Circle 102 on reader service card



The Arborchem Tree Injector from **Arborchem Products Co.** injects liquid tree growth regulator (TGR) into the trunk of a tree, after it has been trimmed, to help extend the trimming cycle. It typically doubles the time-span between trimming cycles, according to the company.

The portable unit is available in either a 3-point or a 6-point model. Both systems are powered by CO_2 and inject the TGR into the trunk between 60 and 90 psi. The 6-point model can inject TGR into six holes simultaneously.

Circle 103 on reader service card

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AMERICAN GROUP MARKETING INC.
201 E. Pine St., Ste. 616
Orlando, Fla. 32801
Providers of insurance since 1966.

Send information on your insurance program to:

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Company Name _____

Address _____

City _____ State _____ Zip _____

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manage pesticide applications and minimize loss due to disease or insects.

PestCaster is a computerized mini-weather station that collects and records a variety of different weather conditions, including air and soil temperatures, relative humidity, rainfall and wind speed direction.

The self-contained unit runs on solar-powered batteries and stores weather data for up to 14 days. Since its introduction in 1986, PestCaster has been helping turf specialists across the nation apply pesticides at the best possible times through the use of predictive models.

The newest predictive model is the PestCaster Annual Bluegrass (Poa annua) Seedhead Formation Model. Using weather measurements, PestCaster predicts the onset of seedhead formation.

Computerized predictive models are software programs that predict disease organism infestation and insect development. Each model is developed through the combined efforts of Neogen and leading university extension specialists and researchers. Anthracnose and Pythium Blight models are also available.

Circle 104 on reader service card

Rhone-Poulenc Ag Company offers the new SEVIMOL® brand 4 carbaryl insecticide for the control of mole crickets in certain Southeastern states.

According to Rhone-Poulenc, the product is a special formulation of carbaryl insecticide plus attractant systems which provide economical and effective control of mole crickets. It does not require pre-watering or watering-in after application. SEVIMOL does not readily photodegrade, has no odor and is a non-restricted use pesticide. In addition, it controls 25 other turfgrass insects and 87 tree and ornamental insects.

Circle 105 on reader service card

PRODUCT SPOTLIGHT

HAND-Y-KLEEN from **Spectrum Technologies Inc.** is a waterless hand cleaner designed specifically for applicators of pesticides and fertilizers. It easily removes pesticide stains and residues, as well as grease, oil and grime.

HAND-Y-KLEEN effectively removes the stains of such pesticides as Treflan® , Surflan® , Prowl® , pendimethalin and other chemicals. Unlike many cleaners, it leaves hands feeling smooth and smelling fresh and clean.

Packaged in portable 22-ounce tubes, the product offers convenience for the applicator who works away from water supplies, reducing exposure to potentially toxic pesticides.

Circle 106 on reader service card

The Environmental Protection Agency has accepted registration for TEMPO™ 2 Ornamental Insecticide from **Mobay Corporation** for use by lawn care and landscape applicators as well as commercial nurserymen.

The advanced-generation pyrethroid provides control for a broad-spectrum of plant and insect species. Tempo 2 is immediately available in 500 milliliter plastic bottles with built-in dose dispensers.

According to Mobay officials, extensive field testing has shown that Tempo provides effective control at significantly lower rates of active ingredients than organophosphates, carbamates or other pyrethroids. The product was tested on more than 250 plant species, with only three showing any signs of pytotoxicity.

Research was conducted at Virginia Tech, Penn State University and Ohio State University.

Tempo 2 was assigned a Category II "Warning" signal word by the EPA signifying that the product is "moderately toxic."

For greenhouse and outdoor use, Mobay's Tempo 2 Ornamental Insecticide is compatible with all commonly used fungisides, miticides, liquid fertilizers and other insecticides.

Circle 107 on reader service card

LESCO Inc. has received a federal EPA label for LESCO TFC™ Herbicide, a dispersible granule turfgrass herbicide for selective spot control of tall fescue on established Kentucky bluegrass, fine fescue, bentgrass, Bahiagrass and Bermudagrass.

According to the company, LESCO TFC represents a major breakthrough in weed control technology because until now, eliminating tall fescue required either physical removal by digging or chemical removal by spot treating with a non-selective herbicide that left unsightly brown patches.

LESCO TFC is a new sulfonylurea herbicide that is active at a rate of just a few ounces per acre. The herbicide will be marketed on a card containing 10 capsules. Each pre-measured capsule is mixed with a gallon of water to spot treat tall fescue in established turf.

LESCO TFC remains in the top layer of soil and is decomposed naturally by soil microorganisms.

Circle 108 on reader service card

Flory Industries is offering the new tractor powered Model 2500 Blower for commerical use in areas where leaves and debris need to be moved out of the way quickly and efficiently.

