

# ALA

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MICHIGAN

**PLANT GROWTH  
REGULATORS:**

**ARE THEY  
READY FOR THE  
FRONT YARD?**

**SELLING FUNGUS CONTROL  
IS DIFFICULT  
BUT NOT IMPOSSIBLE**

**TECHNICAL FEATURES:**

**YELLOW PATCH  
UPDATE**

**TURF SEED  
GERMINATION**







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Pythium weather. High temperatures, high humidity and high anxiety. Once Pythium takes root, it can destroy turf within hours.

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**HOW TO AVOID SLEEPLESS NIGHTS  
DURING PYTHIUM WEATHER.**

**SUBDUE**

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JUNE 1984  
VOLUME 5 NUMBER 4

### THE COVER

Plant growth regulators have been used on rough turf for some time, but now they are beginning to see some use on fine turf. This month's cover story concerns the state of the art in plant growth regulators.

## CALENDAR

### July 12-14

Summer Tri-Board, San Jose Hyatt Hotel, San Jose, CA. Contact: Bob A. Gouley, California Landscape Contractors Association, Inc., 1419 21st Street, Sacramento, CA 95814; 916/448-CLCA.

### August 15-16

Penn State Field Days, Joseph Valentine Memorial Turfgrass Research Center, University Park, PA. Contact: Dr. Joseph M. Duich, Department of Agronomy, 21 Tyson Building, University Park, PA 16802, 814/865-9853.

### Sept. 11

Ohio Turfgrass Field Day, Ohio State University Turfgrass Field Plots. Contact: Karl Danneberger, Department of Agronomy, Ohio State University, Columbus, OH 43210, 614/422-2001.

### Sept. 18-20

Virginia Turfgrass Research Field Days, Virginia Tech, Blacksburg, VA. Contact: J.R. Hall, III, Agronomy Dept., Virginia Tech, Blacksburg, VA 24061, 703/961-5797.

### Sept. 30-Oct. 3

Florida Turfgrass Association 32nd Annual Conference and Show, Hyatt Regency Hotel and Curtis Hixon Convention Center, Tampa, FL. Contact: FT-GA Executive Office, 302 S. Graham Avenue, Orlando, FL 32803, 305/898-6721.

### Sept. 30-Oct. 3

Society of Municipal Arborists 20th Annual Meeting and Trade Show, Sheraton Gardens Hotel, Freehold, NJ. Contact: Dave Shaw, local chairman, 20 Court Street, Freehold, NJ 07728; 201/431-7903, or Robert Miller, exhibits chairman, 7447 Old Dayton Road, Dayton, OH 45427; 513/854-1338.

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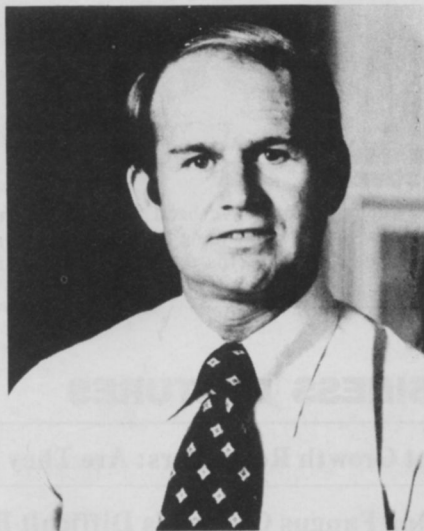


# ALA PUBLISHER'S FEEDBACK

**L**ast month's cover feature presented a dramatic portrait of the growth and dynamics of our lawn service industry — ChemLawn's five-year, 28.5 percent compounded annual performance is amazing considering their level of dollar volume — the fact that hundreds of other service companies around the country are *exceeding* ChemLawn's growth percentages is even more amazing and makes for a very exciting market environment. But to understand the true nature of these successes, we must look beyond the huge marketing potential of lawn service to the nature of businessmen that dominate the industry.

Two key qualities are dominant in the successful individuals in our field — the entrepreneurial spirit and the ability to get along with people. This combination is unbeatable and almost commonplace in our industry.

Lawn service is above all else a people business — businessmen who don't interact well with people don't last long in this business. In fact, human relations skills are perhaps even more important for success than driving ambition. Personally, I'm convinced that the qualities behind good human relations are more instinctive than learned. Skills can be sharpened and refined, but I think you're either a



“people person” or you're not. And looking around the market, you find a tremendous resource of top management — founders — with people-oriented personalities.

In talking with these businessmen, I've noted that they put a high priority on people skills when filling entry level positions — recognizing that this quality is perhaps more important than technical knowledge (which can be learned more readily). It is also positive to note that the majority of top businessmen in the field have a policy of promoting

from within and that most technicians feel that opportunity for advancement is available to them. All of which are very positive signals for success, but the picture is not perfect — fast track entrepreneurs make people mistakes like businessmen in every other field. Most of their errors are the result of promoting their highly productive technicians to service management positions.

It's a common error, unfortunately many businessmen overlook the fact that it is rare to find a technician with good people management skills and know-how. If you have one, by all means promote him, but if you have any doubts at all about a top performer making such a transition, you should look to the outside for an experienced service manager with skills in diplomacy and objectivity as well as an ability to manage and work with people. Promoting a high-quality technician into a management position can be counterproductive and defeating for entrepreneur and employee.

*Dick Foster*

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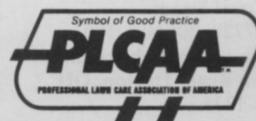
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# HOW TO SELL LAWN DISEASE CONTROL, AND DELIVER IT.



HELMINTHOSPORIUM LEAF SPOT



SCLEBOTINIA DOLLAR SPOT



RHIZOCTONIA BROWN PATCH



FUSARIUM PATCH

## Turn disease problems into profits with **CHIPCO® 26019** fungicide.

Selling disease control is a great way to boost profits and attract new customers.

And CHIPCO® 26019 is the ideal product to help you do both.

## The selling proposition: a beautiful, disease-free lawn.

Everything you do for a customer is designed to create a beautiful lawn. Turf diseases look bad...and that can make *you* look bad. A programmed approach includes an effective, long-lasting fungicide like CHIPCO 26019 keeps your customers satisfied.

## CHIPCO 26019 is the only fungicide you need.

It can be used safely on all lawn grasses nationwide to control the major turf diseases like leaf spot, dollar spot, fusarium and brown patch. Highly effective and long-lasting, CHIPCO 26019 fungicide fits into your treatment schedule and reduces callbacks.

In short, when you've got CHIPCO 26019 on the shelf, you're ready for *business*.

## Send for FREE booklet on how to sell disease control.

We've put together a booklet that details lots of effective techniques and tools for selling disease control to your customers...and delivering it with effective, long-lasting CHIPCO 26019 fungicide.

Turf Fungicide®

# CHIPCO 26019

## TAKING CARE OF BUSINESS

Send to: Rhône-Poulenc Inc.  
CHIPCO Fungicide Lawn Care Center  
P.O. Box 125 Black Horse Lane  
Monmouth Junction, NJ 08852



Please send FREE *How to Sell Lawn Disease Control* booklet to:

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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

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# ALA INSIDE STORY

**T**his month's cover story is a look at the state of the art in plant growth regulators. Plant Growth Regulators (PGRs) have been around since the 1950s, but in recent years chemical manufacturers have made major strides in diminishing the negative side effects of PGRs. While most current PGRs are relegated to use on rough or utility turf, there is a real push on to develop a PGR suitable for use on home lawns. How close are we to the ideal PGR? With a little modification of our expectations, some would say that PGR has already arrived. Check out the cover story on page 20 and see what I mean.

Also in this issue is an in-depth look at selling fungus control to the home lawn market. Fungicide manufacturers have traditionally directed their marketing efforts toward the golf course industry. They have all but neglected the residential lawn service industry — for some pretty good reasons. In this feature, we explore the difficulties inherent in home lawn fungus control, as well as the benefits you can



expect to accrue from this add-on service.

This month we have an abundance of technical features for you. First, there is a "Yellow Patch Update" by T. Abernethy and Dr. Philip Larsen, of the Department of Plant Pathology, Ohio State University. Abernethy and Larsen debunk some misunderstandings about this widely-misunderstood disease, forward some ideas about its transmission and offer some control suggestions.

Thomas W. Fermanian and Jean E. Haley of the Department of Horticul-

ture at the University of Illinois present the conclusions of their low volume spraying research in "Low Volume Liquid Fertilization." Fermanian and Haley analyze the results of several formulations of fertilizers applied on test plots with low volume equipment.

Rounding out our technical features are "Have You Ironed Your Plants Lately?" by Neal Howell, president of Ironman Fertilizer Specialties; "Converting to Low Volume" by Tom Jessen, president of Perma-Green Supreme; "Turfseed Germination" by Dr. Eliot Roberts, director of The Lawn Institute; and "Skin Absorption and the Lawn Specialist" by Jim Vaccaro, research leader, Industrial Hygiene, Dow Chemical Company.

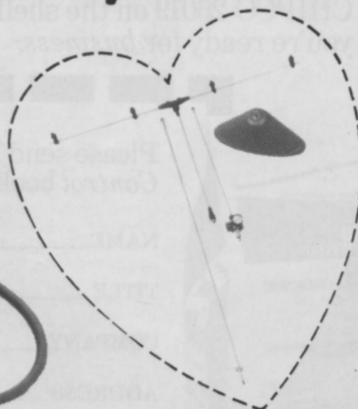
As always, we are proud to bring you the latest technical information and business insight to help you stay ahead in the lawn care industry. Join us again next month for more of the same!

*Tim Weidner*

## We Made It Simple!

### BIRCHMEIER has the Back Pack Sprayer for you —

AVAILABLE IN  
5 GAL. (20 K)  
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2½ GAL. (10 K)



- **QUALITY** — Built with Swiss clocklike precision.
- **LIGHTWEIGHT** — With the comfort of the user in mind.
- **ACCESSIBLE** — A durable self-lubricating and external pump assembly.
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AT THE HEART—DURABILITY OF SERVICE

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Technical data	FLOX 2½ gal.	IRIS 3½ gal.	SENIOR 5 gal.
Weight #	11	11.4	12.1
Tank Capacity	2.6 gals.	3.9 gals.	5.2 gals.
Max. Working Pressure	84 PSI	84 PSI	84 PSI





**For  
Disease Control**

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Insect Control**

## on turf, trees and shrubs

**Duosan is** Mallinckrodt's double-action broad spectrum fungicide. It goes to work instantly as a contact fungicide, then remains active as a systemic fungicide.

Duosan effectively controls 8 turf diseases — including Leaf Spot, Red Thread, Dollar Spot and Brown Patch — and it's now also approved for control of 9 tree and shrub problems including Apple Scab, Anthracnose, Rust, Powdery and Downy Mildews, and others.

With just one fungicide — DUOSAN — you can control 17 disease problems on turf, trees, and shrubs!

**Dymet is** Mallinckrodt's double-action insecticide. It delivers a quick kill upon contact, then provides long-lasting residual control.

Dymet is effective against surface insects such as Cutworms, Chinchbugs, and Sod Webworms, and can also be mixed for use on sub-surface pests. In addition, it controls a wide variety of insects on trees, shrubs, and ornamentals.

With just one insecticide — DYMET — you can control 25 insects on turf, trees, and shrubs!

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For more information on Duosan, or Dymet, or both, call Mallinckrodt toll-free. Or, contact your Mallinckrodt distributor. You might eliminate a long list of problems all at one time!

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## PCA OF LONG ISLAND UNITES LAWN APPLICATORS

The Professional Certified Applicators of Long Island, Inc. (PCA) is a Long Island trade association which has united all certified applicators in an effort to combat restrictive pesticide regulations. The immediate goal of PCA is to participate in all new legislation impacting the industry, which includes lobbying at the local level. The group will also be gathering information on new regulations and legislation affecting the way its members do business. PCA is currently meeting with

far attracted over 150 members involved in lawn care, landscaping, arboriculture, structural pest control and related fields. The organization has a full-time administrative staff.

The group is currently attempting to obtain insurance coverage for its membership at reduced rates. Jack Sheehan, administrative assistant of PCA says many pesticide applicators are finding their insurance rates climbing and coverage difficult to obtain. In the near future,

### PROFESSIONAL CERTIFIED APPLICATORS



the New York Department of Environmental Conservation (DEC) to work together on new regulations which will be enacted before the end of 1984 affecting tree and lawn applicators and certification of category three applicators.

PCA has been viable since last October and has so

PCA hopes to sponsor training and recertification courses to satisfy New York DEC requirements.

To obtain a membership application, write: Professional Certified Applicators of Long Island, Inc., Box 452, Copiague, NY 11726.

## NY STATE TURF ASSOC. HAS TURF SLIDE SETS

Three different 35mm slide sets, one each on insects, diseases and weeds of turfgrass, are now available from the New York State Turfgrass Association.

These slide sets are a useful tool in the identification and diagnosis of turfgrass problems for landscapers and lawn care professionals.

The 66-slide set on turfgrass diseases, compiled by Dr. Richard Smiley of Cornell University, pictures the characteristics and effects of snow mold, leaf spot, dollar spot, rust, red thread, slide mold, striped smut, mildew, fairy rings, brown patch, melting out, fusarium and pythium. The 76-slide set on insects of turfgrass in the Northeast, compiled by Dr. Haruo Tashiro of the New York State Agricultural Experiment Station, pictures a variety of chafers, beetles, weevils, sod webworms and chinch bugs and the damage they do to turf. The 80-slide set on weeds, compiled by Dr. Arthur Bing and Robert O'Knefski of Cornell University, features line drawings and identifying photos of 16 common weeds, including annual bluegrass, crabgrass,

goosegrass, tall fescue, nutsedge, wild onion and garlic, woodsorrel, clover, dandelion, ground ivy, plantain, chickweed, knotweed and black medic.



Each slide set is \$30 for NYSTA members and \$35 for NYSTA non-members, and includes a written key, handling and third class postage. Add \$1.50 per set for first class postage. If membership in NYSTA is desired with the slide set order, send an additional \$25 and pay the member price for the slides. Send your check made payable to NYSTA to the New York State Turfgrass Association, 210 Cartwright Blvd., Massapequa Park, NY 11762.

## NORTHROP KING NAMED PARK KY BLUEGRASS AGENT

Northrup King Co. was named by the Northern Minnesota Bluegrass Growers Association as marketing agent for certified Park Kentucky bluegrass. The assignment, which was previously



**NORTHROP KING CO.**  
1500 JACKSON STREET N.E., MINNEAPOLIS, MN 55413

handled by Twin City Seed Co., entails the development of a marketing program aimed primarily at the wholesale seed trade. Northrup King has been a wholesaler of Park seed for many years.

The marketing effort will be handled by Northrup King's Consumer Products

Group, which is one of the nation's leading producers and marketers of turfgrass seed to wholesale, professional and consumer retail customers. According to Larry Vetter, sales manager for Northrup King's Medalist Turf Products and wholesale activity, "there is a growing

interest in varieties such as Park that are in the low maintenance category, both straight and in mixtures. As a result, we are planning a new and expanded sales program for this superior performing variety." Introduced in 1956, this variety possesses superior characteristics of vigor, mid-summer growth, disease resistance, uniformity and low-fertility requirements.

(continued on page 12)



# UNDERCOVER AGENT

## TURCAM<sup>®</sup> INSECTICIDE

For Use Only by Professional Applicators on  
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ACTIVE INGREDIENT:	Percent by Weight
Bendiocarb: (2,2-dimethyl-1, 3-benzodioxol-4-yl methylcarbamate*)	76%
INERT INGREDIENTS:	24%
Total	100%

\*Protected by U.S. Patent No. 3,736,338

EPA REGISTRATION NO. 45639-59  
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#### HARMFUL OR FATAL IF SWALLOWED STATEMENT OF PRACTICAL TREATMENT

If swallowed — Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to unconscious person. Get medical attention.

If inhaled — Remove patient to uncontaminated area. Keep patient strictly at rest and transfer to hospital immediately to get medical attention.

If on skin — Wash with soap and warm water.

If in eyes — Flush thoroughly with clean water.

NOTICE TO PHYSICIAN: — Contains a benzimidazole carbamate insecticide which may cause allergic reactions. Inform patient of this fact.

An advanced carbamate insecticide that roots out and ruthlessly destroys white grubs, chinch bugs, sod webworms, mole crickets and other lawn and turf "terrorists". This tough operator doesn't get trapped in thatch, thus assuring positive grub control. TURCAM<sup>®</sup> is odorless...works well in spray equipment...won't damage turf or ornamentals. You'll find that TURCAM packs a federally-approved nationwide label, too.

Powerful reasons for assigning TURCAM to your toughest pest control problems.

For more information on TURCAM, including full labeling and recommendations for use, contact your local distributor or write to:



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## NEWS

(continued from page 10)

### PESTICIDE CONTAINER LAW PASSED IN MAINE

Maine has become the first state to pass legislation mandating a deposit-and-return system for limited and restricted-use pesticide containers, according to a report in *Advocate*, the newsletter of the National Fertilizer Solutions Association. Applicators have specific guidelines for handling empty containers. All users must triple rinse containers before returning them to dealers.

A wide range of groups including the Natural Resources Council and the Maine Farm Bureau supported the measure with other special interest groups taking special notice. The discovery of 300 illegal dump sites filled with used pesticide containers produced considerable support for the legislation.

Another regulatory matter on the national front, also reported in the *Advocate*, may affect lawn applicators as well. An Environmental Protection

Agency (EPA) Administrator's Pesticide Advisory Committee has been established to provide EPA Administrator William Ruckelshaus with non-binding recommendations regarding pesticide regulations. The deputy administrator of EPA will appoint committee members.

### EPA GROUNDWATER POLICY DEVELOPING

Also from *Advocate*, ILTA News reports that EPA's Ruckelshaus has indicated that the agency has decided that its plate is quite full, and that it is preferable that the states retain the primary responsibility for protecting underground water supplies

from pollution. Instead of having national groundwater standards that might conflict with states' standards, EPA will offer increased technical help to the states to identify and clean up dangerous chemicals that have seeped into aquifers and other underground water supplies. The federal government would also assist in analyzing how much cleanup would cost and whether it should be undertaken. EPA might centralize all of this assistance in a new office within the agency.

However, some environmentalists and congressmen are opposed to this plan and want EPA to be a strong central force in implementing and enforcing national standards with assistance from the states according to their capability. Most states, these proponents of federal standards believe, are not capable of doing what is required to protect or clean up groundwater. Only time will tell how this trend toward a "New Federalism" plan for EPA will affect the lawn care industry.



The first production model of the Ryan Ride-Aire® riding core aerator comes off the assembly line at the OMC Lincoln manufacturing facility in Lincoln, NB. On hand to observe the completion of the first unit were Dan Hedglin, sales manager (seated on machine) and Frank McDonald, OMC Lincoln director of marketing.

wholesale seed distributors defines Jacklin Seed Company's scope of operations nationally and internationally. One of the world's leaders in grass seed production, Jacklin is involved in grass seed research, production and marketing. Jacklin is one of the world's largest producers of Kentucky bluegrass seed, as well as seed for turf, forage,

reclamation and environmental use.

Headquartered in Post Falls, ID, Jacklin also has offices and production facilities in Nezperce, ID and Tangent, OR. Anyone wishing a copy of the brochure should make the request on their company letterhead, to Jacklin Seed Company, West 5300 Jacklin Avenue, Post Falls, ID 83854-9499.

### JACKLIN SEED COMPANY PUBLISHES NEW BROCHURE



A new 18-page full-color brochure aimed at

### EXMARK MFG. CO. COMPLETES NEW FACILITY

Exmark Manufacturing Company, Inc. has recently completed construction of its corporate office and new 14,000 square-foot production facility located in Beatrice, NB. Exmark recently completed the first series of plant expansions at its Beatrice facility, and according to Robert Martin, Exmark president, anticipated growth will result in additional expansion before the end of the year.

