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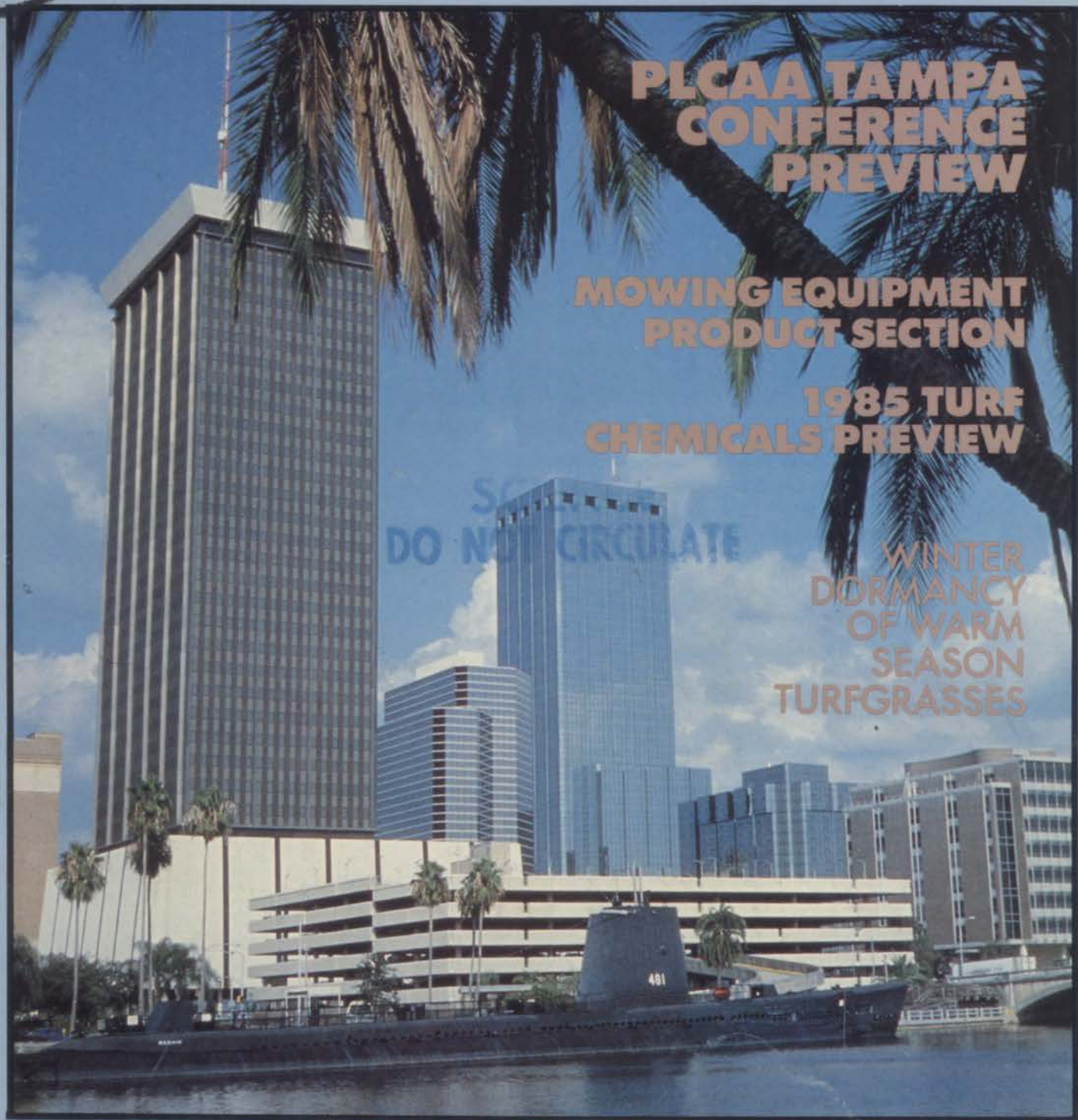
**PLCAA TAMPA  
CONFERENCE  
PREVIEW**

**MOWING EQUIPMENT  
PRODUCT SECTION**

**1985 TURF  
CHEMICALS PREVIEW**

DO NOT CIRCULATE

**WINTER  
DORMANCY  
OF WARM  
SEASON  
TURFGRASSES**





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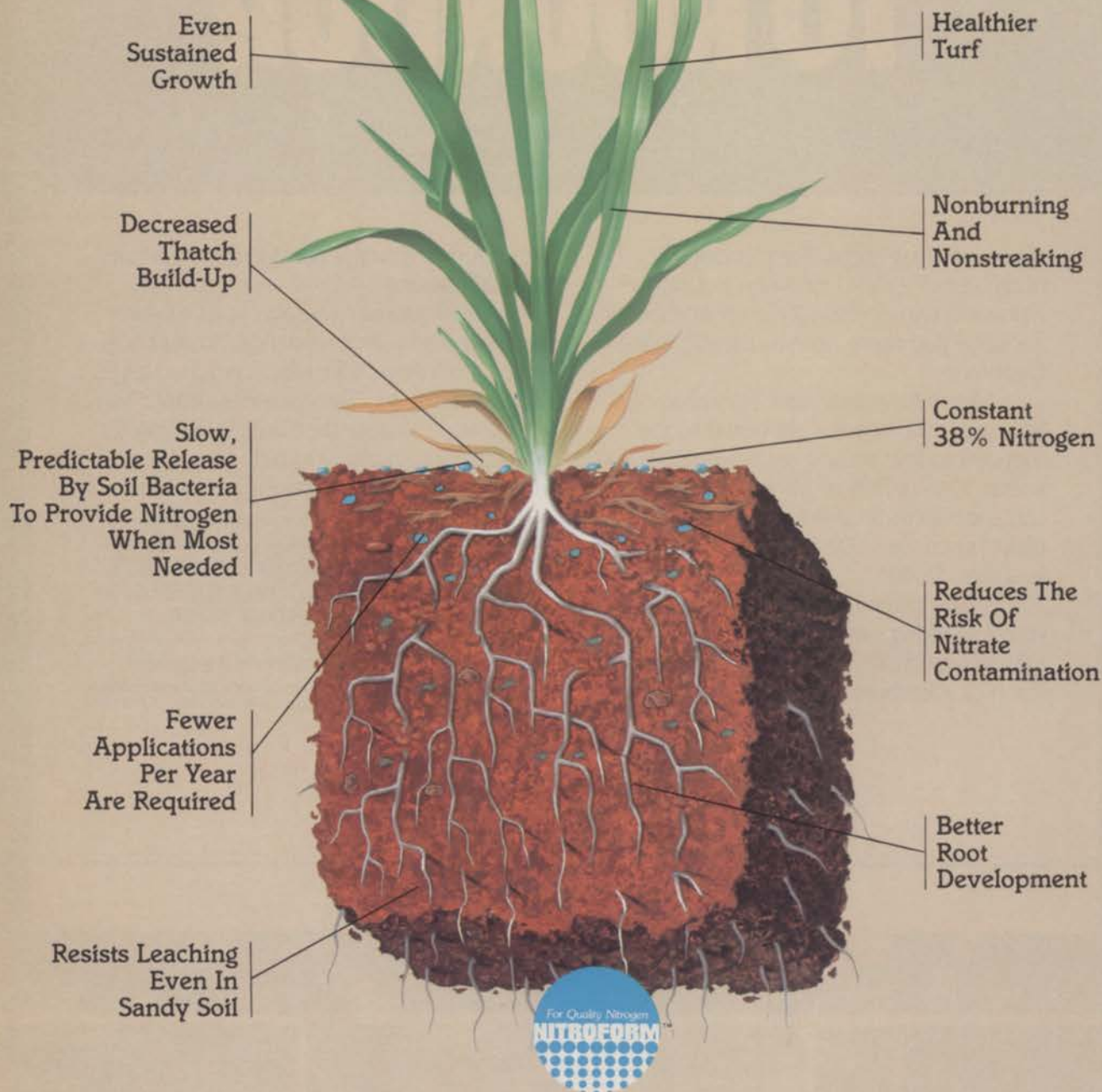


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Always look for the NITROFORM® logo  
It's your assurance of a high quality Nitrogen



NOR-AM Chemical Company, 3509 Silverside Road, P.O. Box 7495, Wilmington, DE 19803

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**ALA**OCTOBER 1984  
VOLUME 5 NUMBER 7**THE COVER**

The Professional Lawn Care Association of America is geared up for a dynamic Conference and Trade Show which will be held in Tampa, FL November 11-15. A preview of the 5th annual convention begins on page 35. Cover photo courtesy of the Greater Tampa Chamber of Commerce.

**CALENDAR****Oct. 7-10**

Professional Grounds Management Society 1984 Annual Conference and Trade Show, Marriott Hotel, Worcester, MA. Contact: PGMS, 7 Church Lane, Suite 13, Pikesville, MD 21208; 301/653-2742.

**Oct. 18-19**

Southwest Turfgrass Annual Conference, Las Cruces, NM. Contact: Dr. Charles Glover, New Mexico State University, Agronomy Department, Box 3Q, Las Cruces, NM 88003.

**Oct. 30-31**

Commercial Grounds Maintenance Short Course, Stone Mountain State Park, Stone Mountain, GA. Contact: Gilbert Landry, Jr., University of Georgia, Soil Testing and Plant Analysis Laboratory, 2400 College Station Road, Athens, GA 30605; 404/542-5350.

**Nov. 4-6**

1984 Southern Turfgrass Association Conference and Show, Hyatt Birmingham and Civic Center, Birmingham, AL. Contact: Richard L. Duble, executive secretary, Southern Turfgrass Association, 3606 Meadow Oaks, Bryan, TX 77802

**Nov. 7-9**

1984 New York State Turfgrass Association Conference and Trade Show, Syracuse, NY. Contact: Ann Reilly, NYSTA, 210 Cartwright Blvd., Massapequa Park, NY 11762; 516/541-6902.

**Nov 7-9**

1984 Oklahoma Turfgrass Conference and Trade Show, Lincoln Plaza Inn and Conference Center, Oklahoma City, OK. Contact: Robert L. Green, Oklahoma State University, Department of Horticulture, Cooperative Extension Service, 360 Agriculture Hall, Stillwater, OK 74078.

**ALA****BUSINESS FEATURES****A Sneak Preview of PLCAA/Tampa '84**

*Highlights of the 5th Annual Conference and Show to be held November 11-15.*

**35****1985 Turf Chemicals Preview**

*A look at the lawn care products chemical companies will be introducing next year.*

**40****Special Mowing Equipment Product Section**

*A guide featuring some of the rotary tractors, reel mowers, push mowers, front-mounted rotary mowers and walk-behind rotary mowers on the market today.*

**44****TECHNICAL ARTICLES****Soil Injection Fertilizing and Mauget Micro-Injection**

*Injections are not a panacea for all tree care problems, but they can augment existing practices.*

**23****Winter Dormancy of Warm Season Turfgrasses**

*Research on this unusual environmental stress known as chilling injury.*

**27****The Lawn Care Herbicides and How They Work: 2,4-D and the Auxins**

*A first in a series of articles which explain how the most commonly-used lawn herbicides selectively control weeds.*

**56****DEPARTMENTS**

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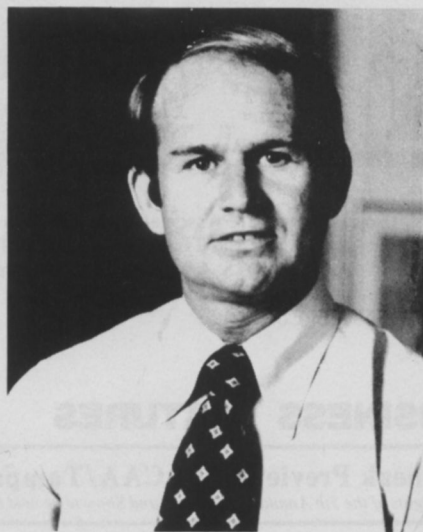
# ALA PUBLISHER'S FEEDBACK

**A**fter 10 months of preliminary planning and field work, Don Burton, chairman of PLCAA's Government Affairs Committee, has issued a "white paper" outlining a strategy for the implementation of a new subgroup of PLCAA to be known as the Public Issues Alert Committee (PIAC). The PIAC action plan calls for a three-level information gathering and reporting system.

At the grass roots level will be "local monitors" — comprised of all PLCAA member firms — who will be responsible for reporting local issues to "state coordinators" who will compile and organize information on statewide activities for PLCAA headquarters. Jim Brooks, PLCAA executive director, will in turn operate a central clearing house on industrywide activity. In this regard, Brooks will prioritize issues and work with the PIAC and PLCAA Executive Board to determine specific operating policies as well as develop guidelines and procedures for implementation by state coordinators and local monitors.

Major public topics Burton wants monitored and funneled to his new committee include the following:

- Pesticide use and handling, including drift, commercial applicator and reporting requirements.



- Hazardous/pesticide waste disposal and toxic chemical spills.
- Residual toxic chemical runoff, especially affecting water resources and other pollution contamination.
- Insurance matters relating to our business, including:

A. Environmental contamination and worker- and customer-related claims.

B. Workman's compensation.

C. Vehicles/accident rates, the kind for trucks used in our lawn service.

D. General business liability, product liability.

- Fertilizer and seed use restrictions.
- Rules governing advertising and promotional practices in soliciting new customers and warranty interpretations.
- Legal issues related directly to our business, particularly matters governing contractor services and "negative option" renewals.

It should be obvious to every businessman in this industry that local regulatory actions are chipping away at our industry's strength. Good communications and a coordinated effort on a national basis is the most logical, and I think productive, means of combating the activities of local anti-pesticide action groups. We applaud the concept behind PIAC and encourage widespread involvement by industry men. If you would like additional information on Burton's white paper plan or would like to become a state coordinator, contact Don Burton at 716/494-1462.

*Dick Foster*

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Mark your calendar! You won't want to miss the green industry event of the year: the 1984 PLCAA Annual Conference and Show, Tampa, Florida, Nov. 12-15



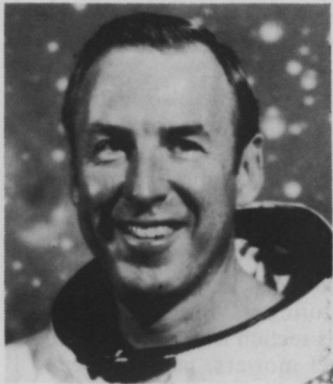
# PLCAA '84 Tampa

NOVEMBER 12-15

NEW LOCATION • NEW PRODUCTS • NEW SEMINARS • NEW SPEAKERS

The 1984 Annual Conference and Show of the Professional Lawn Care Association of America moves South to the heart of sunny Florida—Tampa! PLCAA/Tampa '84 is devoted exclusively to making you a better lawn care businessman. PLCAA/Tampa '84 is where you'll find an exciting blend of new products, new technologies, and new opportunities.

Join the hundreds of lawn care businessmen who will attend PLCAA/Tampa '84. Don't miss the outstanding lineup of workshops and seminars. Learn how to use the latest management and marketing techniques to make your business more productive and more profitable.



## KEYNOTE ADDRESS

### "SUCCESSFUL FAILURES"

JAMES A. LOVELL, Senior Vice President, Centel Corp.

Keynote speaker and former astronaut Capt. James A. Lovell will boost PLCAA/Tampa '84 into orbit on opening day (November 13, 1984). His topic is a provocative one: "Successful Failures"! Don't miss this inspirational public speaker!

## THE TRADE SHOW

Tampa's ultra-modern Curtis Hixon Convention Center plays host to the biggest gathering of lawn care suppliers, equipment makers, and manufacturers in the five-year history of the PLCAA Conference and Show. Exhibit viewing hours are

10:30 AM to 6:30 PM Tuesday and Wednesday. See the latest your industry has to offer!

## EARLY BIRD REGISTRATION AND RECEPTION

Make plans to arrive Monday, November 12th, and take advantage of the Early Bird Registration and Reception Theme Party (6:30 PM to 8:30 PM). Pick up your badge and convention packet and be ready to go Tuesday morning when the Show opens.

## NEW! EARLY BIRD WORKSHOPS

Yet another reason to come early this year—two "Early Bird" workshops are scheduled for Monday, November 12th:

### HOW TO GROW YOUR BUSINESS

Panel: LAWRENCE D. KOKKELENBERG, Ph.D., President, Kokkelenberg Corp.; JAMES SKELTON, MBA, Principal, Ross-Payne & Assoc., Inc.; ED T. WÄNDTKE, CPA, Assoc. Advisor, Advisor Associates, Inc.; and RICHARD I. LEHR, PA, PLCAA Attorney.

### PROMOTIONAL TECHNIQUES FOR THE LAWN CARE MARKET

Panel: KATHY COPLEY, Editor, Grounds Maintenance; and RAYMOND L. GIBSON, President, Ohio City Communications.

## SEMINARS AND TECH SESSIONS

An outstanding group of speakers and topics have been assembled for this year's educational sessions:

### OUR CHANGING INDUSTRY

ROBERT EARLEY, Group Publisher, Harcourt Brace Jovanovich, Inc.

### REGULATORY ASSISTANCE THROUGH THE PESTICIDE PUBLIC POLICY FOUNDATION (3PF).

DAVID H. DIETZ, Principal, David H. Dietz & Associates

### THE OFFICE—ASSET OR LIABILITY?

TOM HOFER, Vice President, Spring-Green Lawn Care Corp.

### STRESS MANAGEMENT; HIS, HERS, OURS

TOM JADIN, Director, Winnebago Mental Health Institute

### REDUCING CANCELLATIONS

LAWRENCE D. KOKKELENBERG, Ph.D. President, Kokkelenberg Corp.

### PRINCIPLES OF TREE & SHRUB FERTILIZATION

Dr. ROGER C. FUNK, Vice President, Davey Landscape

### FERTILIZATION OF SOUTHERN ORNAMENTALS

Dr. ROBERT BLACK, Urban Horticultural Specialist, Florida Cooperative Extension Service, University of Florida

## SOUND BUSINESS CONSIDERATIONS FOR MOWING /MAINTENANCE COMPANIES

ROD BAILEY, President, Evergreen Services Corporation

## TURFGRASS RESEARCH UPDATE: WATER

Dr. JAMES B. BEARD, Professor of Turfgrass Science, Texas A&M University

## THATCH: GENERAL CONSIDERATIONS

Panel: Dr. KIRK A. HURTO, Ph.D., Research Specialist, Chemlawn Corp.; Dr. A.J. POWELL, Turf Extension Specialist, University of Kentucky; JOHN C. PRUSA, Vice President of Operations, Lawnmark, Inc.; Dr. CHARLES PEACOCK, Turf Extension Specialist, University of Florida

## HOW TO AVOID AND RESPOND TO UNION ACTIVITY

Panel: RICHARD I. LEHR, PA, PLCAA Attorney; PAUL DAVEREDE, President, Ever-Green Lawn Corp.; JAMES R. SACKETT, President, Ever-Green Lawn Care, Inc.

## EXPANDING INTO THE COMMERCIAL LAWN CARE MARKET

IRVIN DICKSON, Vice President, Native Tree, Inc.

## PLUS MUCH MORE!

## SPECIAL SPOUSE PROGRAM...DISNEY WORLD SIGHT-SEEING...POST CONFERENCE CRUISE

One of the best things about visiting Tampa is that it offers a wealth of places to visit and things to do. This year's PLCAA Conference and Show offers a chance to take advantage of some exciting fun options for you and your spouse, including a special one-day "Spouse Program" tour of the Sarasota area, a pre-conference tour of Disney World and Epcot Center—even a post-conference Caribbean cruise! Indicate your interest on the return coupon and you will be supplied with costs and details.

**YES!** I'm interested in attending PLCAA's 5th Annual Conference and Trade Show. Send me more information on:

- REGISTRATION  EXHIBITING  MEMBERSHIP  
 POST CONFERENCE CRUISE  SPOUSE PROGRAM  
 PRE-CONFERENCE DISNEY TOUR

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

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

Mail to:

Professional Lawn Care Association of America  
 1225 Johnson Ferry Road, NE • Suite B220 • Marietta, Georgia 30067



# Ryegrass

The Closest Thing to  
An Instant Lawn  
You'll Ever Find

In addition to numerous other advantages ryegrass is the one you can count on to germinate in a matter of 7-10 days.

No other grass germinates faster or so quickly develops a strong, deep root system.

Those are two qualities which make it the ideal choice for the winterseeding of dormant turf in the Southern U.S.