The unit provides the power necessary for quick and efficient high capacity cleaning. It is controlled with a damper and cylinder which allows a variable amount of air without affecting the rpm of the power source. The 3-point hitch and drive shaft hookup allow one person to easily connect and disconnect the blower within minutes.

Circle 109 on reader service card

CLASSIFIEDS

ACQUISITIONS

Wanted to Acquire

Lawn care companies of all sizes in U.S. and Canada being sought by national corporation. Complete buy out or stay and grow with us. If interested please call me directly: John Hayes, President, Tru Green Corporation, 404/442-8700. Strict confidentiality maintained.

Wanted to Buy

Lawn care companies of all sizes anywhere in U.S. wanted to purchase by national corporation. If interested please respond to: ALA magazine, Box 329, 4012 Bridge Ave., Cleveland, OH 44113. Strict confidentiality maintained.

Wanted to Buy

Ever-green Lawns, a Division of ADT Limited, an international service company doing in excess of a billion dollars in sales annually, wants to acquire lawn care companies of all sizes. All inquiries strictly confidential. Please contact: Steve Hirshmugl, Director of Finance and Acquisitions, Evergreen Lawns Corporation, 1390 Charlestown Industrial Drive, St. Charles, Mo. 63303; 314/946-9700.

HELP WANTED

Position Open

Middle Management Position available in 25-year-old financially solid, growth-oriented lawn service company. Equity opportunity can be available to the right party. Seeking a take charge person who can assume responsibility and thrives on challenges. Excellent benefit program. Your comprehensive resume should include business and work experience over the last 5 years, educational background and current or last salary. Write Vice President, Lawn Mate Inc., P.O. Box 403, Metuchen, N.J. 08840.

Manager Position

Top Firm Needs Top Person: Quality conscious, Texas-based landscape management firm has immediate opening for detail-oriented Operations Manager and/or Business Manager. If you have outstanding professional, managerial and horticultural skills and are not afraid of hard and healthy teamwork, then you could qualify for a top position with the finest landscape firm in the Southwest. Outstanding compensation and opportunity. Reply today to: ALA, Box 325, 4012 Bridge Ave., Cleveland, OH 44113.

FOR SALE

Lawn Care Equipment

Hannay reels new in-the-box, E1526s, E1530s, $339; lawn spray hose, 275 psi and 600 psi, all sizes; original Imler measuring wheels, $48; glycerin-filled gauges, 0-6- psi to 0-1,000 psi, $19.95; polypropylene ball valves, 1/2-inch to 2-inch; Chem-Lawn guns, $75.95; lawn spray boots, $16.95; lawn spray gloves, $1.25-pair. **Call Hersch's Chemical, Inc. 800/843-LAWN** — outside of Michigan **13/543-2200.**

Maintenance Business

Established Landscape Maintenance and Tree Service company with contracts and equipment in Southern California, owner retiring. Averaged over $300,000 per year gross sales past three years. Serious inquiries reply to: ALA, P.O. Box 5817, Cleveland, Ohio 44101-9765.

Landscape Publishing Co.

Monthly magazine for landscape contractors and landscape maintenance. Ten book titles, one audio cassette, one video. Can be operated anywhere. Will train, terms available. Call 619/766-4749.

Rates: All classified advertising is 55 cents per word. For box numbers, add $1 plus six words. All classified ads must be received by the publisher before the 10th of the month preceding publication and be accompanied by cash or money order covering full payment. Submit ads to: ALA Magazine, 4012 Bridge Avenue, Cleveland, Ohio 44113.

