



Via mail, e-mail, fax, etc.

"Your editorial in the [September] issue was excellent. It was pertinent, gutsy and to the point. Landscape Management continues to get better with each issue. Keep up the good work."

Ron Kujawa
KEI, Inc.
Cudahy, Wis.

Thanks, Ron. We appreciate getting cards like this through the mail, but we're now open to re-

ceive e-mail through the Internet, too. The rest of this month's "letters" were received electronically.

Terrific idea of providing us with an e-mail address! I hope this works out.

One quick suggestion: please try to keep your articles on one page. Due to lack of space and computer scanning capabilities, I normally just tear out the articles I want to

keep on file. It's not impossible, but mainly aggravating, to have a short article start on the bottom of one page, and the end on the next.

I'm sure some Ph.D. in marketing psychology probably has a dozen good reasons why you do this, but from practicality, it's a pain. Otherwise, a very terrific periodical!

Larry Caplan
Extension Educator
Vanderburgh County, Ind.

Check out this issue, Larry. One of the strong points of the new design we're unveiling this month is that we're no longer jumping half-stories from page to page. The Ph.D. who reviewed our old design must've earned his degree in bad taste!

I would like to thank you for your quick and helpful response to the e-mail I sent you. Your magazine, which I receive free of charge, provides more service than any of the ones I have to pay for. Keep up the good work!

Dave Denison
Hay Harbor G.C.
Fisher's Island, N.Y.

You were lucky, Dave. The information you requested was on file. We've had other requests that weren't as easy, though: one guy wanted to know how to patch up a dusty, weedy football field in 100 words or less. Yeah. Right.

I'm glad to see someone in our industry has entered cyberspace. We can all benefit from better communications. Personally, I don't have time to play phone tag or write letters. I enjoy your magazine. Keep up the good work!

Jim Yonce
Yeamans Hall Club
Charleston, S.C.

Aside to newcomers in cyberspace: if you get lost, hit the "escape" key. Luckily, we found our way back to Cleveland just in time to get out this month's special GIE issue. Enjoy.

What 'seed bargaining' is all about

To the editor:

In your August issue, on page 10 you quoted a very good friend of mine and a former co-worker, Dr. Jerry Pepin of Pickseed West. The quote is subheaded, "Uh-oh" and says:

"Perennial ryegrass prices will be up considerably over last year. The Perennial Ryegrass Bargaining Association is a factor this year. But I don't know how long they will be able to keep prices up, because this is a supply-and-demand industry."

The PRBA acknowledges that it is the major influencing factor for a higher price to the turf-type perennial ryegrass seed producer for the 1995 crop year.

The average grower price for turf-type perennial ryegrass seed...compares with grower prices paid in the early 1970s. However, the prices for tractors, combines and other equipment have doubled since 1970. Additionally, the seed producer has faced increasing restrictions and regulations in field sanitation techniques and the use of pesticides.

Usage of perennial ryegrass seed in the same period has increased from 116 to 174 million pounds...[thanks to] the strong efforts by the Oregon Ryegrass Growers Seed Commission as well as market promotion by each of the companies.

The only aspect that the PRBA has any influence on is the price of the seed being produced under grower contracts. The seed dealer makes the decision on the acreage they want produced. Neither the PRBA nor the seed grower makes decisions on increasing or decreasing production of varieties being produced under a seed grower contract.

Supply and demand governs the commodity market price, whether it's speculative or a true market condition.

The PRBA recognizes the importance of the professional turf market. It is not the objective of the PRBA to cause any hardship on any segment of this market. Our objective is to continue production of a high quality product to ensure the ultimate user is provided with seed that is genetically pure, without weed and crop contamination.

We would like to point out that the quality standards of the PRBA's "Tournament" quality seed are higher than the quality standards for certified seed.

A final objective of the PRBA is to influence a more stable market price that professional turf managers can depend on for the improved turf-type perennial ryegrass varieties.

