

would have required several days. Instant Drainage was suggested and adopted.

Installation was started at 10 a.m. and just three and a half hours later the green was back in play. It has not been out of play since then due to excess water.

The initial root structure was measured at two and a half inches, and just three months later had deepened to four and three quarter inches. We have subsequently and successfully drained fairways and other problem areas on their course.

We have designed various attachments for our vibratory plows to enable the installation of the one inch pipe with a minimum of lawn damage and without digging. By using this size of pipe, we avoid mounding and install it to whatever depth is dictated by the desired root structure, usually just where the topsoil joins the clay or other subsurface material.

Not only does this drain off the

excess surface, water, instantly, but it also aids in the aerification of the soil, and it retards the compaction of the surface in heavily traveled wet areas. In addition, although the pipe has a positive siphonic action, it still retains enough subsurface moisture for root consumption as needed, thus making for a deeper and heavier root structure and healthier plants.

The twenty foot long sections of pipe are permanently bonded together to form whatever continuous lengths are required. We can pull a thousand feet of continuous length in compatible soil, and have installed 5,000 feet of pipe in a day using one machine and an operator.

Over a given area, we will install a greater quantity of Instant Drainage than is normal with four inch pipe, and this permits a greater percolation of water through the soil. Wet areas in which we have compacted tunnels only, without the installation of pipe, have retained

their inch and a half of compacted tunneling for several years.

Examination of 5-year-old installations of Instant Drainage reveals that the pipe is still clean, free of debris, and functioning well. Installation in sandy soil assures that soluble salts in the air can be washed away from the root structure of the grass and/or plants and thereby provide stronger growth.

We recently installed 20,000 feet of Instant Drainage at Cleveland Stadium, which has four season use as the home of a football and a baseball team. The field of this stadium is reportedly fifteen feet below grade and would remain very wet for several days after a downpour. Before the installation was completed, we were visited by a wet weekend during which almost 5 inches of rain fell throughout the area by Sunday evening. At 9 a.m. Monday morning, the field was wet, but by 1:30 p.m. that same afternoon, the field was dry. □

Installation in progress at Cleveland Stadium.



GCSAA SHOW PREVIEW

a week in Portland

The Pacific Northwest is the site for the 48th International Turfgrass Conference and Show, sponsored by the Golf Course Superintendents Association of America, Feb. 6-11 in Portland, Ore.

Over 5000 GCSAA members, exhibitors and speakers and representatives from allied associations, government, industry and education are expected to attend the Conference and Show in Portland's Memorial Coliseum.

This year more than 150 manufacturers and distributors attending the show will be allowed to take orders for their products as a result of the tax reform bill signed by the President. Prior to the signing exhibitors had been limited to displaying their products: order taking and floor sales were prohibited because of GCSAA's non-profit status.

Exhibits of turfgrass equipment and supplies will occupy 100,800 square feet of floor space at the Coliseum. Monday, Feb. 7, will be Distributor's Day. From noon until 5 p.m., manufacturers can show their exhibits to their dealers before the show opens to the public.

The exhibit hall will be open Tuesday and Wednesday, Feb. 8 and 9, from 9 a.m. to 5 p.m. and Thursday, Feb. 10, from 9 a.m. to 4 p.m. Tuesday, the opening day, traditionally has been reserved for superintendents only to view the show.

The continuous educational seminars with the trade exhibits are designed to familiarize superintendents with new methods, products and equipment that can contribute to improved and more efficient golf course maintenance practices. □