But that's not all. Ryegrass is available in either the so-called "workhorse" varieties such as common Oregon annual and Gulf annual or the newer premium quality fine-bladed turf-type "proprietary" varieties.

It is recommended that annual ryegrass be sown at a rate of 10-20 lbs. per 1,000 sq. ft. of turf desired, while the fine-bladed turf-type ryegrasses are normally sown at the rate of 5-10 lbs. per 1,000 sq. ft. Seeding rates will vary, depending upon the desired density of the stand.

Because ryegrass is a cool-season grass it will not survive Southern summers and so can be counted upon to fade in the spring when the native grasses come on. Ryegrass is, however, used for permanent turf in the Northern U.S.

*Ask your dealer for brochures  
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Salem, Oregon 97302

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## ALA INSIDE STORY



**E**very year at about this time a lot of lawn care operators and their spouses get themselves psyched for the annual Professional Lawn Care Association of America (PLCAA) Conference and Trade Show. This year's November 12-15 conference will be a special treat for lawn care people since the PLCAA will be entertaining in one of the country's foremost entertainment centers — Tampa, FL.

Things won't be all fun and games as Assistant Editor Vivian Fotos reports in her conference preview, this month's cover story. Attendees may be distracted by the sights, sounds and tastes of Tampa, but PLCAA Executive Director Jim Brooks assures us there will be plenty of educational seminars and trade show exhibits to keep everyone busy. Still, Tampa visitors will find time to savor this exciting city and should find the entertainment guides prepared by Fotos helpful, even if her glowing prose will make some anxious for November 12 to roll around.

Getting back to business, in this issue we also feature a "1985 Turf Chemicals Preview" in which we round up some chemical company turf product managers and probe their marketing plans for 1985. Most of the chemical companies we contacted do indeed have new turf products slated for introduction next year. Flip a few pages and find out what you may be using next season!

In this issue we won't offer our usual "Products" section because this month we are featuring a "Special Mowing Equipment Product Section." This section is subdivided into categories for rotary tractors, reel mowers, push mowers, front-mounted rotary mowers and walk-behind rotary mowers. Mowing/maintenance operators will find this special section a good place to start their annual equipment shopping spree.

This month's technical feature offerings consist of "Winter Dormancy of Warm Season Turfgrasses" by Keith Karnok and James Beard of the University of Georgia and Texas A&M University, respectively; "The Lawn Care Herbicides and How They Work: 2,4-D and the Auxins," the first in a series of reports on lawn care herbicides by Richard Hull of the University of Rhode Island; "Soil Injection Fertilizing and Mauguet Micro-Injection" by Lauren Lanphear of Forest City Tree Protection Company. Start reading!

*Jim Weidner*



# Before you buy any other machine that fertilizes, seeds, coreaerates and spikes, **READ THIS AD!**

Now there are **three** tough machines built to handle the grueling punishment dished out by today's lawn professional! If you need a machine to perform the functions of seeding, fertilizing, coreaerating and spiking, we offer three great solutions: the Lawn Maker, for seeding, fertilizing, spiking or coreaerating. Also, two sizes of self-propelled coring machines. There's just not enough room in this ad to tell you the whole story, but here are a few facts:



## LAWN MAKER.

The all-in-one seeder/fertilizer/coreaerator for riding operation. Welded construction/Weight, 625 lbs./Seeds, fertilizes and aerates 4,000 sq. ft. in only 9 minutes/11 hp Briggs and Stratton electric start motor/Easy to transport/Variety of attachments/1-year warranty.



## COREAERATORS.

Self-propelled walk-behind units coring up to 30,000 sq. ft. per hour. This unit comes in two sizes, 36- and 30-inch width, both machines give penetration of 2-3/4-inches using 5/8- or 3/4-inch tines. Five horsepower Briggs and Stratton standard or IC engines available.



## NEW! TRANSPORT RAMP.

SALSCO INTRODUCES its new transport ramp for loading lawn care equipment onto trailers or truck beds. Each ramp weighs approximately 35 pounds and will hold in excess of 1,000 pounds. Each ramp can be positioned to accommodate the wheel base of any piece of equipment. We will sell the ramps for \$225 per set and immediate delivery is available.

A ramp is pictured in the photo at left.

Due to tremendous nationwide response, dealer inquiries now invited.

# SALSCO

Welding & Fabrication, Inc.

196 Clark Street, Milldale, CT 06467

To find out more about how you can turn a greater profit in seeding and aeration, call us collect today—203-621-6764.

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SALSCO NOW OFFERS IMMEDIATE DELIVERY ON BOTH MODELS OF CORE-AERATORS

Made-to-spec loading ramps available for all models.

# ALA NEWS IN BRIEF

## KUBOTA CREDIT CORP. OFFERS 8.5% FINANCING

On September 1, Kubota Credit Corporation slashed its financing rate to 8.5 percent on all Kubota tractors, implements and excavators. The new financing rate — the lowest available from any tractor company in the United States — can be obtained for



a limited time from any of the nearly 1,000 participating Kubota dealers across the country.

Kubota established its credit program in 1982 to

help customers combat the prevailing high interest rates of conventional loans. The program began in California, states have been added continuously and the financing was extended nationally this summer.

Kubota is currently the U.S. market leader in under 40 horsepower compact tractor sales and is third in U.S. retail sales of farm tractors. The corporation distributes Kubota diesel tractors ranging from 10 to 85 PTO horsepower. For more information about Kubota financing, contact: Kubota Credit Corporation, 550 West Artesia Blvd., Compton, CA 90224.

## GRASS SEED JUST ISN'T WHAT IT USED TO BE

Have any of your customers commented that in the "old days" turfgrass used to be resilient enough to stand up to assaults from insects, disease and drought without the aid of lawn chemicals? Mark Irwin of Yardmaster, Inc. in Omaha, NB has gotten just such comments, but never knew how to respond. Irwin is sure he is not the only operator receiving these barbs from homeowners. "There are probably many turf maintenance people in the field being asked this same question when problems arise," says Irwin.

But then he ran across a column in the *Omaha World-Herald* of July 20, 1984 that offered an interesting rebuttal to the homeowners' gripes. Columnist Robert McMorris posed the homeowner's query in his column titled "Grass Salesmen Protest 'Weak'



**Eliot C. Roberts**

Lawn Complaints." McMorris says he wrote an open letter to the University of Nebraska's College of Agriculture and his complaint found its way to the desk of J.L. Carnes, president of International Seeds, Inc. in Halsey, OR. Carnes told McMorris that if he thought the grass of his youth was so tough, he should go to the local

garden center and buy that kind of seed because it is still available. Carnes says McMorris' fond memories of lush turf must be clouded by nostalgia.

Carnes says today's lawns only seem to require the special care a lawn service



can give them because homeowners have become increasingly less tolerant of weeds and brown spots. He says modern turfgrass varieties are actually tougher, better-looking and more disease resistant than their predecessors.

Dr. Eliot C. Roberts, director of The Lawn Institute, Pleasant Hill, TN also took the opportunity to

respond in McMorris' column. Roberts also recalls the turf of his youth, but he says it did not compare with the improvements made by Merion Kentucky bluegrass, introduced in the early 1950s. "It was able to withstand closer clipping and finer grooming and had improved disease resistance," Roberts says.

However, turfgrass improvement is a continual process and even the fine Merion variety has been surpassed. Still, it created a demand for high-quality turf in the minds of suburbanites. Suddenly there was "a new demand by the American public that the old 1930 rural lawn standards were not acceptable for modern suburbia," Roberts says.

The next time a homeowner complains to you about his "anemic" lawn, you might want to quote him or her some Carnes or Roberts!

## TURF STUDIES ASSISTED BY NY TURF ASSOCIATION

Turfgrass research at Cornell University conducted by Drs. A. Martin Petrovic, Richard Smiley and Norman Hummel has been aided during the past year through the efforts of the NY State Turfgrass Association (NYSTA) and the granting of over \$28,000, a 40 percent increase over the previous year's efforts.

The research extends over many areas of turfgrass interest and includes fine cultivar evaluations, compaction studies, effect of herbicides, control of fusarium blight syndrome, non-target effects of fungicides on the environment (especially thatch), fungicide screening, nitrogen sources,

chemical control of *Poa annua*, low maintenance, growth regulator studies, soil modification, soil fertility with respect to wear tolerance and water use,

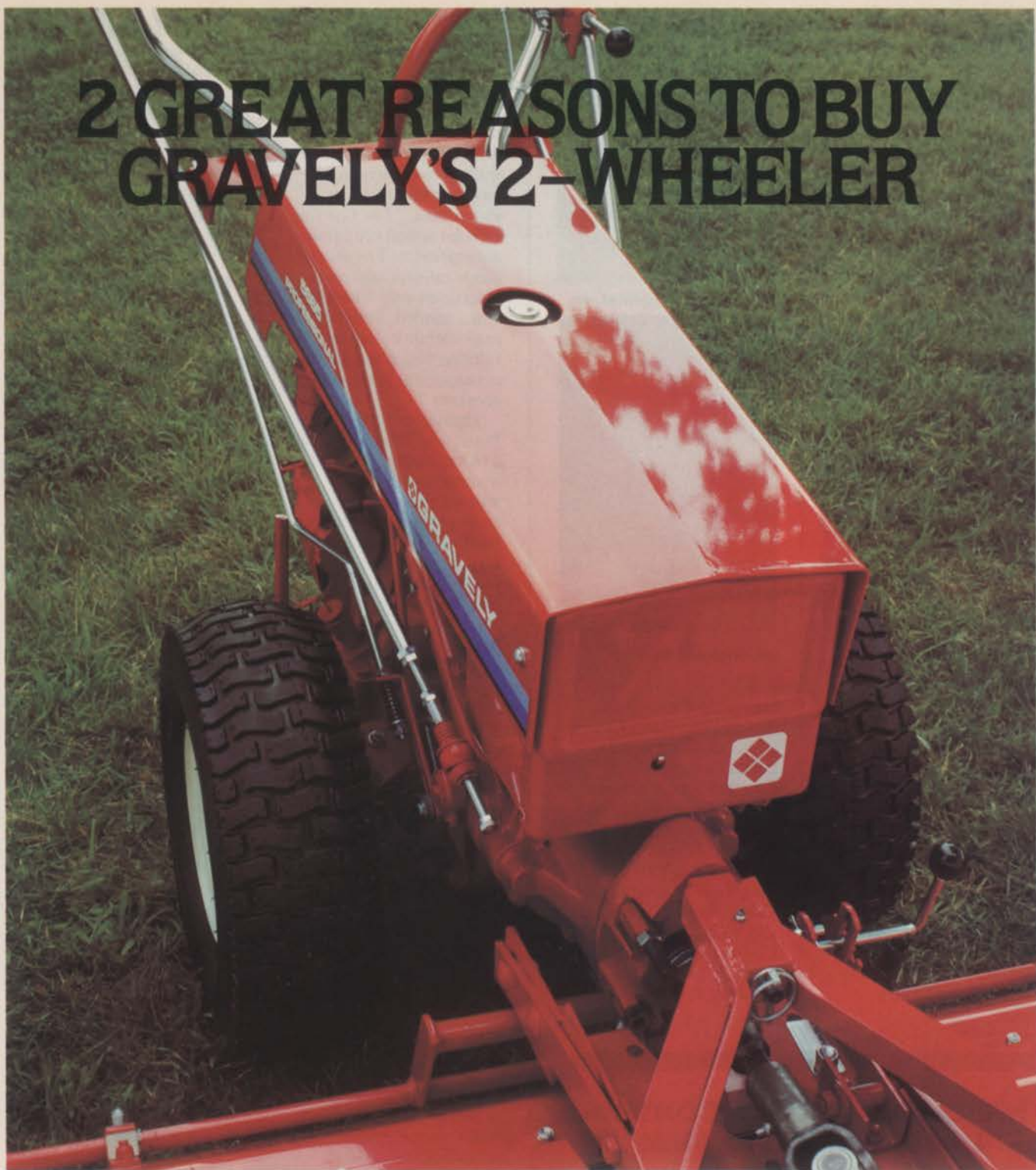


drought tolerance and nitrification inhibition. As part of this research undertaking, NYSTA is funding a graduate student.

During the past year,

(Continued on page 12)

# 2 GREAT REASONS TO BUY GRAVELY'S 2-WHEELER



**Great Versatility.** Start with a 30", 40" or 50" mower specially designed to give a smooth quality cut. Then choose from over 20 attachments custom engineered to give year-round professional results, whether you're mowing grass, cutting high weeds, or removing deep snow. You can get a steering brake kit to increase maneuverability and add a sulky to cover the big jobs in comfort.

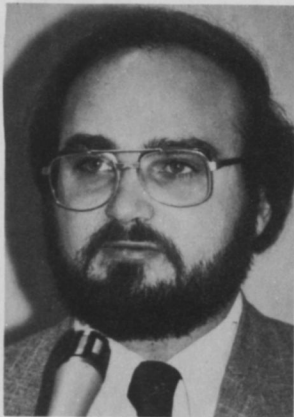
**Great Durability.** You'll get season after season of reliable performance. Our 2-wheel tractors are built with all-gear direct drive transmissions, rugged Kohler engines and strong cast-iron transmission housings. Stop at your Gravelly dealer for a hands-on demonstration. Or for more information, contact Rick Murray, VP, Marketing, Gravelly International, Inc., One Gravelly Lane, Clemmons, NC 27012. 919-766-4721. Telex: 6971451 ARGRA.

**◆ THE 2-WHEEL GRAVELLY SYSTEM**

## NEWS

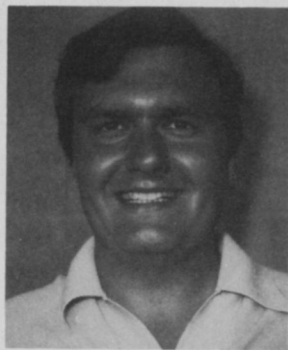
(continued from page 10)

contributions have been received by NYSTA for turfgrass research and donated to Cornell University. These firms and associations that have made contributions include: J. & L. Adikes, Inc.; Aquatrols Corporation; BASF Wyandotte; Canasawacta

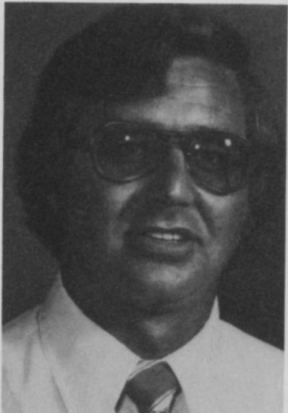


**Dr. Martin Petrovic**

Country Club; Central NY Golf Course Supt. Association; Dolomite Products; Ciba-Geigy; Eli Lilly and Company; Four Star Agricultural Services; Garfield Williamson; Hudson Valley Golf Course Supt. Association; Lebanon Chemical Company; LESCO; Metro-Milorganite; Metropolitan Golf Course Supt. Association; Mobay Chemical Company;



**Norman W. Hummel, Jr.**



**Dr. Richard Smiley**

Monsanto Corporation; Northeastern Golf Course Supt. Association; Finger Lakes Assoc. of Golf Course Supt.; Northrup King; Pocono Turfgrass Association; Rhone Poulenc; SDS Biotech; 3M Corporation; Turf Seed, Inc.; Velsicol Chemical Corp.; Wagner Seed Co.; and Western NY Golf Course Supt. Assoc. To them, NYSTA extends sincerest thanks.

reached.

"Professional turf managers have a dual responsibility to maintain a healthy attractive turf in a manner that is both cost effective and has a minimum of adverse environmental effects," Potter says. "The first role calls for sound economic management. The second factor calls for applying insecticide only where and when needed. Both of these responsibilities can be fulfilled with a threshold management insect control program."

Throughout the film, Potter and Bowers highlight five key concepts of turf management:

- Insect pressure varies from year to year and by location. Therefore, there is no guarantee that preventative action is necessary or will be effective.
- Repeated preventative treatments may upset turf ecology of the thatch and result in thatch buildup.
- Threshold levels vary depending upon the season, amount of moisture available and the type of insect.
- Insect pests can be controlled safely and economically using fast acting, short residual insecticide when insect pressures reach threshold levels.
- Examination of the turf for "threshold" levels must be made before treatment is applied.

In related TUCO news, the company has received registration approval for use of Banol<sup>®</sup>, a systemic turf fungicide, on ornamentals to control root rot and damping-off caused by *Pythium sp.* and *Phytophthora sp.* at all stages of ornamental propagation. Approved directions for use include application of 2 to 3 fluid ounces of Banol in 10 gallons of water as a preventative treatment when weather conditions favor fungal development.

The product contains the active ingredient propamocarb hydrochloride and can be used at all stages of ornamental propagation:

seeding, cutting, transplanting and potting. Banol is labeled for a variety of ornamentals, including azalea, carnation, chrysanthemum, coleus, dahlia, Easter lily, ferns, geranium, poinsetta, snapdragon and woody ornamentals.

## THREE CLASSES OF DEBTORS FROM L. JAMES MARTIN

L. James Martin is an attorney, president of Martin Enterprises, Kent, OH and executive director of the Professional Lawn Care Credit Association of America (PLCCAA). The PLCCAA is the "captive" debt collection service of the Professional Lawn Care Association of America (PLCAA). The very busy Martin says lawn care clients who owe you money fall into three classes.

In the first class is the "circumstantial debtor." Debtors in this class are generally people who find themselves caught up in some unfortunate situation which prevents them from paying your bill. "You need to identify those people rapidly because those are good folks and they will pay you," Martin says. He suggests arranging an extended payment schedule for such people. "They will pay you \$10 a month until they pay you off, but they will pay you off."

The second type of debtor is the financial mismanager. These are the people who will "promise you but won't deliver," Martin says. The financial mismanagers are the dead beats who will require some hounding to make them cough up your money. Finally, the third class is composed of the hard-core debtors, the people holding out on

(continued on page 14)

## THRESHOLD INSECT CONTROL EXPLAINED IN TUCO FILM

Threshold management insect control, the practice of treating for harmful insects only when their populations exceed the threshold level at which turf damage will occur, is detailed in a super eight cassette or 16mm film released by TUCO, Division of The Upjohn Company. The film is available from a local TUCO representative for professional turf managers and lawn care

industry personnel.

Narrators of the film, Dr. Daniel Potter, turf entomologist at the University of Kentucky, Lexington, and Dr. R.C. Bowers, research head of TUCO Plant Health Products, describe the use of threshold management. They identify numerous insect pests, detail how to examine the turf for pests and how to treat the lawn once thresholds have been

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Specify Glade for your next turfgrass mix. You'll appreciate the split personality that thrives in both sun and shade.



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## NEWS

(continued from page 12)

one percent of your receivables which you may or may not recover, even with the aid of an attorney.

If you would like to learn more about the kind of aid L. James Martin and the PLCCAA can give, write: L. James Martin, Martin Enterprises, 138 South Water Street, Kent, OH 44240; or call, 216/678-7900.

## POINTERS FROM NFSA: ANTITRUST GUIDELINES

The National Fertilizer Solutions Association (NFSA) warns us of the dangers of antitrust violations in a recent issue of its *Advocate* newsletter.

Since trade associations are by nature a group of competitors joined together for a common business purpose, they are particularly vulnerable to attacks by federal and state antitrust enforcers. Even if an association member is not an active participant — if you merely sit by at a meeting while members of the association engage in an illegal discussion concerning price-fixing or other illegalities, you may be held criminally responsible, even though you said nothing during the discussion. Mere attendance can imply acquiescence. Anticompetitive acts committed by single persons or companies are covered under various statutes.

Trade association members should be aware of two major problem areas: Price-fixing — in some instances a price-fixing violation may be inferred from similar price behavior by association members, even in the absence of a written or oral agreement. Agreement to divide customers — this is a criminal act even if only an informal agreement to stay out of another's territory.

The American Society of Association Executives has suggested the following topics of discussion which should be avoided at meetings held by trade associations:

- Current or future prices. (Great care must be taken in discussing past prices.)
- What constitutes a "fair" profit level.
- Possible increases or decreases in prices.
- Standardization or stabilization of prices.
- Pricing procedures.
- Cash discounts.
- Credit terms.
- Control of sales.
- Allocation of markets.
- Refusal to deal with a corporation because of its pricing or distribution practices.
- Whether or not the pricing practices of any industry member are unethical or constitute an unfair trade practice.

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## SNAPPER SPONSORS STRATEGY CONFERENCE

Snapper Power Equipment management recently dazzled its United States and Canadian Distributors with a spectacular display of product demonstrations and the most aggressive marketing and advertising promotions in the

(continued on page 17)

**NEWS**

*(continued from page 14)*

company's history. Snapper reports 623 distributors and their management converged at the AMFAC Hotel at the Dallas/Ft. Worth Airport from July 9 - 13.