Jim Carnes
Executive Director
PRBA



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Steve "Bogie" Bogaards, President Preferred Maintenance, Inc. Miami, FL



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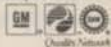
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Circle No. 108 on Reader Inquiry Card

SAFETY & STORAGE

Would your shop pass an EPA inspection? Know the mandates for pesticide containment and storage before you build. Here's an introduction.

Would you pass a Worker Protection inspection for safe chemical storage? If you *think* you have a problem, you probably *do*. Money spent *before* a possible inspection to comply will be saved many times over *after* the inspection.

Some self-contained sheds can be purchased for as little as \$5,000. Tips to remember when storing pesticides:

- ▶ Liquid and dry pesticides should be stored in separate areas, away from offices and workshops.

- ▶ Primary containment is used for storing and mixing concentrated pesticides. The area must be diked. Flooring should be made of impermeable materials like concrete, synthetic materials and steel with no drain, but curbing to retain spilled materials. The floor and dikes must be treated and/or coated with water-tight, wear-resistant materials that are also resistant to chemical corrosion.

- ▶ A ventilator fan that exhausts to the outside of the building is mandatory. The ventilation should go on automatically when the door is opened or the lights turned on.

- ▶ Shelving should be expanded metal with corrosion-resistant coating.

- ▶ Walls should be made of concrete block or steel, and ceiling materials should be fire-resistant.

- ▶ The door should have a lock, and "Warning: Pesticides" signs should be posted.

- ▶ Emergency showers, at least one eyewash station and personal safety equipment should be located outside of the storage room on the wall next to the door.

- ▶ Finally, a kit with absorbent material (cat litter, soil, etc.), a shovel, a broom and buckets—outside of the stor-

age room—should be readily available in case of a spill.

Secondary containment is used for:

- storing and parking spray rigs or trucks,
- loading or fill operations with dilute pesticide mixes and fertilizers, and
- washing and rinsing pesticide residues from application equipment and vehicles.

Fill times can be reduced when primary and secondary containment areas are integrated correctly. Mishandling and accidental spills can also be reduced, as can unnecessary exposure to staff and wasted products.

A proper containment/storage system protects outside water systems from hazardous materials with a back-flow protection device at the main source.

How you will benefit:

- 1) \$8000-\$10,000 in annual chemical waste disposal.

- 2) Reduced exposure to spills, other accidents and cleanup.

- 3) Savings and/or reduction of insurance premiums.

- 4) Environmental benefits, such as reduced or eliminated point source contamination to groundwater, sewer and water systems.

- 5) Employee safety is enhanced, and the day-to-day business operation is simplified and ordered.

—Sources: *Containment System Design* by Fred Haskett, and the Florida Department of Agriculture & Consumer Services. To order the Haskett book, call Advanstar Marketing Services, (800) 736-3665.

STORAGE AND SAFETY PRODUCTS FOR THE GREEN INDUSTRY

Manufacturer	Circle No.	Product
Justrite	201	New Drum Management System meets environmental protection requirements and organizes drum storage for maximum safety, efficiency and productivity.
Direct Safety Co.	202	Wide variety of products including chemical resistant gloves and clothing, waste disposal and storage containers, spill control, emergency showers, safe lighting and safety training.
EarthSafe	203	Above-ground storage tanks for fire safety and environmental regulation compliance when dispensing fuel and storing oil in bulk.
Elvex Corp.	204	Personal protection products to guide against injury from power equipment; hearing protection.
Safety Storage, Inc.	205	Storage building and lockers for hazardous materials. Now with stainless steel interiors for corrosive material storage.
Spectrum Technologies	206	Spill absorbent materials.
Spraying Systems Co.	207	Teejet Pesticide Safety Kit contains face shield, gloves, apron and a nozzle cleaning brush.
J.V. Mfg. Co.	208	Spill absorbent materials in kit form (pads, socks, absorbents, etc.) and complete line of products to identify, contain and treat hazardous spills. Brochures available.