1977 PORTLAND EXHIBITORS

Advanced Drainage Systems, Inc.
Advanced Engine Products
Alpine Mfg.
American Pelletizing Corp.
American Society of Golf Course Architects
Ametek, Inc. — Plymouth Products Div.
Applied Biochemist, Inc.
Aquatrols Corp. of America
Atwater Strong Division
Batrow Inc.
Bogue Electric Mfg. Co.
Briggs & Stratton Corp.
The Broyhill Co.
Bunton Co.
E. F. Burlingham & Sons
Causco, Inc.
Central Texas GCSA
Certified Laboratories, Inc.
The Champion Co.
Ciba-Geigy Corp.
W. A. Cleary Chemical Corp.
Coursigns, Inc.
Dedoes Industries, Inc.
Diamond Shamrock Corp.
Dotech, Inc.
Dow Chemical U.S.A.
DuPont Co.
Eagle-Picher Industries
Eagle-Picher Industries
Elanco Products Co.
Jack Erhardt & Associates
Excel Industries, Inc.
E-Z-Go Car Textron, Inc.
FMC Corp.
Foley Manufacturing Co.
Ford Motor Co.
Fore-Par, Inc.
Gandy Co.
GCSAA Membership & Scholarship & Research
Giant-Vac Mfg. Inc.
Glenmac, Inc.
Golf Business
Golf Course Builders of America
Great Lakes Biochemical Co., Inc.
Griswold Controls
Grounds Maintenance
Hahn, Inc. — Turf Ag Div.
Hancor, Inc.
AMF/Harley-Davidson Motor Co., Inc.
Heckendorn Mfg. Co., Inc.
Hercules, Incorporated
HMC
Howard Commercial Turf Equip., Inc.
Howard Rotavator Co., Inc.
H. D. Hudson Manufacturing Co.
ICI United States, Inc.
International Harvester
International Seeds, Inc.
International Spike, Inc.
Jacobsen Mfg. Co.
Johns-Manville
Kay-Fries Chemicals, Inc.
Kohler Co.
Lakeshore Equipment & Supply Co.
Lawnmower Parts Mfg. Co., Inc.
Lebanon Chemical Corp. (Agrico)
Lely Pacific, Inc.
LEWISystems, Menasha Corp.
Lindig Manufacturing Corp.
Linn-Benton Community College
Little Giant Industries, Inc.
Locke Manufacturing Co. Div. Stellar Inds., Inc.
Lofts Pedigreed Seed, Inc.
Mallinckrodt, Inc.
Manhattan Ryegrass Association
Milorganite Div. Milwaukee Sewerage Commission
Monsanto Agricultural Products Co.
Montco Products Corp.
Moody Sprinkler Co., Inc.
Moridge Mfg., Inc.
Mott Corp.
The F. E. Myers Co.
National Chemsearch
National Golf Foundation
National Mower Co.
L. R. Nelson Corp.
Northrup King & Co.
Nursery Specialty Products
Occidental Chemical Co. (Best Prods. Div.)
Oil Capital Valve Co.
Oil-Dri Corp. of America
Olathe Mfg., Inc.
Onan, Division of Onan Corp.
Onex Industries, Ltd.
Oregon Fine Fescue Commission
Oregon GCSA
Oregon Ryegrass — Highland Bentgrass
Par Aide Products Co.
Pargo, Inc.
Pen-Gro Sales Corp.
Plant Marvel Distr. Co., Inc.
Portland Community College
Pumping Systems, Inc.
R & R Products, Inc.
Rain Bird
Rain-O-Mat Sprinklers, Inc.
Rhodia, Inc. Agricultural Div.
Richway Products, Inc.
Roseman Mower Corp.
Royal Coach Sprinklers, Inc.
Royer Foundry and Machine Co.
Ryan Turf Equipment & Cushman (OMC-Lincoln)
Safe-T-Lawn, Inc.
O M Scott & Sons Co.
Sioux Steam Cleaner Corp.
Smithco, Inc.
The Snow Co.
Southern Golf/Turf-Grass Times
Standard Golf Co.
Stauffer Chemical Co.
Sto-Cote Products, Inc.
Swift Agricultural Chemicals Corp.
Taylor-Dunn Mfg. Co.
Tee-2-Green Corp.
Teledyne Wisconsin Motor
Texas Refinery Corp.
The Golf Superintendent
Thompson Manufacturing Co.
The Toro Co. — Turf Products
The Toro Co. — Irrigation Div.
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Turf Vac Corp.
Universal Sign Systems, Inc.
U.S. Golf Association Green Section
USS Agri-Chemicals
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Velsicol Chemical Corp.
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Weeds Trees & Turf
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Yankee Engineering Co.
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Lescosan puts the pinch on crabgrass



"I've been using Lescosan 4E (Betasan*) for pre-emergence crabgrass control quite successfully. Prior to using Lescosan 4E, I was using a wettable powder and making 2 applications with only moderate success. Lescosan 4E has considerably more longevity for controlling late germination."

A handwritten signature in cursive script that reads "James L. Seigfreid".

James L. Seigfreid
Golf Course Superintendent
Losantiville Country Club
Cincinnati, Ohio

Try Lescosan 4E on your golf course or turf area for control of crabgrass and/or *Poa annua*. Lescosan is very effective on all grasses and many ornamentals and ground covers. It is available in a granular form, too.

You'll not only be surprised with the results, but you will be surprised at how economical Lescosan is. Of course, you'll find all LESCO products to be competitively priced.

If there is not a LESCO representative in your area as yet, write or call us collect at (216) 323-7544.

*(Betasan—registered TM of Stauffer Chemical Company).