Snapper's full line of products were demonstrated under the grueling Fort Worth sun. The theme of the convention was: "Keep the Drive Alive in '85."

**MICHIGAN STATE SPONSORS FIELD DAY**

About 550 people attended the Michigan State University Field Day held September 6 in Lansing. Attendees were able to see test plots where research is

currently being done on: Summer Patch and Necrotic Ring Spot; Kentucky Bluegrass Performance; Turf Responses to Nitrogen



Fertilizers and Iron; Plant Growth Regulators on Highway Roadside Grasses; Effect of Irrigation, Fertility and Wetting Agents on Helminthosporium Melting-Out and Dollarspot; A Microprocessor for Predicting Anthracnose on Annual Bluegrass; Plant



Above, many people attended Michigan State's Field Day. Far left, Tom Wentz of Scotts Pro Turf demonstrates the new R8 spreader with the Helical Cone. Left, Ernie Fuller of Baypoint Golf Club accepts an award for his contributions to the university research program.



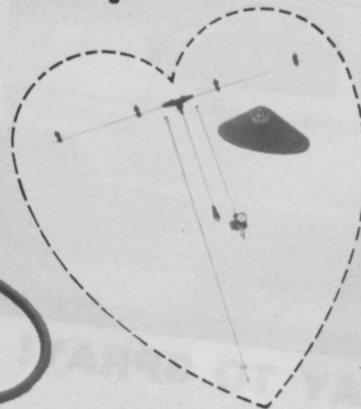
Growth Regulators for Golf Course Turf; Crabgrass

Control; Evaluation of Seven Management Factors and their Interactions on the *(continued on page 18)*

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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 MORE INFORMATION

### TREBOR CORPORATION

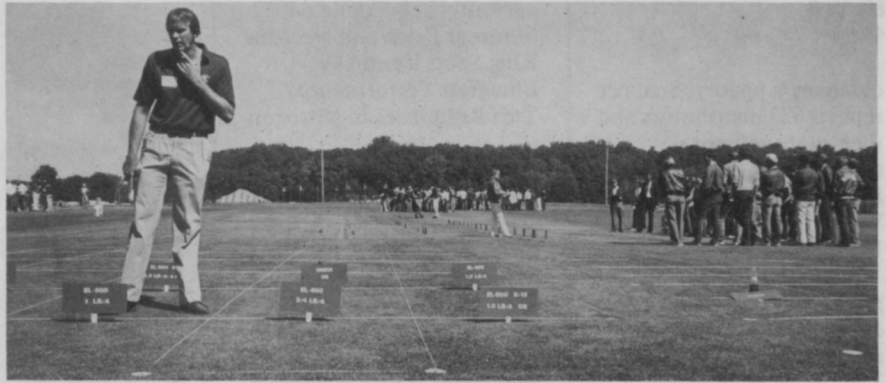
4047-A JONESBORO ROAD • FOREST PARK, GA. 30050 • 404-366-0957

**NEWS**

*(continued from page 17)*

Plant Composition of an Annual Bluegrass-Creeping Bentgrass Polystand; Wetting Agent Use on Turf; and Coring on Golf Course Greens.

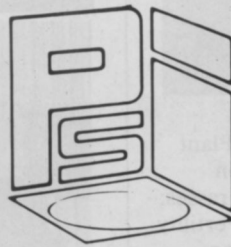
Two new attractions were added to this year's Field Day — equipment and chemical displays and an auction. Twenty-seven vendors exhibited their wares, helping to raise about \$2500 for the university. Over \$3000 in additional funds were raised by the



**Groups of about 50 people tour the test plots at Michigan State's Field Day.**

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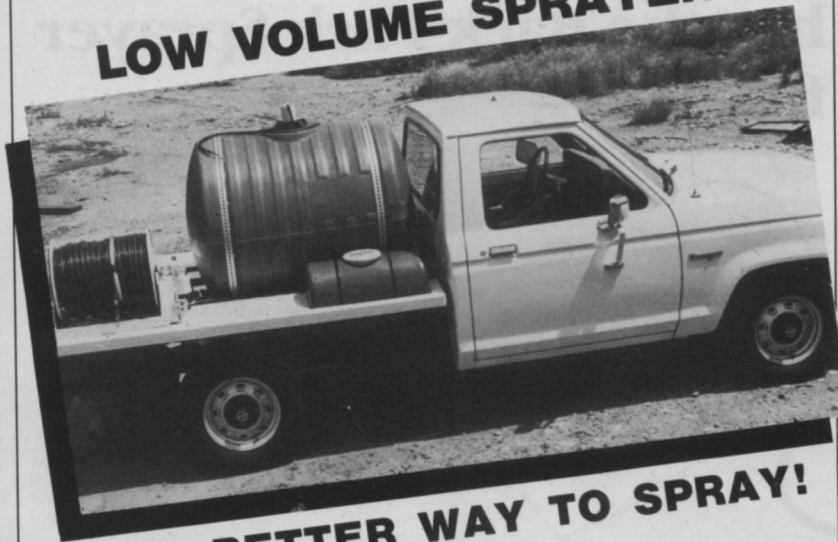
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**People bid on used equipment at the auction sponsored by the Michigan Turfgrass Foundation.**

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auction sponsored by the event's co-host, the Michigan Turfgrass Foundation. Thanks go to Gordie LaFontain of Lawn Equipment in Novi, MI for his work in organizing the auction; to Dr. Al Turgeon of True Green in Lansing who worked hard arranging the exhibitor participation; to Drs. Bruce Brenham, Joe Vargas and Paul Reikie of Michigan State University for their work in organizing Field Day; and to many others too numerous to mention.

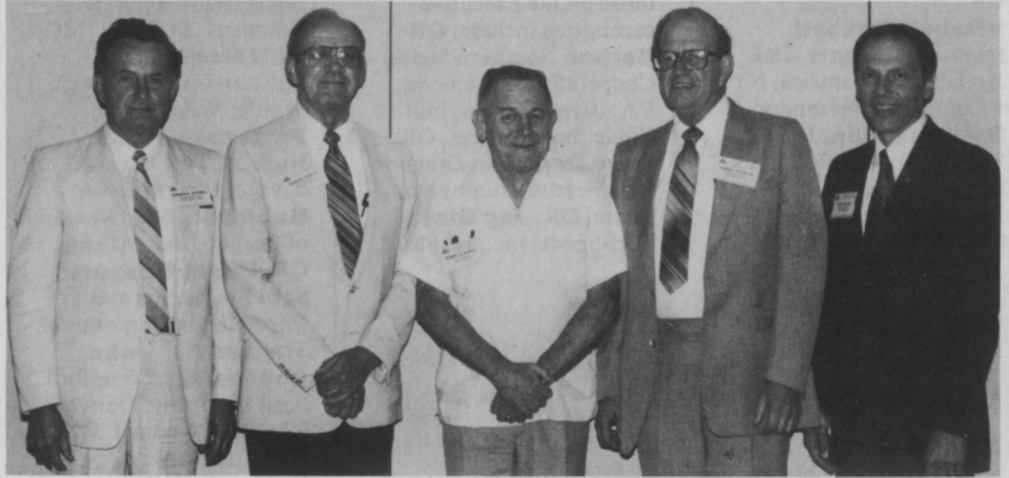


**Exhibitors display their equipment at Field Day.**



**Donald J. Maske** has been honored by The Upjohn Company for outstanding achievement in sales for 1983. He is one of 17 individuals recently named to the company's Agricultural Division Sales Academy.

Maske, an agricultural chemicals products district sales manager for TUCO, Division of Upjohn, joined the company in 1969. His sales district encompasses the north central United States. He is an alumnus of Lewis University and Pennsylvania State University. Each of the winning individuals received a cash award during a recognition conference held recently at Brook Lodge, Upjohn's guest facility located near Kalamazoo. They were accompanied by their



**The 1984-85 Lawn Executive Committee, from left to right: Norman Rothwell, president; Howard Schuler; Robert Russell, secretary-treasurer; Robert Peterson, vice president; and Doyle Jacklin. Not pictured: James Carnes.**

spouses to the four-day meeting.

**Norman Rothwell, N.M.** Rothwell Seeds Ltd., Lindsay, Ontario, Canada,

was re-elected president of The Lawn Institute at its annual meeting, held in Denver, CO in conjunction with the American Seed Trade Association's 101st

National Convention.

The executive committee, in addition to Rothwell, includes:

• **Robert Peterson**, vice

*(continued on page 20)*



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**PEOPLE**

(continued from page 19)

president, E.F. Burlingham and Sons, Forest Grove, OR.

• **Robert Russell**, secretary-treasurer, J&L Adikes, Inc., Jamaica, NY.  
 • Committee members: **Doyle Jacklin**, Jacklin Seed Company, Post Falls, ID; **Howard Schuler**, Northrup King and Company, Minneapolis,

MN; **James Carnes**, International Seeds, Inc., Halsey, OR.

Members of the board of directors, in addition to those on the executive committee include: **Gil Barber**, Southern States Cooperative, Richmond, VA; **Jim Collins**, Full Circle, Inc., Madras, OR; **Dave Doerfler**, Oregon Fine Fescue Commission, Salem, OR; **Jay Glatt**, Turf-Seeds, Inc., Hubbard,

OR; **Bill Hill**, George W. Hill and Company, Florence, KY; **Jon Loft**, Loft's, Inc., Bound Brook, NJ; **Ed Mangelsdorf**, Mangelsdorf Seed Company, St. Louis, MO; **Cliff Matilla**, CENEX Western Commodities, Seattle, WA; **Scott Patterson**, Pioneer Hi-Bred, Turf Division, Savage, MN; **Mike Robinson**, Seed Research of Oregon, Inc., Albany, OR; **Bruce Ruppert**, Seed Production and Introduction Corporation, Syracuse, NY; **John Southerland**, Stanford Seed Company, Denver, PA; **Bob Wetsel**, Wetsel Seed Company, Harrisonburg, VA; **Francis Wolf**, Highland Bentgrass Commission, Salem, OR; **John Zajac**, Garfield Williamson, Inc., Jersey City, NJ.

**Ben Davis II**, former president of The Wholesale Growers Association of America, has been elected

executive vice president of Hard Trigger Trees, Inc. of Muskogee, OK. The announcement was made by Harvey R. Fifer, president of Hard Trigger Trees. Before joining Hard Trigger, Davis was president of Hill Country Nurseries, Inc., Tahlequah, OK, a production nursery selling plants at wholesale to the trade. A graduate of Northeastern (Oklahoma) State University, Davis has been engaged in the wholesale nursery business for the last 24 years. He has been active in trade associations and served as president of the Wholesale Growers from 1979 to 1980.

**Michael Winkler** and Associates recently joined Marathon Rubber Products as sales representatives for industrial accounts in Texas, Oklahoma, Arkansas and Louisiana.

**George Jackson** was (continued on page 22)



Jones Wheelhorse, Inc. of Waterville, OH has been awarded the E-Z Rake "Most Improved Dealer" plaque. The presentation was made by Dick Beach to Bev and Don Fischer.

# Like horror stories? Here's a scary one. You're the victim.

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Fairways  
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Soil Conditioners  
Thinking Superintendent  
Cambridge System  
Winter Injury  
Thatch  
Disease Update  
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## Lawn Care

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Diseases, Insects, Weeds  
Grub Control  
Ohio Pesticide Pro Task Force  
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Soil Conditioners  
Thatch  
Mental Stress  
Fertilizer Update  
Ground Water Contamination  
Aeration  
Pesticide Public Relations  
Drought and Dry Spots

## Workshops

Diseases and Insects on Ornamentals • Ornamental Nutrition • Ornamental Problems • Tree Stress  
Turfgrass Problems • Growth and Development of Turfgrass  
Estimating Grounds Work • Pesticide Training Session

## General Sessions

Image Game • Turfgrass Around the World • Pesticide Controversy  
Update on Fungicides, Herbicides and Insecticides

Ohio Turfgrass Foundation  
Conference and Show  
Ohio Center  
Columbus, Ohio  
Dec. 3-4-5-6, 1984

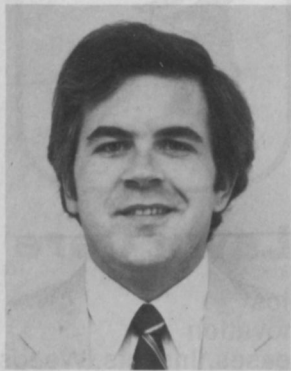
Contact **Dr. John Street**  
c/o Ohio Turfgrass Foundation  
2021 Coffey Road  
Columbus, Ohio 43210  
614-422-2047

## PEOPLE

(continued from page 20)

recently appointed to the position of director of engineering for Mott Corporation, La Grange, IL. Jackson is setting priorities for general enhancement of existing Mott commercial mower products, as well as putting considerable emphasis on research and new product development.

He came to Mott from the Caterpillar Tractor Company. At Caterpillar's Technical Center, he was responsible for new product development, prototype design and product performance evaluation. Jackson holds a bachelor of science degree in Mechanical Engineering



**Jim McCormick**

from Purdue University. He earned his master of science degree in Engineering Management from the University of Missouri at Rolla, IL.

In another Mott appointment, **Jim McCormick** was promoted to customer service manager. Principal responsibilities of McCormick's new position include handling all customer, dealer and distributor contact regarding orders, special orders, specifications, inquiries and complaints; and to administer warranty policy and claim procedure. He will also coordinate dealer and distributor service training programs.

McCormick's most recent position as senior



**George Jackson**



**Jeff Lykins (left) of Lykins Sales and Service, Milford, OH, accepts the E-Z Rake Top Dealer Award from Dick Beach, E-Z Rake representative.**

sales account representative gave him the opportunity to maintain contact and work with the majority of Mott's customers. Before arriving at Mott, McCormick had a strong customer service background as Territory Manager for an industrial rubber goods company and as owner/operator of a liquor and restaurant business.

**J.D. Walker** is the new president of Teledyne Total Power, which handles marketing, engineering and product support of Wisconsin air-cooled

gasoline and diesel engines. Walker previously served as executive vice president of the new Memphis, TN headquarters, and was president of Teledyne Aero-Cal at San Marcos, CA, and Teledyne Crittenden at Gardena, CA.

A graduate of San Diego State University, Walker was chief accountant of Teledyne Micronetics at San Diego, and later served as vice president of Teledyne Sprague at Gardena, CA. His degree is in accounting and business. Walker is a Navy veteran and a member of the National Accounting Society, American Management Association, and the Sales and Marketing Executives Association.

In related personnel news from Teledyne, **Eugene J. Weaver** has been named the new vice president of marketing. Weaver previously was manager of planning and control for Solar Turbines of San Diego, CA, and was a marketing consultant in San Diego. He served on active duty in the United States Navy and in the Reserves as a lieutenant commander.

He has held executive positions with Rohr Institute in Chula Vista, CA; the Ford Motor Company, Dearborn, MI; and the Cummins Engine Company, Columbus, IN. A graduate of General Motors Institute of Technology, he did post-graduate work at the University of Michigan and Wayne State University.



**Fogt's Lawn and Garden of Sidney, OH has been awarded the Outstanding Dealer plaque from E-Z Rake of Lebanon, IN. Shown with the plaque are (left to right) Raymond Buehler, Sally Fogt, Daniel Fogt and Larry Kettler.**

# SOIL INJECTION FERTILIZING AND MAUGET MICRO-INJECTION

BY LAUREN S. LANPHEAR

**T**here are several basic advantages to consider when considering tree and shrub care as an adjunct to your existing lawn care business. Obviously, where you find turf, you will find trees and shrubs — they are all together in the urban landscape. Much of the equipment and technology you presently use in your lawn care business can also be utilized for tree and shrub care. The specialized knowledge you have of plant physiology, entomology and pathology will certainly apply to trees and shrubs.

As far as business advantages, it provides you with an opportunity to extend your season into periods which may be slack for lawn care. There are definitely things to be done in tree and shrub care during the lawn care off-season.

However, there are also some disadvantages which one should consider before jumping into a new field. First of all, you will need knowledge specific for trees and shrubs. A great deal of what you already know about turf can help, but you will need to have some background on trees

**In my opinion, the optimum time to fertilize trees is after leaves have fallen and before the ground freezes. This is a time of the year when your lawn care operation is perhaps not in full gear. Tree and shrub fertilization offers an alternative for what might normally be a "slow" season.**

and shrubs.

There is a tremendous variety of trees and shrubs — hundreds of different plants that one must not only be able to identify, but also understand the diseases and insects which affect them.

It may also be difficult to enter just a few



**Dosage is determined by measuring the tree's diameter at breast height. This photo also demonstrates treating each trunk of a multiple-trunk tree as separate trees.**

select areas of tree and shrub care. Perhaps you only wish to offer fertilizing, but your clients demand pruning or other services. You must determine ahead of time which services your clients will need and which of these services you are prepared to provide.

Soil injection of fertilizer for trees is certainly compatible with your lawn care business since essentially the only piece of equipment you won't have already is the feeding gun or hydro-spear attachment for your spray rig. You have the trucks, pumps, tanks, hoses and reels. You are familiar with fertilizing and you have the personnel.

In my opinion, the optimum time to fertilize trees is after leaves have fallen and before the ground freezes. This is a time of the year when your lawn care operation is perhaps not in full gear. Tree and shrub fertilization offers an alternative for what might normally be a "slow" season.

☛ Your clients will readily understand the need

*(continued on page 24)*

## SOIL INJECTION

(continued from page 23)

for tree fertilization. Trees left in a natural setting are provided the required elements through organic matter as it decays and is constantly replenished. In the urban setting, we situate trees within sidewalks and patios or surround them with grass which competes with them for water and nutrients. In this urban environment we must augment nature's supply of nutrients to meet a tree's needs.

For several reasons, liquid fertilization has become popular, not just amongst the lawn care industry, but with the tree care industry as well. Ten years ago the prevalence of liquid fertilization methods within the tree care industry was much lower when the drill-hole method using dry granular fertilizers was popular.

The current popularity of liquid fertilization must be attributed largely to new developments in products. We now have much more soluble



**This applicator injects liquid fertilizer into the soil around the root zone of a tree.**

products, along with slow-release sources of nitrogen. High concentrations of nitrogen are available with low salt content and low burn potentials. A decade ago, in order to avoid potential phytotoxicity and retain good solubility, we really did not have the capability to provide adequate nutrients for a tree using liquid application methods.

**Soil injection.** The drill-hole or vertical mulch method, still used by many professionals, has a drawback in that it is quite physically demanding. A gasoline- or electric-powered earth auger is required. (Wet weather presents a safety problem if using an electric-powered auger.) There is a real potential here for damaged tree roots, sprinkler systems, drainage tiles and underground utilities.

On the average, for a given tree we recommend three pounds of actual nitrogen per thousand square feet of root area per year, based upon research done by Dr. Elton Smith of Ohio State University. I would definitely suggest soil

testing to be sure the rate you use meets the needs of the trees in your area. Depending upon which products you use, you will have to make the appropriate adjustments in dilution rates and determine how many gallons of solution must be distributed within a given square foot area of root zone.

As an example, the product we use in our tree care division and handle in our supply division is Dogett's Injecto Feed For Trees® 32-7-7 with 59 percent of its nitrogen in a slow-release form. Label recommendations call for 20 pounds of actual fertilizer per 100 gallons of water. In that 20 of the 32-7-7, you will have 6.4 pounds of

---

**Let me emphasize strongly that I don't believe injections are or ever will be a panacea for all tree care problems. Injections will never replace spraying or ground applications of fertilizer. However, when properly done by trained professionals, injections can augment existing practices and allow us to do things we couldn't do previously.**

---

actual nitrogen, a little over half of which will be slow release (approximately 3.78 pounds of slow release). Using 100 gallons of solution over 1,000 square feet of root area, you will be providing about 6 pounds of actual nitrogen released over a two-year period.

In terms of pressure, we recommend about 200 pounds per square inch for the feeding gun at the end of the hose. Considering pressure loss through the hose reel and fittings, you will need slightly higher pressure at the pump.

Begin fertilizing about 2 to 3 feet away from the trunk, spacing your injections about 18- to 30-inches apart. Inject about 12- to 18-inches deep into the soil where the majority of feeder roots can be found. Follow a concentric circle pattern out from the tree until you have evenly distributed the required gallons over the root zone of the tree. The drip line is generally considered to be the practical extension of the root zone for fertilizing purposes.