Extreme heat was an absolute in summer '95



Terry McIver

TERRY McIVER
Managing Editor

In days when every opinion on a certain topic is given a hearing on radio, television or in the newspapers, it's nice to see a group of experts come forward with the absolute last word on a subject, which none will dare dispute or criticize.

That's what we've received from The Ohio State University's Cooperative Extension. Some of the leading turf scientists there—John Street, Karl Danneberger, Bill Pound, Barbara Bloetscher and Joe Rimelspach—have issued a report on the disease pressure exerted on golf courses across the Midwest during the heat-wave of 1995.

The report says high soil temperatures were a major cause of root decline and provided, "No opportunity for root re-growth and recovery."

That "No" makes you sit up and take notice.

"Hot, humid days and nights," says the report, "provided no relief for turfgrasses..."

Another unqualified "no!"

Is there any hope for the future, when a heat-wave will *certainly* hit us again, you ask? The answer is an unqualified...YES!

Monitoring the weather and knowing the most likely sites for disease development on the golf course are two factors the OSU extension says can help you time and plan fungicide application strategies.

"Once a disease is active, fungicide applications to stop the progress are often ineffective," say the authors. "With many of these diseases, a preventive fungicide program is critical for successful management."

Management practices some superintendents were expected (forced?) to follow didn't help.

"To prepare for golf tournaments or special events, greens were often cut lower and more frequently to increase ball speed," says the report.

[GOLF / GROUNDS]

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Steady workers: dream come true

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Roadside brush control

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Designing tees for everyone

Turf had literally "no opportunity to recover" after July 4th, assert the OSU scientists.

A crushing "NO" to the midsection!

Small greens were especially hard-hit as pin placements dwindled quickly. Greens with poor tile drainage or internal soil drainage or inadequate irrigation systems also suffered.

Solutions for turf survival during the next heatwave begin with raising the height of cut.

"High-quality turf was maintained at the courses at which mowing heights were raised early, before the onset of heat," and where rollers were used to compensate, say the experts.

"GREEN SPEED MAY HAVE TO BE SACRIFICED for the overall betterment of turf and playability under extreme environmental conditions," say those in the know at OSU (emphasis mine).

Hard answers sometimes mean hard choices.

I ask you: Will golfers playing in 100° heat quibble over a measly sixteenth or thirty-second?

Let me know what you think of closing a course for some days—or even half-days—during severe heatwaves. Have you done it? If so, do you lose money, or ultimately save money from less turf repair maintenance?

I'd also like to know how you went about keeping turf alive in the summer of '95, and what you plan to do to prevent damage from heat stress the next time. Because it will happen again.

Absolutely.

Call me at (800) 225-4569, ext. 709.

Steady workers a dream come true

The days of 'political appointments,' goof-offs are gone at Ridgewood Country Club.

by TERRY MCIVER / Managing Editor

For years, the summer workforce at Ridgewood Municipal Golf Course in Parma, Ohio, was composed of teens whose fathers "knew somebody at city hall."

It was never a surprise when, on a day in early June, a few guys with very little ambition and a strong desire to goof off would mosey onto the course to begin their summer of fun.

"We had our share of misfits," remembers superintendent Ted Benze, who smiles with relief as he describes the changes that took place about eight years ago, after a new city administration took over. At that time, Benze had strongly suggested to the new mayor that politics be left out of golf course crew staffing.



Ted Benze finds continuity pays off when it comes to maintaining a well-trained, dedicated workforce.

Benze now relies on a dozen retirees to round out his peak-season staff of 22, and he praises the work ethic and dependability of the older men.

"Before," remembers Benze, "you'd get seasonal help and you couldn't keep them year after year. There was constant retraining. Now, I've got one guy who cuts greens, one guy who cuts fairways, right on down the line. The one who takes care of the greens mowers has been here eight years."

Ridgewood is located smack-dab in the middle of Cleveland's largest suburb. Main roads pass less than 100 yards from the clubhouse and along the number 10 and 11 fairways. The city's biggest shopping mall is about 500 feet away.