Martin stated that a distributor organization is now being developed

(continued on page 15)



## NEWS

(continued from page 12)

-selectively, but key organizations within the outdoor power equipment industry are now part of the Exmark team. During the latter part of 1983, Exmark expanded production of the first two units in its Ranger® lawn mower line, a 48-inch walk-behind mower as well as a 36-inch walk-behind. Exmark is also marketing through the Ranger line, a turf rake and grass catcher attachment for the walk-behind Ranger models

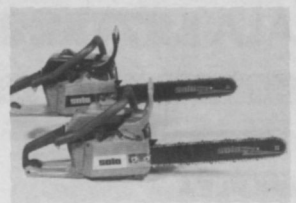


## SOLO REPORTS STRONG SALES INCREASES OVER 1982

Solo, Inc., of Newport News, VA, reports strong sales increases for the fourth consecutive year. 1983 sales increased by 68 percent over 1982 and 1984 sales are expected to be equally strong. Solo manufactures manual sprayers, as well as lawn mowers, chain saws, mistblowers, outboard motors, generators and pumps. Substantial sales increases were reported in each product group with the Solo Multimot System®, a two-cycle engine with over 20 different attachments, leading the power equipment products.

The news of Solo's sales gains came at about the same time the company announced the introduction of a new line of chain saws. Solo will officially introduce its new 647 and 654 model chain saws at the International Expo in

Louisville, KY, in July. The new saws represent a continuing commitment to the production of professional quality equipment. "We will remain committed to the world-wide marketing of chain saws through service-oriented channels and we will offer a complete



line of modern, quality saws with professional features," said Hans Emmerich, president/CEO of Solo.

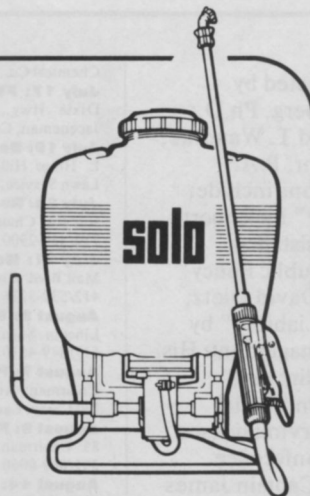


(from left to right) Wolfgang Emmerich, Reinhard Straube and Hans Emmerich.



### SOLO JETPAK-425 Knapsack Sprayer

World's first manual sprayer designed without metal or rubber parts subject to contact with chemical formulas. Guaranteed against corrosion, swelling, shrinking or dissolving of pump components when used with accepted agri-chemicals dissolved in water or oil. The pump design allows application at any desired pressure from 0 to 85 psi.



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## ALA LETTERS

### 3PF PLEA

I need your help right now.

The Pesticide Public Policy Foundation, which has to date been a tremendous success, is in immediate need of your financial support.

I am sure you have been following 3PF developments in the trade magazines during the last year and have no doubt heard at least one presentation at a regional or national trade conference. Virtually no other national organization has ever been so well known and better received at the tender age of seven months than 3PF. At the same time, it is hard to believe that any other organization has had such a critical mission. The level of activity has been far beyond anyone's expectations. The 3PF operation's office in Oregon is receiving an average of 10 phone calls per day — a total of over 1,500 calls so far for help, assistance and guidance.

To date, 3PF has actively engaged regulatory issues in Idaho, Illinois, Indiana, Maryland, Minnesota, New Jersey, New York, Oregon,

Washington and Florida. Dozens of regulatory initiatives have been analyzed in states other than those cited. Proposed legislative analysis requests continue to rush in at the rate of three to four every week.

3PF is also very actively engaged in activities at the Federal Government level. Proposed amendments to FIFRA would be devastating to lawn care operations. Current review by the courts of the National Environment Policy Act (1969) are also threatening the use of pesticides. 3PF has conclusively demonstrated its worth and value even beyond its own expectations. To date, although many issues are still pending, 3PF has not allowed any ground to be lost. Many of us are operating today because of 3PF involvement in our local issues. This work must continue and will intensify. But someone has got to pay the bills. In seven months, 3PF cash flow has been approximately \$75,000. Expenses have exceeded revenue with accounts payable covering the difference.

The amount you send today and pledge for the future is up to you. But I must ask you to consider more than just a token amount. Hydro Lawn has forwarded over \$20,000 to 3PF so far and will add an additional \$20,000 before the year's end. I cannot, and

doubt you expect me to carry the ball alone. So, please.. help to the greatest extent that you can. It's an investment in *your* future and must be considered a cost of doing business until the severity of the current issue diminishes.

If you have already sent money and/or pledged something, you have demonstrated your concern. Please write another check today. Pledges are just great and we need ongoing support, but I have yet to find someone who will take pledge cards instead of cash for payment of their bill. Please don't let 3PF lose any momentum. Help today. Thank you for your kind consideration of my thoughts, and thanks in advance for your support.

Jerry Faulring  
Hydro Lawn  
Gaithersburg, MD

*ALA encourages industrywide support of 3PF objectives. Contributions should be made to Pesticide Public Policy Foundation, c/o Jerome R. Faulring, Hydro Lawn, 7905 Airpark Road, Gaithersburg, MD 20879.*

If you would like to comment on anything you have read in the magazine or have observed in the lawn care field, write: ALA, 4012 Bridge Avenue, Cleveland, OH 44113. ALA reserves the right to edit letters for reasons of space or clarity.

## ALA PLCAA UPDATE

**M**embers of the Professional Lawn Care Association of America (PLCAA) are beginning to make their plans to attend the 1984 PLCAA conference and show at the Curtis Hickson Convention Center in Tampa, FL on November 11-15.

This year's show will offer more exhibit booths as well as expanded exhibit hall hours, according to Jim Brooks, PLCAA executive director. "Interest in exhibit space already exceeds what was sold in 1983," Brooks says. "We have committed more booths at this point than we sold last year in Indianapolis. Island spaces have doubled. We had seven island spaces in Indianapolis; we know of 15 requests right now."

**Conference workshops.** When not on the trade show floor, conference-goers will have the opportunity to attend a variety of educational sessions. "How to Grow Your Business," the early bird workshop scheduled for Monday

afternoon, will be conducted by Lawrence D. Kokkelenberg, Ph.D.; James Skelton, MBA; Ed T. Wandtke, CPA; and Richard I. Lehr, P.A.

Other workshop sessions include: "Our Changing Industry" by Robert Earley; "Regulatory Assistance Through the Pesticide Public Policy Foundation (3PF)" by David Dietz; "The Office—Asset or Liability" by Tom Hofer; "Stress Management: His, Hers, Ours" by Tom Jadin; and "Expanding into the Commercial Lawn Care Market" by Irvin Dickson.

This year's PLCAA conference keynote speaker will be Captain James Lovell, former astronaut.

**PLCAA seminars.** Fifty people attended PLCAA's Gainesville, FL seminar held at the Gainesville Hilton on May 16. Eight exhibitors displayed their products and answered attendees' questions. Here's a look at PLCAA's upcoming regional seminars:

**May 16: Gainesville, FL.** Gainesville Hilton, 2900 SW 13th St. Chairman: Nick Dennis, Pro Lawn, 904/737-8873.

**June 19: Omaha, NE.** Old Mill Holiday Inn, 655 North 108th Ave. Chairman: Chip Doolittle, Northern Lawns, Inc., 402/493-2252.

**June 26: Denver, CO.** Holiday Inn Denver, 15500 E. 40th Ave., I-70 East. Chairman: Dick Miller, Ever-Green Lawns, 303/442-7415.

**July 11: Wooddale, IL.** Elmhurst Country Club, Wooddale Road. Chairman: Rick White, Village Green Ltd., 312/293-1036.

**July 12: Livonia, MI.** Livonia West Holiday Inn, I-275 and 6 Mile Road. Chairman: Don Benham, Benham

Chemical Co., 313/624-3200.

**July 17: Ft. Mitchell, KY.** Holiday Inn South, 2100 Dixie Hwy., Interstate 71 and 75. Chairman: Paul Jacqueman, ChemLawn Corp., 614/888-3572.

**July 19: Boston Heights, OH.** Brown Derby Inn, 344 E. Hines Hill Rd. Chairman: Fred Haskett, Greenworld Lawn Service, 216/364-1142.

**July 26: Rochester, NY.** Rochester Hilton, 175 Jefferson Rd. Chairman: Dave Sek, Monroe Tree and Lands., 716/438-2900.

**July 31: Monroeville, PA.** Monroeville Marriott, 101 Mall Blvd. Chairman: Jim Walter, Specialty Spraying Inc., 412/539-3226.

**August 2: Worcester, MA.** Marriott of Worcester, 10 Lincoln Square. Chairman: Steve Evans, Turf Doctor, 617/879-4510.

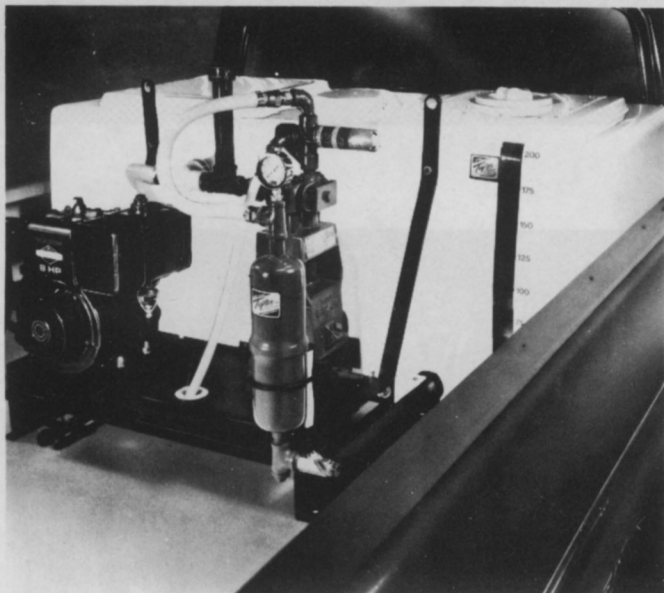
**August 7: Paramus, NJ.** Treadway Inn, 601 From Rd. Chairman: Al Rumbo, LST Industries, 201/666-1333 or Bill Carey, Lawn Masters, Inc., 914/769-1256.

**August 9: Frederick, MD.** Sheraton Inn, I-270 and Rt. 85. Chairman: Gary Mack, American Lawn of Maryland, 301/662-6060.

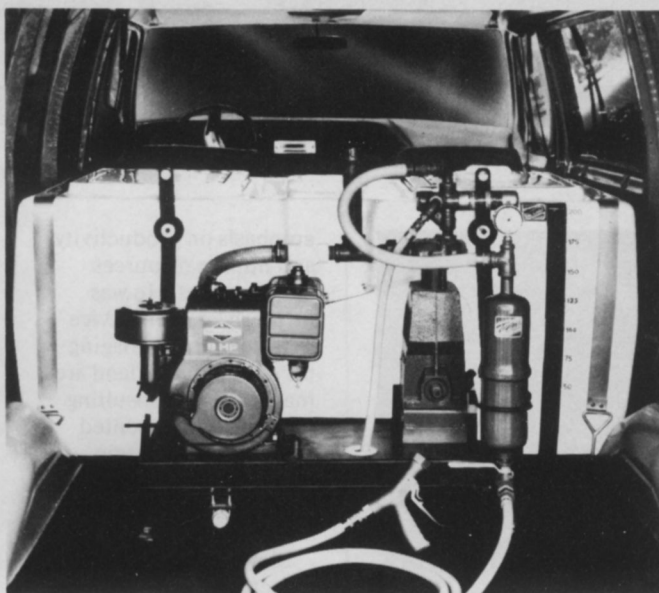
**August 14: Atlanta, GA.** Holiday Inn Airport North, 1380 Virginia Ave. Chairman: Chuck Baird, Green Thumb Chem., Lawn Care, Inc., 404/944-8140.

**Safety first.** Information on everything from pesticide safety procedures to employee health programs is now available in the PLCAA's new *Safety Manual*. The 52-page handbook also includes categories on emergency procedures, fire safety, shop and machinery safety, chemical safety, motor vehicle safety, safety inspections and accident reporting and investigation. PLCAA is sending a free copy of the manual, along with an order form, to all members. Additional copies are \$10 for members. Non-members may purchase the *Safety Manual* for \$20.





PC200 gallon spray unit shown mounted in bed of pick-up.



PC200 gallon spray unit shown here through rear door of van.

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**Heinz Emmerich**

**Heinz Emmerich**, part owner and director of engineering for Solo Kleinmotoren GMBH died January 12, 1984, at the age of 64. Emmerich, along with his brother Hans (Solo president) founded the company in 1948 in Stuttgart, West Germany.

Under the leadership of the Emmerichs, Solo has become one of the world's leading manufacturers of outdoor power equipment, while remaining a privately held, family-owned business. Heinz Emmerich was the recipient of numerous awards and recognition for innovative product design and engineering. Hans Emmerich's son, Wolfgang, after working with Heinz Emmerich for many years, will now assume responsibility for Solo product design and engineering.

The Charles H. Lilly Co., Portland, OR, has added two new executives to its staff. **Terry O'Connor** has been selected to the position of executive vice president. **Richard Mayo** has been appointed vice president of sales and marketing. O'Connor's primary responsibilities will be in strategic planning, with

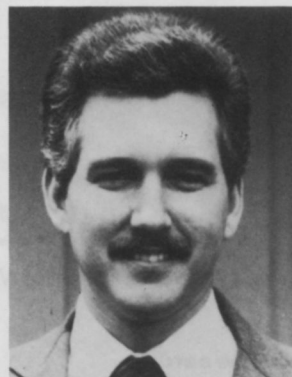
emphasis on productivity and human resources development. He was formerly executive vice president and managing partner for a Portland area management consulting firm. He has presented seminars on strategic planning, management and productivity at the regional and national level.

Mayo will oversee all aspects of the Lilly Company's sales, distribution, advertising and promotional activities. He was previously with another lawn and garden products manufacturer in Atlanta, GA.

Promotion of four veteran employees of International Seeds, Inc., Halsey, OR have been announced by president J.L. Carnes.

**Harry Stalford** has been named vice president, Product Development. An I.S.I. employee since 1974, he was previously product manager.

**Rich Underwood** has been advanced to vice president, Sales. Underwood has been with the firm since 1972 and was formerly manager of sales and shipping. **Randy Waldie** has been named vice president, Distribution and Warehouse Operation. Waldie, an I.S.I. employee since 1977, was formerly manager of traffic and production. Carnes also



**Les Guedel**



**Pictured are the 1983 President's Award winners presented at the 1984 Echo Distributor Meeting held recently in Orlando, FL. They are (left to right) Robert and Fran Krause, Silver Award winner; Rock Watanabe; Barry Herr and Merrell Clark, Bronze Award winners; Donald A. Bartelt; H. Kajiyoshi; Robert Hurst and Jack Wilson, Gold Award winners; and M. Maeda.**

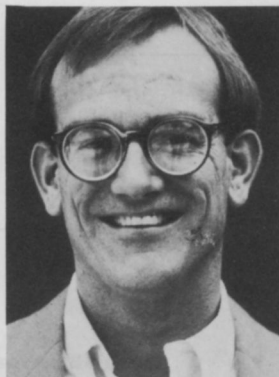
named **Bruce Chase** as Director of Production.

LESCO, Inc., Rocky River, OH, has named **Les Guedel** and **Jim Johnson** to management positions. Guedel has been named manager for LESCO's East Coast region. Guedel, who worked as a LESCO Truck Salesman for four years, first in Ohio and then in New Jersey, is a former golf course superintendent. Before joining LESCO in 1979, Guedel was superintendent at Union Country Club, New Philadelphia, OH.

Johnson will manage LESCO truck sales in

Wisconsin, Illinois, Indiana and Michigan. A LESCO truck salesman since March, 1981, Johnson has served LESCO customers in western Michigan and Chicago/Milwaukee. Before joining LESCO, Johnson was club manager at Forest Hills Country Club and then assistant superintendent at the Country Club of Lansing, MI. Johnson received his bachelors degree in crop and soil science with a specialty in turfgrass from the Michigan State University where he received a GCSAA scholarship.

**Bulkem Corporation**, bulk supplier of lawn care chemicals, Normal, IL, is proud to announce the addition of **Steve Carrell** to their staff. Carrell will function in sales and support the operations of Bulkem. Prior to joining Bulkem, he was bulk pesticide coordinator for an agricultural chemical company. He also served as chairman of the Illinois Fertilizer and Chemical Association Hazardous Waste and Toxic Substance Committee.



**Jim Johnson**



# A Powerful, Anti-Pesticide Lobby is Substituting Scare-Talk for Science.

## You are the Target.

**FACT:** The overwhelming, supportable, verified conclusions of the scientific community find that pesticides are not an immediate, inherent, or significant danger to our society.

**FACT:** The obvious benefits of pesticides to mankind far outweigh any possible proven risk.

But sometimes facts aren't enough. A powerful, well-funded and growing coalition of self-appointed "public interest" groups are mounting an ever-accelerating attack on pesticides and their use. Lacking hard, scientific data to support their cause, they have substituted emotion, pseudo-science, and sophisticated media manipulation.

If they succeed, the result will be disastrous for our health and our economy. And if the use of pesticides is an important part of your business, you would most likely be out of business.

This is not scare talk. The threat is real.

**Item:** HR 3818, a proposed congressional amendment to FIFRA would devastate the pesticide registration process.

**Item:** Federal courts, by relying on National Environmental Policy Act technicalities, have banned governmental herbicide spraying.

**Item:** Recently introduced HR 5495 would tighten governmental procedures for changing pesticide tolerances and exemptions, and would authorize emergency action with respect to pesticides which "present an imminent hazard to the public health."

This threatening trend in national legislation, combined with the absolute explosion of state and local government pesticide regulatory efforts, could result in nothing less than an effective ban on pesticides.

What can we do about it?  
Plenty!

We must tell our story. We must reassert the benefits we gain from pesticides – disease prevention; pest-free hospitals,

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restaurants and homes; an agricultural industry that is the envy of the world; and an enjoyable environment.

That's why we're asking your support of 3PF – The Pesticide Public Policy Foundation. 3PF was organized in September, 1983, by the National Arborists Association, the Professional Lawn Care Association of America, and other interested affiliates. The goals of 3PF are straightforward:

- To identify, inform, involve, and educate those of us who recognize that pesticides are necessary and safe to use for health protection, environmental enhancement, and our nation's economic growth.

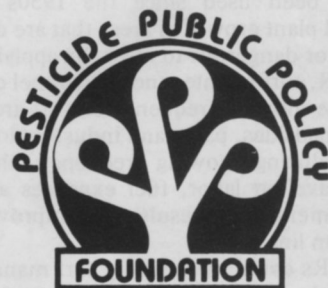
- To combat federal, state, and local regulatory initiatives that unreasonably or unnecessarily impact pesticide development and usage.

- To get the facts to the decision-makers, the media, and the public before the emotional momentum building against pesticides overwhelms all opposition.

To succeed, we need your help. It's that simple. And we need your financial backing. The groups seeking to cripple pesticide usage have vast financial resources to draw from. If we are to have any chance against this juggernaut we must have sufficient funds to put up a fight.

**Without your financial support we will not succeed.**  
Join us now. The final chapter in the pesticide story is yours to complete. If you want to help, return the coupon or call 3PF today.

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1-800-438-7773.**



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# PLANT GROWTH REGULATORS:

## ARE THEY READY FOR THE FRONT YARD?

BY TIM WEIDNER

**T**he market is ripe, but the technology is not quite ready for the lawn service market. That is perhaps the best way to describe the situation with plant growth regulators suitable for use on home lawns. Plant growth regulators (PGRs) are chemical formulations that have been used since the 1950s to retard plant growth in areas that are difficult or dangerous to mow. By applying a PGR, turf maintenance personnel can reduce mowing frequency on turf areas like roadsides, parks and industrial lots. By reducing mowing frequency, they can save on labor, fuel expenses and equipment wear, resulting in improved bottom line profits.