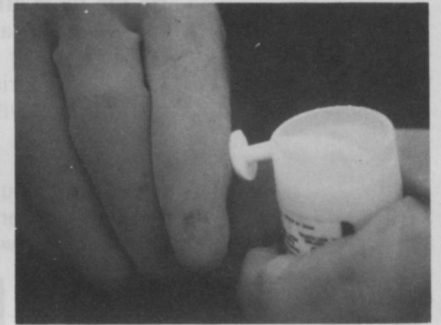
Another advantage of liquid fertilization is its ease of pricing because it is not labor intensive and like lawn care applications, it can be performed by one man. You will have to know what you need to return on your man and a truck per day. Then determine how many gallons (on the average) that man can pump out per day. This allows you to calculate your price on a per gallon basis.

In our company's experience over the past several years, material costs have represented about 10 percent of sales and labor costs about 7 percent of sales, leaving an 83 percent gross profit to cover overhead and net profit.

**Micro injection.** One of the most exciting developments in tree care has been the Mauget Micro-Injection® system. It permits us to place



At left, an applicator drills an injection hole with an 1/64-inch diameter at the root flare. Below, he places a micro-injector tube into the capsule prior to placing it into the injection hole at root flare. Bottom, The applicator taps the insecticide capsule and micro-injector tube into the injection hole which sets the tube at proper depth, then punctures the capsule's membrane which permits the chemical to flow into the tree.



sever part of initial process. The process in this system is designed to move material out of the capsule through a leader tube into the tree.

chemicals directly into the sap stream of a tree and avoid applying chemicals into the soil or on the trunk and foliage. The whole issue of drift can be averted with the ability to make applications in a closed system.

We are able to treat trees that we could not treat before. Injections allow us to treat the tree in a parking lot or planter or one surrounded by driveways and sidewalks with no root area available for ground applications. Sprays are particularly difficult to schedule in situations such as a school property with heavy pedestrian traffic. Injections can be scheduled regardless of the proximity or density of people.

Some tree problems can best be controlled by the injection method. The borer insect is an excellent example. Insecticide is delivered where the insect is active. With sprays, this insect can only be controlled during the short period it is outside the tree. There are also a number of canker or fungus problems systemic in a tree where again, sprays are only moderately effective, but more often ineffective.

Let me emphasize strongly that I don't believe

**On the average, for a given tree we recommend three pounds of actual nitrogen per thousand square feet of root area per year, based upon research done by Dr. Elton Smith of Ohio State University.**

injections are or ever will be a panacea for all tree care problems. Injections will never replace spraying or ground applications of fertilizer. However, when properly done by trained professionals, injections can augment existing practices and allow us to do things we couldn't



do previously.

Early injection techniques were developed primarily on elm trees with the hope of controlling Dutch elm disease. Unfortunately, the elm tree can take an awful lot of punishment without any obvious negative effects. Injection practices we now recognize as improper, went undetected because adverse results were not initially apparent on elm trees. When injection techniques were applied to other trees, problems quickly began to arise.

Wound response was perhaps the most ignored issue during the early days of injection work. The processes of uptake and distribution really were not understood. Success was judged by whether or not chemical emptied from the capsule or container. Gradually tree functions became apparent — where chemical was going and where it was not going. We now know there

*(continued on page 26)*

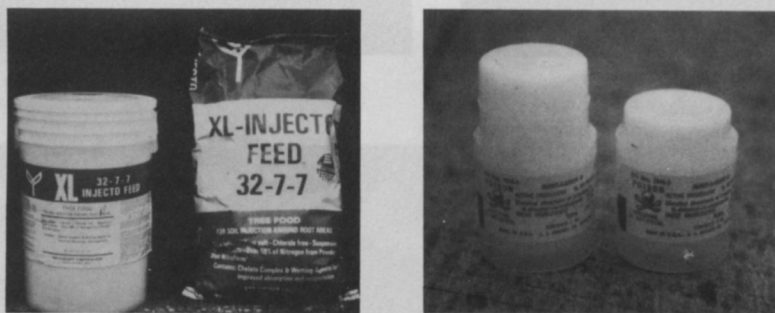
## SOIL INJECTION

(continued from page 25)

are some general guidelines which should be followed regardless of the injection system used.

Mauget Micro-Injection is the system we use and handle and is by far the most prevalent injection system used by professionals today. Injection is often referred to as "trunk injection," a reflection of earlier preference for the trunk as an injection site. Convenience was probably the primary reason the trunk was used. We now realize the most effective site for injection is at the root flare, an area of cell tissue physiologically different from the trunk or roots. Wound response is superior here to the trunk. Uptake and distribution will be much better and more consistent.

Size of the injection hole is important in regards to wound response. In terms of hole diameter, generally the smaller the better. Understand that when drilling a hole in a tree, if



**Above left, an example of currently available soluble tree fertilizer, Doggett's Injecto Feed for trees 32-7-7. At right is an example of an uncompressed insecticide capsule, as packaged on left; compressed capsule on right with 5-7 psi.**

you change drill bits from let's say 1/4-inch to 1/2-inch, you will actually remove four times the volume of wood tissue with the larger bit.

We have learned a great deal concerning the depth of injection. Normally it is most effective to inject chemicals within the five most recent annual rings, or on the average, approximately 1 inch beyond the bark into the xylem. This is where the most active conducting of water and nutrients takes place. Certainly it is not going to be the same for all trees, but on the average, this will be the most active area. Chemical placed deeper than this, as in earlier injection techniques, will more than likely not move up into the crown of the tree.

A sharp drill bit rotating at the proper RPMs is very important. Hand augers rip and tear wood tissue. The "insertion tool" used initially with the Mauget system punctures wood tissue. As one might imagine, a tree responds to these injection methods with a shock-like reaction. The tree's wound response mechanism is disturbed, not to mention the uptake and distribution of chemical.

We have learned some things about weather conditions regarding the relationship to chemical movement within the tree. When injecting we are "plugging-in" to the tree's existing transpiration system. Factors which affect transpiration will affect injections as well.

When the soil or air temperature is below freezing you might as well not even attempt to inject since there is going to be very little transpi-

ration activity in the tree at these temperatures. Within the 40 to 50 degree Fahrenheit range you will experience moderate uptake. Above 50 and below 80 degrees is probably the optimal range for injections.

Soil moisture is also critical. Without adequate soil moisture, the tree's transpiration system will not function. Injected chemicals will either not go up at all in the tree, or up in a very concentrated form, risking phytotoxic reactions. Always request that the homeowner water thoroughly following an injection. During periods of drought be sure the tree has been watered prior to the injection.

Humidity is another important factor. High humidity means that leaves cannot transpire water out of the stomas into the air. With the transpiration system stopped or slowed considerably under these conditions, we can expect to experience slow uptake of injected chemicals. Wind will aid the uptake rate as it increases the evaporation process on the leaves.

The Mauget system consists of all liquid materials packaged in capsules that when compressed, will develop approximately five to seven psi of internal pressure. The pressure in this system is designed to move material out of the capsule through a feeder tube into the tree. The plastic feeder tube is placed into an 11/64-inch hole at the root flare. Depth is maintained in the range of 3/8-inch to a maximum of 3/4-inch beyond the bark. Available in the Mauget system are several selections of fertilizer combinations as well as insecticides, fungicides and a streptomycin product.

Regarding selling and pricing, we find the public extremely receptive to the concept of injections. It is a scientific method and generally more appealing to homeowners than foliar applications of chemicals. We suggest estimating your prices on a per capsule basis. Most operators will figure \$3 to \$5 per capsule installed in conjunction with some minimum price.

As an example, let's consider a pesticide injection for a 24-inch DBH (diameter breast height) tree. Pesticide dosages are determined by dividing the DBH by two. This number represents the maximum number of capsules needed, in our example it would be 12. The price range for this treatment would be in the neighborhood of \$35 to \$40 as a minimum, up to \$60. In our experience, around 17 percent of sales goes for material costs and 7 percent for labor with 76 percent gross profit left to contribute towards overhead and net profit.

As a supplier, we offer yearly classroom seminars providing in-depth information on injection technique and products — how and when to use them along with dosage calculations. We also offer "hands-on" field training sessions on a regular basis. A comprehensive "Field Manual" is available which includes research data and background information on insects, diseases and timing for their control.

*Lauren Lanphear is vice president of the Forest City Tree Protection Company, Inc., Cleveland, OH. If you would like more information about soil injection fertilizing or Mauget Micro-Injection, contact Lauren at Forest City Tree Protection Co., Lanphear Supply Division, 1884 South Green Road, Cleveland, OH 44121; 216/381-1704.*



# WINTER DORMANCY OF WARM SEASON TURFGRASSES

BY KEITH J. KARNOK  
AND JAMES B. BEARD

**W**arm season turfgrasses are the primary species used in the southern United States. They have an optimum growth temperature range of 80 to 95 degrees Fahrenheit and the characteristic of going dormant during the winter months. However, contrary to popular belief, winter dormancy of warm season turfgrasses can and does occur at temperatures above 32 degrees.

In fact, with the advent of cool fall temperatures of 50 to about 60 degrees, warm season perennial turfgrasses will undergo discoloration and enter a state of dormancy. This is a physiological phenomenon referred to by plant physiologists as "chilling injury." Chilling injury is injury observed in plants of tropical-subtropical origins when exposed to temperatures above freezing, but below approximately 60 degrees. Although the effects of chilling temperatures on chill-sensitive plants have been researched by agronomists, horticulturists and plant physiologists, there has been little work or discussion of chilling injury in grasses, or turfgrasses in particular.

A review of the literature shows some classical work by Younger (1,2,3) on this unusual environmental stress. Younger found that high light levels and low temperatures interact to cause growth stoppage and winter discoloration of bermudagrass and zoysiagrass. He found that when bermudagrass was exposed to 44 degree temperatures and relatively high light levels (75 percent of full sunlight), shoot growth ceased and severe shoot discoloration occurred. However, discoloration did not occur at 44 degrees when the light was reduced to low levels (15 percent of full sunlight). Unfortunately, as far as turfgrasses are concerned, Younger's work is all that existed up to the late 1970s.

There are two primary reasons why a more thorough understanding of winter dormancy of

warm season turfgrasses is important: 1) Management, timing and type of fertilization and herbicide application as well as mowing height and irrigation scheduling are critical. 2) Deciding on the method used for providing a green cover during the dormant period is equally critical. The second reason is of particular interest when one considers the cost involved in overseeding or spraying with a green colorant.

With the above facts in mind, a study was conducted at Texas A&M University to document and detail the 1) morphological development of chilling injury symptoms on two warm season

**Although the effects of chilling temperatures on chill-sensitive plants have been researched by agronomists, horticulturists and plant physiologists, there has been little work or discussion of chilling injury in grasses, or turfgrasses in particular.**

turfgrass species (each having a chill sensitive and chill tolerant cultivar), and 2) to evaluate the effects of an applied plant hormone (gibberellic acid) in delaying the onset of winter dormancy.

(continued on page 28)

GA oz/acre	Bermudagrass		Clipping wt. (mg/pot) St. Augustinegrass	
	Pee Dee	Ormond	Floratam	Texas Common
0	135c <sup>2</sup>	183b	183b	201b
1.0	342a	296a	214b	203b

<sup>2</sup>Numbers with common letters are not significantly different 5% level.

Table 1. Effect of gibberellic acid on dry weight clippings from two bermudagrass and two St. Augustinegrass cultivars following two weeks exposure to chilling stress.

## WINTER DORMANCY

(continued from page 27)

**Methods.** Mature sod of two bermudagrass cultivars, 'Pee Dee' (chill sensitive) and 'Ormond' (chill tolerant) and two St. Augustinegrass cultivars, 'Texas Common' (chill sensitive) and 'Floritam' (chill tolerant) were used in the study. The sod was maintained in pots 3.5 inches in diameter by 5 inches deep containing 100 percent mortar sand. The plant material was maintained outdoors about four weeks prior to being exposed to chilling temperatures. The average day/night temperature during this period was 95/77 degrees. The turf was irrigated with distilled water as needed to prevent wilt and received a complete nutrient solution twice weekly. The bermudagrass and St. Augustinegrass were clipped twice weekly to a height of 0.75 and 2.75 inches respectively.

**With the advent of cool fall temperatures of 50 to about 60 degrees, warm season perennial turfgrasses will undergo discoloration and enter a state of dormancy. This is a physiological phenomenon referred to by plant physiologists as "chilling injury."**

A two-week acclimation period involved the transfer of two pots (one of each cultivar) from outdoors to an environmental growth chamber. A 12-hour photoperiod and a day/night temperature of 88/80 degrees were used throughout the acclimation period. A high light level (75 percent of full sunlight) was provided throughout the duration of the study. Following the acclimation period and at the beginning of the following dark period, the temperature was lowered 5 degrees per hour until leaf temperature reached 40 degrees. An atomizer was used to apply gibberellic acid (GA) 1.0 ounce/acre (28 grams/acre) to the foliage two hours after commencement of the next light period when leaf temperature was at 50 degrees. A day/night air temperature of 44/40 degrees and a 12-hour photoperiod was maintained for 14 days.

Visual estimates of turf quality were made weekly. Rankings were based on shoot density and color. Detailed observations of the progression of chilling injury symptoms were made daily. The turfs were clipped back at the conclusion of the chilling stress period to the original height maintained during the acclimation period. The collected clippings were dried and weighed. Treatments were replicated three times.

**Bermudagrass chilling symptoms.** The rate of development of visible chilling injury symptoms was extremely variable within the turfgrass community. Earliest symptoms of chilling injury in bermudagrasses occurred during the first day following initiation of the chilling stress. Both Pee Dee and Ormond developed a light discoloration over the top side of the leaf blades located near or at the surface of the turf canopy.

First signs of tissue discoloration appeared 2.5 to three days following initiation of the chilling stress. Occasional purplish discoloration of Pee Dee was observed on individual stems and young leaf blades, such as the folded bud leaf, as early as one night following exposure to 40 degree temperatures. A definite lightening or bleaching of the fully expanded leaf blade began at the tip and progressed downward toward the base of the blade of both cultivars after two to three days of chilling stress.

Leaf blades showing the greatest damage were located at the surface of the canopy and were oriented in a horizontal position. The most obvious symptoms were normally on the third, fourth and fifth fully expanded leaves on the shoot. In contrast, those blades located deep within the canopy remained normal in appearance. The folded leaf bud never underwent bleaching, but readily exhibited a dark purple color which first appeared at the base of the blade and progressed upward to the tip.

**St. Augustinegrass chilling symptoms.** Chilling injury symptoms exhibited by the two St. Augustinegrass cultivars were similar to each other, but markedly different from those of the two bermudagrasses. As was observed with bermudagrass, chilling injury was most severe on those plant parts positioned near the top of the canopy.

The first symptom in the St. Augustinegrass cultivars was a folding of the leaf blades followed by a general wilting appearance. Neither leaf age nor orientation seemed to influence susceptibility or resistance to this wilting effect. Floritam showed wilting symptoms between the second and fourth day, whereas it required four to six days for wilting to appear in Texas Common.

Dark lesions formed on many of the leaf tips within 24 hours following folding of the leaf blades and wilting. These lesions were visible on both folded and non-folded mature leaf blades, providing the leaves were directly exposed to light (Figure 1). Initiation of lesions on the blades appeared comparable among all vertically and horizontally exposed leaves, regardless of age. However, once initiated, the rate of lesion development was greatest in the more horizontally-oriented leaves. Young, folded leaves did not expand any further once subjected to chilling and also readily exhibited the formation of lesions, although they did not die within

GA oz/acre	Duration of chilling exposure (wk)	Clipping wt. (mg/pot)			
		Bermudagrass		St. Augustinegrass	
		Pee Dee	Ormond	Floritam	Texas Common
		Quality Rating <sup>Z</sup>			
0	1	5.0efg <sup>Y</sup>	7.5 abc	6.0 ced	8.5a
	2	3.0 h	5.0 efg	3.0 h	5.5 def
1.0	1	8.5 a	8.0 ab	4.0 fgh	8.0 ab
	2	7.0 bcd	7.5 abc	3.5 gh	4.0 fgh

<sup>Z</sup>Visual quality estimates based on 1 (poor) to 9 (excellent).

<sup>Y</sup>Numbers with common letters are not significantly different.

**Table 2: Effect of gibberellic acid on the visual quality estimates of two bermudagrass and St. Augustinegrass cultivars following one or two week exposure to chilling stress.**

the 14-day observation period.

As observed with the bermudagrasses, leaves positioned deepest in the canopy were the last to show chilling injury symptoms (Figure 2). St. Augustinegrass leaves that had been clipped exhibited more advanced lesion development from the cut end of the blade than uncut leaves. The lesions were light brown at first and became

darker as the leaf began to die. Overall, the youngest fully-expanded leaf blades were the last to show total loss of color.

**Effects of gibberellic acid.** All four cultivars showed a reduction in shoot growth during continual chilling stress. Pee Dee had a significantly lower clipping weight than Ormond, Flora-

*(continued on page 34)*



**Above: Warm season turfgrass home lawn during summer.  
Below: Warm season turfgrass home lawn during winter.**





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\*Comments of university extension experts available on request.

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## WINTER DORMANCY

(continued from page 29)

tam and Texas Common following the two-week chilling stress (Table 1). Both Pee Dee and Ormond bermudagrasses treated with GA showed a significant increase in shoot growth compared with untreated turf during the stress period. This new growth was very resistant to chilling stress and showed a few or none of the typical chilling injury symptoms.

There were no differences in shoot growth between Floratam and Texas Common St. Augustinegrass with or without GA treatment (Table 1). Both St. Augustinegrass cultivars treated with GA had significantly lower clipping weights than either bermudagrass treated with GA, which was not the case when the cultivars were chilled without the GA treatment.

All cultivars showed significant reductions in the visual quality estimates following two weeks of chilling stress (Table 2). Pee Dee and Ormond treated with GA showed increased quality, whereas quality of Floratam was unchanged and Texas Common showed a significant reduction in quality.

There was not a positive response to GA application on either St. Augustinegrass cultivar at the treatment rate used. In fact, chilling injury symptoms on both GA-treated St. Augustine-

grasses proceeded more rapidly and were more pronounced than on the untreated turfs. The fact that Texas Common treated with GA had a significantly lower visual rating than the non-treated control following two weeks of chilling temperatures indicated a possible GA toxicity effect at the rate applied. Thus, a lower rate could possibly give a positive color and/or growth response.

This study showed that cultivars of the same

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**GA is most effective in very mild climates. Frequent freezing temperatures (32 degrees or below) will negate any beneficial effects of GA. GA is best suited for fall application in those climatic regions where freezing temperatures are infrequent.**

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species vary in their tolerance of chilling injury. Although the general symptoms and order of appearance were similar, the rate of progression varied among the cultivars within a species. GA at 1.0 ounce/acre (28 grams/acre) improved the color rating and growth of both bermudagrass cultivars but increased the severity and rapidity at which chilling injury symptoms appeared in both St. Augustinegrasses.

**Conclusions.** The use of GA for delaying the onset of winter dormancy of warm season turfgrasses has potential use in the field. In fact, this management tool has been used on a limited scale by turfgrass managers in the past. However, there are several factors which should be considered before this technique is used. First, GA is most effective in very mild climates. Frequent freezing temperatures (32 degrees or below) will negate any beneficial effects of GA. GA is best suited for fall application in those climatic regions where freezing temperatures are infrequent.

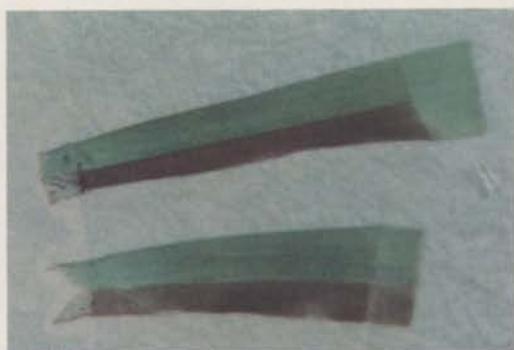
In addition, as already discussed, species and cultivars within a species may vary in their response to GA. Research by Dr. A.E. Dudeck at the University of Florida has shown positive responses of turf to rates as low as 1 to 2.5 grams per acre. Additional research is needed to establish rate-response information for the various warm season turfgrass species.

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Keith Karnok is an assistant professor in the Department of Agronomy at the University of Georgia. James Beard is a professor in the Department of Soil and Crop Science at Texas A&M University.