Disease hits hard

Benze says the heat wave of '95 didn't seriously affect Ridgewood's turf until the end of August, but when it hit, it hit with a vengeance.

"I usually buy pesticides out of season, but this summer was one of the few times we bought during the summer, due to the disease pressure," says Benze.

"There will always be a year like this year, where you get some surprises. At one time [during the heatwave] I had something I thought was sum-



mer patch; but I checked it up so fast that I'm not positive it was summer patch, or a form of anthracnose, or the two working together. I went out there with six ounces of Cleary's 3336, which everybody was trying, and it worked for me.

"Mercury would have knocked it down," insists Benze, "but it's not

labelled to use anymore. That's why you see a lot of these things showing up that never did before. You haven't been able to use mercury during the summer for 15 years now. You can use it during winter only, for snow mold control."

Designing to aid playability

Benze has modified the course design

considerably during his 15 years at Ridgewood. The back nine is now the front nine, a change which was made based on player preference and general playability.

"We've added blue tees, and an irrigation system (see sidebar) and enlarged the fourth tee, which used to be the 14th."

One hole on the front nine was decommissioned, and a new hole was added in its place, primarily as a way to shorten the walk between two holes which were very far apart (a player peeve for many years).

Benze buys good trees at bargain prices in late summer from a local nursery known for its end-of-summer clearance sales, such as red maples for \$30. He also grows trees in a small nursery near the maintenance shop. □

New irrigation system a double-row wonder

A new Buckner "Genesis" double-row irrigation system installed at Ridgewood Golf Course two years ago has made water management much more efficient.

Superintendent Ted Benze decided to use city water as the source for the system, after determining that a nearby lake contained too much septic and salt content. The lake has since been cleaned, but it still lacks sufficient volume.

Pressure drop is one of the challenges you face when you draw from a water source that also supplies a city of 88,000 people, especially during a heat wave, but the new system helps Benze adjust run times easily to compensate.

"Last year I had 120 pounds of pressure coming in from the city," recalls Benze. "This year I was lucky to have 57 pounds.

"The Buckner Genesis has been a big asset. Last year I was able to pump close to 1000 gallons per minute. This year, because of the pressure coming in to



the place I could only pump 600. If it wasn't for the convenience in changing the program around, I would never have been able to do it easily. I can change run times or lanes in less than 20 minutes. Using city water was still the best way to go."

The area from tees to fairways is covered by single-row irrigation; fairways are covered by a double row configuration.

C.J. Colein & Associates of Rochester, Mich., designed the configura-

tion. Benze is glad he went the route of an irrigation consultant. He tried to solicit bids and designs from individual contractors, but it became too confusing and complicated.

"I would recommend anyone—public, private or municipal golf course—to go that route," attests Benze.

"Carol Colein came up with a bid package and a system that fit our needs, and it turned out better than we expected." □

—T.M.

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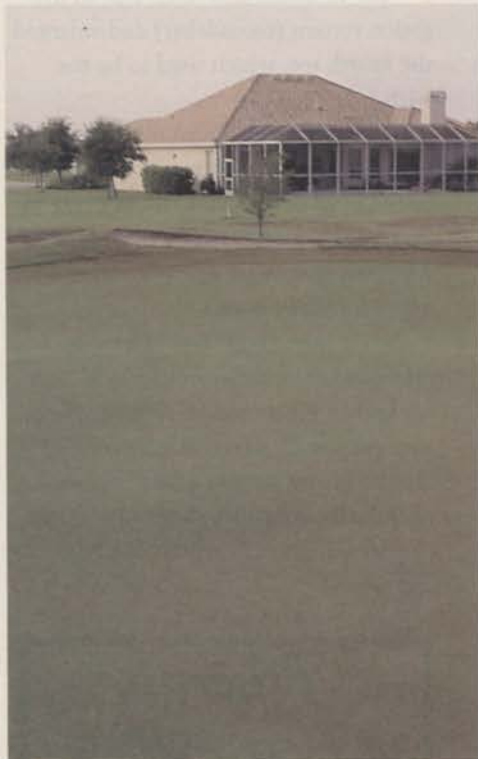


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Circle 106

Learning by doing

by TERRY MCIVER / Managing Editor



Dan Hall's prescription for fast greens: 'If I have a big event coming up on a Sunday, I topdress lightly on Tuesday or Wednesday. Then we single-mow on Thursday, Friday and Saturday nights, and double-mow on Friday, Saturday and Sunday mornings.'