PGRs could make every turf manager's job a lot easier — but there is a catch. Every PGR currently registered for turf growth regulation produces some combination of unfavorable side effects. All of them will yellow or "tan" the turf to a certain degree, especially during the first week or two following application. There is also a problem

with variable regulation of different species of plants. The average turf area is composed of a mixture of grass and weed species, each of which will be affected to varying degrees by a given PGR. When the effects of the PGR wear off in six to eight weeks, the turf has a ragged appearance due to uneven resumption of growth. With some PGRs there is a problem with seedhead control. This is especially critical in roadside applications since the two- to three-foot seedhead stalks create the most unsightly aspect of roadside vegetation growth.

These side effects and others, have kept PGRs relegated to rough or "utility" turf where some discoloration and uneven growth can be tolerated. Still, the most recent PGR formulations have shown significant improvement and some turf managers are beginning to consider them for fine turf applications. One of the most significant developments in this regard is a growing interest in PGRs for *Poa annua* seedhead suppression on golf course fairways. This market is definitely primed for a fine turf PGR, but PGR manufacturers can only say, "We're working on it."

**3M's Embark.** The marketing people in 3M Corporation's Agricultural Pro-





ducts Division are certainly aware of the need and desire for a fine turf PGR, but their current PGR formulation, Embark®, is not labeled for high quality turf. "We are positioning our product for difficult to mow areas," says Jeffrey Hagman, marketing supervisor, 3M Ag Products, St. Paul, MN, "also for some broadleaf hedges, shrubs and ground-covers to reduce growth."

Most lawn care applicators are using plant growth regulators on commercial and industrial accounts, Hagman says, but not on fine quality turfgrass. Homeowners who are interested in fertilization, weed control and other services designed to produce an idyllic lawn are not going to quibble over mowing their lawns once or even twice a week. "Lawn care companies are directing their efforts at the homeowner who is willing to pay a lot to have good weed control and also the greenest green he can get out of his lawn," Hagman says.

This isn't to say that all lawn care operators have turned their backs on PGRs for the home lawn market, in fact, Hagman is certain there are lawn care businessmen who are working PGRs into the residential setting. "A lot of lawn care companies have tried Embark on commercial/industrial jobs and then expand into other areas where they feel appropriate, considering the length of control, color, etc." Lawn care companies may be selling PGR applications on residential vacant lots and other low maintenance areas, but Hagman doubts that any sales are being made on the front lawn. "There is an interest by manufacturers to put the product in the type of formulation to make it more acceptable for front lawn situations," Hagman says, "but I don't think that product is here today."

The "front lawn" PGR may still be a twinkle in the researcher's eye, but Hagman claims the PGR concept has taken off with record-breaking Embark sales this year. "Sales this year are already way over what we sold all of last year." There are over 45,000 3M

*(continued on page 22)*



## GROWTH REGULATORS

(continued from page 21)



**This photo, provided by 3M Corporation, shows a roadside park three weeks after an Embark application. Note the turf growth in the untreated plot on the left.**

products, but Hagman says there are more calls coming in for Embark than any of the company's other products. This growing interest has given 3M the incentive to lower Embark prices to become even more competitive with Embark's biggest competitor — commercial mowing equipment. It is now generally cheaper to spray Embark once than to mow once, according to Hagman.

Computing the savings afforded by reducing mowing frequency with Embark applications is not so simple, so 3M "embarked" on a consumer education program. The company did marketing studies in the green industry, according to Hagman, and found most mowing/maintenance operators did not have a good fix on their mowing costs. At the time the studies took place, Embark cost \$140 a gallon, it now costs \$79 a gallon with the price reduction. But even at \$140 a gallon, Hagman says an Embark application would more than pay for itself in reduced mowing costs.

The company knew it would be difficult to convince mowing operators of the savings, so they came up with a

"mowing cost guide" which is a listing of the factors that have to be considered to figure mowing costs. "We also list industry averages for people to plug into their own calculations," Hagman says.

In addition to the cost comparison booklet for the PGR-buying market in general, 3M has enhanced its marketing efforts by creating advertising campaigns targeted to specific market segments. Trade press and supplier brochure advertising proclaim the benefits of Embark for commercial/industrial mowing, roadside maintenance, golf course *Poa annua* seedhead control, ornamental growth regulation and barnyard mowing.

Trimming of fine and utility turfs is a specialty maintenance service that 3M is also going after with advertising and promotions at its "Mowing Break Seminars." Embark is making inroads as a trimming tool to regulate the growth of grass around cemetery monuments, utility poles and other obstacles. The product's chief advantage in this role is its ability to control turf growth without encouraging the kind of encroachment by weeds into chemically-trimmed areas typical of

"bare earth" materials like Monsanto Chemical Company's Roundup®.

3M is also investigating ways to market Embark to the residential lawn market in the future. Hagman says there is a segment of the home lawn market not being exploited by the lawn care industry, which is ripe for PGR application as an add-on service. "Now they (lawn care operators) are appealing to the people who really want to have a beautiful lawn," Hagman says. "They should redirect a little of their marketing efforts to people who have some really difficult-to-mow areas and areas that have low-maintenance type grass. Those people wouldn't care if they had just a little bit of off-color or if it looked a little bit ragged, as long as they didn't have to be out there mowing it themselves."

Just think of it, plant growth regulators could open up a whole new and untapped market for lawn care businessmen. The state of the art in PGRs is not quite refined enough to sell PGR applications to homeowners who regard their lawns as works of art or status symbols. It is refined enough to sell to people who cannot afford a mowing service, and yet despise doing the weekly task themselves. A homeowner who has a large lawn that is perhaps not all that visible from the street would probably not quibble over the minor side effects of a product that could save him some time and effort.

There is also little danger of the lawn applicator selling himself out of this service because current PGR formulations will never hit the garden center shelves. Even the latest PGRs, like Embark, require a little more application skill and equipment than the average homeowner would possess. Application timing is a well-understood concept for lawn care applicators and is important to halt the formation of turfgrass seedheads. Tankmixing is a mystery to the average homeowner, but the professional realizes how important it is to achieve the proper ratio of water to concentrate. It is also necessary to have spray equipment that will broadcast a uniform pattern and applications must overlap or bands of unregulated turf growth will result.

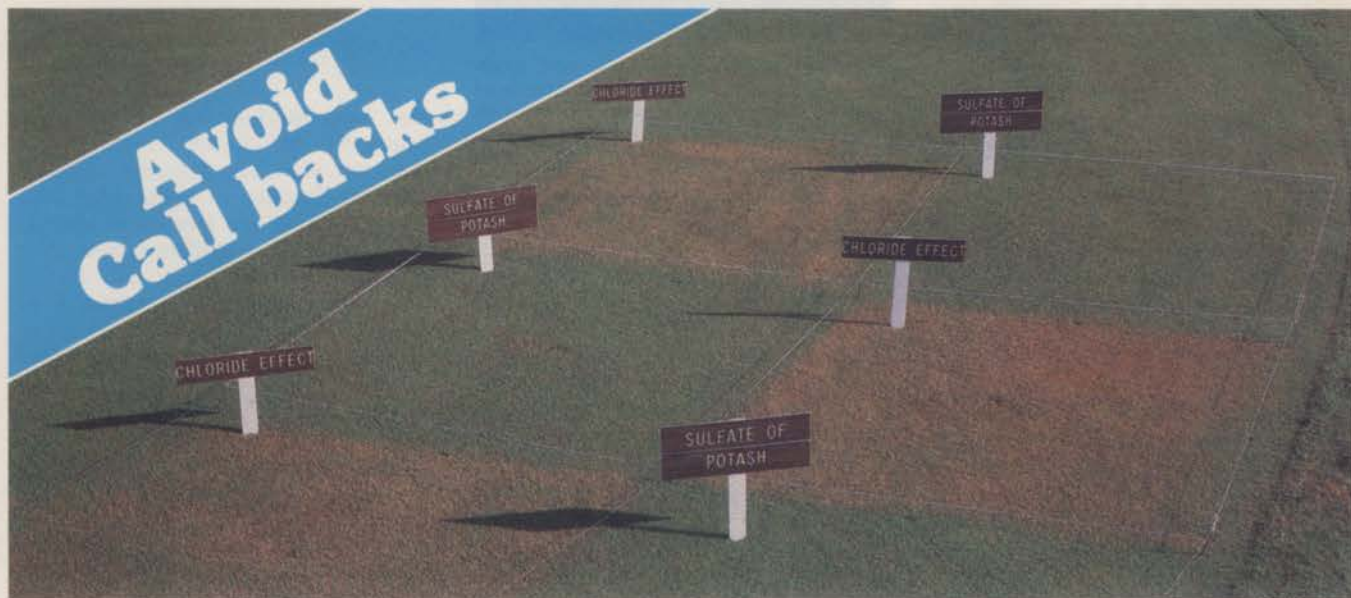
Hagman suggests that lawn care businessmen should redirect their marketing efforts to homeowners, but perhaps 3M should redirect their marketing efforts to lawn care operators. Instead of selling Embark as a six-week growth inhibitor, John A. Jagschitz of the University of Rhode Island in Kingston, RI, proposes that an application of a PGR like Embark could be sold to homeowners as a short-term regulator. "Why try to use enough so there is complete suppression?," Jagschitz asks. "Maybe just tell homeowners

(continued on page 24)

**New  
Product!**  
**N.V.N.**

**Non Volatile Nitrogen (N.V.N.)** is a new product specially developed for the professional lawn care industry. It provides for more efficient use of Nitrogen. Less **N.V.N.** can be applied than other forms of Nitrogen for the same results or the same

amount may be applied for keeping lawns green longer. GSL's **N.V.N.** is a Nitrogen stabilizer that turns lawns green, promotes good root and rhizome growth and has a low burn potential. (Compare N.V.N. vs. other Nitrogen products in photo.)



**Sulfate of Potash** is the safest and most effective potash money can buy! The trade has reduced or eliminated potash in summer applications because of the hazard of burn. **Sulfate of Potash** can be used at the recommended ratio with complete safety. We guarantee it!

Turf burn is a result of high salt index fertilizer, too much chloride and high summer temperatures. **Sulfate of Potash** is nearly chloride free and has a salt index of 0.85 vs. 1.94 for muriate of potash. Other sources of sulfur, such as ammonium sulfate, have salt indexes as high as 3.25. There is far less chance of burning turf and gardens if it is mistakenly over applied, spread unevenly or unexpected weather conditions favor damage.

In addition to  $K_2O$ , **Sulfate of Potash** contains 18% Sulfur in the sulfate form, which is the form preferred by lawns and gardens. **Sulfate of Potash** gives better disease resistance to Fusarium Patch, Ophiobolus Patch, Dollar Spot Fungus and Powdery Mildew. It is also effective in suppressing Poa Annua.

**Use of Sulfate of Potash** also results in better rooting, drought resistance, heat and cold tolerance and better wear resistance. And, its excellent potassium/sulfur ratio increases grass response to nitrogen, phosphate and other nutrients. Leading researchers recommend an N-P-K ratio of 3:1:2 for applications on turf. **Sulfate of Potash** can be included in the hottest months to provide vital potassium and sulfur without fear of damage to turf.



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they will get some reduction in mowing and not try to guarantee them five or six weeks without mowing. On highways you can take the full rate and tolerate some off-color."

Even if a half-strength application would mean only two to three weeks of turf growth suppression, the homeowner could still be sold on the idea of mowing twice a month instead of the usual once a week. Selling mowing reduction as an add-on service would be even more attractive to homeowners since the applicator could promise only slight turf discoloration.

**PGR research.** Only in recent years have turf researchers begun to receive PGRs in a favorable way, according to Jagschitz. The advent of new and improved formulations have helped inspire more positive research results. "Maybe they (researchers) will even turn around and say, it may suppress some top growth, but you are going to get more tillering," Jagschitz says. "That's what they are all looking for." Some recent research has suggested that certain PGRs not only control leaf blade growth, but they also enhance root, tiller and rhizome formation to create a stronger grass plant in the long run.

Dr. Thomas Fermanian, assistant professor of Turfgrass Science at the University of Illinois, Urbana, IL, believes PGRs have really come a long way in terms of effectiveness and the way they affect the plant based on rate and timing. Still, Fermanian has some reservations. "We have some good materials," Fermanian says, "the trouble is, there is still a lot of question about how to use them. We are still five years down the road before we have something that would be applicable to an average homeowner."

The professional applicator PGR market is certainly closer at hand than five years, in fact, 3M is already making money in this market. It would be more accurate to say the professional applicator PGR market is still in its infancy, as evidenced by the fact that 3M is the only company with a turf PGR on the market. Maag



**This 3M photo depicts a turf area 12 weeks after an Embark application in which the crew neglected to overlap each pass of the sprayer.**

Agrochemicals, Inc., headquartered in Vero Beach, FL, has a PGR called Atrinal® which is registered for the landscape and nursery markets, but has no applications for turf. ICI Americas has an experimental PGR which should soon be labeled for tree growth regulation, but it too has no applications for turf under the current formulation. (See related story.)

Several companies, including Maag and ICI, are now in the race to produce a viable turf PGR to break 3M's monopoly on the market. The contenders are in various stages of preparation. Some companies are still in the preliminary research phase, while others are field testing potential products under experimental-use permits. American Cyanamid, based in Wayne, NJ, has some PGRs registered for agricultural uses, but so far has none for turf.

Charles Adams, Cyanamid product manager, says his company is working on a turf PGR, but they have a lot of research to do before they can begin to think about marketing decisions. "We are still in the throes of looking for compounds," Adams says. "We, like many other companies, are thoroughly involved in a research effort to come up with something that is applicable to the (lawn care) field."

Companies like Cyanamid may want to accelerate their PGR research now that O.M. Scott and Sons, the Marysville, OH turf products giant, is

# TREE AND

**P**lant growth regulators still have to undergo considerably more development before they are ready for the home lawn market, but PGRs are only months away from making a big splash in the tree and ornamental market. Embark®, from 3M Corporation, is already labeled for ornamental control and is becoming popular on the west coast for ground cover growth regulation. Atrinal®, marketed by the Vero Beach, FL facilities of Maag Agrochemical, is also labeled for ornamental growth regulation.

Atrinal really has a dual purpose. It is formulated to serve as a chemical "pinching agent" to increase branching in greenhouse and nursery plants and it is also used as a PGR in landscape maintenance. "We have had it

also busy working on a turf PGR. Scotts has an extensive plant growth regulator screening program using its research facilities in Ohio, Maryland, Florida, Texas and Oregon to identify the most promising compounds from the basic manufacturers. Out of this program, Scotts is working on PGR products that will be unlike any of its competitors. "Our program is designed to develop unique products using our formulations expertise that will provide the user with important value-added features," says Roger Farrington, Scotts marketing manager, Pro Turf Division.

Like Cyanamid's PGR project, Scotts' potential products are still in the early research stages, so they will only say that they could be marketed in both the retail homelawn market and Pro Turf lawn care service and golf course markets. Scotts products may also be unique in that they could be marketed in both the granular and liquid form. This would be a departure from Scotts' historical concentration on only granular products.

Mobay Chemical Corporation, Kansas City, MO, is another turf products manufacturer that has shown an interest in PGR research. Like several other companies, Mobay is still sorting out basic formulations in their search for a viable turf PGR. "We have about three products that are in early research that look like they have potential," says Alan Haas, manager for Mobay's Specialty Products. Haas says one potential product is currently being developed in conjunction with a fertilizer

# ORNAMENTAL GROWTH REGULATORS

registered for four or five years now for greenhouse and nursery use," says Dr. Lee Benson, Maag Agrochemical. In addition to increased branching, Benson says Atrinal will produce "...a more even plant with more flowers."

Atrinal is registered for about 40 species of ornamentals, including azaleas, begonias, myrtles, hollies, junipers, ivys and privet. When used as a landscape PGR, the product is applied at a slightly higher rate than when it is applied as a chemical pinching agent.

Maag's product was found to be too inconsistent on turf, according to Benson, but it has a third application as a tree growth regulator to control growth under power lines. "We work with USDA, power companies and tree companies like Davey (Tree Expert Company) and Asplundh and have



developed a technique for pressure injection," Benson says. Atrinal injections have provided up to two years' extension on the normal period of time between tree trimmings, according to Benson.

Another tree PGR, this one from ICI Americas, Ag Chemical Division, is not currently on the market, but sales are expected sometime in 1985. The material is still being tested for growth regulation of trees under power lines,

but will be sold under the trade name Clipper®. The base material, code named PP-333, has shown regulatory activity on a wide range of plants, but its use on ornamentals and turf is still being investigated.

"We are looking at both a soil application and trunk injection means of putting Clipper into the tree," says John Birch, Ag Chemicals Division, ICI Americas. "Our ultimate customer is going to be the utility companies that we see spending an awful lot of money in tree trimming." Like Atrinal, Clipper has been found to regulate tree growth for an average of two years, but has affected some species even longer, according to Birch. He is very optimistic about Clipper's future because he says it has shown no discoloration or phytotoxicity in trees.

— Tim Weidner

company. "It still allows growth, but it is more lateral growth than vertical growth," Haas says. Though this experimental material has produced encouraging results, Haas expects that it and any other potential Mobay PGRs are still four to five years away from reaching the market.

Monsanto Ag Product Company, St. Louis, MO is also in hot pursuit of a viable turf PGR, but they are a little ahead of Cyanamid, Scotts and Mobay in the research game. Monsanto has a PGR formulation that is still being tested, but has undergone limited test marketing for non-residential use only under the code number "MON 4621," according to Dr. Dave Gerwitz, Monsanto's MON 4621 product manager. Gerwitz says MON 4621 has shown itself "...to be a significant technical advance." The goal of Monsanto's development of 4621 is to "...provide a product that will be able to slow the growth of grasses by approximately 50 percent for an eight to 10 week period," according to Dr. John Kaufmann, research and development, Monsanto. "We are hoping to have our complete registration for non-residential property within a year," Gerwitz says, "within a year after that, to have it for residential."

With 4621, says Gerwitz, Monsanto will attempt to overcome application difficulties and the kind of results that most homeowners would find unacceptable in currently available PGRs. "It is really a problem with the limitations of the chemistry available," Gerwitz says. The state of the art in PGRs

has progressed to the point where phytotoxicity is no longer an issue, according to Kaufmann. Leaf aging is the next big obstacle to hurdle. "Most everyone working in this area is convinced that if we can slow down growth or even stop it with no leaf aging and therefore no color loss in the stand, that we could sell such a compound," Kaufmann says.

Elanco Products Company, Indianapolis, IN, is also working on the elusive home lawn PGR. "We are now testing the product Cutless® under an EUP (experimental use permit) on golf course turf," says Stan Geiser, Elanco advertising manager. "We are also doing research on homeowner turf." Elanco's Cutless, better known by its code number, EL500, is also being tested on utility turf, trees and ornamentals, so the company hopes to market a broad-spectrum PGR. At this time, Elanco cannot predict when Cutless will achieve registration and go to market, but company officials say it will be soon.

The lawn care companies themselves have not taken a passive role in all this PGR activity, at least one hasn't. ChemLawn Corporation has been conducting PGR research since 1976 in search of a PGR suitable for home turf. "Our objective is to find a PGR that can be used on high-quality lawn turf, without objectionable side effects," says Dr. Charles Darrah, ChemLawn research and development, Columbus, OH.

So far such a PGR has eluded ChemLawn. Darrah cites such factors as turf discoloration and uneven reac-

tion by various grass and weed species to a given PGR as drawbacks a customer would object to. ChemLawn's PGR screening procedures at its three testing facilities have isolated one PGR (which Darrah would not name) that nearly made the grade. "It looked very promising at the research center, so we went after some customer reaction," Darrah says. "We used it with the customer's consent on 30 or 40 lawns." The negative feedback from the customers consisted mainly of the drawbacks already listed.