**Figure 1. High light and chilling temperatures interact to cause winter dormancy. The discolored area of each leaf blade was directly exposed to high light while the shaded half of the blade remained green.**



**Figure 2. St. Augustinegrass shows chilling injury. Shaded or leaves-deep in canopy, it shows little discoloration.**



# A SNEAK PREVIEW OF PLCAA/TAMPA '84

BY VIVIAN FOTOS

If *bigger* and *better* are two of your favorite words, you'll find they're just the ones to describe this year's PLCAA Conference and Show which runs November 12-15 at the Curtis Hixon Convention Center, located on the riverfront in downtown Tampa, FL.

So what makes the 5th annual show unique from its forerunners? For starters, says PLCAA executive director Jim Brooks, "It's bigger by 30 percent. We have over 35 first-time, new exhibitors." And attendance is expected to top 2,000, he adds. An expanded educational program will certainly attract more attendees, but the PLCAA knows they'll also have to credit Tampa's sunny days and balmy nights for luring more lawn care professionals down to Florida.

Aside from an enticing tropical environment, PLCAA/Tampa '84 offers lawn care businessmen the op-

**Aside from an enticing tropical environment, PLCAA/Tampa '84 offers lawn care businessmen the opportunity to swap notes, exchange ideas and discuss industry issues with colleagues from around the country.**

portunity to swap notes, exchange ideas and discuss industry issues with colleagues from around the country. The convention provides a forum for sharing thoughts on market trends, business management and field



**More than \$800 million in new construction has dramatically changed downtown Tampa's skyline during the past year. The city is the site of this year's PLCAA annual conference and show.**

techniques, and it's a great chance for lawn care operators to view leading suppliers' products and state-of-the-art technology.

Although the official conference kick-off is Tuesday's keynote address by former astronaut James A. Lovell, two early bird workshops launch the convention's educational events on Monday. The pre-conference sessions concurrently scheduled are new to PLCAA's line-up. One program focuses on "How to Grow Your Business." It will be hosted by a panel of speakers, featuring Lawrence D. Kokkelenberg, Ph.D., president, Kokkelenberg Corporation; James Skelton, MBA, principal, Ross-Payne and Associates, Inc.; Ed T. Wandtke, CPA, associate advisor, Advisor Associates, Inc.; and Richard I. Lehr, P.A., Sirote, Permutt, Friend, Held and Apolinsky, P.A.

The second session, entitled

"Effective Advertising and Promotion Techniques for the Lawn Care Market," will be a dual presentation by Kathy Copley, editor, *Grounds Maintenance*, and Raymond Gibson, president, Ohio City Communications.

Following the lead-off educational programs, conventioners can mingle with old friends at the early bird reception from 6:30 p.m. to 8:30 p.m. at the Tampa Hilton. Food, drink and entertainment will highlight the evening.

On Tuesday morning the conference blasts off with Captain Lovell's inspirational speech on "Successful Failures." Having logged 715 hours in space while serving as an astronaut from 1962 to 1973, Lovell is now senior vice president—administration of Centel Corporation, Chicago. He has been successful in several American businesses, including marketing to the lawn and garden industries.

(continued on page 36)

Lovell will narrate a 13-minute film about his flights and experiences with the United States Space Program, then discuss the past and future of America's space program.

After the keynote address, the exhibit hall will open, unveiling a showcase of aerators, dethatchers, power rakes, irrigation systems and mowers, includ-

ing reel, push and rotary equipment. A variety of manufacturers and suppliers will display their wares in over 200 booths, exhibiting everything from line trimmers, edgers, spray rigs and tank, reel and pump components to complete lines of herbicides, fungicides and insecticides, grass seeds and clipping catchers. Companies specializing in sales brochures and direct mail pieces design, as well as representatives from business computer firms and

trade publications, will also be available to assist lawn care specialists with their specific business needs. The exposition will be open for 15 hours during the three-day conference—plenty of time for meeting with manufacturers, viewing demonstrations and placing orders for products and equipment.

While business transpires on the trade show floor, education will be the order of the day in the seminar rooms. A full schedule of educational sessions

## VISITOR'S GUIDE TO TAMPA

**A**s one of the country's most popular vacation kingdoms, Florida has a lot to offer its visitors. Tampa in particular is the home of many attractions, including the well-known Busch Gardens — The Dark Continent. So while you're down in the Sunshine State for the PLCAA conference in November, take advantage of the locale and many sights. The Greater Tampa area is eager to share with you its numerous beaches, parks, golf courses, tennis courts and recreational centers, as well as its historic sites, museums, art galleries and amusement attractions.

**Busch Gardens.** You don't even have to leave the country to get a taste of 19th century African romance and adventure. It's all in Tampa — wild jungle animals, thriller rides, exotic gardens and birds, delicious food, authentic crafts and dazzling shows. The Dark Continent has seven regions for visitors to explore. In the Congo you'll see rare white tigers of Claw Island, two of only 51 in captivity in the world. Try sailing the Congo River Rapids. They'll send you swirling past gushing geysers and through a mysterious cavern with cascading waterfalls. Then brave the Monstrous Mamba, the Python and other hair-raising rides.

The aroma of barbeque beef ribs and roasted corn-in-the-husks lure visitors to Stanleyville, as well as the Log Flume, the largest ride of its kind in Florida. After watching animals perform at the Stanleyville Theatre, observe the alligators, crocodiles and wild monkeys of Nairobi. You'll also see night-stalking creatures, such as the Nile Monitor lizard and African crested porcupine, inside Nocturnal Mountain. Also in Nairobi, children can ride a real elephant and touch smaller animals at the Petting Zoo.

In the Serengeti Plain, rare Cape buffalo roam the plains and waterways. So do giraffes, zebras, elephants and gazelles. Watch them romp around their natural surroundings via steam train or monorail, then head for the



Nearly 1,000 workers made cigars at the Ybor Factory in its heyday.

Bird Gardens where pink flamingos, blue and gold macaws, black swans, cockatoos and amazon parrots strut their stuff. In Timbuktu, you'll be captivated by dolphins that obey human commands. You'll also enjoy the German cuisine and German entertainment at Das Festhaus, an enormous festival hall inspired by early African trading posts. And if you dare, take a ride on the Scorpion, a vertical-loop roller coaster that soars people over the white sands of Timbuktu. When your stomach's done doing flip-flops, get ready for your last stop — to Marrakech! Home of the Moroccan Fantasy Show which features agile belly dancers, Marrakech boasts native crafts from around the world and tasty treats at the Boujad Bakery and Zagora Cafe. Visitors also ooh-and-ahh when a sensuous snake charmer dances with live serpents, intertwining her body with the slithery reptiles. Certainly an action-packed day at Busch Gardens!

**Ybor City — the Latin Quarter.** The aroma of tobacco still lingers in the air of this historic city where the first "clear" (pure leaf imported from Cuba) Havana cigar was hand-rolled in 1886. Named after Vicente Martinez Ybor, a Cuban cigarmaker who helped launch Tampa's famous cigar industry when Spanish oppression forced many cigarmakers to leave Cuba, the city still retains its original charm and Latin

culture. The V.M. Ybor Cigar Factory, renamed Ybor Square in honor of its builder, is now a unique collection of shops, boutiques and restaurants. Outside the square is a large brick patio which was once a recreational area of the cigar workers. And on the east entrance on Avenida Republica de Cuba are the historic iron steps that Jose Marti, the famous Cuban patriot, stood on in 1893 when he encouraged cigar workers to take up arms against the Spanish oppression in Cuba. He also brought notoriety to a nearby corner where the famous social meeting place, "El Liceo Cubano," once stood. Now recognized as the Cradle of Cuban Liberty, it was here that Marti gave two of his most patriotic speeches in 1891.

Seventh Avenue, the busy shopping street, is still as exciting in Ybor City today as it was in the late 1800s when street vendors sold their fresh fruits and vegetables, shoppers scurried in and out of stores looking for bargains and old men swapped stories in the park, deeply inhaling the tobacco-scented air. Much of that activity is still bustling along the street.

Also located on Seventh Avenue was the Sanchez y Haya Cigar Factory. On your tour of the city, visit this site for a history on the factory that rolled the first clear Havana cigar. Because of a labor dispute, it was this factory that rolled the first cigar rather than the V.M. Ybor Factory.

Much of the neighborhood's history is housed in the Ybor City State Museum, the old Ferlita Bakery Building at 9th Avenue and 19th Street. The bakery's original ovens and many interesting artifacts depict the founding of Ybor City, the cigar factories, Ybor's involvement in the Spanish American War and Ybor City in its heyday in the 1920s.

For something new in a quaint, old atmosphere, stop by the St. Augustine Winery. Built in the traditional Ybor City style, this is the largest and most lavish winery in the Sunbelt. Free tours and tasting are held daily. Several other

is planned, offering extensive technical, marketing and business guidance. On Tuesday, Robert Earley, group publisher, Harcourt Brace Jovanovich, updates lawn care professionals on "Our Changing Industry," and David Dietz, principal, David H. Dietz and Associates, discusses the importance of "Regulatory Assistance Through the Pesticide Public Policy Foundation (3PF)." Tom Hofer, vice president, Spring-Green Care

**The convention provides a forum for sharing thoughts on market trends, business management and field techniques, and it's a great chance for lawn care operators to view leading suppliers' products.**

historic treasures dot the streets of this colorful neighborhood. It's a must-see for Tampa tourists.

**Adventure Island.** Slide in. Surf in. Splash in. Ease in. Dive in — just *get* in and enjoy this exhilarating water wonderland. It's a family day of splish-splash at Adventure Island's 10 acres of tropical paradise. Located a quarter of a mile northeast of Busch Gardens, the park is an endless maze of water slides with steep, whirling water shoots for the real thrill-seekers and gentle-sloping water slides for the less adventuresome. After sliding down the water shoots, you can bask on the beach, relax under the waterfalls or sip a cool drink at the Surfside Cafe. And kids can venture off to their own hideaway, the Fountain of Youth, complete with fountains, slides, swings and water guns.

**Museum of Science.** Adjacent to the University of South Florida, just one mile north of Busch Gardens, is a fun learning experience for the entire family. The Museum of Science and Industry features all kinds of hands-on exhibits about sun, weather, electricity and other scientific phenomena, making education unique and enjoyable. A simulated gulf coast hurricane, Dr. Thunder's Magic Boom Room and Phineas Phosphate's Computer Mine are among the exhibits. The museum is open daily and admission is \$2 for adults, \$1 for children ages 5 to 15.

**Pabst Brewing Company.** Whether you're a beer guzzler or an occasional sipper, you'll enjoy learning all about the beer-making process on a plant tour of Pabst's facilities. Tours run every half hour, from 10 a.m. to 3 p.m., Monday through Friday. Make sure you stop by the Hospitality House before you leave!

**Golf and Tennis.** If you come down to Tampa in November from the Midwest or northern parts of the country, you'll especially appreciate the opportunity to shoot a few holes of golf or play a few sets of tennis. Tampa offers

many recreational facilities for the sports-minded. A complete listing of golf courses and tennis courts is available through the Greater Tampa Chamber of Commerce.

**Beaches and Parks.** If you're looking for nothing but rest and relaxation, try finding it at one of the city's sandy beaches or wooded parks. Bahia Beach is a 200-acre waterfront park located south of Tampa in Ruskin. Boat ramps and a boat-tel facility are available. Also south of Tampa, off U.S. 41, is Ellsworth Simmons Park, 254 acres with more than 1,000 feet of sandy beach. Closer to downtown is Ben T. Davis Municipal Beach, located along the scenic Courtney Campbell Causeway on Tampa Bay. For camping, fishing, boating and picnicking, drive north from Tampa on U.S. 301 to Hillsborough River State Park. Or, for a day with the animals, take the family to Lowry Park. You can feed the deer in



**A dolphin jumps through hoops for his trainer in the Dolphin Theater of Timbuktu at The Dark Continent—Busch Gardens.**

Corporation, presents "The Office—Asset or Liability," and wrapping up Tuesday's sessions is a look at "Stress Management: His, Hers, Ours" by Tom Jadin, director, Winnebago Mental Health Institute.

After a full day of walking the exhibit floor and absorbing new information on the lawn care market at numerous educational sessions, you can relax at the exhibitor-sponsored reception and

*(continued on page 38)*

Bambiland, then visit Fairyland, a storybook park with a chimp and elephant act, jungle train ride and life-size fairytale set-ups.

**Fishing.** You have your choice — salt water versus fresh water. Just make sure you get your fishing license before venturing inland if you choose the latter. A license is not necessary for salt water fishing. Tampa offers some mighty good fishin' within its city limits. Try dropping a line from Channel Drive on Davis Islands or from anywhere along the five-mile long Bayshore Boulevard. Ballast Point Fishing Pier, a historic site where in-bound schooners once dumped their ballast of rocks, is open for public fishing. So is Gandy Bridge, a four-lane span across old Tampa Bay to St. Petersburg and the Gulf beaches. There you can fish from a custom fisherman's catwalk.

For fresh water Bass, Bream, Speckled Perch and a variety of pan fish, check out the many lakes and rivers of Hillsborough County.

**Excursion and Cruise Ships.** A 300-passenger, two-deck "Cabaret Fun Ship," known as the Island Adventure, cruises the Hillsborough River and Tampa Bay daily, except Monday. The boat is docked on Ashley Street between Kennedy and Brorein. Also docked on Ashley Street is a larger-capacity boat. The Spirit of Tampa, a 600-passenger, three-deck, dinner/dance boat, also offers scenic trips around the Harbor and Bay. Both boats feature afternoon and evening sailings, so you can enjoy the lovely Bay by sunshine or moonlight.

Cruises for many different ports of call leave from Tampa. (See the related story about PLCAA's cruise to the Western Caribbean.)

A complete listing of all the things to see and do in Tampa is available through the city's chamber of commerce. For more information, contact: Greater Tampa Chamber of Commerce, 801 E. Kennedy Blvd., P.O. Box 420, Tampa, FL 33601; 813/228-7777. — *Vivian Fotos*

social. It will be held at the convention center, immediately after the exhibit hall closes for the day, from 5 p.m. to 6:30 p.m.

New PLCAA members will be recognized at a new member reception and breakfast on Wednesday at the Downtown Holiday Inn. According to Jim Brooks, the association has been growing annually by about 35 percent, so Brooks expects a large breakfast gathering.

The second round of educational sessions gets underway after the reception and breakfast, starting with Lawrence Kokkelenberg's tips on "Reducing Cancellations." Next, you'll have to choose between attending the one-hour workshop, "Sound Business Considerations for Mowing/Maintenance Companies," by Rod Bailey, president, Evergreen Services Corporation, or the two half-hour sessions on fertilization of trees, shrubs, and ornamentals — "Principles of Tree and Shrub Fertilization" by Dr. Roger C. Funk, vice president, Technical and Human Resources, Davey Lawnscapes, and "Fertilization of Southern Ornamentals" by Dr. Robert Black, urban horticultural specialist, Florida Cooperative Extension Service, University of Florida.

Later in the afternoon, Dr. James B. Beard, professor of turfgrass science at Texas A&M University, will discuss his area of expertise in a presentation entitled "Turfgrass Research Update:

**Another added program to this year's show is the special spouses' tour, "A Day with the Classics." Beginning at 9 a.m. with chilled juice and danish, participants will be driven south to Sarasota to visit the waterfront estate of John and Mable Ringling.**

Water." A panel discussion on "Thatch: General Considerations" will conclude Wednesday's workshops. Participating in the session are: Dr. Kirk A. Hurto, Ph.D., research specialist, Chemlawn Corporation; Dr. A.J. Powell, turf extension specialist, University of Kentucky; John C. Prusa, vice president of Operations, Lawnmark, Inc.; and Dr. Charles Peacock, turf extension specialist, University of Florida.

Although exhibitors will be striking their booths on Wednesday evening,

## DINING AROUND TOWN

**P**lanning to start a diet *now*? Before the PLCAA '84 conference? Nonsense! Not even the most noble weight-watcher will be able to resist Tampa's tummy-tempting treasures. The city boasts all kinds of exciting eateries, everything from casual pubs and comfy taverns to gourmet restaurants and romantic dinner cruises. You'll find fresh seafood, succulent prime rib, Oriental stir-fried, authentic Spanish paella, zesty pasta, tangy enchiladas, sinful French pastries, exotic fruit drinks — the list is endless! And you're appetite will be, too, once you discover the culinary arts which are flourishing in Tampa. To whet your palate, here's an appetizer to the city's extensive menu of eating establishments. Bon appetit!

**Ashley's** Tampa Hilton Inn—Downtown, 200 Ashley Drive, 223-2456. Featuring a continental menu. Reservations suggested. Valet parking available. Hours: 6 p.m.-10 p.m., Monday through Saturday.

**Captain Anderson Dinner Boat** 4901 Gulf Boulevard, 360-2619. The Captain Anderson offers a choice of two different cruises. Two-hour, narrated cruises on Boca Ciega Bay daily (except Sunday). Evening Sunset Dinner and Dance cruise makes for a luxurious three-hour vacation highlight including cruising, dancing to live music, a view of a Florida sunset over the Gulf and a choice steak dinner.

**Benihana of Tokyo** Sheraton Hotel—Downtown, 515 East Cass Street, 229-6862. Authentic Japanese steak house featuring steak, chicken, seafood and vegetables prepared according to ancient Japanese recipes by chefs performing right at your table. Reservations requested. Hours: lunch 11 a.m.-2 p.m., Monday through Friday; dinner 5 p.m.-10 p.m., Sunday through Thursday, until 10:30 p.m. Friday and Saturday.

**Columbia Restaurant** Ybor City, 2117 East 7th Avenue, 248-4961. Established in 1905. Authentic Spanish entertainment nightly (except Sunday). Reservations required. Sophisticated jazz combos in the Cafe and the Warehouse at the Columbia from 9 p.m.-3 a.m., Tuesday through Saturday. Hours: 11 a.m.-midnight, seven days a week.

**Island Excursion Boat** Downtown Tampa, 251-8008 and 251-2952.

Docked next to the Hilton Hotel on Ashley Street, the Island Adventure features a three-hour dinner/dance cruise with a live band. Complete New York Strip Steak dinner with dessert. Sail beautiful Tampa Bay, the Harbor and the Hillsborough River. Reservations recommended. Operates Friday through Sunday.

**Yankee Trader Restaurant** Bay Harbor Inn, 886-5705. Overlooking Tampa Bay. Tampa's finest restaurant presents superb cuisine in an excellent atmosphere for your dinner pleasure. Specializing in fresh seafood, prime rib and steaks. Unique cocktail lounge. Hours: 7 a.m.-11 p.m., lounge 11 a.m.-2 a.m.

**Matterhorn Hofbrau Haus** 810 E. Skagway (I-275 at Busch Blvd.), 932-0780. Specializing in German cuisine. Continuous authentic music and entertainment with a total German Oktoberfest atmosphere featuring festive decorations, hostesses and waitresses wearing dirndl and musicians and bartenders in lederhosen. Hours: 5 p.m.-midnight, Wednesday, Thursday and Sunday; 5 p.m.-1 a.m., Friday and Saturday. Happy Hour from 4 p.m.-6 p.m. in Edelweiss Lounge.

**Spanish Park Restaurant** 3517 E. 8th Ave., 248-6138. This is the restaurant Tampa's natives prefer for Tampa's most authentic Spanish food, excellent service and the most generous cocktails in town. Under the same family management and ownership for over 50 years. Located on the estate of Ybor City's first citizen. Hours: 11 a.m.-11 p.m.

**The Old Spaghetti Warehouse** Ybor Square, 1911 N. 13th Street, 248-1700. A "must see" for visitors at historic Ybor Square. The Old Spaghetti Warehouse has an ambience of antiques and an exciting variety of menu items. Specialties include lasagna, cannelloni, chicken pettazzi—to name a few. Reservations accepted. Open seven days a week.

**Po Folks—A Family Restaurant** 236 N. Dale Mabry, 379-2882. Serving a combination of good food, big servings, fair prices and friendly service. Menu items include country-style foods; fried chicken, chicken and dumplings, kuntry-fried steak and a large variety of seafood. Hours: opens 10:30 a.m. daily.

*We suggest you call ahead to confirm restaurant hours as they often change.*

lawn care operators still have several activities scheduled before the PLCAA conference comes to a close. The annual business meeting will be from 5:30 p.m. to 6:30 p.m. on Wednesday, and two final educational sessions are planned for Thursday morning before the conference's noon adjournment—a panel discussion on "How to Avoid and Respond to Union Activity" with participants Richard I. Lehr, PLCAA attorney; Paul Daverede, president, Ever-Green Lawn Corporation; and James R. Sackett, president, Ever-Green Lawn Care, Inc.; and a discussion on "Expanding Into the Commercial Lawn Care Market" by Irvin Dickson, vice president, Native Tree, Inc.