You can't tell Daniel Hall, Jr.'s story without first saying something about his dad.

D. Lester Hall, Sr. began working on courses in 1915, when the only "utility vehicle" was a good, strong mule or plowhorse.

He developed U-3 and Hall Superior bermudagrasses, and helped build Atlanta's Peachtree Golf Course.

Hall Jr., 68, learned the art, craft and science of golf course turf management from working with his dad,

and, later, from his own study and experimentation. A few continuing-education credits were added along the way to dot the i's and cross the t's, but the wealth of his knowledge has come from the doing.

There isn't an area of turf management to which Hall hasn't applied his own methods, intuition and common sense. He's taken what he's needed from all the theories and let the rest go dormant.

Peachtree, San Jose, Imperial and Savannah are just some of the golf courses he's walked and rode, seeded and hoed.

Hall has been the superintendent at Serenoa Golf Course in Sarasota, Fla. since it opened in 1989.

A public-fee course in a neighborhood of more than 30 public courses, Serenoa holds its own against the competition. Thanks to Hall, his crew, and club president and pro Jim Owen, Serenoa is known as the best-conditioned course in Sarasota. It'll host about 70,000 rounds of golf, in this, its sixth year of operation.

Working with the weather

Stormy weather has made mole cricket control especially challenging.

"This is the worst year I've had for mole crickets only because the pastureland around the course has been flooded," says Hall. "They used red-eye fly (a predator form of biological control) out here four or five years ago; last year and the year before we didn't have any mole crickets."

Hall spot-treats with control products only when mole cricket or other pest populations warrant.

Eighty-plus inches of rain pelted the course from June to October, which altered Hall's usual fertility program.

"This year, with the rains, I put out about 18 pounds of nitrogen per 1000 square feet. Normally, I run about 12 to 16 pounds, depending on rainfall.

"Potash is more essential than nitrogen, as far as I'm concerned," Hall explains, "in a ratio of almost 1:3. But then, I don't use any potash until mid-October, when the overseeding starts to show."

Hall believes in the value of Milorganite as a nitrogen source.

"It's clean, it's easy to apply, and it will not burn except under sheer, stupid misuse. It absorbs heat and energy, it's got carbohydrates, amino acids and nitrogen; it's not going to release if the ground temperature is much below 72 degrees, because the bacteria's not working. It serves the same purpose as charcoal, and the golfers don't complain about it."

Serenoa is home to a thriving wildlife. Deer

roam the course in the early mornings to nibble on sugar-rich bermudagrass. Eagles and heron nest on the course, and live off fish from Serenoa's 83 acres of lakes.

Well-respected in changing times

Hall has always won the respect of co-workers and employers, thanks to his airtight knowledge of the business and a no-nonsense style.

Throughout his career, he's usually been able to convince golf course owners, club presidents and whomever else was his boss at the time that the way of the experienced superintendent is the only way to care for a golf course.

As the jargon of golf has expanded to include terms such as "bottom line," "profit-and-loss statement," and "stockholder dividends," Hall believes it's important that superintendents—largely at the private courses—communicate clearly what corners must not be cut in the interest of profits.



If you want to really ruin Dan Hall's day, tell him he's got to stay inside. Hall, left, insists that a superintendent has to be out on the golf course every day. 'When you get to be a manager, you lose contact with the people. You're in the office with the paper, the computer and the telephone.'