**Conclusions.** It is evident from the opinions of manufacturers, researchers and users that plant growth regulators simply are not refined enough for use on high-quality home lawns. However, they are quite effective for regulating growth of utility turf in low maintenance areas — as ChemLawn will attest since they use PGRs on their commercial accounts.

It may be more accurate to say that PGRs are not acceptable for use on home lawns at *full* strength. John Jag-schitz touched on an excellent idea when he suggested that lawn care businessmen should try selling reduced mowing with half-strength PGR applications rather than attempting to virtually eliminate mowing with full-strength PGR applications. Low-powered PGR applications would bring the side effects to a tolerable level and still cut a homeowner's mowing hassles nearly in half. You might want to bounce this idea off a few of your customers — and let us know what kind of reception you get!



# YELLOW PATCH UPDATE

BY T. ABERNETHY  
AND P.O. LARSEN

In the last few years yellow patch or cool weather brown patch, as it is sometimes called, is becoming an increasingly important disease on Kentucky bluegrass. This disease was probably not given much attention until the past few years because the symptoms caused by this fungus, *Rhizoctonia cerealis*, greatly resembled those associated with another turf disease called Fusarium blight. We now know, however, that these symptoms are initiated in

the spring and fall when temperatures are cool and very moist, contrasting with Fusarium blight, in that plant damage associated with that disease occurs only during the summer in hot, humid weather where soil moisture levels are low.

Another major distinction, of course, is the presence of *Rhizoctonia cerealis* in diseased plant tissue affected with symptoms of yellow patch. This disease was originally referred to as "cool weather brown patch" because a "*Rhizoctonia*" fungus was isolated from diseased plant tissue and the symptoms were similar to those often caused by *Rhizoctonia solani*, the fungus which causes brown patch, during warm, moist weather conditions. We can now readily distinguish between *R. solani* and *R. cerealis* on the basis of their growth habits in culture and their microscopic appearance. Thus, to avoid further confusion we should no longer refer to yellow patch disease as "cool weather brown patch."

In the initial stages of the disease, leaves of affected plants become yellowed and eventually brown as the plants die. A reddening of the leaves is also not uncommon. As symptoms progress, circles of yellowed and eventually blighted turf plants result, ranging from six inches to approximately two feet in diameter. The frequent presence of healthy grass in the center of the circles results in a symptom expression very similar to those associated with Fusarium blight as previously mentioned. In the majority of instances where we have observed yellow patch in Ohio, the disease has been associated with turf that has been established from peat-grown sod that usually has a thatch layer in excess of an inch.

**Thatch involvement.** Many turfgrass pathogens commonly survive in the thatch layer. Yellow patch is no exception. In research at Ohio State University, thatch taken from a diseased



Patch and ring symptoms of yellow patch on a Kentucky bluegrass lawn.

area from which *R. cerealis* had been isolated was mixed with soil and planted with "Fylking" Kentucky bluegrass. An equal amount of thatch was sterilized before mixing with soil and planting. After eight weeks, bluegrass planted in sterilized thatch and soil was dense and healthy, while bluegrass planted in unsterilized thatch and soil showed a much thinner stand, with chlorotic, necrotic and red leaves. This is evidence for the fact that the pathogen survives in the thatch layer, and removal of inoculum may be accomplished through dethatching. In addition, *R. cerealis* was isolated from diseased plants grown in this thatch.

We have seen three-year-old sodded lawns developing this disease at approximately the same time at three different locations in the same community. All the lawns were established with sod from the same source suggesting that the pathogen was present in the sod thatch layer and that this could be a major avenue for spread of the yellow patch fungus.

**Fungicide research.** Attempts to evaluate fungicidal control of yellow patch in the field in Michigan and Ohio have not been successful to date. Failure of fungicides to control this disease under field conditions may relate to the excessive thatch which is usually associated with diseased areas, preventing effective penetration of the fungicide to areas where the fungus may initially penetrate the plants. Much research remains to be done to attempt to provide effective chemical control procedures. Several fungicides have been found to be effective in control of yellow patch on seedling Kentucky bluegrass plants artificially inoculated and grown in the greenhouse.

Figure 1 shows the curative action of five fungicides against *Rhizoctonia cerealis* on Fylking Kentucky bluegrass when the fungicides were ap-

(continued on page 42)

TREATMENT	DIS. RAT. (0-10)*	
	APPL. 2 DAYS AFTER INOC.	APPL. 4 DAYS AFTER INOC.
Chipco 26019, 2 oz.	0 A <sup>+</sup>	1.3 A
Daconil 2787, 9 fl. oz.	0.3 A	1.7 A
Vorlan, 2 oz.	1.0 A	1.3 A
Banner, 4 fl. oz.	0 A	3.3 B
Inoculated, Untreated		9.7 C

\*Disease rated 24 days after inoculation.  
0 = no disease, 1 = 1-10%, 10 = 91-100%  
<sup>+</sup>DMR (P = .05)

Figure 1. Curative action of five fungicides on *Rhizoctonia cerealis* on Fylking Kentucky bluegrass in growth chambers (20 C).

CULTIVAR	DIS. SEV. (0-10)*
Adelphi	0.7 A
Cheri	2.3 A
Touchdown	8.0 B
Parade	8.7 B
A-34	8.7 B
Baron	10.0 B
Merion	10.0 B
Shasta	10.0 B
Fylking	10.0 B

\*0 = No disease, 1 = 1-10% and 10 = 91-100%; 20 degrees C, 14 days after inoculation

Figure 2. Susceptibility of nine Kentucky bluegrass cultivars to yellow patch.



"Fylking" Kentucky bluegrass planted in sterilized and unsterilized thatch from yellow patch diseased area. Note reduction in stand from unsterilized thatch.



# TURFSEED GERMINATION

BY ELIOT C. ROBERTS

**T**he structure and germination processes of lawngrass seed are fundamental to an understanding of how to start a new lawn or improve an old one. It is the seed that serves as the reservoir of new life and contains the germplasm so important for the development of improved lawns for the 1980's. Each seed's potential can be maximized by enhancing your knowledge of how seeds germinate and grow.

**Viability.** Seed viability is the ability to germinate for varying lengths of time. Some types of seed remain viable for only a few days; others retain their ability to germinate for hundreds of years. Lawngrass seed does not fit either of these extremes. Viability decreases with time and is accelerated by warm, humid storage conditions.

Increased respiration occurring with moist,

warm environments decreases food reserves in the seed. When such seed is planted, there is often inadequate food supplies for normal germination. Also, as seeds grow old, protein in the protoplasm is known to coagulate. This is often accompanied by a loss of activity among growth regulators and cells lose some of their ability to divide.

In addition to heat and moisture, there are other factors that influence seed viability. Seeds produced by vigorous, disease-free parent plants usually retain viability longer, germinate more rapidly, grow more vigorously and produce healthier plants. Also, seeds which are allowed to mature normally and are harvested properly have improved viability. Thus, it pays to know your seed source. Seed quality does vary depending on how it has been handled.

**Germination.** Many external environmental influences affect sprouting and early growth of lawngrass seeds. Among these, moisture, temperature and oxygen are most important. Oxygen, needed in embryo cells, passes more readily in the presence of moisture. All physiological processes are accelerated in moist environments with warm temperatures. In general, optimum germination temperatures are about the same as those required for active plant growth.

With the absorption of water by seeds, digestion of stored food starts. This leads to increased respiration and the assimilation of food substances into protoplasm. Growth begins. As stored food decreases, seeds weigh less because of food utilization in respiration. The energy released by respiration is used in cell division and in other phases of growth. Some energy is lost as heat. Soon the embryos become too large for the seed coat. This splits and the root forming tip of the hypocotyl emerges.

Thus, the young plant is anchored and soon water and minerals will be absorbed. By the time the epicotyl begins its development into the shoot system, the roots are actively involved in absorption. As shoots appear above the soil surface, photosynthesis begins and the germinated seed becomes a seedling ready to grow as an individual new plant.

Soil nutrients are not required for seed germination. They are required for continued growth and development of the seedling plant and thus must be in adequate supply in the soil prior to seeding.

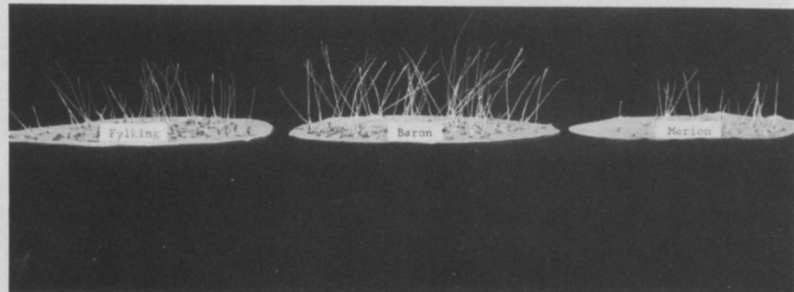
**Normal seedlings.** The planting of seed that will not grow or that is low in viability amounts to a loss of time and money. We know that just because a seed will absorb water, swell and initiate roots does not mean that it will continue to grow and develop into a healthy plant. There may be only enough vigor within the seed to form a root. A new shoot may start to form and then die.

Even when a complete seedling is formed, it may be so weak that it cannot establish itself under existing soil conditions. The hazards encountered by seedlings are many; only the strongest survive. Laboratory tests for germination are designed to determine as closely as possible the percentage of seeds that can be expected to germinate and develop into strong, healthy lawngrasses.

**Seed testing.** Laboratory evaluations for



**Turf-type perennial ryegrass germinate quickly and develop vigorous seedlings.**



**Germination and early seedling growth are characteristics that vary among bluegrasses.**

germination are done on nontoxic media, such as blotters, towels or filter paper. These may be used in the open, or placed in glass-covered dishes. Standard germinators provide the proper temperature, humidity, gaseous atmosphere and light.

Most serious seedling abnormalities are caused by mechanical damage to the seed, insect or disease damage, decay of seedling parts, or injury from various chemical or environmental conditions. Reputable firms market seed of high germination with few seedling abnormalities.

**Pregermination.** Pregermination of lawngrass seed shortens the time necessary for establishment and boosts client satisfaction in lawn construction and renovation. There is nothing really new about seed pregermination. Over 25 years ago, O.J. Noer, agronomist with the Milwaukee Sewerage Commission, and Beryl S. Taylor at Iowa State University had worked out a practical system for pregermination of seed for athletic turf. This system utilized well-recognized principles of lawngrass seed germination.

Two to three parts of vermiculite or perlite were mixed with one part seed. In order to provide best conditions for mixing, the vermiculite or perlite was moistened first and then the seed mixed in. Following this, the pile was moistened thoroughly. Excess water seeped away on a slightly sloping concrete floor and onto a drainage outlet.

The pile was covered with a tarp and kept moist for five to 10 days at a temperature above 70 degrees Fahrenheit. Temperatures closer to 80 degrees shortened the time of pregermination to about five days; those closer to 70 degrees lengthened the time to a week or more.

The pile was turned and remoistened at least once a day and inspected for seed swelling and the emergence of root tips through the seed coat. This sign of seed germination determined the appropriate time for planting.

Pregerminated seed was dried to a consistency suitable for spreading by mixing with Milorganite®. Spreaders were calibrated and the mixture distributed on the prepared seed bed without delay. Material spread was worked lightly into the soil or turf stand being renovated or overseeded. Depending on specific conditions, the area was topdressed, mulched or rolled prior to watering in.

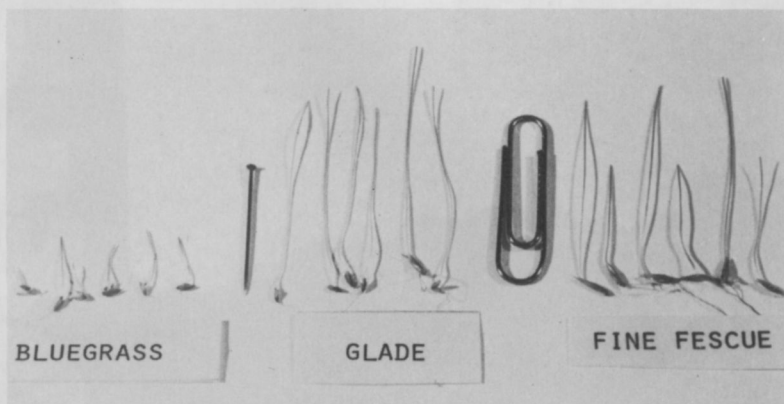
In general, annual ryegrass could be made ready to seed in about three days, while most bluegrasses required some 10 days. Now, turf-type perennial ryegrasses and fine fescues can be pregerminated in about five days.

More recently, 55 gallon drums have been used for seed soaking. Most grounds managers for professional sports turf and most golf course superintendents, who overseed regularly during the season, adapt these drums so that they are open at the top and have a drainage outlet at the bottom. The outlet is protected by a screen so that seed remains inside when water is drained out.

Seed placed in the drum is covered with water. The water is drained out and replaced every 12 hours during the soaking period. Germination is observed in about the same time periods specified for the pile method, perhaps a little more rapidly. When ready, seed is removed from the drum and dried with Milorganite as previously



**Fine fescue seed germinates quickly and produces seedling growth that is less rapid than the perennial ryegrasses.**



**Glade Kentucky bluegrass and the fine fescues possess similar seedling vigor. Many other bluegrasses make slower seedling starts.**

described. Certainly other materials may be mixed with the wet pregerminated seed as drying agent and carrier, but over the years, the Milwaukee Sewerage product has become a standard difficult to improve upon.

**Damping-off.** At times of excessive moisture, with associated lack of oxygen, seeds fail to germinate and often rot. Damping-off is a major disease of germinating seeds. A number of fungi may be involved. The disease often causes a failure of the seedling to emerge. In some instances, the seedling dies shortly after emergence. Thus, new tissue is highly susceptible to damping-off. Care not to overwater new lawngrass stands does more than anything else to prevent damping-off.

**Conclusions.** Once the process of lawnseed germination starts, it must continue without interruption until the seedling has become well established with well developed roots and foliage. In addition to favorable conditions for germination, a two- to three-week period following germination is of critical importance. During this time young plants are most susceptible to injury from fluctuations in temperature and moisture and from disease. Pregermination of seed provides for a more rapid establishment and is good insurance against the possibility of adverse climatic changes. By knowing what to expect from the seed during these periods, you will be better able to assure its most complete transition into lawn turf of highest quality.



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# LOW VOLUME LIQUID FERTILIZATION

BY THOMAS W. FERMANIAN AND JEAN E. HALEY

**T**he use of liquid fertilizers is new to the turfgrass industry. They have been widely used for less than 10 years. Before 1978, liquid fertilizer solutions were combinations of urea, or nitrogen salts and water, targeted for foliar uptake. These solutions provided a cost-effective, easy to handle nitrogen source for field crops, but their potential for foliar injury limited their use on perennial crops, such as turf. Research indicated little advantage in yield or quality in field crops with the use of liquid materials over their dry counterparts.

For many years lawn care companies used granular fertilizers because these materials provided a safer means of application than the liquid fertilizers that were available. As the professional lawn care industry developed, many of the larger companies expanded nationally. Their areas of operation encompassed a wide variety of climates and soil types. This brought about the need for greater control of the fertilizer materials and the ability to adapt application programs to a particular environment. Liquid-applied fertilizers offer both ease of handling and the versatility of rate adjustment for each

truck. What was needed, however were liquid materials that could be applied safely.

The earliest materials used on turf, urea, urea ammonium nitrate and other nitrogeous solutions, were applied in large volumes of water to prevent foliar injury. Spray volumes of four to five gallons per 1,000 square feet were typical. High spray volumes increase transportation costs and an applicator is limited in the number of sites he or she can reach in a day. New liquid fertilizers were needed which could be applied with a lower spray volume and thereby reduce the amount of water transported for each site.

With the increased expansion of the lawn care industry, new sources of fluid fertilizer were developed to meet this demand. Materials such as Formolene®, FLUF®, FAN® and others were developed for the professional lawn care market. Many of these materials showed much less potential for injury. While this was recognized, no formal investigation was undertaken to evaluate the effects of low spray volume applications.

In 1981, a series of studies were initiated at the University of Illinois at Urbana-Champaign, to investigate the efficacy of these new liquid-applied materials as turfgrass nitrogen fertilizers and to measure their potential for foliar injury at low spray volumes. An initial test was developed to compare the quality and growth rate of Kentucky bluegrass fertilized with various fluid nitrogen materials and to determine the efficacy of the fertilizer sources by measuring the nitrogen content of turfgrass clippings.

Treatments were designed to evaluate the fertilizer materials in three basic groups. In the first group, fluid fertilizers were contrasted with a comparable granular source. In the second group, urea was added to the fluid slow-release sources to increase the quickly-available nitrogen portion of the fertilizer. Fertilizer and chelated iron combinations made up the third group.

This last group was added because earlier studies at the University of Illinois indicated it was possible to substitute iron sulfate or iron chelate for a portion of the nitrogen in summer applications, without reduced turf quality. Iron, unlike nitrogen, will darken the turf without the problems associated with high nitrogen fertilization. Studies conducted at the University of Illinois in 1980 and 1981 indicated that foliar application of iron sulfate or iron chelate at two or four pounds per acre will rapidly darken light green cultivars of Kentucky bluegrass for at least 21 days without increasing the growth rate of the turf.

In the first test to examine fluid

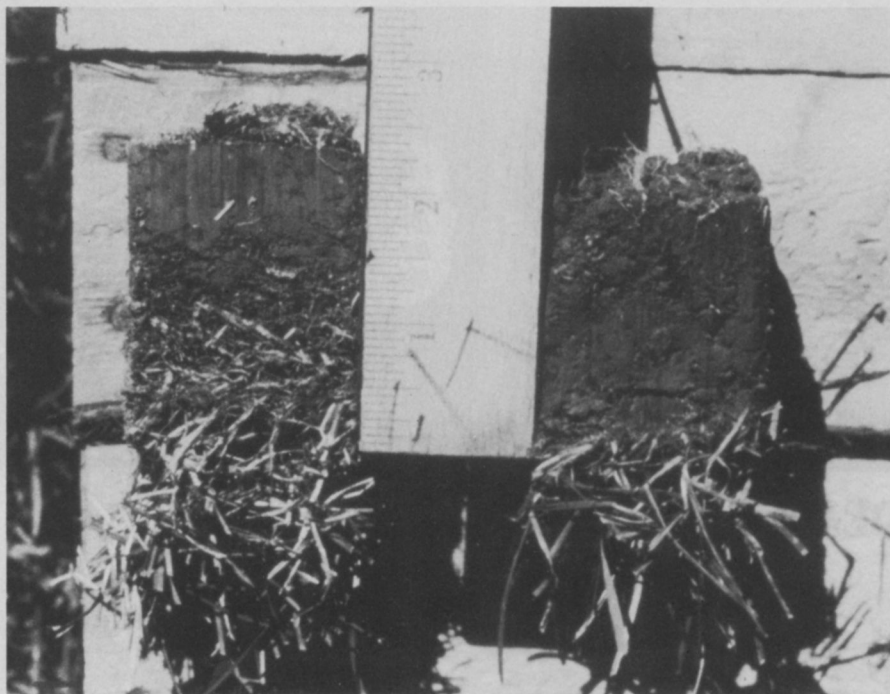


Figure 1.

nitrogen fertilizers, liquid sources of nitrogen included FLUF®, urea-ammonium nitrate solution, Formolene®, Folian®, urea and Nitroform®. Granular sources were ammonium sulfate and urea (Table 1). All treatments were applied to a four-year-old blend of 'Columbia-Touchdown' Kentucky bluegrass. Routine soil analysis indicated a pH of 6 and sufficient levels of P and K. All treatments were applied four times a year, approximately eight weeks apart, to simulate the four-round application schedule used by most professional lawn care services in Illinois. Each treatment was applied at the rate of one pound nitrogen per 1,000 square feet, with the exception of Lakeshore SCU (37-0-0). This material was applied twice at a two pound nitrogen per 1,000 square feet rate. An evaluation of color was taken daily for the first week after application and then weekly for the next seven weeks.