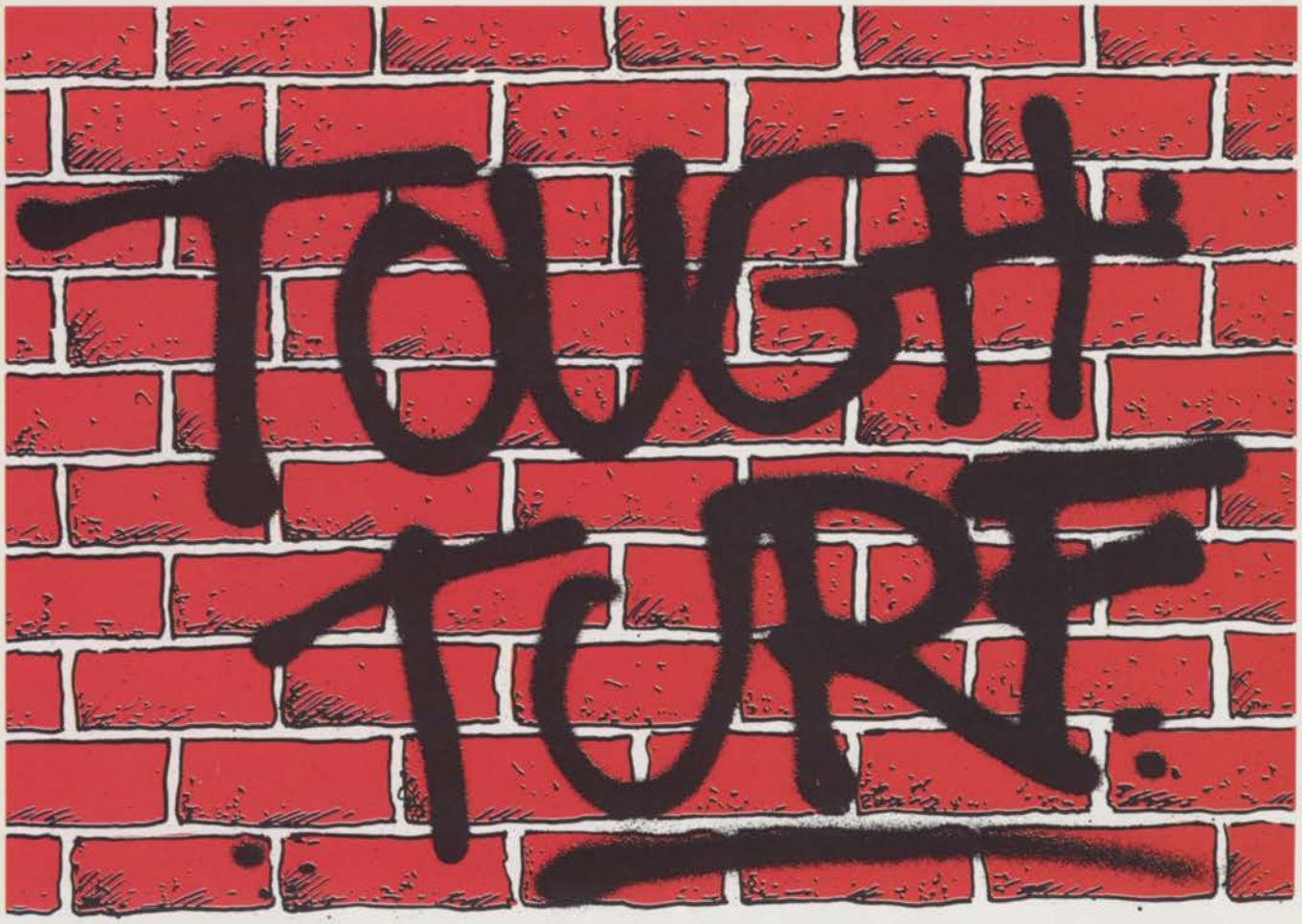
AD INDEX

**Depicts regional ad*

COMING NEXT MONTH

No doubt the drought and hot weather is getting you and your business down. ALA will take a look at the drought situation and how it has affected business and the landscape in all areas of the country. We'll investigate how the drought will affect future prices and supplies.

In August, ALA will also bring you a feature on the identification and control of diseases in turf and ornamentals and an article on the use of specialty products in the industry.



IS YOUR CUSTOMER'S TURF LIKE A BRICK YARD?

Hard? Non-porous? It's hard to grow grass on a brick. Almost impossible.

Hahn professional aerifiers are the answer to your "brick yard" problems.

Choose from self-propelled, walk behind, tractor drawn or riding aerifiers. Hahn aerifiers are designed and manufactured especially for tough, professional use.

The JR-4 Aerifier 24-inch swath. Self propelled when transporting and aerifying. Easy to use controls. Aerifier reel holds 40 tines.

The EA-3 Aerifier 22-inch swath. Simple to operate, maneuverable and small enough to get into tight spots. Fingertip throttle. Powered reel "walks" EA-3. Aerifier reel holds 16 tines.

The TB-60 32-inch swath tow-behind. Hydraulic cylinder for raising and lowering. Aerifier reel holds 60 tines.

The TM-60 Same as above. Utilizes category 0 or 1 tractors 3 point hitch.

The TMV 30-inch swath. Optimum professional machine. Riding aerifier with 34-inch overall width. Aerify more than 1 acre/hour. Electric start. Hydrostatic drive. 8 hp Kohler Magnum engine. Aerifier reel holds 40 tines. The ultimate!