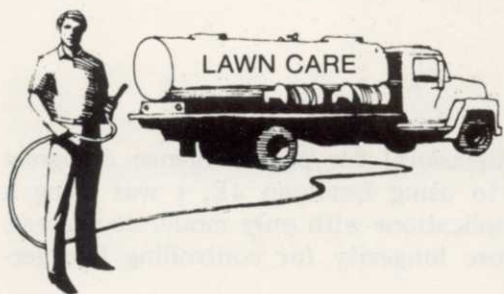


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Div. Lakeshore Equipment & Supply Co.
300 S. Abbe Road
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A Family of Fine Products:

Lescosan 12.5G — Lescorene — Lesco 4 — Lescobor — Lescopar — Lescopex — Lesco Non-Selective Herbicide
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TURF

Unrivaled control of

Kills these weeds, and others:

Common Chickweed
 Mouse-Ear Chickweed
 Lambsquarter
 Milford (Yarrow)
 Morning Glory
 Shepherdspurse
 Spotted Spurge
 Carpet Weed
 Sheep Sorrel
 Black Medic
 Wild Lettuce
 Bedstraw
 Bindweed
 Clover
 Dandelion
 Dichondra
 Ground Ivy

Heal-All
 Henbit
 Knotweed
 Mustard
 Peppergrass
 Pigweed
 Plantain
 Purslane
 Ragweed
 Smartweed
 Sunflower
 Thistle
 Wild Garlic
 Yarrow
 Curled Dock
 Wild Onion



Special Bentgrass formula also available
 TRIMEC is a registered trademark of PBI-GORDON Corporation, U.S. Patent No. 3,284,186

Learn why Trimec efficiency gives you unparalleled economy:

TRIMEC today is the standard in weed control, offering unprecedented benefits.

Perhaps you know about its efficiency. What you may not appreciate is its economy. Actually, they're twin benefits — both remarkable, both from a common source. Here's the story:

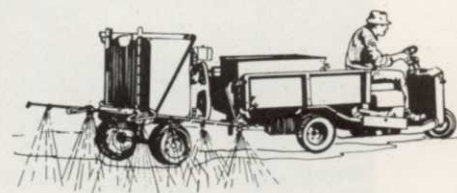
Synergism is the word frequently used to describe a truism — that certain chemicals combined in certain ways create a multiplying effect greater than the sum of their parts. Synergism is basic to Trimec's renowned success.

Trimec's active ingredients — 2, 4-D, MCPP and Dicamba — are synergistic. Precisely formulated, Trimec has tremendous power and high efficiency. It delivers great wallop with less chemicals. It's hard working. And that's the basis for yet another advantage —

Trimec Economy

Comparisons show that Trimec costs less per acre for weed-free turf than any other herbicide. You use fewer gallons . . . you seldom need retreatment . . . your total cost is less . . . period.

Such economy/efficiency alone is reason enough to make Trimec your herbicide. And we haven't mentioned the third great advantage —



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 • Tieco, Inc.
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 • Occidental Chemical Co.
 • Target Chemical Co.
 Tucson
 • Capitol Nursery Supply
 • Copper State Chemical Company

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 • Capital Equipment Co.
 Little Rock
 • Capital Equipment Co.

CALIFORNIA

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 • Occidental Chemical Co.
 Bakersfield
 • Abate-A-Weed Co.

Carson • Kellogg Supply, Inc.
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 • Butlers Mill, Inc.
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• Target Chemical Company
 Clovis • Amvac Ag-Chem
 • Custom Chemicals, Inc.
 Coachella • Foster-Gardner, Inc.
 Lathrop
 • Occidental Chemical Co.
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 • Amvac Chemical Corp.
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 • Orchard Supply Co.
 San Diego • Butlers Mill, Inc.
 • San Diego Chemical Co.
 San Gabriel
 • J. Harold Mitchell Co.
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Arvada • Gorby-Horning, Inc.
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 • Swift Agricultural Chemicals Corp.
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 • Gulf Shore Turf Supply, Inc.
 • Tieco Gulf Coast
 Sanford • Chase & Company
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 • Swift Agricultural Chem. Corp.

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 College Park
 • Stephenson Chemical Co.
 Conyers • Lawn & Turf, Inc.
 Doraville • Georgia Golf & Garden
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 • Wolfolk Chemical Works, Inc.

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 Idaho Falls
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 Rupert • Wasatch Chemical Co.

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 Chicago • George A. Davis, Inc.
 W. Chicago • Turf Products Ltd.
 Decatur
 • Scruggs-Drake Equipment, Inc.
 Geneseo • C. D. Ford & Sons
 Peoria • Behm & Hageman, Inc.
 • Liqui Green Lawn Care Corp.

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 Rockton
 • Turf Management Supply
 Springfield
 • Drake-Scruggs Equipment, Inc.
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 Wheeling • Arthur Clesen, Inc.

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 • Hawkeye Seed Co., Inc.
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broadleaf weeds

Trimec is trouble-free

The same efficiency that makes Trimec less costly, makes it trouble-free. Puts less chemicals in the soil, so there is less root absorption by trees, flowers and ornamentals. Minimizes "drift". Pampers tender grasses. Eliminates errors of tank-mixing at the site, because Trimec's components are precisely formulated in right proportions. And, happily for the environment, the residue is biodegradable.

Another Trimec plus: it works effectively in cool weather as long as weeds are growing, controls cool-season weeds when some other herbicides can't.