A difference in turf color between

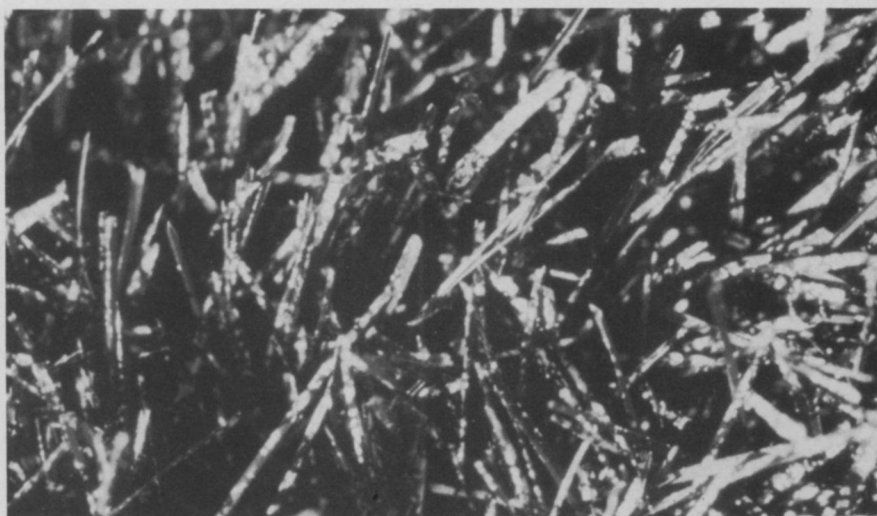


Figure 2.

dry and liquid urea-treated turf was generally found in the middle of each eight week round with a minimal response to liquid sources in the third round (Table 2). Turf color response to liquid urea was used as a standard, since urea solutions are still widely used in the professional lawn care industry. In addition to Formolene by itself, Formolene was combined with urea or water insoluble nitrogen (WIN), was added by decreasing the pH of the stock solution.

Color enhancement with Formolene was good compared to color enhancement with liquid urea. When some urea was substituted for Formolene, turf color was lighter. Turfgrass color was also enhanced with Formolene containing WIN, particularly in late summer. Initial response of Formolene was slow. Color values of Formolene-treated turf took 14 days before they equalled the color values of liquid urea-treated plots.

Turf color of Nitroform® treated plots darkened slowly early in the year, but color increased rapidly in late summer. Nitroform alone was significantly darker in color for 75 percent of the evaluation dates. Adding urea to Nitroform improved turf color earlier in the year but at a sacrifice to late season color. FLUF also performed as

(continued on page 36)

Treatment	Application rate (lb N/1,000 sq. ft.)			
	5/01/81 4/21/82	6/18/81 6/18/82	8/06/81 8/19/82	10/09/81 10/14/82
<b>Granular applied</b>				
Ammonium nitrate	1.0	1.0	1.0	1.0
Ammonium sulfate	1.0	1.0	1.0	1.0
Sulfur-coated urea	2.0	—	2.0	—
Urea	1.0	1.0	1.0	1.0
<b>Liquid applied</b>				
Fluf	1.0	1.0	1.0	1.0
Fluf/urea 50:50	1.0	1.0	1.0	1.0
Fluf/urea 75:25	.75/.25	.75/.25	.75/.25	.75/.25
Fluf/iron <sup>a</sup> 1&2	.5/.05 <sup>b</sup>	.5/.05	1.0/0	1.0/0
Fluf/iron <sup>a</sup> 2&3	1.0/0	.5/.05	.5/.05	1.0/0
Folian 12-4-4	1.0	1.0	1.0	1.0
Folian 12-4-6	1.0	1.0	1.0	1.0
Folian 12-4-4/iron <sup>a</sup>	.5/.05	.5/.05	1.0/0	1.0/0
Formolene	1.0	1.0	1.0	1.0
Formolene w/WIN	1.0	1.0	1.0	1.0
Formolene/urea 50:50	.5/.5	.5/.5	.5/.5	.5/.5
Formolene/iron <sup>a</sup>	.5/.05	.5/.05	1.0/0	1.0/0
Nitroform	1.0	1.0	1.0	1.0
Nitroform/urea I	0/.5	1.5/.25	0/0	1.25/.5
Nitroform/urea II	0/.5	.5/.5	.5/.5	1.0/.5
Urea	1.0	1.0	1.0	1.0
Urea/iron <sup>a</sup> 1&2	.5/.05	.5/.05	1.0/0	1.0/0
Urea/iron <sup>a</sup> 2&3	1.0/0	.5/.05	.5/.05	1.0/0
UAN	1.0	1.0	1.0	1.0
Chelated iron (1982)	.05	.05	.05	.05
Check (no fertilization)	—	—	—	—

<sup>a</sup>chelated iron (Ciba-Geigy Sequestrene 330)

<sup>b</sup>lb iron/1,000 square feet

Table 1. Schedule of treatment rates and dates of application for the first field experiment.



# CONVERTING TO LOW VOLUME

BY TOM JESSEN

**A** major topic of conversation in the industry is the efficacy of low volume (LV) lawn spraying (at one gallon of fertilizer solution per thousand square feet). The interest in LV from a lawn care operator's point of view is obvious. LV enables an inexpensive, high mileage mini pickup truck to do the work of a large, expensive one- or two-ton truck. Jim Walter expresses the feelings of a growing number of operators using LV from coast to coast when he says, "The potential of LV to cut operating costs is too large to be ignored."

The urgency of Walter's message is heightened for companies operating older fleets of worn out equipment which are plagued by astronomical maintenance costs. Many are finding it difficult, if not impossible, to replace old high volume equipment with new high volume rigs which can easily cost \$30,000 or more per unit. They are looking to LV as a practical alternative because professional quality LV spray equipment can be purchased at the rate of two to three LV units for the cost of a single high volume two-ton truck. There are, however, various concerns

about LV which are brought on primarily by unfamiliarity with the system. This article will address these concerns through the responses of turf experts and turf professionals around the country who are using LV in their operations.

The first concern is that LV applications are not safe. This topic is addressed at length in this issue by Dr. Tom Fermanian of the University of Illinois. Two main conclusions can be drawn from Dr. Fermanian's research. One, burn is affected more by the source and amount per thousand square feet of the fertilizer applied than by the volume of water in the solution. Two, fertilizer products are now available which can be applied low volume providing a high margin of safety. Mike Scribner, national sales representative for Formolene®, a Hawkeye Chemical Company product, says "Formolene can be applied LV at rates of one pound nitrogen in 95 degree temperatures with no burning."

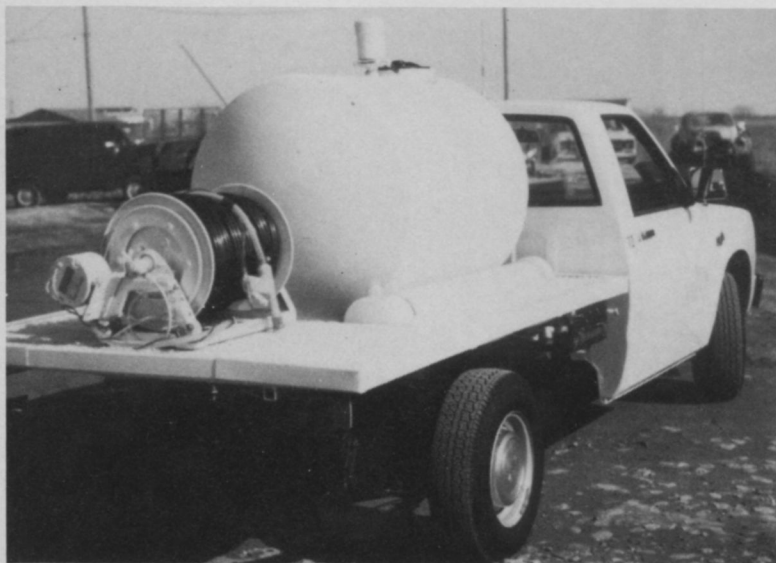
But what happens when we take LV away from the test plots and put it into the field? Jim Mello, owner of Nice N' Green Plantfoods and Nice N' Green lawn care company, tells of his experience with low volume spraying. "Last year I converted one high volume spray rig to LV to compare the agronomics of LV spraying versus high volume and found no significant difference," Mello says. "This year I converted my entire fleet to LV. By using MO nitrogen products (liquid urea formaldehyde solutions) in various combinations with Urea-base mixes, I maintained the flexibility to alter the ratios of each to insure safety against burn in any climatic condition at a lower cost."

The second concern is that smaller equipment doesn't convey a professional image. A well-designed, professional LV system not only looks good, but radiates an image of efficiency, attracts attention because of the contrast in size and also differentiates your company from the competition. Kevin Fitzpatrick of Leprechaun Lawns, Crown Point, IN has had good customer acceptance of his LV vehicles. "Many operators think they need the macho image of driving the big trucks, but 90 to 97 percent of my customers are more concerned with results and service than the size of my truck," Fitzpatrick says. "Anyone that asks about the small truck is told they are getting a higher concentration of fertilizer for their money, and they like that."

Pete Shiplov, manager of Perma-Green, Inc., Valparaiso, IN, points out a negative aspect of the big trucks. "Many homeowners fear for the safety of their small children when big trucks are in the neighborhood, and I don't blame them. When I was driving the two-tons, I had blind spots in front and behind. My customers seem to prefer the smaller trucks in their neighborhood."

The third concern is that LV spraying is hard to learn and easy to make mistakes. LV spraying has been done using flood jet, T-jet or ChemLawn-style nozzles. There is no question that LV requires applicators to learn new techniques, but training aids like the "Low Volume Spray Manual" by this author are available which describe the proper method to assure even distribution of product. Bill Schaek from Chem-green, based near Los Angeles, CA, is into his second season with low volume and has no complaints. "There is no difficulty training

(continued on page 41)



Low volume rigs can utilize fuel-efficient mini-trucks.

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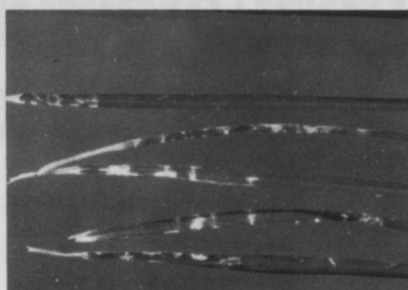


expected for a ureaform-based material. FLUF-treated turf was slow to greenup in early spring, taking three days to reach the color level of turf treated with liquid urea. However late in the season, the color of FLUF-treated turf was equal to or greater than urea-treated turf.

Chelated iron, (Sequestrene 330®), combined with several liquid-applied nitrogen sources, was also evaluated. Both nitrogen sources (one pound N/1,000 sq. ft.) and the iron chelate (.75 oz. Fe/1,000 sq. ft.) were applied alone. Evaluation of turf color three days after the first application showed no significant response from the iron alone or iron added to FLUF. However, turf color was enhanced on plots treated with iron plus Formolene, or iron plus urea. In the eight week period after the first and second applications, turf treated with the materials FLUF and Formolene alone, were darker than a half rate of each material plus iron. However, following a third and fourth application, there was no difference in turf color between the nitrogen fertilizers alone and the half rate plus iron treatments.

**Thatch buildup.** The buildup of thatch on a lawn is closely-related to the turfgrass growth rate. As the growth rate rises, greater amounts of plant debris (dead stems, leaves, roots, etc.) will be shed to the turf environment, adding to the thatch layer. Since each nitrogen source influences the turf growth rate, it was important to measure how this influence affected thatch buildup.

Thatch measurements were taken both at the beginning and at the end of the 1982 season. Thatch buildup was considerable in the low pH soil at the site (Figure 1). It was particularly thick for treatments that were acidifying in nature, ammonium sulfate and ammonium nitrate. However, those treatments that provided a slower growth rate without the acidifying effect showed very little thatch buildup over the two year period. Slowly available materials, in particular Nitroform and Formolene, showed little difference in



**Fertilizer burn to bluegrass.**

thatch buildup when compared with the untreated control. Other materials, sulfur-coated urea, FLUF and liquid-applied urea showed a slight buildup of thatch, but much less than other acidifying fertilizers

**Low volume safety.** The next step in our investigation was to determine

the relative safety of liquid-applied fertilizers to the turf. In 1982, a study was designed to evaluate the potential for injury resulting from low volume applications and determine the minimum spray volume at which each liquid fertilizer could be safely applied, assuming that any injury to the turf is unacceptable in a commercial application. The study also evaluated the effect of fertilization rate, regardless of concentration, on the potential for turfgrass injury.

Materials were applied to a 'Columbia-Touchdown' blend of Kentucky bluegrass with a CO<sup>2</sup>-propelled backpack sprayer. This versatile sprayer can apply a variety of materials with a wide range of spray volumes, however, it does not directly simulate commercial application. With this sprayer, the droplet size is much finer than normally-

Treatment <sup>a</sup>	Color <sup>b</sup>	
	1981	1982
<b>Granular applied</b>		
Ammonium nitrate	8.3 b	7.9 b-d
Ammonium sulfate	8.1 bc	7.5 c-g
Sulfur-coated urea	8.9 a	8.7 a
Urea	8.1 bc	7.9 b-d
<b>Liquid applied</b>		
Fluf	7.9 b-e	7.8 b-e
Fluf/urea 50:50	7.9 b-e	7.1 g-k
Fluf/urea 75:25	7.4 d-f	7.5 c-g
Fluf/iron 1&2	7.3 ef	7.1 g-k
Fluf/iron 2&3	6.9 fg	7.5 c-g
Folian 12-4-4	—	7.3 f-j
Folian 12-4-6	—	6.9 jk
Folian 12-4-4/iron	—	7.0 h-k
Formolene	7.9 b-e	7.4 e-i
Formolene/urea 50:50	7.9 b-e	7.5 c-g
Formolene/iron 1&2	7.7 b-e	7.3 f-j
Formolene w/WIN	6.9 fg	7.6 c-f
Nitroform	7.6 c-e	8.3 ab
Nitroform/urea I	6.7 gh	7.0 h-k
Nitroform/urea II	7.6 c-e	7.6 c-f
Urea	7.7 b-e	7.2 f-k
Urea/iron 1&2	7.4 d-f	7.1 g-k
Urea/iron 2&3	7.6 c-e	7.3 f-j
UAN	7.4 d-f	7.1 g-k
Chelated iron (no N)	—	5.9 l
Check (no fertilization)	5.9 i	5.1 k
LSD (0.05)	0.5	0.5

<sup>a</sup>See Table 1 for treatment rates and schedule.

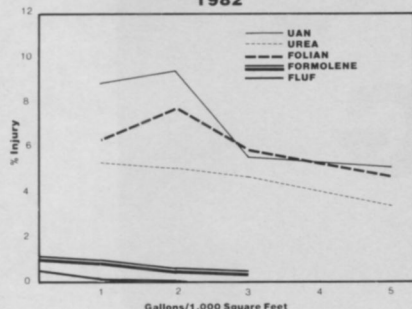
<sup>b</sup>Means followed by the same letter are not significantly different as determined by Fisher's LSD test at the five percent level of probability. Dates approximately one week apart used to generate means.

**Table 2. Mean color of Kentucky bluegrass turf for nine weeks (1981) and eight weeks (1982) following the third application of fertilizers in 1981 and 1982.**

applied through conventional spray equipment. Spray volumes ranged from .5 to five gallons per 1,000 square feet. This required several different nozzle tips with various pressures and different requirements for overlap.

FLUF, urea ammonium nitrate (UAN), Formolene, Folian and urea were applied at the rate of one pound N/1,000 sq. ft. The area was not irrigated prior to evaluation. To measure the potential for foliar injury under varying growing conditions, four applications were made in 1982. Foliar injury was found to be most severe in June and July. Changes occurred to the experimental area within 48 hours of application. Plots treated with low volumes of FLUF appeared white or grey (Figure 2). The insoluble FLUF adhered tightly to the leaf blades, changing the turf color. Although evident for some time after application, the color was removed with mowing.

**Effect of Carrier Rate on Leaf Injury 1982**



A visual estimation of injury to individual leaf blades was taken 48 hours after application. Materials which contained large volumes of liquid urea showed a high potential for injury, although Formolene, which is 50 percent urea, caused very little injury. At the rate of one-half gallon per 1,000 sq. ft., less than one percent of the leaf blade area was damaged. UAN showed the greatest potential for foliar injury at volumes below four gallons per 1,000 sq. ft. The same general trends were also found for urea, although the magnitude of injury was about half that of the UAN solution.

FLUF was found to be very safe with no injury on plots treated with undiluted FLUF (.59 gallons per 1,000 sq. ft.). The same materials were applied to an adjacent site in 1983. FAN was also tested in two formulations, a complete source (16-2-5) and FAN in a 20-0-0 formulation. Spray volumes ranged from .5 to four gallons per 1,000 sq. ft. An early application in June resulted in no major injury from any source. A second application in July, did show a light amount of injury for several treatments (Table 3).

In this second application in 1983,

the fertilization rate was also increased for some treatments above the one pound N/1,000 sq. ft. rate in order to further evaluate the potential for injury. As in 1982, some leaf tip injury was found with urea at all application volumes. Significant injury was shown in the urea plots where twice the fertilization rate was used.

Urea and UAN solutions caused significant leaf blade injury at all spray volumes evaluated. Both formulations of FAN showed injury at the one pound rate in a spray volume of one

gallon per 1,000 sq. ft. When this rate was doubled, significant injury was found for the complete source of FAN. No leaf blade injury was seen with Formolene and FLUF at any of the rates or spray volumes tested. Formolene was applied undiluted at a rate of 1.6 pound N/1,000 in .5 gallons of water per 1,000 and no injury occurred. FLUF was applied undiluted with no resulting injury.

**Conclusions.** While this study hardly represents an exhaustive investigation into the potential for turf injury

(continued on page 41)

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# HAVE YOU IRONED YOUR PLANTS LATELY?

BY NEAL HOWELL

**I**ron is definitely established as an essential micronutrient, required by all plants and animals. What exactly is a micronutrient? Does the "micro" mean it is less important than N, P or K, the so-called macroelements? No! The only difference between a micronutrient and a macronutrient is in the amount consumed by the plant. Instead of speaking of pounds per 1,000 square feet, ounces or even fractions of an ounce per 1,000 square feet are needed. Plant performance is limited by the availability of the least plentiful essential element, whether micro or macro element. "Iron deficiency has been documented as one of the most commonly occurring micronutrient or trace element deficiencies," V. Sanchelli says<sup>1</sup>.

The chief visual symptom of iron deficiency is a chlorotic or yellow mottling of the leaf, particularly on the young growth. Deficiency patterns in turfgrasses usually consist of alternate stripes of green veins and yellow interveinal areas. The deficiency symptoms appear on the new growth, as iron is very slow to translocate, or move within the plant.

In cases of severe deficiencies, the young growth will appear almost white due to the lack of chlorophyll; in extreme cases like this, the older growth may exhibit the chlorotic pattern also. "This chlorotic effect was described and attributed to iron deficiency as early as 1844 by E. Gris of France," J.J. Mortvedt says<sup>2</sup>. Of all the elements needed for plant health, iron is probably

the most difficult to work with. Its total functions within the plant are not fully understood and there is no general agreement on how it is picked up by the plant and subsequently utilized.