Another added program to this year's show is the special spouses' tour, "A Day with the Classics." Beginning at 9 a.m. with chilled juice and danish, participants will be driven south to Sarasota to visit the waterfront estate of John and Mable Ringling. After a morning at the Venetian-like palace and the famous Ringling Circus Museum, the spouses will then travel to St. Armand's Circle, a unique area of shops and restaurants. Full details on the program are available with the PLCAA registration material.

Also new this year is some post-

## POST-CONFERENCE R&R

**R**est and relaxation. What better place to get it than aboard an oceanliner bound for the Western Caribbean. Spectacular sunsets over shimmering waters, cool sea breezes, warm rays of sunshine — all very inviting to the lawn care professional who will be wrapping up a week's worth of business and education at the 1984 PLCAA conference and show in Tampa, FL. This year the association is offering a post-convention cruise to its members, their families and friends aboard the luxurious Nieuw Amsterdam, one of the newest ships in the Holland America fleet.

The seven-day adventure is scheduled for November 17-24, with stops at three ports of call — Cozumel, Mexico; Montego Bay, Jamaica; and

George Town, Grand Cayman. While sailing the blue waters of the Caribbean, you'll want to indulge yourself in some of the ship's amenities. Sign up for an exercise class or participate in trap shooting, a golf clinic or a bridge lecture. There's music on the Lido Deck, horse racing at the Nieuw Amsterdam Downs, Bingo, shuffleboard, table tennis tournaments, the Ocean Spa and Sun Deck — an activity for everyone.

Cruise fares start at \$1,195 per person. They include ocean transportation, stateroom accommodations, all meals, entertainment and air transportation. For more cruise information, contact PLCAA, 1225 Johnson Ferry Road N.E., Suite B-220, Marietta, GA 30067, 404/977-5222. — Vivian Fotos

convention fun and sun aboard the Nieuw Amsterdam, a Caribbean cruise ship. If you want to extend your stay and visit the ports of Cozumel, Mexico; Montego Bay, Jamaica; and George Town, Grand Cayman, make sure you make your reservations soon.

(See related story for more details.)

With a full agenda of seminars, trade show activities and social events, it is no wonder Jim Brooks says this will be PLCAA's biggest and best conference and show to date. We're looking forward to it and hope you are, too!

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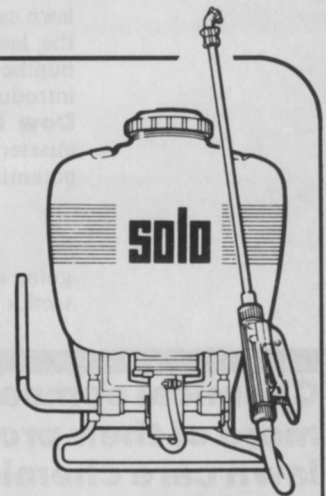
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# 1985 TURF CHEMICALS PREVIEW

BY TIM WEIDNER

**W**hen an industry is growing as fast as the lawn servicing industry, its support industry must keep up with its growth by supplying the needed materials. Earlier this year we addressed the topic of industry growth as reflected in more and more specialized lawn care equipment coming from major equipment manufacturers. The same sort of analogy can be made for the agricultural chemicals industry, which has also recognized the growth potential inherent in the lawn service industry. Chemical companies are devoting more of their production capabilities to lawn care chemicals. But even more indicative of the lawn care industry's growing status is the number of new lawn care chemicals slated for introduction in 1985.

**Dow Chemical.** Dow Chemical USA, headquartered in Midland, MI, recognizes the sales potential in the lawn care market and will be



DOW

going after those sales with aggressive marketing tactics. "We will be increasing our field sales

## Chemical companies are devoting more of their production capabilities to lawn care chemicals.

force around 25 percent," says Mike Hoff, Dow's turf product communications manager. Dow will take advantage of the exposure provided by the Professional Lawn Care Association of America (PLCAA) Conference and Trade Show in Tampa, FL on November 11-15 with the first screening of their new slide show presentation on turf insect control.

Hoff says Dow's biggest seller to the residential lawn care segment of the turf market has been Dursban® insecticide, but he says overall sales volume growth was excellent in 1984 and should be even better in 1985. "Our biggest strength in the turf industry is the lawn care professional segment," Hoff says. "The lawn care industry really is not in a cycle like the economy.

As the industry grows, we will introduce more and more products."

Many of the products Dow and other lawn care chemical companies will be introducing will be reformulations of existing products. For example, up until this year, Dow only offered Dursban as an emulsifiable concentrate. Now there is Dursban 50 Wettable Powder®. Hoff says word came back from the field of a need among applicators for a wettable powder formulation. "Market research still tells us the industry does not like a wettable powder, but (sales) volume on our wettable powder to date has been beyond our expectations." In fact, Hoff says the Dursban 50 formulation has gone over so well that "key users" in the lawn care industry are evaluating a water-soluble packet version of Dursban 50 that may hit the market in 1984.

Despite the success Dow has had in the lawn care market, Hoff realizes there are obstacles which could stand in the way of future success. This industry and the chemical companies which supply it must allay the public's growing fear of pesticides. Hoff feels that pesticide phobia will subside once the public becomes better informed about the relative safety of pesticides. He says Dow is involved in pro-pesticide coalitions such as the Pesticide Public Policy Foundation and has begun work on educational brochures and door hangers which applicators can leave with customers.

But perhaps the best way this industry can calm the public's pesticide fears is by improving its own image and professional status from a product stewardship perspective. "We have got to do a better job of training the end user and the end user has got to do a better job of communicating with the public," Hoff says.

**Stauffer Chemicals.** Herb Day, marketing and specialty products manager with Stauffer



Stauffer  
CHEMICALS

Chemicals, Agricultural Chemicals Division, Westport, CT, feels state-by-state regulatory activity may be the single greatest threat to this industry. One set of regulations handed down

from the Environmental Protection Agency (EPA) at the federal level could be dealt with in the labeling process at each chemical company. "But when you might have 30 or 40 different (sets of state regulations) across the country," Day says, "it is almost impossible to put together the necessary information. It just takes too long sometimes to follow the regulations, which in many cases really aren't needed."

The Stauffer people have not let their anxieties over dealing with state regulations stand in the way of developing new products for the lawn care industry. Day says Stauffer will not have any new products slated for introduction in 1985, but he notes that the company recently introduced a new southern turf herbicide called Deminol®. The Stauffer marketing staff does have new plans for its plant growth regulator Eptam® for highway and other utility turf applications to reduce seedheads on tall fescues primarily.

Day predicts the 1985 pricing picture for these and other Stauffer lawn care products will remain pretty much the same as in 1984. "There may be a slight change, but not much," Day says. The stable market is at least partly due to the steady growth of the market in recent years. Day says the herbicide market is still growing with the lawn care market, but the insecticide market is drawing the most sales for Stauffer. He cites bumper crops of turf insect pests over the last couple years as the reason for the sales boost.

Day also predicts the introduction of some

new turf product innovations, but not in the foreseeable future. He says his company has been doing some work with insect growth inhibitors for use in shade tree applications. Day says Stauffer also has plans for pyrethroids and *Bacillus thuringiensis* in turf applications, "but that won't be out in the next couple of years for turf."

**Mobay Chemical.** Mobay Chemical Company, Kansas City, MO, also has a growing interest in developing an insect growth inhibitor compound for the lawn care market. Mobay already has an experimental use permit for an insect growth inhibitor for controlling gypsy moths and is working on a formulation for lawn

## The industry's growing status is evidenced by the number of new lawn care chemicals slated for introduction in 1985.

insect pests. "You will find some kind of growth inhibiting product in the lawn servicing market within the next three to five years," says Allan Haas, Mobay's specialty products manager.

Haas also predicts growing interest in plant growth regulators for controlling turfgrass growth, but more importantly, he predicts a new reliance on an already-established turf product

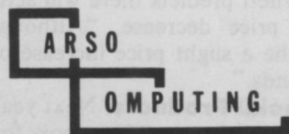
(continued on page 42)

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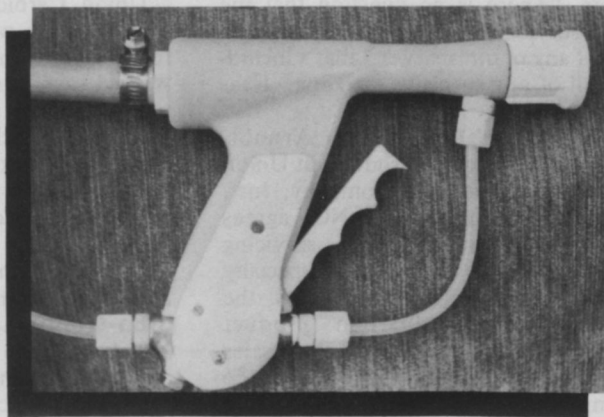
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— fungicides. "Fungicides will play a bigger part in the lawn service business," Haas says. "As people do a better job of taking care of their lawns and become more proud of them, they are going to be more cognizant of the disease pressure they have and will want something done about it."

Haas says Mobay has no plans for new turf care product offerings for the 1985 season, but the company will begin an intensified marketing push for its Oftanol® insecticide. According to Haas, "1985 will be the first time we really get behind it (Oftanol) for surface feeders and fire ants."

He says there will be no pricing surprises in store for lawn care businessmen in 1985. "Our pricing is going to remain the same in some cases as in 1984. There will be some slight increases on some products," Haas says. The "slight" increases will reflect shifts in the inflationary rate, according to Haas.

Even in the face of inflation, the lawn care market and Mobay's sales to this market are growing proportionally. Haas attributes sales growth to market growth and the natural progression in sales expected of the new products Mobay has introduced over recent



years. "There is no question that the lawn service market is the fastest growing of any of our markets, that's including all of our specialty markets," Haas says.

**Union Carbide.** Tom Arnold, manager of specialty products at Union Carbide Ag Products Company, Inc., Research Triangle Park, NC, agrees with Haas that the lawn servicing market is the fastest growing specialty market. However, Arnold says the retail/home and garden product market still brings in the largest sales volume for Union Carbide of the company's five-segment specialty market. The five segments include: retail/home and garden, professional lawn care, professional grounds maintenance (including golf), structural pest control and nursery/ornamentals.

Union Carbide has experienced sales growth in the lawn servicing market partly because the company has only recently begun to target products specifically to this market. "We recognize it as a growth market and are designing products specifically for lawn care applicators — Weedone DPC® and Seven

SL® are two examples," Arnold says. "Those products are primarily designed for the lawn care market."

Union Carbide is coming out with a new product sometime next spring, but Arnold could not divulge any details. He could say the new product will be essentially a reformulation of existing materials with label modifications. In 1985 key marketing emphasis will be placed upon Weedone DPC herbicide since it has only been on the market for about a year. Union Carbide is working on new compounds from scratch, but in the near future, the company is concentrating its efforts on reformulations of current products.

**Dow recognizes the sales potential in the lawn care market and will be going after those sales with aggressive marketing tactics. "We will be increasing our field sales force around 25 percent," Hoff says.**

"Our emphasis is on taking existing compounds and, by using unique formulation technology, making those products more adaptable to turf situations," Arnold says. For example, Arnold cites the recent reformulation of Union Carbide's Sevin insecticide to create Sevin SL, a liquid formulation "which appears to work better on turf insects than some of the older wettable powders."

Union Carbide is doing aggressive reformulation work to create products for the lawn servicing market because Arnold says this is an "opportunistic" market. He says the agriculture market, once prime for Union Carbide, has been wracked with problems like hostile weather conditions and acreage decreases due to PIK programs. "You have to look to other areas to improve your position and the specialty markets have been the opportunistic areas."

**Ciba-Geigy.** Lawn care businessmen who have been following the fate of compounds in the throes of the product registration process will recognize the name of Ciba-Geigy Corporation's broad-spectrum insecticide Triumph®. Marketing executives at the Greensboro, NC company now assure us that Triumph is expected to hit the market in 1985. "Labeling is our only hold up at this point," says Ron Fister, Ciba-Geigy's turf sales manager. "The data is in and we are waiting for (EPA) registration." Fister says a new Ciba-Geigy fungicide called Banner® is in the same EPA limbo.

Although the company has had the

insecticide Diazinon® on the market for some time, Fister says Triumph will be Ciba-Geigy's first real entry into the lawn care market. The lawn servicing

## CIBA-GEIGY

market's increasing growth momentum, as well as the realization of the market's sheer size, attracted Ciba-Geigy's renewed interest. "With Triumph, we did some research back in the early 1970s and did not do any more research until recently, with the growth in the market." Fister says his company's realization of this industry's incredible growth got Triumph off the dusty laboratory shelf and back into the registration process.

**Rhone-Poulenc.** In 1985, Rhone-Poulenc, Inc. of Monmouth Junction, NJ, will have no new products to offer the turf care industry, but there will be an upgrading of the Chipco® product line. Packaging of Chipco products will receive a "whole new, fresh image," according to Jerry Garnett, Rhone-Poulenc's Chipco 26019 product manager. But more importantly, the Chipco 26019 fungicide label will be expanded in 1985 to include a fifth fungus — *Corticium fuciforme*, better known as red thread.

"For lawn care people we will now address more strongly than ever, the five most serious fungi they are concerned with," Garnett says. "Those five are Helminthosporium leaf spot, Sclerotinia dollar spot, Rhizoctonia brown patch, Fusarium blight and Corticium red thread."

Without giving away any marketing secrets, Garnett predicts that Rhone-Poulenc will have "some very interest-



ing offers to make to the industry in the coming season." The new marketing "offers" will emphasize usage of Chipco 26019 for two primary reasons, first, that the product "fits in best" for lawn care operators' treatment programs, and second, that the product is one of the most environmentally safe turf chemicals.

Garnett says the pricing picture for 1985 will include some price increases, but they will be "marginal." In real terms, Garnett predicts there will actually be a price decrease. "Although there will be a slight price increase on certain brands."

**UAP Special Products.** Next year, lawn care businessmen can look forward to two new products from UAP Special Products, Inc. of Omaha, NB.



"We have a water-dispersable granular 75 percent Dacthal® formulation," says Rich Mulder, UAP's turf sales manager. "It is basically a wettable powder form of Dacthal." Mulder says the new Dacthal formulation will be packaged in 25 pound bags.

The second new product for 1985 from UAP is McAmine-D® herbicide. "It is a three-way combination of 2,4-D amine, dicamba and MCPP," Mulder says.

**Monsanto Chemical.** Monsanto Ag Product Company, St. Louis, MO, will be introducing a new non-residential plant growth regulator in 1985 called Limit®. Limit is the trade name for a Monsanto growth regulator which previously went by the experimental code name MON 4621. "We are targeting the product based on a successful test market in 1984 for use on medium to low management turf," says Dr. Dave Gerwitz, Monsanto's Limit product manager. Typical turf situations suitable for Limit include hospital grounds, parks, golf course roughs, industrial parks and cemeteries. "We think the product has got outstanding potential for use in turf that is much improved over highway (rights-of-way)," Gerwitz says.

Limit will be available for use only in the northeast quarter of the United

States and is effective only on the major cool season turfgrasses. The geographic quadrant Limit will encompass stretches in a band eastward from Minneapolis, MN in the north to St. Louis, MO in the south. "It is not effective on the warm season grasses so it would not have utility in the Gulf Coast states — areas where Bermudagrass and Zoysiagrass are the dominant species," Gerwitz says.

**SDS Biotech.** SDS Biotech of Painesville, OH will introduce a new product in 1985 called Frigate®, which will have applications in the lawn care field. The new product will first be launched under a test marketing program in as yet undetermined markets. "It is for use with EPA-registered formulations containing the herbicide glyphosate," says Gary Klein, SDS Biotech's manager of corporate communications. "You could call it an agricultural adjuvant."

Klein says Frigate will be labeled for tank-mixing with glyphosate formulations for the control of quack grass in orchards, small grain stubble following harvest and in non-crop areas. The lawn care operator will be interested in Frigate because it will have labeled applications for use with glyphosate in turf renovation.

Klein says SDS Biotech will also be

stepping up its sales efforts behind Dacthal® in 1985, in the form of more promotional activity. Lawn care businessmen can rest assured, however,




that increased sales activity will not mean increased prices. "We don't anticipate any unusual shifts in the pricing of our lawn care products for the 1985 season," Klein says.

**Conclusions.** This abbreviated sampling of new products due in 1985 from some of the chemical companies supplying the lawn care industry should be enough to convince you of the marketing importance placed upon this industry. There are literally dozens of companies whose plans were not touched upon here, but you can bet they also have new products or reformulations of old products due out in 1985 or shortly thereafter. The lawn care industry will certainly be an exciting place to work in the years to come and chemical companies will be contributing to the serviceman's prosperity and effectiveness.

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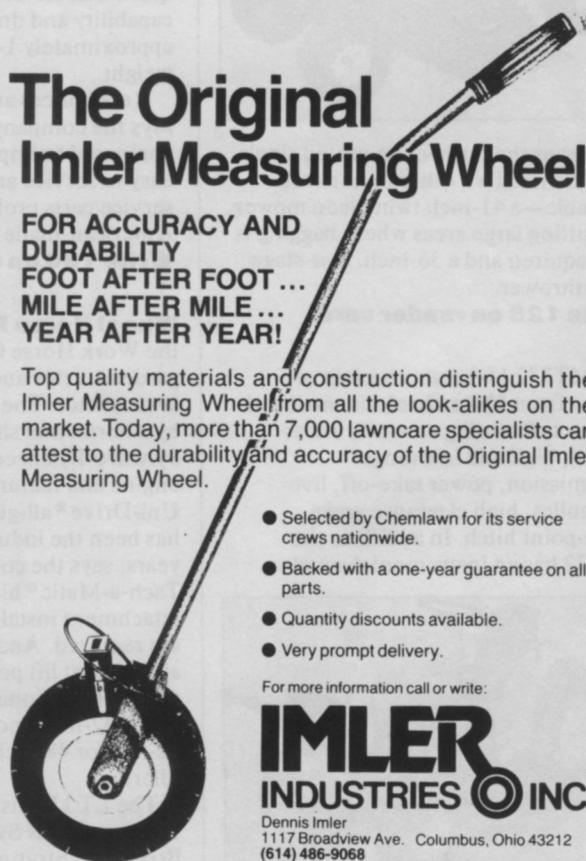
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# ALA SPECIAL MOWING EQUIPMENT PRODUCT SECTION

## Rotary Tractors

**Snapper** announces the addition of the LT 11000 lawn tractor to its line of outdoor power equipment. The LT 11000 features an 11-horsepower, horizontal shaft engine; friction disc drive for ease of operation and on-the-go shifting; 33-inch Hi Vac cutting system for bagging even in high moisture conditions; and a tilt steering wheel for ease of operation, mounting and dismounting.

Other standard equipment includes an electric clutch, a cutting height range from 1 inch to 5 inches and a dual-range transmission that provides 12 forward and two reverse speeds.

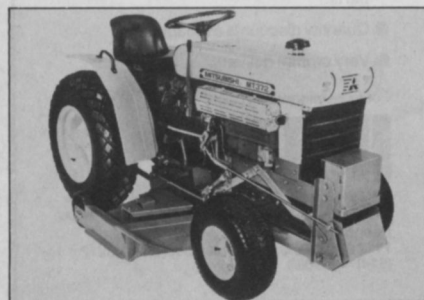
Bagging attachments for the LT 11000 include the 30-bushel Bag-N-Wagon, the new twin bag



catcher or the bumper-mounted single bag catcher. Two other options are available—a 41-inch twin blade mower for cutting large areas where bagging is not required and a 36-inch, two-stage snowthrower.

**Write 128 on reader card**

The MT372 15-horsepower diesel tractor from **Mitsubishi** is small and compact, featuring a twin-cylinder engine, high and low range transmission, power take-off, live hydraulics, high clearance and a three-point hitch. In addition, the MT372 has an instrumental panel



containing monitor lights and gauges, headlights and spring-cushioned seating. It can be used for mowing, raking, tilling, snow moving, log splitting, hauling and other property maintenance jobs.

**Write 129 on reader card**

**Speedex Tractor Company** has strengthened its line with the introduction of two new models. The



new 1041 and 1240 models offer several new features. They come with a choice of 10-horsepower Briggs and Stratton or 12-horsepower Kohler engine. Each has a ground clearance of 11.5 inches for tackling rough terrain, a new mower hitch and drive quick-disconnect with transport capability and draw bar effort approximately 1-1/2 times its own weight.