Years of commercial use throughout the U.S. prove it: Trimec gives positive broadleaf weed control under widely different conditions. The formulation is unique. Patented. No other offers all these benefits:

- Controls the widest range of broadleaf weeds
- Gets hard-to-kill species with one treatment
- Wide safety margin for lawn grasses, ornamentals

- Minimum hazard from root absorption
- No vapor action after application
- Effective weed control in wide temperature range
- Unique formula overcomes water hardness problems
- Treated areas may be seeded within two weeks
- Non-flammable and non-corrosive in use
- Product stable several years above 32° F.
- Biodegradable: friendly to the environment

"We've used Trimec for 3 years with good results. We've found it trouble-free and efficient. The all-in-one formula stops on-site mixing errors, and that's important."

C.M. Dailey, Pres.
Liqui-Green Lawn Care, Inc.
 Peoria, Ill.

"We used to use separate herbicides to control clover and broadleaf weeds. Now Trimec does the entire job and, in addition, gets such tough weeds as Filaree and Mallow. Trimec saves us money and does an outstanding job. Our turf has to be excellent — we supply it to the Camelia Bowl."

H. B. Michelson, owner
Michelson's Turf Grass Nursery
 Elk Grove, California

If you demand professional results, use the professional's herbicide — TRIMEC. It sets the standard.

For information and prices, see your local authorized TRIMEC distributor

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PROFESSIONAL TURF PRODUCTS



G

pbi / Gordon

CORPORATION

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 KANSAS CITY, KANSAS 66118
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| <p>NEWTON CENTRE</p> <ul style="list-style-type: none"> • Grounds Equipment Co., Inc. Waltham • Farm Bureau Coop Assn., Inc. West Newton • The Clapper Co. <p>MICHIGAN</p> <ul style="list-style-type: none"> Birmingham • W. F. Miller Co. Detroit • Terminal Sales Corp. Turf Supply Hartford • Denco Chemical Division Kalamazoo • J. J. Dill Company Royal Oak • Lawn Equipment Saginaw • Burdick Seed Company Traverse City • Ferguson's Company <p>MINNESOTA</p> <ul style="list-style-type: none"> Minneapolis • Minnesota Toro St. Paul • Associated Producers, Inc. R. L. Gould & Co. Turf Supply Company Savage • Castle Chemical Co. <p>MISSOURI</p> <ul style="list-style-type: none"> Chesterfield • Beckman Turf & Irrigation Prod. Grandview • The Landscap Corp. • Robson's Lawn & Golf Co. Kansas City • Bartels & Shores Chemical Co. | <ul style="list-style-type: none"> • Champion Turf Equipment, Inc. Neosho • Artec Chemical Co. St. Louis • Crown Chemicals • Outdoor Equipment Co. Springfield • Champion Turf Equipment, Inc. <p>MONTANA</p> <ul style="list-style-type: none"> Billings • Turf Aid Dist. Company <p>NEBRASKA</p> <ul style="list-style-type: none"> Lincoln • Rhodes, Inc. McCook • Harris Serum & Supply Co., Inc. Morrill • Jordon Agri-Chem, Inc. Omaha • ADI Distributors, Inc. • Big Bear Equipment, Inc. Midwest Toro <p>NEVADA</p> <ul style="list-style-type: none"> Las Vegas • Clark County Whol. Merc. Co. <p>NEW JERSEY</p> <ul style="list-style-type: none"> Boundbrook • Vaughan-Jacklin Corporation Freehold • Green Hills Turf Supply, Inc. Maplewood • Pearson's Mill Co. Rahway • Ferti-Soil Co. Saddle Brook • The TERRE Company Union • Andrew Wilson, Inc. West Caldwell • Rockland Chemical Co. | <p>Yardville • Jep Sales, Inc.