**Common, but unavailable.** Suppose for a minute that you, a typical good-looking, cultured, semi-wealthy lawn applicator, were leaning against the wall of a major bank which had a

million dollars in its vaults and that you had one dollar in your pocket. There would be a total of \$1,000,001 within the area occupied by you and the bank. From this total, you have only the use of the one dollar in your possession. This is the same problem we have with the iron content in many of our soils.

A typical soil in the United States may contain as much as 918 pounds of iron per 1,000 square feet in the top six inches and yet plants grown on it may show iron deficiency symptoms. "Iron is one of the most abundant elements in the soils of the world comprising, on the average, from one percent to five percent of their total content," R.L. Hausenbuiller says<sup>3</sup>. Even with the enormous amounts of iron found in the soil, it is generally found only in forms unavailable for plant utilization.

Iron in the ferrous<sup>++</sup> state is most available to the plant. While conventional iron sources such as iron ferrous sulfate would supply the need, unless the plant has a root system quicker than a Kirby vacuum cleaner, the soil-applied iron rapidly oxidizes to the ferric<sup>+++</sup> state and the plant is unable to utilize it. Once oxidized, the reversal is slow to nonexistent, hence the problem with iron chlorosis. "The reverse action, the nonbacterial reduction of Fe (III) (iron) oxide to Fe<sup>++</sup> with organic matter acting as a reducing agent, is very much slower — with

## Have You Ironed Your Plants Lately?

**What do you know about iron? To find your I.Q. (Iron Quotient), take the following test.**

### True or False

1. Iron is an essential part of the chlorophyll molecule.
2. Iron is one of the least abundant micronutrients found in the soil.
3. Nitrogen is more important than iron to a growing plant.
4. EDTA chelated iron is one of the most effective chelates for treatment of soils with a neutral pH.
5. Very heavy applications of iron to most soils are toxic to plants.
6. One heavy application of iron is usually sufficient to last a complete growing cycle.
7. Foliar applications of iron result in slower plant responses than do soil applications.
8. Moving soil, as in leveling or contouring, brings additional available sources of iron into the plant root zone.
9. High iron content soils do not need supplemental iron applications for healthy plant growth.
10. Repeated applications of a "total" fertilizer such as 13-13-13 enhance iron pickup by plants.

*Answers: All are false.*

### SCORE:

All correct . . . . . An Ironman  
9 correct . . . . . Pretty Green  
7-8 correct . . . . . Slightly Chlorotic  
6-0 correct . . . . . Possible Paving Contractor



most organic materials, the process is so slow that there is even a question whether it would occur at all in geologically reasonable time," Mortvedt says<sup>4</sup>. Considering the immobility of iron within the plant, multiple applications are usually needed to avert deficiency symptoms and maintain color and plant vigor.

Despite the early interest and subsequent research, there is still no universal, cost-effective cure for iron chlorosis, although new materials are being tested and evaluated continually. "It should be emphasized that no acceptable chemical test for determining iron availability has yet been approved officially in the United States," K.C. Berger says<sup>5</sup>. A procedure for a reasonably accurate soil test for available iron has only recently been proposed. The DTPA (diethylene triamine pentaacetic acid) extraction method for iron was developed by Lindsay and Norvell of Colorado State University. It seems to be the most relevant available iron test to date.

"Discussions about the role of Fe in plant metabolism began historically with the observation by Gris in 1844 that Fe is necessary for the maintenance of chlorophyll in plants. Since that time, plant scientists have tried to discover the mechanism by which Fe exerts its control. Much of the resulting work has lead to a cataloging of the many compounds that contain Fe, of deficiency symptoms, of interactions with other elements and of other descriptive observations, but no accounting of this primary effect of Fe," Mortvedt says<sup>6</sup>.

Iron is essential for the production of chlorophyll. Although not a part of the chlorophyll molecule, iron is a necessary part of the sequence of processes involved in its production. The lack of iron to fulfill this process results in the yellow chlorotic appearance known as iron chlorosis or iron deficiency. While the absence or severe deficiency of iron can cause symptoms ranging from a yellow interveinal chlorosis to actual death of the plant, "...soil applications of over 400,000 pounds of a 30 percent iron oxide per acre on soil with a pH of 7.0 and above produced no toxic effects," J.L. Stroehlein says<sup>7</sup>. This product, called Ferrosul®, contained about 60 percent calcium sulfate and 30 percent iron oxide and had a pH of 7.5.

Unlike other micronutrients which can produce various levels of plant toxicity if overapplied, it would seem that the only casualty in overapplication of soil-applied iron in soils of pH 7.0 and above would be the applicator's wallet. However, care should be taken in applying any micronutrient indiscriminately in that the balance of micronutrients within the plant are as important as the lack of any one element. At

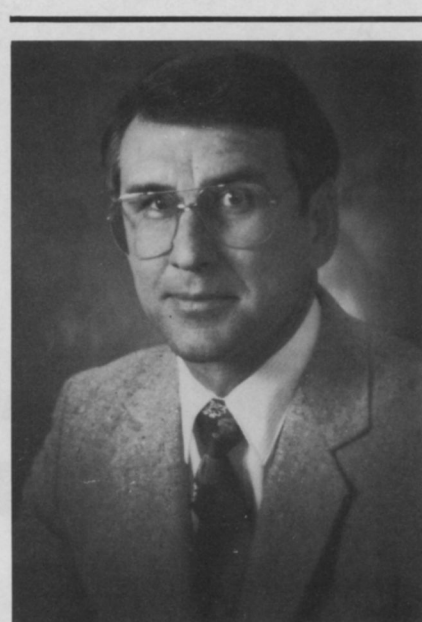
times, the deficiency or excess of a particular element can confuse the visual symptom of a plant and render visual identification of an elemental deficiency impossible. Again, the best means we have to date of identifying problem areas remains with soil and tissue tests, yet in the development of soil tests, those for the micronutrients are in their infancy.

**Iron chlorosis situations.** A number of situations can contribute to iron chlorosis problems. Iron chlorosis can result in soils low in iron content (low organic matter and sandy soils), or because iron content is unavailable or removed due to one or more of the following:

- Alkaline soils — pH 7.0 or above.
- Excess soil acidity (low organic matter content) — pH 5.0 or below.
- High calcium carbonate (lime) levels in soil (three to five percent of total weight).
- Extensive earth moving or contouring which removes the top six to 12 inches of topsoil (most available iron has accumulated in the upper six inches of topsoil through plant action).
- Low soil temperatures inhibit iron uptake (especially after dormancy).
- Moisture extremes.
- Compaction of area caused by intensive use, especially during or immediately after rainfall or irrigation — aeration may help alleviate this problem.
- Excessive amounts of copper, zinc, manganese or heavy metals like nickel available in soil. An imbalance of these metals within the plant can prevent it from absorbing iron.
- Indiscriminate use of phosphate fertilizers. Repeated use of a "total" fertilizer such as 13-13-13 have caused more problems than they have solved. Phosphate-induced deficiencies are probably more prevalent on highly maintained turf areas and are the cause of more iron and zinc deficiency than any other cause other than alkalinity. "Again, where excessive amounts of soluble phosphate are added to the soil, the iron in it may be made unavailable to plants by being precipitated as insoluble iron phosphate. This may happen in acid as well as in alkaline soils," Howard B. Sprague says<sup>8</sup>. Again, soil and tissue tests can help spot and prevent this problem.

**The iron solution.** The solution to the iron deficiency problem is a matter of deciding upon which form of iron to apply. Inorganic compounds, chiefly ferrous sulfate, are one iron source. The main advantage with this source is low cost. However, inorganics have several disadvantages.

They are seldom effective as a soil application, as they rapidly oxidize to the unavailable ferric state. A foliar application will generally give faster response than even a chelated soil



Neal Howell is president of Ironman Fertilizer Specialties, Ennis, TX, a fertilizer company specializing in turf and ornamental micronutrients.

application. If weather conditions are unfavorable for rapid absorption (hot and dry) or if rainfall moves them to the soil, they are usually lost to the plant. Staining is always a problem, as is mixing and handling.

The chelates are a second source of iron. "A chelating agent is a compound (usually organic) which can combine with a metal ion in such a way that a ring structure is formed between a portion of the chelating agent molecule and the metal. This combination prevents the metal ion from reacting with other substances to form insoluble compounds. A chelate is the compound formed by the combination of chelating agent and metal," Ray B. Diamond says<sup>9</sup>. Some forms of iron chelates are highly stable. Their stability ranges for iron are as follows:<sup>10</sup>

EDDHA ..... best in all soil pHs  
DTPA ..... good in fairly alkaline soil  
HEEDTA ..... good in fairly acid soil  
EDTA ..... good in acid soils

Organic ligands are a third iron form. These are heterocyclic compounds attached with two or more ligands to a metallic ion. They are stable through low temperatures and appear to fall somewhat below DTPA Fe in ability to sequester metallic ions. Their ease of handling and cost are advantages, and staining is less a problem than with inorganics.

Finally, lawn care operators can turn to organic complexes for a source of iron. Lignin sulfonates, citric acid and humic acids are all naturally occurring substances and are used almost entirely in foliar applications as they quickly oxi-

(continued on page 58)

## CONVERTING TO LV

(continued from page 34)

new applicators or retaining experienced personnel..no problems..I'd never go back (to high volume)." Mike McNaulty from McNaulty Lawn and Garden, Penfield, NY, says, "I'm completely happy working with LV..I love it!"

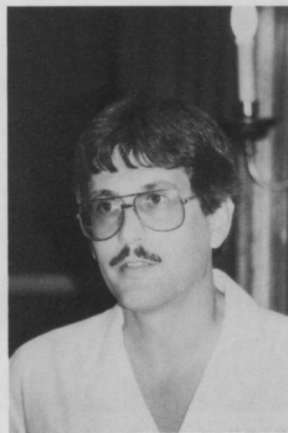
A fourth concern is that it is hard to get good weed control with low volume applications. But Dr. Ray Freeborg of Purdue University and co-author of the *Turfgrass Managers Handbook* maintains that, "High volumes of spray solution tend to dilute and wash the herbicide off the foliage, thereby reducing the herbicide's effect on the weeds to some extent. Low volume applications are more concentrated and more herbicide adheres to the leaf. As the application rate increases above 1.5 gallons per 1,000 square feet, we begin to lose herbicide, and the more volume over 1.5 gallons, the more we lose."

There are many LV points to consider, but here are a few to ponder. The small vehicles are more maneuverable, can be turned around in a driveway, are faster to clean and fill, can service distant accounts economically and more of them fit into a warehouse. In the event of an accident, the LV pesticide spill probably would contaminate less area and be less expensive to clean up.

There is one final point to consider when converting to low volume. What can you do with all those big trucks? You can use them for right-of-way or industrial work, sell them to another lawn care operator or a farmer, or sell the cab and chassis and make the spray system into a

batch mix and fill station. A single 1,000 gallon tank can hold enough fertilizer and water on a single fill to supply four to five LV trucks with pre-mixed products. You can save fill time and have better quality control.

Some people are calling LV a revolution, but it is more like an evolution. In the history of any industry, it is only natural that inefficient business methods will be replaced as technology advances. Judging from the comments of your fellow operators, the evolution in the lawn care industry is moving towards low volume spraying.



Tom Jessen is president of Perma-Green Supreme, makers of low volume spray rigs. If you would like to learn more about LV, contact Tom at Perma-Green Supreme, P.O. Box 8326, Merrillville, IN 46410; 219/663-8417 in Indiana, or toll-free at 1/800/346-2001.

## LOW VOLUME

(continued from page 37)

from liquid-applied fertilizers, some conclusions can be drawn from the results. Most liquid-applied fertilizers can be grouped into either a slow-release group or a group that is mostly urea. The urea-based sources tend to give the highest quality turf in the spring and the fall, while the slow release sources give the best quality during mid season. While the substitution of some urea for the slow-release materials helped quality early in the season, some summer quality is sacrificed.

The slow-release materials in general accumulated less thatch than urea-based materials. The addition of iron chelates to liquid-applied fertilizers helped speed up the color response with each application. While these studies helped to point out the efficiency and safety of nitrogen-based materials applied as liquids, it should be emphasized that nitrogen is only one of a number of important nutrients for turfgrass growth. The addition of other nutrients can have a dramatic effect on both the efficiency and safety of these materials.

Material	Analysis	Nitrogen rate lb N/1,000 sq. ft.	Carrier rate gal./1,000 sq. ft.	% Leaf blade injury <sup>b</sup>
Urea	46-0-0	1	4	5.2 b
	46-0-0	2	4	20.0 a
	46-0-0	1	3	4.0 b
	46-0-0	1	2	3.8 b
Formolene	30-0-2	1	2	0.0 c
	30-0-2	1	1	0.0 c
	30-0-2	2	1	0.0 c
	30-0-2	1	0.5	0.0 c
	30-0-2	1.62	0.5	0.0 c
Fluf	18-0-0	1	2	0.0 c
	18-0-0	2	2	0.0 c
	18-0-0	1	1	0.0 c
	18-0-0	1	0.59	0.0 c
	18-0-0	2	1.18	0.0 c
Fan	16-2-5	1	1	0.0 c
	16-2-5	1.6	1	5.0 b
	20-0-0	1	1	0.0 c
	20-0-0	1.9	1	2.5 bc

<sup>a</sup>All values represent the mean of four replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

<sup>b</sup>Percent leaf blade injury is a visual rating of describing the total leaf blade injury appearing on the plots after fertilizer applications.

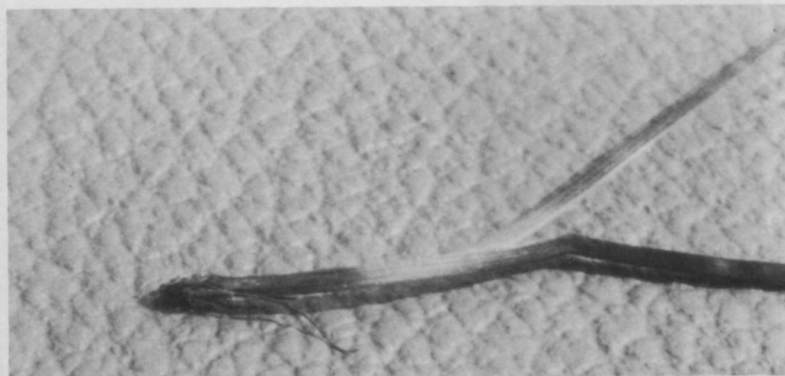
**Table 3. Percent leaf blade injury with low volume fluid fertilizer applications on July 19.<sup>a</sup>**



## YELLOW PATCH UPDATE

(continued from page 27)

plied two and four days after inoculation of the turfgrass seedlings. All fungicides tested gave excellent to good control when applied as much as four days after the plants were initially infected with *Rhizoctonia*. These data indicate that there



Reddish leaves frequently associated with yellow patch.

are fungicides available which are capable of controlling the yellow patch if they can be applied in such a manner that they can be effectively placed in contact with the fungus at very early stages of infection. We expect that this greenhouse observation may also hold for the field although at this point we have been unable to locate field test plot areas where symptoms are in the very early stages of development to verify this observation on established turf.

**Genetic resistance.** Another approach to controlling this disease involves looking for sources of resistance within Kentucky bluegrass cultivars that are currently available. To this end, nine Kentucky bluegrass cultivars were inoculated with *Rhizoctonia cerealis* in the greenhouse to evaluate their relative resistance to yellow patch. The results are shown in Figure 2. Of those cultivars tested, Adelphi and Cheri were found to be resistant to isolates of *Rhizoctonia cerealis* used in this study. Additional research is now being done to look for other sources of resistance within Kentucky bluegrass cultivars and within other turf species and cultivars to determine their relative susceptibility to the yellow patch fungus.

**Recommendations.** At the present time, the only recommendations that we are able to provide are that 1) we expect that if the disease can be detected early enough, applications of fungicides such as Chipco 26019®, Daconil 2787®, Vorlan® and Banner® may prove effective in controlling the disease if applied at, or before, symptom initiation; 2) re-establishment of an affected area with the Kentucky bluegrass cultivars

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**Dr. Philip Larsen**

T. Abernethy and P.O. Larsen are graduate student and professor, respectively, in the Department of Plant Pathology, Ohio State University, Columbus, OH.



**"Crater-like" symptoms associated with yellow patch on a Kentucky bluegrass lawn.**

Adelphi and Cheri may prove beneficial in preventing further problems with the disease in areas that have been affected. We would not recommend overseeding or slit seeding into established turf where the disease has been active, since the chances of successful establishment of the plants in this sort of environment would probably be minimal.

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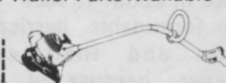
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# SKIN ABSORPTION AND THE LAWN SPECIALIST

BY J.R. VACCARO

If you were to ask the average American worker how chemicals can enter their body, you might be surprised at their answers. Most workers would understand the phenomenon of the inhalation of airborne substances such as gases, vapors, smoke or aerosols. Most would understand the danger of ingestion of foreign materials either by accident or on purpose. However, skin absorption is the route of exposure least likely to be understood by the average worker. It is difficult for the untrained person to comprehend how a substance could pass through intact skin, never leaving a mark on the skin surface, and yet cause systemic injury.

The phenomenon of skin absorption is an especially appropriate subject for the lawn care industry. Several studies strongly suggest that the skin, especially that which is below the waist, is the source of greatest chemical exposure for the lawn specialist. The contact comes from allowing spray mist to saturate the pants.

An adult human has an average skin surface of about 18 feet<sup>2</sup>. The skin acts as a formidable barrier between a person and their environment. However, because of the chemical composition of the skin, certain chemicals will more readily dissolve than others in the lipid-rich layers of the skin, thereby enhancing the opportunity for absorption. Materials of high oil solubility are, in general, more readily absorbed. The most readily absorbed materials are those that have both oil

and water solubility. The chemical make-up of most lawn care products afford them oil-soluble properties.

It is generally thought that the outer skin layer is that part of the skin structure that determines the rate at which chemicals pass through intact skin. If an oil-soluble material is allowed to contact the skin, the substance, after dissolving into the fat components in the skin, will pass at some rate through the layers of cells until it can enter a capillary. Capillaries are the smallest blood vessels which serve the outermost skin layers and which can take up the penetrating chemical into the circulating blood. Once the material enters the bloodstream, it will either be metabolized to a new chemical form and then excreted or directly excreted in a manner the body finds most efficient.

There are substances that can pass through intact skin at astonishing rates. Dimethylsulfoxide (DMSO), a solvent and highly-advertised medicament for arthritis, passes through intact skin almost instantaneously. A number of pesticides are known to be absorbed through intact skin and injuries or illness have occurred with certain pesticides because they were not immediately and effectively removed from skin after contact occurred.

Skin absorption potential can be evaluated on several species of laboratory animals. Some animals are better models for comparison with humans, but this will vary with the class of chemicals tested. Although the albino rabbit is commonly used in acute skin absorption studies, the skin of pigs and the squirrel monkey are more similar to man in permeability properties. Rats tend not to be such good models for skin absorption studies for many com-

pound classes, but can be good models for some.

Our studies at Dow Chemical have suggested that the majority of applicator exposure to organophosphates such as chlorpyrifos (Dursban®, a Dow insecticide) stems from liquid spray which deposits on the front of legs and ultimately leads to skin penetration. The inhalation route appears to be of lesser importance. These results have been duplicated by Daniel and co-workers<sup>1</sup>, when they evaluated both inhalation and skin exposures of lawn specialists during application of diazinon, chlorpyrifos and trichlorfon insecticides. Their conclusion was that absorption from the scrotum made a significant contribution to the total absorbed dose. Very little insecticide was measured in the breathing zone of the applicators when they were monitored for airborne exposure. With significant skin absorption of organophosphates occurring, it is not surprising to see reduced plasma cholinesterase enzyme in lawn specialists.