Retail prices are very competitive, says the company, even when compared to imports. The tractors are easy to service and there are never any service parts problems with this American-made product.

**Write 130 on reader card**

**Wheel Horse Products** presents the Work Horse GT 1100 8-speed garden tractor and LT 1100 3-speed lawn tractor. The GT 1100 is powered by a horizontal shaft Synchro-Balanced® Briggs and Stratton engine and features the patented Uni-Drive® all-gear transaxle, which has been the industry standard for 20 years, says the company. The Tach-a-Matic® hitch system makes attachment installation simple; no tools are required. And the manual attachment lift positions the mower and other optional attachments, such as the 42-inch snowthrower, the 42-inch or 48-inch blade and 36-inch tiller.

The LT 1100 is also powered by an 11-horsepower Synchro-Balanced Briggs and Stratton engine. It has a manual transmission with in-line shift



pattern for easy speed selection and a manual attachment lift that conveniently positions attachments. The operator can choose from five full-floating mowers that provide a smooth, even cut. In addition, the LT 1100 3-speed can be a year-round helper with the optional six-bushel rear bagger, 37-inch snowthrower or 42-inch blade attachments.

**Write 131 on reader card**

A line of water-cooled, diesel-powered lawn and garden tractors designed specifically for home owners and grounds keepers are now available from **Kubota Tractor Corporation**. According to the company, these are the first tractors of their kind to be introduced in the United States.

The new G-series includes four tractors that range in horsepower from 10 to 14. Designated the G3200, G4200, G4200H and G5200H, the new tractors come equipped with a 44-inch, mid-mount rotary mower. A shaft drive from the "live" PTO to the mower eliminates slippage, wear and inefficient power transfer problems



caused by long drive belts common in many other garden tractors, says the company.

The rigid mower deck and three

cutting blades are designed to allow better grass discharge. Blade cutting heights range from 1.4 to 3.5 inches, and are adjustable through a seven-stage gauge wheel system. To reduce the chance of accidental operator injury, the G-series has a seat safety control that automatically cuts the engine power in case the operator leaves the seat while the mower is engaged. A safety device prevents the engine from starting while the mower is engaged.

The compact diesel engine delivers fuel-efficient, low-maintenance, economical operation without a carburetor, spark plugs or distributor to wear out. The multi-cylinder design (two cylinders in the G3200, G4200 and G4200H and three cylinders in the G5200H) keeps noise and vibration at a minimum and contributes to smoother output.

Engine cooling efficiency is enhanced by a radiator fan that draws clean air from the operator's area. This keeps the operator cool and helps reduce clogging of the radiator and air cleaner.

The two top models feature hydrostatic transmission for simpler operation with less fatigue. Direction change is accomplished by using only a foot control, eliminating the need for

manual shifting. The other models have gear-type transmissions with three forward speeds and reverse.

For operator convenience and comfort, standard equipment includes electric start, an adjustable seat and built-in instrument panel indicators with glow plug light, engine oil pressure light, head light switch and an optional hour meter and temperature gauge.

**Write 132 on reader card**

## Reel Mowers

**Bunton Co.** introduces its new multi-use tractor and also announces the increased versatility of its triplex mower. The multi-use tractor, Multi-Trac, is suitable for professional grass cutting, snow clearing, brushing and forklifting. The unit changes from one mode of operation to another without the use of any tools. Both five and seven gang reel mowers are available, as well as three gang flail mowers and three gang rotary mowers. Additional attachments include side-mounted flail cutters, forklift, bucket, sweeper, dozer blade and snowblower.

The cutting height of the reels is

adjusted from inside the tractor cab and, because of the advanced hydraulics employed, weight distribution is easily transferred to and from the drive wheels to increase traction for hillside work. The Multi-Trac is powered by a 52-horsepower diesel engine and is



especially suited to facilities requiring year-round maintenance, such as golf courses, schools, parks, airports and sports complexes.

The Bunton triplex mower is gaining wide acceptance for golf course and park maintenance due to the versatility achieved through its design, according to the company. The unit features six-blade cutting reels that can be

*(continued on page 46)*

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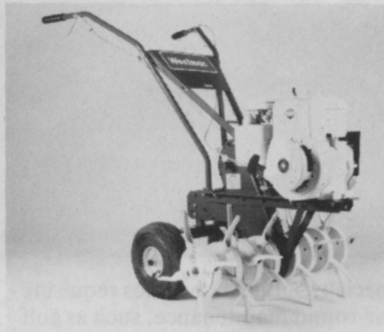
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## MOWING EQUIPMENT

(continued from page 45)

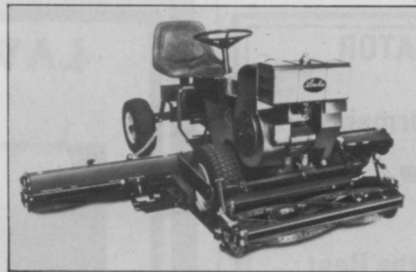
individually adjusted for cutting heights from 7/16-inch to 2 3/4-inch. The three wheels give a total cutting width of 73 inches. They are hydraulically raised and lowered for transportation, and have front and rear rollers to eliminate scalping.

The mower is constructed with heavy-duty welded steel for heavy commercial use. Speed is variable up to 10 mph with a four-cycle, 8-1/2 horsepower Robin engine. Automotive type steering wheel and choice of plastic or metal catchers are standard.

### Write 133 on reader card

According to **Locke Manufacturing Inc.**, their new Locke Professional 87-inch, riding triplex reel mower is the result of over 10 years of technical development and refinement of the riding triplex mower. It replaces the Maxi II model. The company says the Professional is best suited for large grounds where a high quality cut is required, golf course approaches and tee boxes.

The Professional is powered by a 16-horsepower, electric-start Briggs and Stratton cast iron engine and driven by an infinite ratio Eaton hydrostat via a Peerless transaxle. This delivers ground speeds of 7 mph in



transport and 4 mph while mowing. The mower provides a cut height that ranges from 3/8-inch to 2 1/4-inches, with the adjustments made via changeable gauge shoes. The unit features malleable ductile cast iron forgings, welded steel frame, forged steel cutting blades, spring-loaded reels, a 3 1/2-foot turning radius, direct belt drive with belt idler, foot peddle controls and easy-to-raise side-cutting units.

### Write 134 on reader card

## Walk-Behind Rotary Mowers

Three new out-front mowers have been added to the **Gravely International** line of grounds maintenance equipment. Dubbed the Time Cutters by their manufacturer for



their durability, efficiency and ease-of-operation, the new Pro Series includes the Pro Master-50, the Pro-40 and the Pro-50.

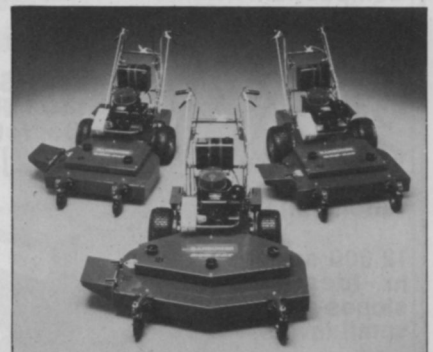
The Pro Master-50 is engineered to transfer weight to the drive wheels for better torque and stability, and to perform like a conventional tractor on slopes. This model combines a zero degree turning radius, individual wheel brakes and instant forward/reverse to provide easy maneuverability.

The Pro-40's transmission engineering, with five forward speeds and reverse, operates with single lever, on-the-go shifting and instant reverse, providing a ground speed for every operating condition. The unit's mowing deck is a one-piece, stamped design that delivers smooth, unobstructed flow of grass clippings, and the low height of the mower permits cutting under guardrails, shrubs and fences. The Pro-40 will not free-wheel when going downhill. Each drive wheel is controlled by a clutch and brake which provides effective sidehill control. It is equipped with a Briggs and Stratton 11-horsepower Industrial/Commercial engine. Options include an 11-horsepower Honda GV400 engine, two grass catcher models, a wire basket and an all-metal dump style.

In addition to the Pro-40's versatility and maneuverability, the Pro-50 includes standard deluxe features, such as electric key ignition for operator convenience and a 16-horsepower, twin-cylinder, Briggs and Stratton Industrial/Commercial engine with fuel pump to provide the power for the larger cut. A riding sulky is also an available option.

### Write 135 on reader card

**Ransomes** crew of self-propelled rotary mowers offers three different cutting widths to meet specific job



(continued on page 50)

# Parker's full line keeps the grounds up and the costs down.

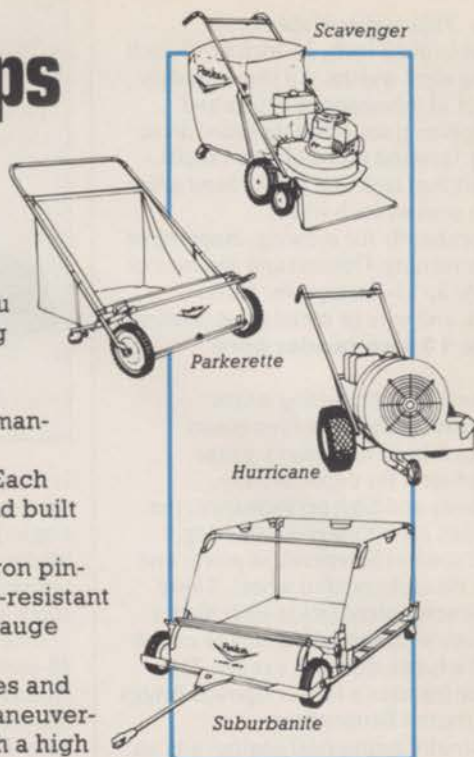
To get ahead in the grounds maintenance business, you need equipment that can perform well under punishing conditions . . . and survive. In other words, you need Parker quality.

Parker's full line of grounds care products includes manually operated, trailing and powered lawn sweepers, thatchers, leaf blowers, and indoor/outdoor vacuums. Each one is a superior performer, designed for efficiency and built tough to keep repair costs down.

Parker sweepers feature cast iron wheels, sintered iron pinions, long-life polypropylene brushes, tear and mildew-resistant baskets, rust-resistant plated steel tubing, and heavy gauge steel hoods with baked-on enamel finish.

The heavy-duty VAC-35 features large pneumatic tires and plated, plow-type handles for ease of operation and maneuverability. The rugged HURRICANE Blower generates both a high velocity and large volume air blast. The versatile Scavenger vacuum quickly converts to a powerful blower for windrowing leaves and other debris.

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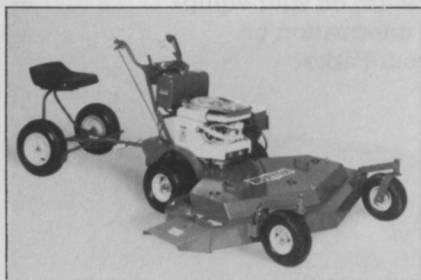
## MOWING EQUIPMENT

(continued from page 46)

needs. This mid-size mower is available in 32-inch, 36-inch or 48-inch cutting deck widths. All three models feature 11-horsepower Briggs and Stratton engines, variable speed drive pulley (ground speed of 2 to 4 mph), 8-quart fuel tank and power hand grips which control each wheel independently for mowing, stopping or power turning. Options and accessories include an 11-horsepower Honda engine and wire or metal grass catchers.

**Write 136 on reader card**

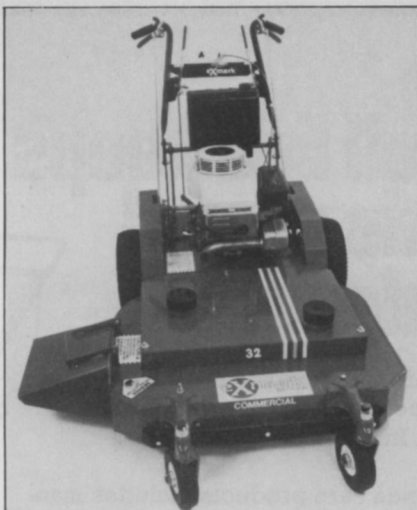
The new 61-inch cutting width **Bunton Co.** walk-behind rotary mower is built with heavy-gauge, welded steel for dependability, durability and high performance, the company says. Finger-tip steering levers control independent power and brake on each traction wheel. Three non-synchronized sickle steel blades combine with special baffling to mulch and discharge clippings evenly. The mower features a 16-horsepower Briggs and Stratton Battery Start Industrial/Commercial engine, and an optional rider attachment provides productivity equal to tractor mounted mowers.



Bunton also announces the availability of the 11-horsepower Honda 4-cycle commercial engine which can be purchased with its lawn and turf-type mowers with cutting widths of 36-inches, 40-inches, 48-inches and 52-inches. The Honda engine features a cast iron cylinder sleeve, synchro-balancer, crankshaft supported by ball-bearing on P.T.O. and flywheel side, recoil starter, replaceable valve guides, mechanical governor, trochoid oil pump, dual element air cleaner and automatic decompression easy-start system.

**Write 137 on reader card**

**Exmark Manufacturing Company** has added a new member to its Ranger family of commercial lawn and garden mowers. The 32-inch walk-behind Ranger power mower, which is like the 48-inch and 36-inch models, has an 11-horsepower Briggs and Stratton engine with an optional 11-horsepower Honda engine. The unit



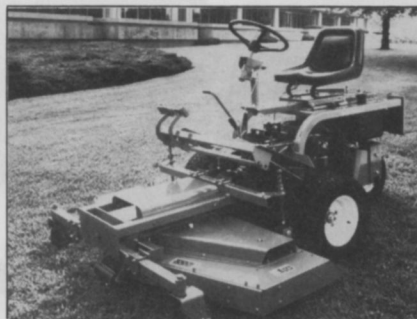
is designed with two-ply, semi-pneumatic, as well as single-piece, high-quality, lift-type blades which are manufactured with tempered steel. An optional riding sulky is also available.

Like the 32-inch walk-behind, the 48-inch mower also offers an optional Honda engine. Heavy-duty in built, this unit has a wide-sweeping cutting base. Finger tip controls make the 48-inch Ranger easy to operate. It also has protective front deflectors which insure operator safety.

**Write 138 on reader card**

## Front-Mounted Rotary Mowers

The Pro Master-60 by **Gravely International** features maximum maneuverability, easy operation, low maintenance and longevity. It is designed for operating efficiently and saving time on the really big jobs. The Pro Master-60 is equipped with a



60-inch mower and a 17- or 19-horsepower Kohler engine.

This out-front mower offers a hinged frame that transfers weight to the drive wheels for stability on hills and allows the mower to follow ground contours and ride over obstructions.

Additional features include all-gear

(continued on page 52)

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## MOWING EQUIPMENT

(continued from page 50)

direct drive, instant forward and reverse, individual wheel brakes, non-slip shaft and gear-driven mower, safety interlock system, maintenance-free battery and a big 5.1 gallon gas tank.

**Write 139 on reader card**

**Magic Circle Corporation** has pioneered a new zero turning radius mower with cool running power. Dixie Chopper mows grass and cuts it clean at



6.5 mph with the 50-inch floating mower deck that adjusts with a foot activated lever from 1-inch to 6-inch cutting height. The mower ground speed is 0 mph to 8 mph.

The Dixie Chopper has an engine oil cooler, oil filter, temperature gauge, circulating pump and a new low restriction muffler which reduces engine temperature up to 120 degrees, thus extending engine life.

**Write 140 on reader card**

## Push Mowers

A new lawnmower from **Aircap Industries** reduces the weight of a conventional lawnmower by up to one-third, making it easier to maneuver on small lawns, according to the company. Part of the decrease in the unit's weight is made possible by



mounting the engine on the first all-plastic mower deck with a rotary steel blade.

The deck is resistant to damage from gasoline spills and ultraviolet rays from the sun. It is also rust-free.

**Write 141 on reader card**

**Toyotomi America Inc.** introduces its new Toyoset electric reel lawn mower, a unit especially designed to provide precision cutting of finer, short-blade turf grasses including Tif



Bermuda. The appliance has reel blades cutting cleanly at 2,000 RPMs, and adjusts to four cutting heights from 3/8 inch to 1 inch.

Designated CGS-300A, the unit uses standard 120 volt power. It's only 16-inches wide and weighs 19 pounds.

**Write 142 on reader card**

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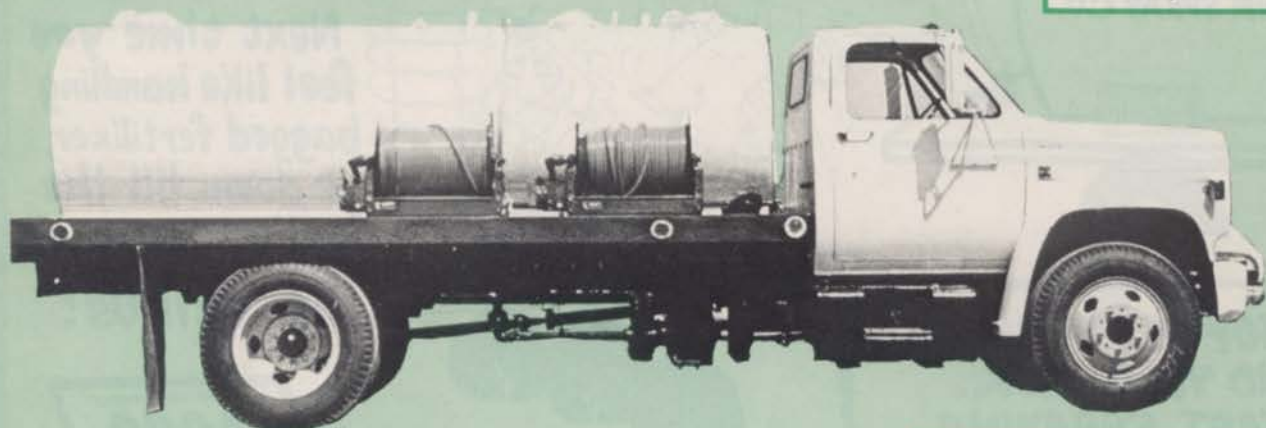
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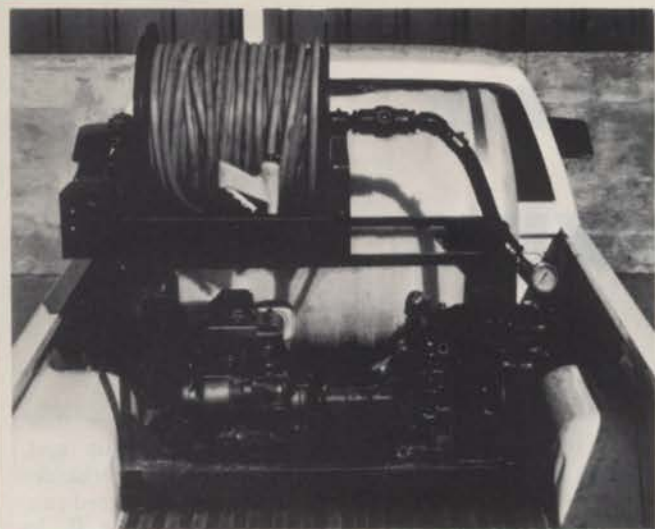
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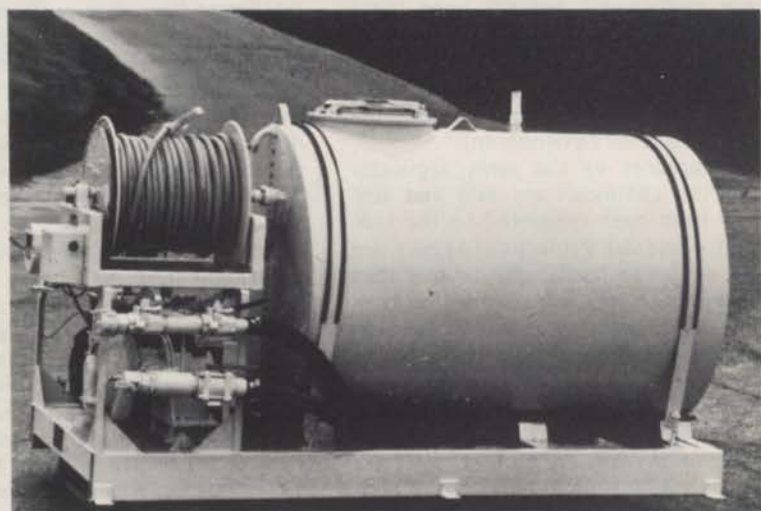


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# THE LAWN CARE HERBICIDES AND HOW THEY WORK: 2,4-D AND THE AUXINS

BY RICHARD J. HULL

**F**ew aspects of the lawn care profession have created more public concern or generated more controversy than the use of herbicides, insecticides and fungicides on home lawns. While the lawn care professional depends upon these tools to provide the quality of service expected, the client on the other hand is understandably concerned over the use of what are seen as toxic substances in the domestic environment.