</p> <p>NEW MEXICO</p> <ul style="list-style-type: none"> Albuquerque • Albuquerque Chemical Co., Inc. <p>NEW YORK</p> <ul style="list-style-type: none"> Birmingdale • Waggoner Seed Co. Dix Hills • Island Golf & Turf, Inc. Hauspaug • Maxwell Turf, Inc. Jamaica • J & L Adikes, Inc. Latham • Grassland Equipment & Irrigation Corp. South Hampton James H. Lynch, Inc. Syracuse (De Witt) • Agway, Inc. <p>NORTH CAROLINA</p> <ul style="list-style-type: none"> Charlotte • E. J. Smith & Sons China Grove • Regal Chemical Co. Winston-Salem • Goltra, Inc. <p>OHIO</p> <ul style="list-style-type: none"> Canton • Letherman Seed Co. Cincinnati • Century Toro Dist. Inc. • Thornton Wilson Cleveland • U.S. Garden Sales, Inc. Columbus • Century Toro Dist. Inc. | <ul style="list-style-type: none"> • W. R. Grace & Co. Dayton • Century Toro Dist. Inc. Finlay • Denco Chemical Division Marietta • Altco, Inc. Toledo • Century Toro Dist. Inc. <p>OKLAHOMA</p> <ul style="list-style-type: none"> McAlester • Tony's Chemical House Oklahoma City • Estes Chemicals, Inc. Tulsa • All Best, Inc. • Thompson-Hayward Chemical Co. • Wait Sales Company <p>OREGON</p> <ul style="list-style-type: none"> Portland • The Chas. H. Lilly Co. • Van Waters & Rogers • Wilbur Ellis Co. <p>PENNSYLVANIA</p> <ul style="list-style-type: none"> Hanover • Miller Chemical & Fertilizer Corp. Horsham • Pocono Supply Co. Malvern • Fisher & Sons, Inc. Philadelphia • Farm and Golf Course Supply Co., Inc. Pittsburg • E. H. Griffith, Inc. • Krigger & Company | <p>RHODE ISLAND</p> <ul style="list-style-type: none"> East Providence • Old Fox Chemical, Inc. <p>SOUTH CAROLINA</p> <ul style="list-style-type: none"> Columbia • Regal Chemical Co. Myrtle Beach • Bingham Seed Co. <p>SOUTH DAKOTA</p> <ul style="list-style-type: none"> Sioux Falls • C & R Supply Co. <p>TENNESSEE</p> <ul style="list-style-type: none"> Knoxville • Regal Chemical Co. McMinneville • Forrest Nursery Memphis • Oldham Chemicals Company, Inc. • Bob Ladd Co. Nashville • Tico Tennessee <p>TEXAS</p> <ul style="list-style-type: none"> Dallas • Chemical & Turf Specialty Co. • Van Waters & Rogers El Paso • El Paso Turf Supply Houston • Swift Agricultural Chemicals Corp. Lubbock • Williamson Seed Co., Inc. Paris • Estes Chemicals, Inc. San Antonio • Aggie Chemical Industries | <ul style="list-style-type: none"> Waco • Estes Chemicals, Inc. Wichita Falls • Estes Chemicals, Inc. <p>UTAH</p> <ul style="list-style-type: none"> Orem • Wasatch Chemical Div. Salt Lake City • Steve Regan Company • Wasatch Chemical Div. <p>VIRGINIA</p> <ul style="list-style-type: none"> Chesapeake • Turf & Garden Harrisonburg • Wetsel Seed Co. Richmond • Richmond Power Equipment Roanoke • Agri-Turf Products, Inc. <p>WASHINGTON</p> <ul style="list-style-type: none"> Kent • Van Waters & Rogers Renton • Pacific Agro Co. Seattle • The Chas. H. Lilly Company Tacoma • NuLife Fertilizers <p>WISCONSIN</p> <ul style="list-style-type: none"> Chilton • Horst Distributing Co. Milwaukee • Loft-Kellogg Seed, Inc. Sun Prairie • Turf Management Supply |
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LUCKY DEBBIE.