There are several interesting factors that may affect skin absorption. Two of the more influential factors are concentrations of the applied dose and the extent of the exposed surface area. As the applied dose is increased, the total amount absorbed into the body may increase, depending on the chemical, therefore increasing the potential for toxicity. Also, an increase in surface area of contact will likely increase the absorption. Therefore, the greatest potential for skin absorption is likely to occur when a high concentration is spread over a large area of the body.

Another important factor is the site of application, since there is strong evidence of regional variation in the extent of absorption. In man, the scrotum appears to yield the highest absorption, with other sites of highest absorption being the scalp and forehead<sup>2</sup>.

Skin absorption is affected and may be enhanced if the application or contact site is covered following application. Occlusion (or covering) changes the hydration and temperature of the skin, which in turn increases the opportunity for skin absorption. In handling lawn care chemicals, this fact makes it very important to change clothing immediately upon receiving a significant contact exposure.

Skin disease or physical injury to the skin makes it more vulnerable to penetration because of the loss of barrier function. Dr. Howard Maibach, a well-known researcher in the field of skin permeability, has conducted studies to determine the effect of damaged skin on total absorption<sup>3</sup>. In Maibach's studies, cellophane tape was used to cover a portion of the forearm of human volunteers. When the tape was

removed, part of the outer skin layer was removed in the process. Several commonly-used herbicides were then applied in small doses to the skin of different volunteers to determine if damaging skin had enhanced the magnitude of the absorption. Four- to eight-fold increases in total pesticide or its metabolite were observed in the urine over the experimental test period, after application to the "damaged" skin site.

An obvious question then is: How do lawn specialists protect themselves from such exposures? The obvious answer is to wear protective clothing, but other measures can help diminish the exposure as well. If a concerted effort is made to keep the spray low and off the legs, much of the skin contact will not occur. This means not applying it when it is windy or at least changing the direction of the spray in accordance with wind direction so the spray is blown away from the body.

The use of protective rubber boots in place of canvas shoes are essential in preventing skin absorption through feet. It has been suggested that an apron, made of impervious material, could be used to keep spray off the legs. The apron offers protection without completely enclosing the legs during warm days. Materials such as neoprene

and PVC offer good protection against dilute water-based insecticide formulations.

Some work has been conducted using normal cloth to which water repellent materials had been applied<sup>4</sup>. These studies revealed that the addition of fluoroaliphatic resins and Scotchgard® adds appreciable protection to both 100 percent cotton and 65/35 percent polyester/cotton. In the same study, it was found that 100 percent cotton was more impervious to liquid spray than 65/35 percent polyester/cotton denim material.

Lawn specialists are unique in that they have a reasonably high potential for skin absorption while conducting their normal duties. They require some minimal protective equipment to protect their bodies from spray that could get onto their clothing. Only this, and the encouragement of supervisors, will build a safe working environment for the lawn specialist.

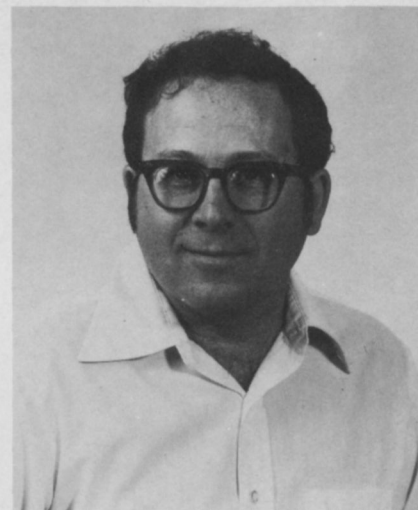
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J.R. Vaccaro is research leader in the Industrial Hygiene Department of The Dow Chemical Company, Midland, MI.

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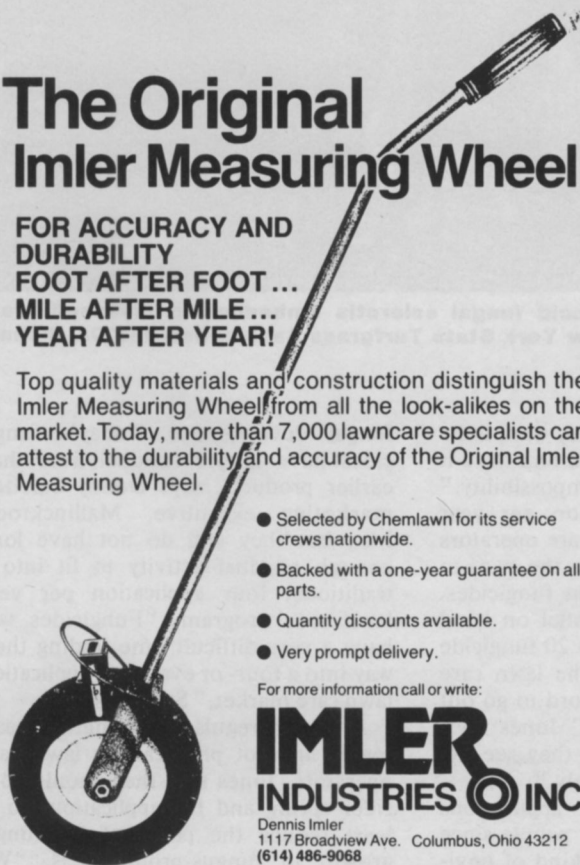
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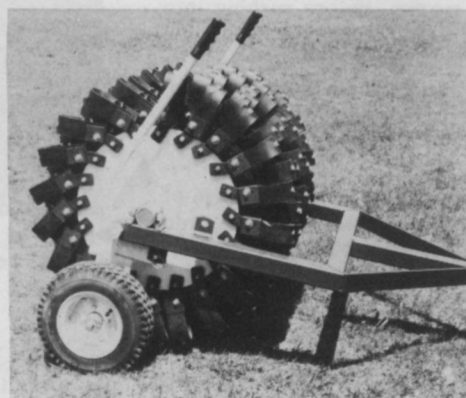
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# SELLING FUNGUS CONTROL IS DIFFICULT BUT NOT IMPOSSIBLE

BY TIM WEIDNER

**T**he good news generally sounds better when it follows the bad news, so perhaps you would like to hear the bad news first: Lawn care businessmen can anticipate numerous logistical problems when engaging in home lawn fungus control as an add-on service. The good news is residential fungus control can bring in enough supplementary revenue to make it worth the trouble.

**The bad news.** Before rushing into residential fungus control, the lawn care operator should know about the typical hassles he can expect. Most of the chemical companies that manufacture or formulate fungicides have not made a concerted marketing effort towards the lawn care market because of the inherent difficulties. Fungicide producers spend most of their marketing dollars on the golf course market because intensive management practices on golf courses have created a demand for fungus control.

"We have been involved in the golf course industry for some 30 years," says Casey Jones, sales manager, TUCO Division of The Upjohn Company, Kalamazoo, MI. Jones says TUCO has become well-established in the golf market by selling fungicides in both curative and preventative control programs. The company has had the same kind of success in the lawn care market with lawn insecticides, according to Jones, but the limitations of current lawn application schedules has prevented successful fungicide sales in this market.

"People in the lawn care industry want a product with the longest possible



Photo of gray snow mold fungal sclerotia embedded in diseased grass plants. Courtesy of New York State Turfgrass Association and Dr. Richard Smiley.

residual," Jones says. "They want to be able to put the thing down and have it last all year. That is an impossibility." The four-to-five-application per year schedule that most lawn care operators follow is not conducive to the two- to six-week life span of most fungicides. Golf courses have personnel on hand to make upwards of 15 to 20 fungicide applications per year. "The lawn care companies really can't afford to go out and treat every 21 days," Jones says. "They have to wait until they see the disease and treat it curatively."

Preventative fungicide applications are difficult for lawn care people since they must anticipate the kind of environmental conditions which will favor

fungus development. Today's fungicides have longer residual lives than earlier products, says Denny Salettel, marketing executive, Mallinckrodt, Inc., but they still do not have long enough residual activity to fit into a traditional four application per year lawn care program. "Fungicides will have a very difficult time finding their way into a four- or even five-application lawn care market," Salettel says.

Although regular preventative treatments are not practical for lawn care operators, Jones says they should consider spring and fall applications to at least reduce the potential for fungal growth in fungus-prone areas. "We

(continued on page 50)

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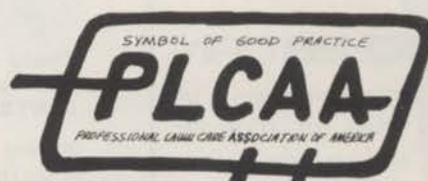
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## FUNGUS CONTROL

(continued from page 46)

emphasize a late fall application to reduce the potential for leaf spot and also to control snow mold," Jones says. "That cuts down the number of spores that over-winter so the grass will green-up a little faster and there will be less potential there for disease to start in the spring. We are also looking into



Photo of melting-out which caused rotting of stem and crown. Courtesy of NYSTA.

making early spring applications to cut down the spore population."

Although there are several good broad-spectrum fungicides, an applicator still must have the ability to correctly diagnose a fungus problem to achieve control. This brings up another problem with selling fungus control to homeowners: the applicator must be able to differentiate between the many types of fungus that often have similar symptoms. Jones says this is less of a problem for golf course superintendents who have learned to anticipate the fungus diseases common in their area. "The guy who just signed up with a lawn care company doesn't have any idea what disease is prevalent in a particular customer's yard."

There is also a problem with "watering-in" fungicides. Following an application of many fungicide products, the turf must be irrigated to activate the material. Golf course personnel have the irrigation equipment and control over that equipment to assure a proper treatment, but lawn care applicators must depend upon the homeowner to follow his instructions after he is

gone. Jones has found that homeowners are not always cooperative with their lawn service.

Lawn care businessmen must also consider the economics of selling home lawn fungus control. Since fungicides are relatively expensive, an operator must consider carefully how he will cover his cost to the customer. Losing a customer is costly under any circumstances, but losing a customer and his payment after a fungicide application hurts the bottom line even more.

Some fungus diseases, especially leafspot, can actually "force" an operator into the fungus control business. In a typical home lawn treatment scenario, Salettel says in many leafspot-prone regions it is common for the disease to hinder spring green-up — following a year-long fertilization program during the preceeding year. "The average homeowner isn't going to say, 'Gee, I should have paid that lawn care guy a few extra bucks (for a fall fungicide application)'," Salettel says. Instead, most homeowners will conclude that their lawn serviceman did not do his job or even injured the lawn and will start shopping for a new lawn service.

"A lot of times, disease control adds up to an insurance program," Salettel says. "They are not only giving their customer what they need, they are also covering their own butts. As long as the customer turnover rate in the lawn care industry remains as high as it still is, they have to worry about how they are going to make that customer the happiest."

The lawn care operator must realize that it is up to him to shape his customer's perception lawn care. Most homeowners probably do not readily associate diseases with plants. The operator must know something about turf fungus so he can convey that information to the customer and sell the need for fungus control. "Too often — in any business — people are afraid to speak up and say if you spend a little bit more, you get this," Salettel says.

Like Salettel, Don Newhart, marketing manager, PBI Gordon Chemical Co., also believes the lawn care operator must explain and sell. "You have to explain the cycle of the disease, that it might have been prevalent in the neighborhood before and will likely be prevalent again," Newhart says this explanation "...has to be accompanied by a sales pitch."

Neither PBI Gordon nor Mallinckrodt have made concerted efforts at selling their fungicides to the lawn servicing market, since the service is difficult to sell to homeowners. But TUCO has plans for launching a direct mail campaign to the lawn care industry which the company hopes will open the

(continued on page 52)



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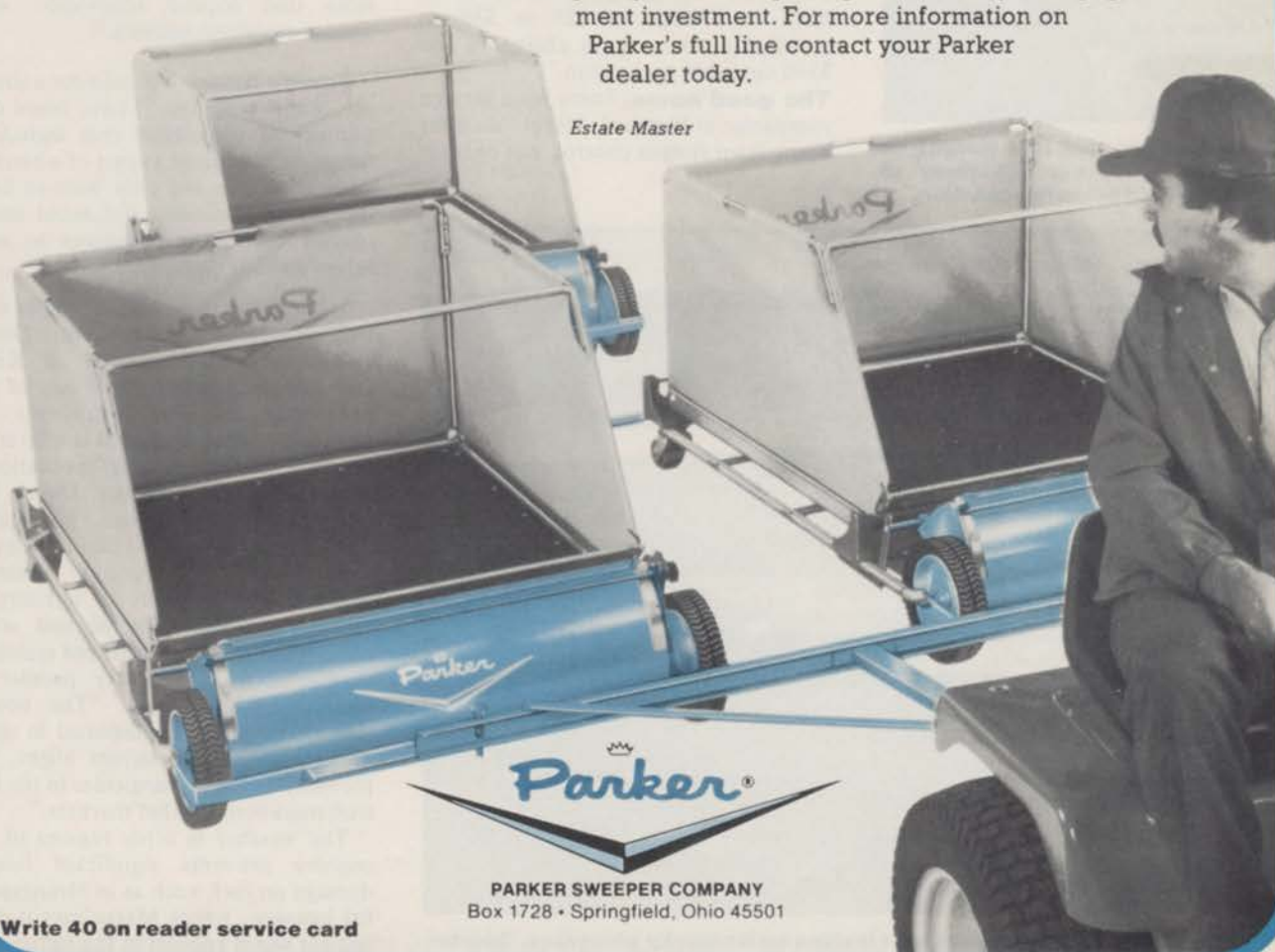
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## FUNGUS CONTROL

(continued from page 50)

door for fungicide sales to this industry. "We are going to target some direct mail pieces to some lawn care companies informing them of what TUCO can do for them," says a TUCO spokesman. "We are going to talk about insecticides mainly, but we are going to mention fungicides. If that is successful, we hope to talk more about fungicides."

Rick Steinau, president of Greenlon,

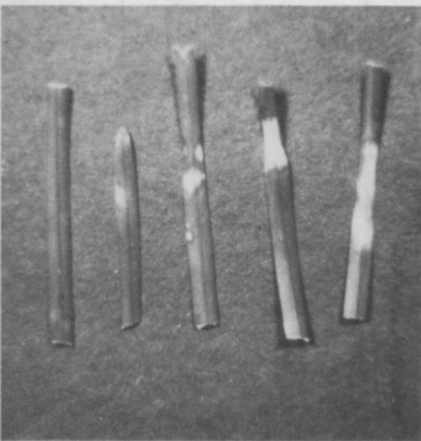


Photo of dollar spot leaf lesions on Kentucky bluegrass. Courtesy of N.Y. State Turfgrass Association.

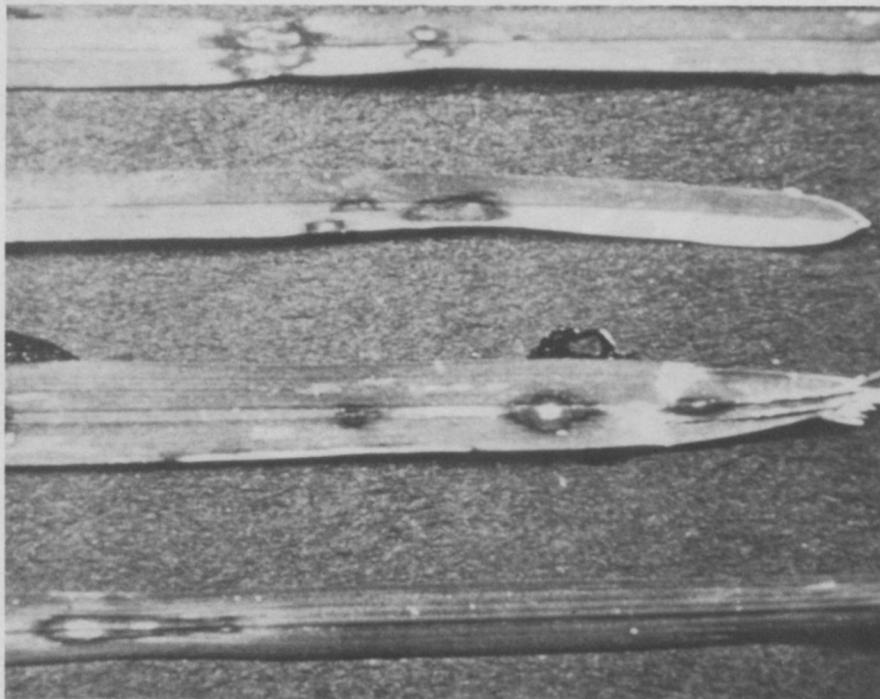


Photo of helminthosporium leaf spot lesions on Kentucky bluegrass. Courtesy of N.Y. State Turfgrass Association.

Inc. in Cincinnati, OH, would prefer not to talk about fungicides. Steinau's company services its 15,000 accounts much the same way as ChemLawn Corporation's branches service their accounts in the Cincinnati area. Neither company wants to get into a manpower-intensive lawn care add-on service and Steinau feels home lawn fungus control is just that. "It is not even a matter of charging the right amount," Steinau says. "It is the kind of personnel you have to train and put on staff. That person has to be trained and you have to pay him a decent salary. It gets to the point where it is just not worth it."

Steinau does not leave his customers hanging, however, if a fungus problem does crop up. He says the applicator will identify the fungus if he can and advise the homeowner what he should do. "We will even locate the product for them if that is what it takes." When it comes to specific services like fungus control, says Steinau, the big companies like his can give advice, but will seldom do the service themselves.

He would like to find a fungicide he could tank mix with his current spray program at a modest cost to the customer, but that fungicide simply does not exist. "There are some applicators who apply fungicides, but generally, they are not competing at our level," Steinau says. "Whereas we have an average of \$25 to \$30 an application, those guys charge in the \$100 range per application."

**The good news.** Some lawn service companies at Steinau's "level" do offer home lawn fungus control, but only on

their terms. Tru-Green Corporation, headquartered in East Lansing, MI, offers fungicide treatments at an additional cost. "If there is a history of a recurring problem, or new symptoms are diagnosed, we offer preventative or curative treatments as supplements to our regular program," says Cindy Brown, Tru-Green Technical Services.