Assurances by the spray applicator that the chemicals are safe and that they have been registered by the U.S. Environmental Protection Agency for use on home lawns may be less than totally reassuring, considering the level of confidence many people have in federal agencies. If, in response to questions, the applicator can explain how the chemicals do their job of killing weeds and insects, the client is more likely to be reassured that the applicator is indeed a professional and understands the materials being used. Many concerns can be allayed if the applicator appears knowledgeable, has answers to

the client's questions, and takes the time to explain why pesticides are being used.

This is the first in a series of articles which will attempt to explain how the most commonly-used lawn herbicides selectively control weeds. While a comprehensive understanding of this subject would require an extensive background in biochemistry and plant physiology, a general appreciation of herbicide action can be acquired by the intelligent lawn care professional. Certainly the lawn applicator can be expected to understand herbicide action in terms more than sufficient to answer the questions of most clients. This understanding will also help insure against ill-advised herbicide usage or the selection of the wrong chemical for a specific weed control job.

Because of its widespread use in lawn management, I shall begin this series with the auxin herbicide 2,4-D and related compounds. During the past decade, some of these herbicides have received much public attention because of a highly toxic dioxin contaminant found in commercial formulations of the 2,4,5-T series of auxin herbicides. This situation was very ably reviewed by Stephen Brown (*ALA*, July/August, 1981) and more recently by Bruce Branham (*ALA*, January/February, 1984),

so that aspect of the 2,4-D story will receive no further attention here.

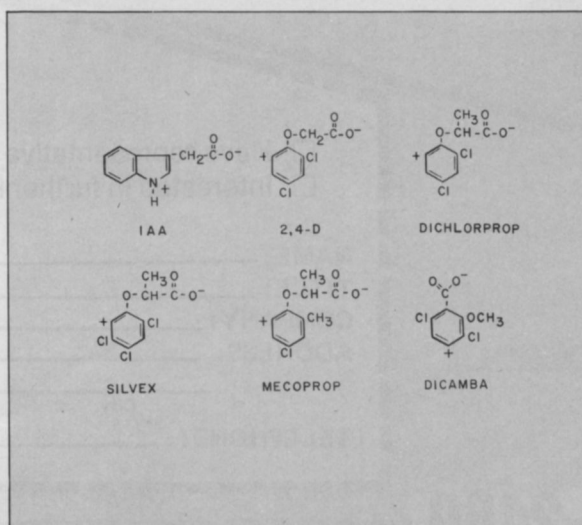
**Background.** 2,4-D, which is short for 2,4-dichlorophenoxy acetic acid, was one of the first organic herbicides and was introduced for lawn weed control shortly after World War II. Its highly selective action in controlling broadleaf weeds in grass crops at application rates of one or two pounds per acre made the concept of selective chemical weed control a practical reality. Even today, 2,4-D in combination with other related compounds is the mainstay of broadleaf weed control in lawn turf management. The most common herbicides of the auxin type used for lawn care are depicted in Figure 1.

Two basic types are used on lawns: the phenoxy acids (2,4-D, mecoprop, dichlorprop) and the benzoic acids (dicamba). Silvex is a phenoxy acid type but is no longer registered for use on turf because of the dioxin problem. These herbicides are regarded as auxins because they cause the same response in plants as the natural hormone auxin IAA (Indoleacetic acid). While the structural similarity between IAA and the various auxin herbicides may not be obvious, all have at least three features in common. They all have a flat ring with alternate double bonds, the ring contains groups substituted for hydrogen (Cl, CH<sub>3</sub>, OCH<sub>3</sub>) which produces an electropositive center (Figure 1), and finally, they all have a negative charge caused by a free carboxyl group (-COO<sup>-</sup>) which is 5.5 angstroms from the positive site.

These minimum structural features of auxins were first identified by Professor Kenneth Thiman (1977), one of the pioneer researchers on auxin function. Presumably, these structural similarities allow all chemicals which exhibit auxin properties to bind in a predetermined way to specific cellular proteins. The important point here is that all these herbicides function within the plant much as does the natural auxin IAA.

All this does little to explain the mechanism by which synthetic auxins act as herbicides. To understand that,

At right, Figure 1. Chemical structure of the natural auxin IAA and several auxin herbicides. Similarities in charge distribution are shown.



you must first have an appreciation of how plant growth is controlled. Just as in animals, the form and timing of growth in plants is regulated by the action of hormones. These hormones are synthesized in one part of a plant and are translocated to other parts where they promote specific growth responses.

For example, IAA is synthesized in the growing tips of shoots and in leaves and moves downward in the stem where it promotes elongation of young shoots and inhibits the growth of lateral buds. Another group of hormones, the cytokinins, are synthesized in the roots and are transported to the shoots where they stimulate bud growth and delay leaf senescence. Other hormones promote seed germination, induce flowering, cause leaves to yellow and initiate root formation.

All these hormones operate together and a normal sequence of plant growth occurs when the hormones are in proper balance with each other. This balance is critical because, if it is disturbed for any period of time, growth becomes uncoordinated and the plant will not develop normally. The proper balance of plant hormones is achieved through the control of hormone synthesis and degradation. In most plant tissues, hormone degradation is the principal regulatory mechanism because synthesis usually occurs elsewhere in the plant. Thus, in any plant organ, growth and function are controlled by a number of hormones arriving from different parts of the plant and maintained in the proper mixture through the control over their rate of breakdown.

Hormone degradation is caused by organic catalysts (enzymes) which are produced in each plant organ in response to environmental signals or the metabolic status of the organ. In short, growth regulation in plants is complex and depends upon the mixture of hormones maintained within each organ by balancing their rate of arrival with their rate of degradation.

Given this carefully tuned growth control process, what will happen if a growth regulating chemical is introduced which cannot be degraded by the plant organ? This is exactly what occurs when an auxin herbicide is sprayed onto a plant. The herbicide auxin enters the plant, moves to organs where auxin-controlled processes can occur, and turns on all the auxin-stimulated reactions. The plant may compensate for this auxin shock by altering the concentration of other balancing hormones but, because the plant cannot degrade the synthetic auxin like it can IAA, a serious hormonal unbalance almost always occurs.

Consequently, growth becomes uncoordinated, stems swell and twist,

leaves become misshapen, tumor-like structures appear and roots are initiated on stems. These symptoms of auxin unbalance soon become obvious after a plant has been sprayed with an auxin herbicide (Figure 2). Death eventually occurs from a number of causes, but a disrupted vascular system or energy exhaustion are two common reasons. A more detailed account of plant growth responses to auxin herbicides has been presented by Kefford (1976).

**Selective toxicity.** Understanding how auxin herbicides kill plants does little to explain how these chemicals can be used on lawn grasses to control broadleaf weeds without also killing the grass. This selective toxicity gives auxin herbicides their real value to the turf manager. In his review of the mechanisms of herbicidal action, Carl Fedtke (1982) concluded that the selectivity of auxin herbicides may arise from three different processes: variation in the rate of metabolic inactivation, variation in rates of uptake and transport and differences in the physiology between sensitive and

tration by herbicides have been reported, the selectivity of auxin herbicides used for weed control on lawns is more related to leaf angle and the amount of solution contact than to absorption rate per se.

Translocation is also a contributing factor to the selectivity of auxin herbicides, it might indeed be the most important factor. Unlike broadleaf dicotyledonous weeds, the leaves of lawn grasses have two regions of intense metabolic activity through which a herbicide must pass as it is translocated from the leaf to other parts of the plant. These regions of metabolic activity are the two intercalary meristems at the collar and base of each leaf. These are sites of cell division which contribute to the growth of the leaf blade and sheath, respectively.

Bernard Forde (1965) observed that the phloem, that specialized tissue through which herbicides move en route from the leaf, often narrows to a single conducting cell in each vascular bundle at the intercalary meristems. This constriction at these sites of rapid



**Figure 2a. Auxin injury to broadleaf weeds. Dandelion sprayed with Trimec, a mixture of 2,4-D, mecoprop and dicamba.**

resistant plants. In the case of differential auxin toxicity between lawn grasses and broadleaf weeds, all three of these factors probably are involved.

Grass leaves have an upright growth pattern and tend to retain less herbicide spray solution than broadleaf weeds which have a more horizontal leaf display. Because less herbicide is captured and retained on the grass leaf surfaces, the herbicide has less opportunity to penetrate the leaf and translocate to sites of toxic action. While species differences in the rate of leaf pene-

cell division and growth, subjects the translocating herbicide to a greater opportunity to be altered chemically (metabolized) than is the case in a broadleaf plant which has no leaf meristems. Although this has not been investigated extensively, several studies have reported that auxin herbicides are translocated more slowly from grass leaves than from leaves of dicotyledonous plants (Ashton and Crafts, 1981). There is also considerable evidence that auxin herbicides form

*(continued on page 58)*

At right, Figure 2B. Wild mustard sprayed with 2,4-D.

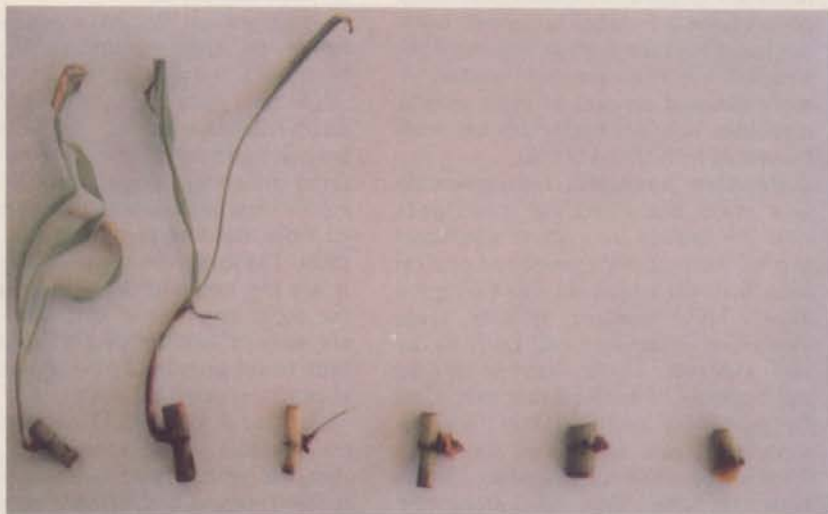


Figure 3. Top: 2,4-d toxicity range; inhibits bud at 10  $\mu$ M (2.2 ppm). Above: Dicamba toxicity range; inhibits bud at 10  $\mu$ M. Right: Flask culture of single-bud rhizome segments to which herbicides are added.



when they were introduced through cut stems.

Johnsongrass would have exhibited little injury if these herbicides had been applied as a foliar spray. Also, 2,4-D resistant crops such as corn or cereal grains can be injured by a foliar spray of

chemical complexes (are detoxified) more rapidly in grass plants (Hatzios and Penner, 1982). Thus, the anatomy and growth characteristics of the grass leaf contribute in a major way to the tolerance of lawn grasses to auxin herbicides.

Fedtke (1982) concludes that the main reason for differences in plant resistance to auxin herbicides resides in specific variations in the physiology of plants. He points to differential responses in the stimulation of nucleic acid (RNA) synthesis caused by auxin herbicides as an example of such physiological differences. While all growth-regulating chemicals probably involve changes in nucleic acid metabolism and

some plants may respond more dramatically than others, I believe most plants which exhibit resistance to auxin herbicides do so because they possess protective morphological or metabolic properties.

This was demonstrated in a study of the comparative toxicity of Johnsongrass to several herbicides. In order to reduce effects of leaf penetration, translocation and metabolism in leaf tissue, rhizome (stem) pieces were inserted directly into a medium containing several concentrations of the herbicides being studied. As illustrated in Figure 3, Johnsongrass was seriously inhibited by very low concentrations of the auxin herbicides 2,4-D and dicamba



the herbicide if it is applied during a susceptible growth stage. Thus, the basic physiology of a plant seems less responsible for herbicide resistance than does the defense offered by structural or metabolic features.

**Important concept.** This is an important concept for the lawn applicator to understand. The 2,4-D-type herbicides, while generally regarded as nontoxic to turfgrasses, can cause severe injury if applied under unsuitable conditions. Seedling turf is often injured when sprayed with auxin herbicides (Jagschitz, 1981). Young grass plants do not have mature leaves which can rapidly metabolize the herbicide, so the relatively unprotected growing point receives excess auxin and is killed. Cool season lawn grasses growing under excess heat or drought can also be injured by auxin herbicides.

In this case, leaf growth has been slowed by environmental stress and the metabolic activity at the intercalary meristems is reduced, allowing more herbicide to translocate from the leaves to the sensitive growing points. In using auxin herbicides on lawn turf, it is good to remember that while lawn grasses can resist the toxic action of these materials, they do not have inherent immunity to them. Turfgrasses are most resistant to auxin herbicides when they are growing rapidly under favorable conditions. Spring and fall are the safest times to apply these herbicides.

The metabolic inactivation of auxin

herbicides not only helps protect lawn grasses, it also grants resistance to some broadleaf weeds. This process of metabolic alteration is not simple. Figure 4 summarizes the basic metabolic paths of 2,4-D in plants. Even this is greatly simplified and only includes those reactions known to contribute toward herbicide selectivity (Hatzios and Penner, 1982). Reaction 3 is the most common reaction of 2,4-D in grasses. It forms a simple glucose ester of 2,4-D using the readily available glucose carrier UDP-glucose. This sort of reaction is especially likely in tissues undergoing cell division and cell wall synthesis, e.g. intercalary meristems of grass leaves.

The hydroxylation of the 2,4-D ring followed by the formation of a glucoside (Reaction 1) is a true detoxification reaction because it alters the basic structure of the 2,4-D molecule. It is a more complex reaction and consequently does not occur as rapidly as ester formation. It occurs in most plants, but seems to be the principle detoxification mechanism in dicotyledonous plants. These reactions contribute to the moderate tolerance of bean and cucumber to 2,4-D, but because the process is more complex, it is easily saturated by rapid 2,4-D uptake and plant injury often results.

The conjugation of 2,4-D with amino acids (Reaction 2) also contributes to herbicide resistance in many broadleaf plants. This reaction is also complex, more so than shown in Figure 4, and the 2,4-D-glutamate produced is toxic, but does not move out of the leaves where it is formed. Under the proper conditions, these amino acid conjugates of 2,4-D can be hydrolyzed, liberating free 2,4-D which can then translocate and cause injury. This mechanism of herbicide detoxification, or more correctly immobilization, is only partly effective as a defense against auxin

injury, in that it is a complex reaction, probably does not occur rapidly and does not chemically degrade the toxic substance.

In general, the presence of meristematic regions in grass leaves, positioned in the path of translocation of foliar-applied auxin herbicides, insures a rapid rate of glucose ester formation and effective herbicide detoxification. Broadleaf plants depend upon slower, more complex detoxification reactions and do not have leaves as well designed for spray avoidance or for inhibiting herbicide transport to growing points. Thus, grasses are better able to tolerate auxin herbicides while dicotyledonous plants will be injured, depending on how well their protective metabolic reactions are operating.

The metabolic paths outlined for 2,4-D also operate on the other phenoxy herbicides mecoprop, dichlorprop and silvex, but sometimes not as efficiently. This results in better control of some weeds with mecoprop or silvex than with 2,4-D. Table 1 summarizes the effectiveness of three auxin herbicides on several common lawn weeds. Dicamba is effective against several weeds which are resistant to the phenoxy auxins, e.g. red sorrel and knotweed. Dicamba is metabolized less readily than most phenoxy herbicides. It is detoxified by ring hydroxylation at several positions followed by the formation of a glucose complex. This occurs in both grasses and broadleaf plants, but much more slowly in the latter.

**Conclusions.** A few general rules can be made governing the use of auxin herbicides for lawn weed control. Those perennial weeds with buds near the crown and close to the site of herbicide application, are normally controlled by 2,4-D. Extensive translocation is not required and 2,4-D is not metabolized rapidly enough to prevent

(continued on page 60)

Weed	Herbicide		
	2,4-D	mecoprop	dicamba
	†		
Black medic	G	G	G
Buttercup, creeping	G	G	G
Chickweed, common	G	E	E
Chickweed, mouseear	F	G	E
Cinquefoil, Canada	VG	—	E
Clover, white	P	VG	E
Dandelion	E	F	F
Knotweed	F	F	E
Plantains	E	F	F
Sorrel, red	P	P	VG
Violet	F	—	F
Woodsorrel, yellow	F	P	F

\*Based on USDA Home and Garden Bulletin No 239, 1984.  
 †Symbols: E = excellent, VG = very good, G = good, F = fair, P = poor

Table 1. Comparative effectiveness of three auxin herbicides for the control of broadleaf lawn weeds.\*

## LAWN CARE HERBICIDES

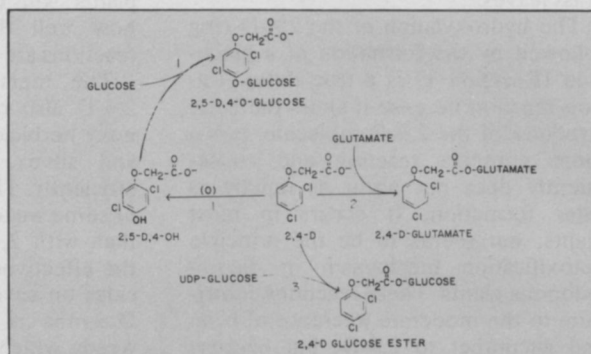
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movement to the emerging buds, e.g. dandelion, the plantains. Those broad-leaf weeds with stolons which grow along the soil surface (chickweeds, knotweed, white clover) or with underground rhizomes (cinquefoil, red sorrel), which have growing points some distance from the leaves which receive the herbicide, are less likely to be controlled by 2,4-D, but may be susceptible to the more mobile mecoprop or dicamba. Differences in rates of herbicide metabolism probably explain the failure of dicamba to control dandelion

and the plantains.

Because lawn weed problems rarely consist of only one plant species, it is generally recommended to use mixtures of auxin herbicides in order to broaden the spectrum of weeds controlled. Combining 2,4-D with a more mobile herbicide, e.g. dicamba or mecoprop will provide general broad-leaf weed control. The more mobile herbicides, because they are degraded less rapidly, may also be more persistent in the soil. This is especially true of dicamba which can wash into the soil and be absorbed by trees and shrubs where it may cause injury (Partyka, 1981). For this reason, auxin herbicide

**Figure 4. Paths of metabolic detoxification of 2,4-D.**



mixtures must be formulated to meet the weed and landscape requirements of each client. Understanding the nature of these herbicides and how their selective action is achieved should help avoid misuse and costly damage claims.

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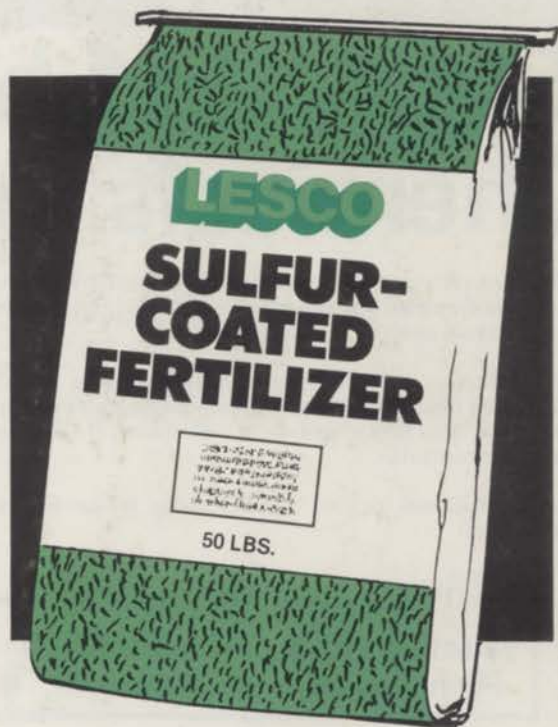
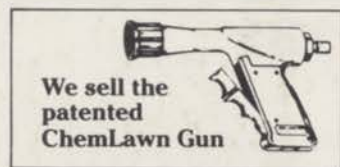
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