Don't feel sorry for Debbie. She's getting the special education she needs. Her handicap won't go away. But she will learn to overcome it, and lead as normal a life as possible.

The ones we should worry about are the handicapped children who are not getting the help they need.

If you know a child who is not getting special education, we have free information that can really help... no matter what kind of handicap he has. Just fill in this coupon.

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(a free service of the U.S. Office of Education,
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PRINCETON

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We revolutionize tradition with innovation.

1977 will be the year of the greatest advancement the sod industry has ever known. Princeton is the reason.

We're moving . . . bigger in every way.

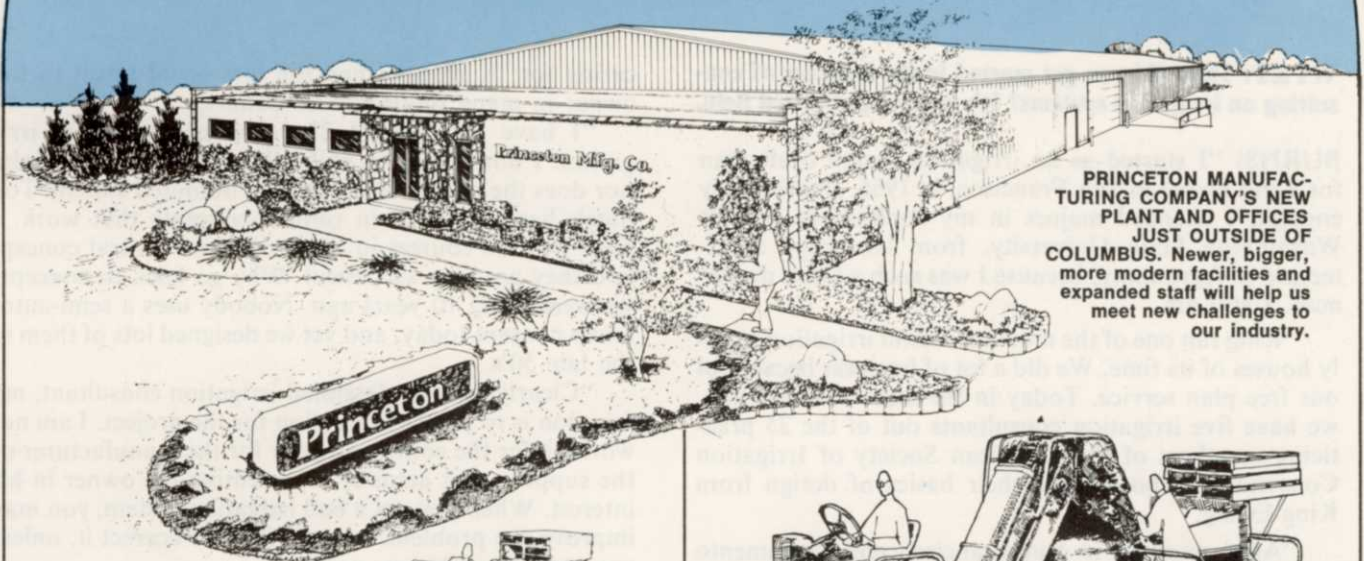
Moving to a bigger, brand new manufacturing plant . . . a production facility that will help us meet your overwhelming demand for Princeton Manufacturing Sod Harvesters and Nursery Equipment.

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Princeton experience and the quality of our prod-

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We are proud of the reputation that Princeton has earned. We are grateful for your trust and acceptance. We will continue to live up to this trust.



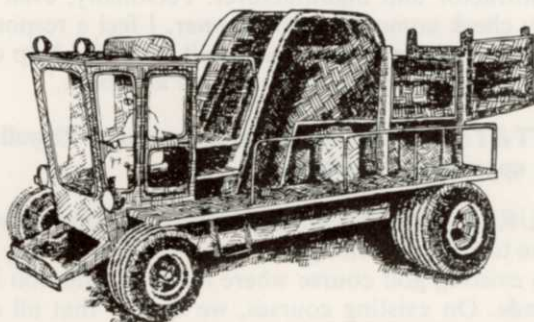
PRINCETON MANUFACTURING COMPANY'S NEW PLANT AND OFFICES JUST OUTSIDE OF COLUMBUS. Newer, bigger, more modern facilities and expanded staff will help us meet new challenges to our industry.



The first, and finest, low-priced, high-output, cost and labor saving harvester, 108,000 square feet of sod harvested per day with three man crew. The PRINCETON "TOW BOY" Sod Harvester.



Reduced costs and increased production mean bigger profits. Three man crew can harvest up to 180,000 square feet of sod per day with the PRINCETON SELF-PROPELLED Sod Harvester.



The only sod harvester that does it all . . . with just one man! Harvest up to 216,000 square feet of sod per day, with a crew of one. The PRINCETON AUTOMATIC Sod Harvester.



Keep your eye on Princeton . . . the "New Concept" people! Soon, we'll be expanding our services in the sod harvesting, nursery, and related fields with revolutionary new products that will mean greater profits and more efficiency to you. In '77, the spectacular will come from PRINCETON!

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MANUFACTURING COMPANY

THE METICULOUS CONSULTANT

Don Burns is a specialist by trade, and a perfectionist by nature. Through constant and often critical self-analysis, he has developed a modus operandi for designing irrigation systems which combines scientific thoroughness with the determination to excel.

WT&T: How did you get started in the business of consulting on irrigation systems? It's a very specialized field.

BURNS: "I started as an irrigation design draftsman for King Ewing in San Francisco, in 1956. Interestingly enough, I changed majors in my sophomore year at Washington State University, from landscape architecture to Agronomy, because I was such a lousy draftsman. I still am.

"King ran one of the most successful irrigation supply houses of its time. We did a lot of business because of our free plan service. Today in the State of California, we have five irrigation consultants out of the 25 practicing members of the American Society of Irrigation Consultants, who learned their basics of design from King Ewing.

"After working in San Francisco and Sacramento for Ewing, I started my own supply house in Fresno. Eight years in Fresno and running all over the state finding golf course irrigation systems to design and sell told me I wasn't in the right place — so I sold out six years ago and moved to La Jolla as an irrigation consultant."

WT&T: How many golf course irrigation systems have you designed?

BURNS: "I'm sure over the past 21 years, I've designed well over 300 golf course irrigation systems — maybe more. In the supply business, we did a lot of designs that weren't installed. In the past 6 years as a professional, I have designed over 80 courses with some 50 completed and installed under our direction."

WT&T: How do you see your role, as it relates to the golf course owner, the contractor and the superintendent, and how are these relationships defined on a given job?