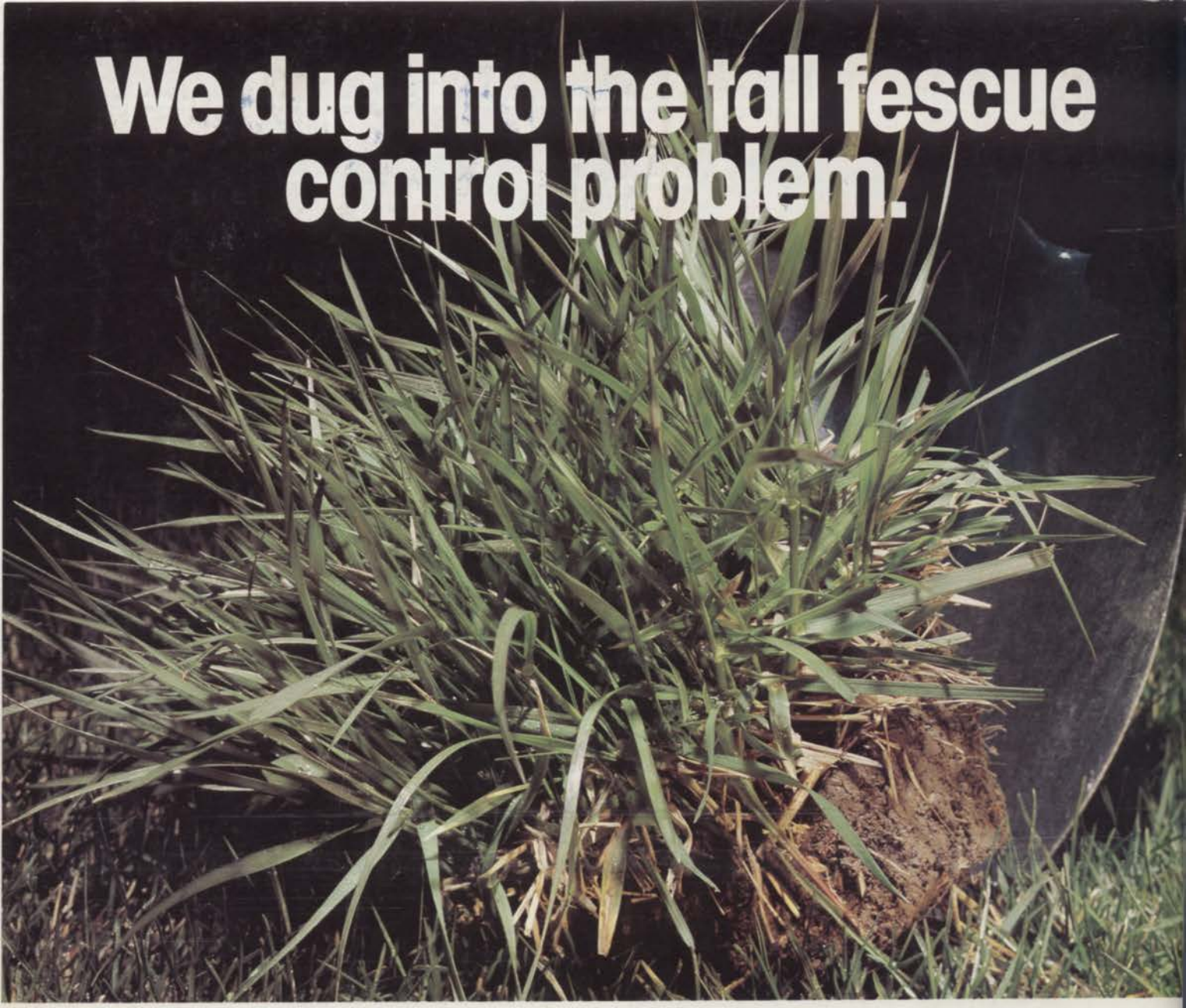
For more information or free product brochure call 1-800/457-HAHN.
In Indiana, call 1-812/428-2027 (collect).

Circle 5 on reader service card

Hahn

1625 N. Garvin St.
Evansville, IN 47711-4596
Telex: 27-8429

We dug into the tall fescue control problem.



So now you don't have to.

Until now, getting rid of ugly clumps of tall fescue was no easy task. The weed had to either be physically removed by digging or chemically removed by spot treating with a non-selective herbicide that left unsightly brown patches for weeks.

LESCO TFC™ Herbicide changes all that. It's the first product to provide selective spot control of tall fescue in established Kentucky bluegrass, fine fescue, bentgrass, bahiagrass and bermudagrass turf. Active at a rate of just a few ounces per acre, the convenient water dispersible granule formulation exhibits both contact and residual soil activity. It slowly eliminates tall fescue, while allowing the desirable grass to fill in.

For tall fescue control without the digging, make LESCO TFC Herbicide part of your application program.

Order today. Contact your LESCO sales representative, visit the nearest LESCO Service Center or call us toll free.

LESCO (800) 321-5325 NATIONWIDE (800) 686-7413 IN OHIO

LESCO, Inc., 20005 Lake Road, Rocky River, Ohio 44116 (216) 333-9250

Always read and follow label instructions before using any chemical product.

Circle 43 on reader service card