But selling home lawn fungus control requires a little consumer education. "It is difficult for a customer to understand the dynamic nature of diseases," Brown says. "It may be a particularly susceptible host, a period of favorable environmental conditions, or severe plant stress that tips the balance in favor of the pathogen."

The homeowner must understand that fungicides are only a small part of the lawn management picture, according to Brown. "Any one can apply a fungicide, but unless that homeowner is taking proper care of their lawn, and the lawn care company has developed programs that are not increasing disease susceptibility, the results may be very disappointing," Brown says.

A lawn care company may also have to look beyond fungicides for a solution to fungus problems. "Fungicides aren't always the best solution," Brown says. "Sometimes there are persistent problems that require renovation with disease-resistant cultivars."

Brown's bottom line calls for a sound agronomic program. "I have heard of a number of companies that include a fungicide treatment as part of a blanket application. We not only want to limit the use of pesticides, but avoid unnecessary costs and exposures to ourselves and our customers."

While Tru-Green offers fungus control as part of their program, Davey Lawnscape, headquartered in Kent, OH, does not include it in any of the programs in the company's 27 territories. Fungus control is offered to homeowners as a "special application," according to Greg Mazur, Davey Research and Development, but makes up less than five percent of total sales.

However, the fungus situation changes from territory to territory in Davey's market universe and some areas require more specialized attention than others. "It is very popular in Detroit," Mazur says. "The people there seem to be conditioned to using preventatives on fusarium blight. We probably sell more fungicides in the Detroit market than other markets."

The weather in other regions of the country prevents significant fungus damage on turf, such as in Minneapolis for instance, where Mazur says it does not get warm enough in the summer to activate diseases long enough to do



much lawn damage. The same is true for Milwaukee and Cleveland's east side where the "lake effect" off Lake Erie has a moderating effect on the weather.

The weather also plays a role in planning fungicide applications. Mazur says most fungicides applied for control of fusarium must be applied before temperatures drop below 70 degrees Fahrenheit in the evening. Depending upon the region of the country, an applicator must draw upon past experience and apply the material in the middle of month, hoping that those temperatures will develop at the end of that month. If the correct weather conditions develop too soon or too late, the operator has wasted an application.

To insure that applicators are as well prepared as possible to anticipate and diagnose fungus diseases, Davey has an annual fungus control training session. "Depending on when the technician is hired, he may have to wait up to one year to receive that training," Mazur says. "We recommend that until they get the hang of associating symptoms with a fungus to send samples to us in Kent."

One reason the fungus training is held only once a year is the minuscule role fungus control plays in Davey's entire lawn care scheme. In 1983, Mazur says of all diagnosed customer lawn problems, in all of Davey's markets, about 1.8 percent were found to have dollar spot. In the same year, .59 percent had fusarium blight, 2.1 percent had leaf spot and 1.2 percent had other diseases. These percentages fluctuated considerably from area to area with changing weather conditions. To put the situation in perspective, it is interesting to note that confirmed weed problems for 1983 accounted for 28 percent of all Davey's diagnosed lawn problems.

As Mazur has already noted, the various environmental conditions across the country exert a considerable amount of control over the severity and types of diseases present in any given area. Down in Birmingham, AL, the primary market for Green Care Lawn Service, dollar spot is the most prevalent fungus problem. Ronnie Zwiebel, Green Care president, says his company will apply fungicides only when absolutely necessary and even then, strictly as a curative treatment rather than a preventative treatment. "Generally, we will put on fertilizer and grow out from under the problem," Zwiebel says. "Because of the disease situation down here, we generally put down disease control as a last alternative, because nine times out of 10, fertility will correct the problem."

If the fungus problem persists, Zwiebel says his company will apply

fungicides, but in an average year Green Care will put down only about 150 fungicide applications. In most cases, the applications are billed to the customer as an additional service that most customers do not question. "Diseases are a common enough problem that they usually accept it," Zwiebel says, "especially when you can show them the lesions and back it up with textbook pictures."

In Fort Wayne, IN, the base of operations for Emerald Green, Helminthosporium leaf spot is the most abundant fungus problem. Steve Juntgin, Emerald Green president, also uses

printed material to convince customers that they have a fungus problem, but he says a little salesmanship is necessary to lock a client into a yearly preventative program. "Tell them not to expect

(continued on page 54)

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## FUNGUS CONTROL

(continued from page 53)

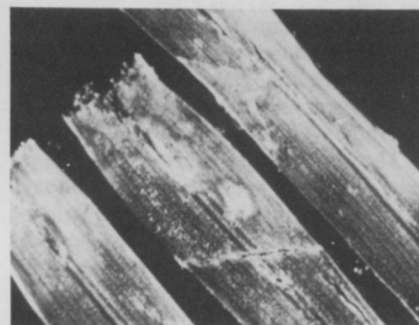
much the first year," Juntgin says. "Be honest and say, 'This is going to slow it down, but year after year the plants will be healthier and in the long run the turf will be thicker and greener'."

When selling an annual preventative fungus program, Juntgin says it is crucial to avoid lifting the homeowner's expectations too high. "I never oversell

myself; I protect my rear end," Juntgin says. "If it works well, I look like God."

Although fungus control accounts for only 3-1/2 percent of all the services Juntgin sells, he says by offering fungus control he has conveyed a professional image to prospective customers and gotten their business. "I have had my competitors not show customers leaf spots and I have gotten sales from them." Still, the minor role fungus control plays in Juntgin's total sales picture has restricted him to marketing the service only to his existing customers. "You couldn't send a brochure out," Juntgin says. "It would cost a lot to illustrate it and if they (prospects) have another service, they would just have their service do it."

**Conclusions.** Despite the

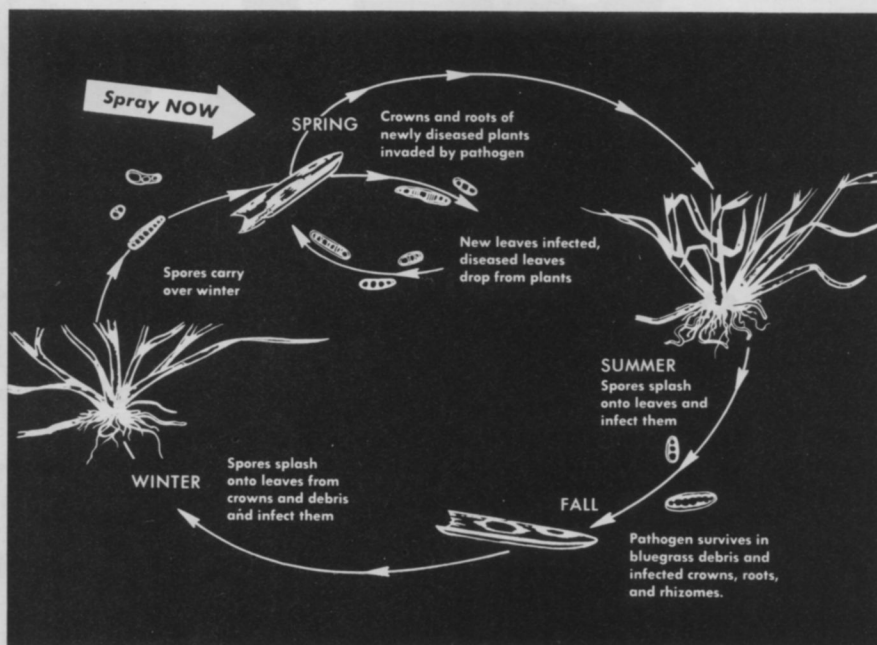


**Photo of fusarium blight leaf lesions on Kentucky bluegrass. Courtesy of N.Y. State Turfgrass Association.**

drawbacks, it is clear that home lawn fungus control can be sold as an add-on service and can function as a source of extra revenue. Obviously, a specialized service that brings in only three to five percent of total sales for most companies cannot be relied upon too heavily for support revenue. Still, the service should not be condemned for meager sales potential since, as Juntgin mentioned, the mere fact that you or someone on your staff is qualified to identify and control fungus should carry some promotional weight with prospective customers.

Keep in mind that existing customers have hired you to create a green, lush lawn for them and in many parts of the country, fungus problems are simply too intense to remedy by out-growing fungus damage with heavier fertilizer applications. A knowledge of fungicides and other agronomic tools such as fungus-resistant cultivars could mean the difference between a satisfied customer and no customer at all.

But obtaining that fungus control knowledge is one of the major drawbacks. As Rick Steinau noted, people who can identify and understand fungus dynamics require training or have already received training (most likely in college) before coming on board and will not work for minimum wage. So those who would consider offering fungus control had better be willing to make a commitment to skilled personnel.




Courtesy of Du Pont Company.

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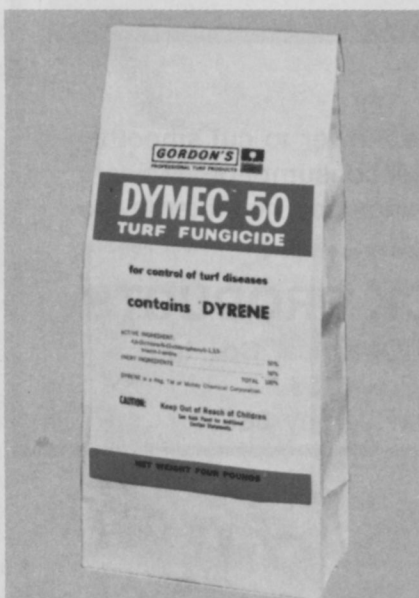
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# ALA PRODUCTS

**PBI Gordon Corporation's** Dymec 50® is a broad-spectrum turf fungicide for outstanding control of a wide range of fungus diseases, particularly dollar spot and helminthosporium diseases, according to the company. The product is labeled for control of brown patch, copper spot, dollar spot, helminthosporium leaf spot, melting-out and rust. Dymec 50 is an organic, non-mercurial wettable



powder. It has no phytotoxic effects at recommended dosage levels. And its powder form won't freeze or salt-out in winter storage.

Formec 80®, also from PBI Gordon, is a broad-spectrum fungicide designed for preventative rather than curative disease control, according to PBI. It controls certain fungus diseases on lawn turf and certain ornamentals and flowers. With the phasing-out of the cadmium and mercury compounds, Formec 80 is one of the few products registered to control red thread.

**Write 100 on reader card.**

Bayleton® 25 percent wettable powder from **Mobay Chemical Corporation** is a new fungicide which has the ability to control, as well as prevent, certain important fungus diseases, according to the company. The product is absorbed rapidly and works systemically from within the plant. It mixes readily with water to form a suspension that can be used in all conventional hand- and machine-operated sprayers.

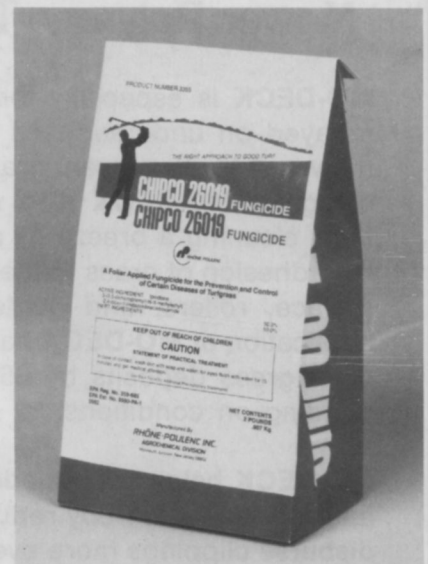
Dyrene, another Mobay fungicide, is labeled for control of brown patch, copper spot, dollar spot, leaf spot, melting-out, rust and snow mold. For control of snow mold, apply Dyrene at lower specified rate after the first killing frost in the fall. A second application should be made when the lawn is free of snow in mid-winter, and this should be followed by a third application after the final melting of snow in late winter or early spring.



A third Mobay fungicide, Lesan 35 percent wettable powder, is a non-mercurial fungicide recommended for use on ornamentals and turf. The company recommends the product for control of *Phytophthora* and *Pythium* organisms. Lesan mixes readily, according to the company, with water to form a suspension. It can be used a soil drench, soil spray treatment or as a dry soil mix by mixing soil and Lesan in any suitable mixing equipment.

**Write 101 on reader card.**

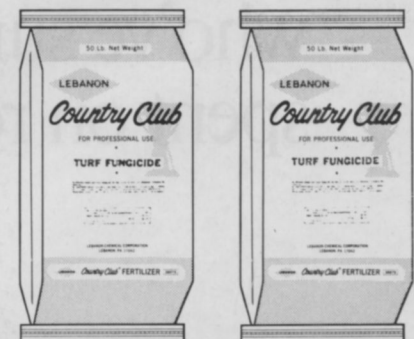
Chipco® 26019 from **Rhone Poulenc, Inc.** protects turf against helminthosporium leaf spot, melting-out, dollar spot, brown patch, fusarium patch, fusarium blight, pink



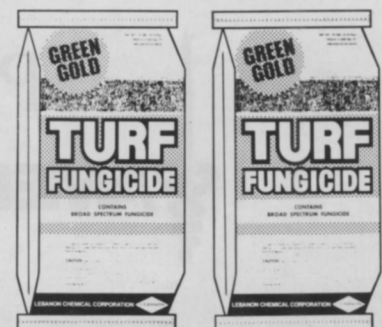
snow mold and grey snow mold. The product will deliver up to 28 days of control. Rhone Poulenc claims that for every treatment eliminated by the long residual life of 26019, you will save up to \$10 per acre in fuel and labor expenses. Each application costs just nine cents per 1,000 square feet per day of control.

**Write 104 on reader card.**

**Lebanon Chemical Corporation** offers Country Club® and Green Gold® turf fungicides. Country Club



will prevent or control curvularis, leaf spot, dollar spot, brown patch,



helminthosporium, melting-out, copper spot, gray leaf spot and stem rust. The product comes in a granular formulation and has excellent tolerance even in hot, humid weather. Green Gold contains Daconil 2787® and controls leaf spot, melting-out, curvularia, copper spot, dollar spot, brown patch, gray leaf spot and stem rust. It should be applied when the grass is damp, as after a rain or in the early morning.

**Write 105 on reader card.**

**Mallinckrodt, Inc.** has several products labeled for turf fungus control: Vorlan®, Fungo® 50 and Duosan®.

Vorlan is a new chemistry fungicide for the prevention and control of leaf spot, red thread, dollar spot and pink snow mold. Its specific action on leaf spot and red thread, two major diseases of cool season grasses, provides superior control over other fungicides, according to the company. The product's long-lasting control is safe on all common turfgrasses. One two-pound bag will treat four average size home lawns without the inconvenience of watering-in.

Fungo 50 is a broad-spectrum systemic fungicide for control of fusarium blight, dollar spot, brown

patch, copper spot, red thread, stripe smut and fusarium patch. Since it is systemic, it provides longer control than organic contact fungicides, according to the company. There is a high safety factor; it will not damage or discolor most grasses. It is compatible with Koban and can be tank-mixed for broad-spectrum summer disease control, including pythium.

Duosan is probably the "broadest" broad-spectrum turf fungicide offered by Mallinckrodt. It controls most major spring and summer diseases, including dollar spot, brown patch, copper spot, red thread, fusarium patch, rust and even troublesome leaf spots.

### Mallinckrodt®

Synergistic action provides a higher level of control than can be achieved by using each component separately. Duosan has the benefit of immediate contact action plus long-lasting systemic control. This combination reduces the probability of resistant diseases developing.

**Write 103 on reader card.**

Tersan 1991® from **Du Pont Company** is recommended for use as

a spray for the control of dollar spot, large brown patch, fusarium patch (pink snow mold), fusarium blight and



stripe smut on turf. A second Du Pont fungicide, Tersan LSR® is designed for control of leaf spot diseases incited by helminthosporium, rust and rhizoctonia brown patch on turfgrasses. Tersan 1991 plus Tersan LSR fungicides are recommended for use as a tank mixture for preventative control of the following disease situations: helminthosporium leafspot and dollar spot and/or brown patch; dollar spot and brown patch; or brown patch alone.

The repeated and exclusive use of Tersan 1991 has led to the development of benomyl-resistant strains of dollar spot fungi in some locations and may lead to the development of tolerance in other strains of fungi. The use of Tersan 1991 as a tank mixture with Tersan LSR may delay the development of tolerant strains of fungi.

**Write 102 on reader card.**

## ALA PRODUCT PROFILE

### LOFTS INTRODUCES INSECT RESISTANT TURFGRASS: REPELL PERENNIAL RYEGRASS

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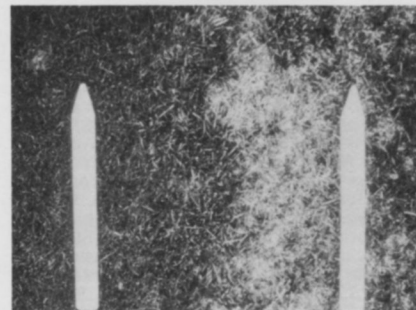
Repell is a leafy, turf-type perennial ryegrass capable of producing a persistent, dense, attractive, low-growing turf of a bright, dark green color. It provides excellent turf performance in both full sun and moderate shade on golf courses, lawns, parks, school grounds and sports fields in areas where turf-type ryegrasses are well adapted, according to the company.

The seed contains an endophytic

fungus which causes Repell to resist insect attack. An endophyte is an organism, such as a fungus, which lives within a host plant, but is not necessarily parasitic upon its host. Upon seed germination, the endophyte grows into the seedling and continues to live in the tissue of the mature grass plant.

Plants containing endophytes also may show improved disease resistance, drought tolerance and seedling vigor, as well as stress tolerance and persistence. Repell perennial ryegrass seed is produced to insure that over 80 percent of the seed will contain viable endophyte at the date of testing as required by the recently organized Endophyte Enhanced Performance® (EEP) program.

Repell perennial ryegrass is EEP tagged to ensure the presence of the endophytic fungus. Endophyte viability can be lost by normal seed storage practices within two years. (Use only freshly harvested seed for insect resistant



**Repell turf on the left shows resistance to cutworms in Lofts, Inc. test plot.**

turf.) To prolong endophyte viability, cold storage (40 degrees Fahrenheit) is recommended. Use Repell within nine months of the test date indicated on the EEP tag to insure a high viable endophyte level.

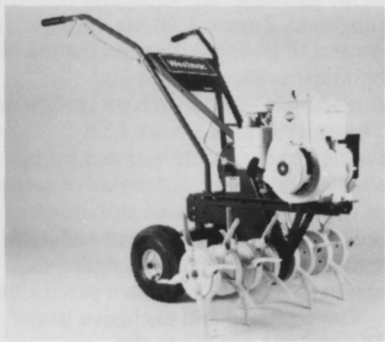
For more information on Lofts' Repell perennial ryegrass, write 199 on the reader service card. For further details on the EEP program, write: Dr. Richard Hurley, Acting Chairman, EEP Committee, Box 146, Bound Brook, NJ 08805. — Vivian Fotos



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## IRON YOUR PLANTS

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dize on soil contact. They are usually economical, but are difficult to use in tank mixes.

**Conclusion.** The professional applicator should be aware of the benefits of using micronutrients in his fertilizer program. Although micronutrient testing and the resulting interpretations are still not state of the art, micronutrients can provide the quick green color necessary for a happy bill-paying customer. A total fertility program utilizing a balanced plant diet can enable a perceptive applicator to trim back on excess macronutrients and still maintain the necessary color and growth.

It should be re-emphasized that it is the limiting, or element in the shortest supply, that controls plant growth and health. Even if adequate N, P, K and S are available, if Fe is in short supply, then the plant can only utilize the macro elements up to the point that Fe limits it; above this point, all other elements are in excess and are often wasted! An area representative of the typical area of application should be utilized as a test area to determine plant responses to different elements. A discerning applicator can then let performance be his guide.

As more research is done, more answers will be found as to iron's function and its role in plant metabolism. Until these answers are found, iron will remain an enigma — necessary, yes — but not clearly understood.

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