BURNS: "The owner spends \$200-300,000 and needs one person to act as a responsible party or as an authority and represent the owner in the decisions that are needed in such a large expenditure. Generally, the superintendent is not going to take that kind of responsibility. While my academic background may be strong in turf management, I would not take the responsibility of

cares for 18 greens when the loss could result to the owner in many thousands of dollars.

"I have had almost 22 years' experience in irrigation. I don't need to make the same mistakes again, nor does the owner need to get an outdated system. Too much has happened in central concepts that work. I have over 60 courses in the ground on central concept and they are very successful. Why go back to concepts we were using 10 years ago. Nobody uses a semi-automatic concept today, and yet we designed lots of them in the late 50's.

"Clearly, as a professional irrigation consultant, my function is to provide direction for the project. I am not working for the contractor, nor for the manufacturer or the supplier, but actually representing the owner in his interest. When you get a bad irrigation system, you may improve the problem, but you'll never correct it, unless you start the job over again.

"I would group the supplier and the contractor together, because the contractor, like it or not, is responsible to the owner for the equipment he installs. The relationship between the contractor and his supplier must be good for all concerned. Our specifications call for contractor responsibility and supplier responsibility. This is intended to get the service thing started right.

"Our position is to represent the owner, but you can see we sit somewhere in the middle when it comes to what's fair for all parties — owner-superintendent-contractor and manufacturer. Personally, even though my check comes from the owner, I feel a responsibility to all these parties — because it takes the help of all to get a good job. That's what it's all about."

WT&T: What has been your experience with pulling pipe as opposed to trenching?

BURNS: "I find it different with each contractor. Some like to pull everything they can — most will only pull on an existing golf course where a new installation is being made. On existing courses, we specify that all existing pipe, 2 inches and smaller, will be pulled. It is much less damaging to the course, and allows play to continue during the installation.

"On new golf courses, where the trench is not tearing

up anything, I find that most contractors would rather trench and backfill.

"Pulling pipe is here to stay, even on a course where rocks may be of concern. The chance of damaging the pipe during the pulling operation is worth it in comparison to the additional cost of open trenching and expensive backfill. Plus, there is a loss of revenue to clubs for closing holes when there are a lot of trenches open. This does not occur when pulling, because it's a much cleaner operation."

WT&T: To what extent have you used effluent water and how do you see the future of this type of usage?

BURNS: We are using effluent water on two jobs right now — the Royal Kaonapali in Maui and the New Molakai Beach course in Molakai. I feel we really should be considering using this water all over the world and not losing it by dumping it into the oceans and rivers. It has an ecological value in conservation and has added nutrition for plant life.

"Not all effluent water is usable, but if we can generalize, I would answer as above. If you are going to use effluent water, you must consider two points — (1) the quality of the original water sources; and (2) the renovation treatment. The dissolved salt content, the sodium absorption ratio which reduces soil permeability, the trace elements which are potentially toxic, the chlorine content, and, if course, the biological composition for health reasons.

I would recommend an analysis be made on any water from a soil and water testing laboratory."

WT&T: How about drip irrigation?

BURNS: "Our only use of drip irrigation has been as additional water for trees. It is very important in the desert that trees get more water than just that offered by the irrigation system. We run a manual system off the main with tubing supplying an emitter at each side of the tree. It has been very effective and inexpensive to install. The tubing can be pulled shallow after the trees are planted."

WT&T: You seem to be a perfectionist in your design. It must be difficult to work with a contractor who feels the urgency of getting a job done more poignantly than the need for farsighted design.

BURNS: "I don't feel many contractors will try to cheat, if the contract is reasonable. It must be fair for both the owner and the contractor. If the contractor is losing money, he will try to make it up.

"A contractor who specializes in golf course irrigation usually is pretty set in his thoughts of what is a good

irrigation system. He's usually pretty proud of his job record. I don't always agree with his concepts but we do find that in the end an agreement is made to the benefit of the owner. I try to help the contractor so he will help me — it gives the owner more for his money."

WT&T: Can you explain why your approach to irrigation design is different from the other 25 consultants in California?

BURNS: "In the first place, 95 percent of our work is golf course irrigation, which separates most of us. Of those who do do golf course irrigation, very few will do their own staking. After the normal preliminary and final design with complete sets of specifications and details, as performed by all irrigation consultants, our scope of work differs in that it extends to total responsibility of staking of all sprinkler heads, valves, and controllers. This personal staking allows changes in head location and programming of heads due to: construction changes, site conditions or contours, wind and soil conditions, and existing trees, sand traps, or cart paths.

"Following this staking, we must do another plan because of the changes. This plan becomes an 'As Staked Drawing' and is the guideline for the contractor during installation. When the contractor completes this phase of the installation, we do another drawing showing all corrections and changes in pipe and valve locations for a final 'As Built Drawing.'

"In the end, this means we made three drawings of each area and walked the same fairway four different times:

- (1) during staking
- (2) doing the 'As Staked Drawing'
- (3) while checking the 'As Staked' for corrections
- (4) a final walk-through with the 'As Built' drawing with the superintendent and contractor for check list to sell job.

"This involves over 30 days, or parts of days, on a site, over a period of 4 to 6 months. This is a lot of time on-site, but I know of no other way to assure the owner he is getting the best possible job."

WT&T: Is business competitive among irrigation consultants?

BURNS: "Generally I am competing with two or three other consultants and price doesn't necessarily determine how the owner makes his selection. Rather, the scope of work of a consultant and his past experience are the major factors. The selection of a consultant should be made independent of manufacturer or supplier presentations. There are two things you must get across to the owner and superintendent, when making your presentation: (1) you don't really care what brand of equipment they use, as long as two brands are

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listed (I think it important that competition be involved in the equipment); and (2) you are open to their concepts of design as long as they will let you express your experience on your own concepts of design, and together come to a mutual acceptance.

"There are things I won't do and if I feel they are really wrong, I politely say I don't think they need me. If they have made a decision on a direction and it is not in agreement with what I know to be good practice, sometimes I have to allow them to go ahead and make their mistakes because they are paying the bills."

WT&T: Your design concepts are rather technical. Have you encountered any difficulties in presenting your ideas to owners and superintendents?

BURNS: "I try to cover this in making the client understand what C.U. means. C.U. means the Co-efficient of Uniformity, which is a percentage figure, derived from the precipitation rates at various points of one sprinkler to another, totaled together and averaged out giving the efficiency of coverage.

"One thing I work on the hardest is a high C.U., and this comes only with the use of the right head at the right spacing. We use two size heads to accomplish this; to make the two areas fit together, one to the other, takes two size sprinklers. It is not possible to hold to a total equilateral triangular spacing like many plans are drawn. Drawing circles on a flat piece of paper is not the same as staking to site conditions. Our 'as staked' drawings relate to a custom design to the site conditions.

"One thing we will not tolerate is, if we are on a basically 70 foot spacing, and we jam heads in to make it cover where some heads are on 40 feet and some on 70 feet and some on 75 feet. We have destroyed the C.U. in this area obviously creating a wet spot or dry area. This must be corrected during staking. By using two sizes of sprinkler heads, it is possible. It is important that you understand the need to make the spacing correct all the way through.

"Back to the question, it's very hard to present these concepts, but it's a lot easier and a lot more understandable when you visit an existing job and see the heads in operation. In addition to the correct spacing, I feel our most important job is in establishing proper programming, often referred to as the heart beat of the system. Custom programming to conditions as found on site means programming to the drainage or contours as they are found on site.

"I am a total believer in the Master Central Controller concept. I have been responsible for over 75 installations of this type, and when properly used, they save labor, money in the waste of fertilizer and water, and improve the conditions of play by preventing wet spots and over-watering."

WT&T: I realize that this may be academic, but can you explain how you evaluate the irrigation needs of a particular site.

BURNS: "Prior to design, we make a site visit for survey of (1) terrain; (2) soil; (3) water availability and requirements; (4) wind and how constant it is; then we follow this all up with input from the superintendent. We ask him to give us: programming time; number of hours we can water at night; and the spacing that he would like. Next I ask very pointed questions as to the supplier in the area who offers the best service. Then I ask what they expect the cost of the system to be. From this data, we do a preliminary design.

"A meeting is again held on site with the owner and the superintendent to go over these concepts and expected costs. From the feedback of this meeting, a final design is made with a complete set of specifications and details of the pumping plants.

"Variables that distinguish one design from another are: (1) owners' requirements — type of system, budget, how many hours we can operate per night, and how much water is required (1 inch a week, 1½ inches a week, etc.); (2) wind conditions — the head location must be in relation to the normal wind current; (3) soil conditions — heavy soil must have more control because wet spots will result if you aren't controlling the area (sandy soil has little or no lateral water movement so that consistent spacing is critical); (4) water supply — pump control, clean or dirty water, and whether we have to put up some sort of sand separation or purifying plant. Obviously all these things are going to make for extreme cost differences.

"We worked on contracts last year with a low of \$180,000 for 18 holes, and a high of \$520,000 on 18 holes.

"We are working on our eighth golf course in Hawaii and the high cost still amazes me. Next year we will be bidding on a job in 100 percent total lava. I'm still unsure of its cost or exactly how we're going to do it. This year we worked on Honolulu International Country Club. The total cost of the golf course, alone, is going to exceed \$12 million. They actually filled a lake to create the land.

"We are completing two other projects at this time — one is Oahu Country Club, which has a rainfall of 180 inches, and the other is Molakai Beach, with an average rainfall of less than 12 inches."

Every job is difficult in some way. Our concepts are always changing. We hope with improvements in equipment, they will continue to change.

WT&T: Where do you think the decision-making input should come from when specifying for designing an irrigation system?