The status quo, says Hall, has become "saving money," which can be bad for a work environment and bad for turf.

He quotes turf research legend O.J. Noer: "A golf course is no place to waste money, but it's also no place to save money.'

"And Noer also calculated that for every dollar a course saves off bottom line in salary, it costs them \$3 to \$7 per year."

The member syndrome

"You take the most prominent people in the community—doctors, lawyers, businessmen, judges; it doesn't make any difference who they are," explains Hall. "Normally, those are the better-educated people in the community. As a general rule, they're also the most affluent people in the community, who donate the most time in areas of leadership for charitable institutions. And they do a lot of good.

"But for some reason, the minute they become a member of a board of directors of a private country club...you start to get political factions. Some want to renovate, and some don't want to renovate...And guess who's always in the middle of it? The superintendent!"

Hall estimates the average tenure at a Florida golf course to be about five-and-a-half years.

"Some younger fellows are also being squeezed out," he says. "Some are now selling equipment. They became disenchanted. Many would not go to work for a private course for any salary."

Member apathy for the superintendent's plight doesn't bode well for Florida superintendents who have had to deal with up to 100 inches of rain this summer.

"When them Yankees start coming down from the East Coast into the Naples/Ft. Myers/Sarasota area, and find that the golf courses are not in the condition they normally have

QUOTABLE QUOTES

from Dan Hall Jr.:

- ▶ 'Nobody knows the road better than somebody who's already travelled it.'
- ▶ 'What members forget is that the superintendents at tournament courses have had all year to get ready.'
- ▶ 'If you know turf, it really is the simplest part of the whole operation.'
- ▶ 'I know superintendents who wouldn't know how to start a triplex mower.'

been in, there's gonna be hell raised. There'll probably be guys who'll lose their jobs.

"That's why I would never work at another private golf course, especially in Florida."

Balance responsibilities

Today's "do-it-all" superintendent, says Hall, wants to give equal attention to all areas, which isn't always easy.

"If he's someone who is naturally most adept at growing grass, he'll spend more time on the appearance of the grass.

"And I don't care how smart you are. Whatever area you focus your attention on, other areas have got to go lacking. There are very few people who can oversee that infinite number of specialties."

Hall plans to work at Serenoa until it dries up and blows away, which is unlikely to happen, with all the rain they've had down there.

The point is, he will not retire.

That's one of the traits of many superintendents from Hall's generation. Their "What's-life-without-work?" philosophy is hard to dispute. □

Smoking out brush control on roadsides

by JAMES E. GUYETTE / Contributing Editor

A new cutting-edge program for controlling brush along highways actually involves cutting back: it's cheaper to spray once than it is to continuously mow.

The program, known as "Brush Busters," is being developed by Dr. Darrell Ueckert and Dr. Allan McGinty, Texas Agricultural Extension Service range scientists. The new approach is being funded through Texas A&M University with a \$222,000 contract from the Texas Department of Transportation (TxDOT).

"Brush Busters is a newly-packaged, common-sense brush control concept that uses proven chemical methods to selectively remove noxious plants without harming nearby desirable vegetation," Ueckert explains. "The funding is for developing uniform, statewide guidelines and procedures for use by TxDOT maintenance personnel. We plan to refine our new Brush Busters program to meet TxDOT needs."

The main target is the mesquite tree. And while mesquite wood may be in hot demand elsewhere as a flavorful fuel source for backyard barbecues, in the Lone Star State wild mesquite trees are an ongoing problem.

"They're considered a hazard to motorists," says Ueckert. The thorns find their way into tires, and the trees inflict serious damage to a vehicle that crashes into them. Some species of thorned shrubs are known for their ability to safely ease a careening car to a stop—but mesquite is not among those. "Most motorists, when they fall asleep and run off the road, wake up," Ueckert observes, "but if they were to run into a thicket of mesquite, they would not wake up."

Mesquite infests some 51 million acres of



The thorns of the mesquite find their way into automobile tires.

Texas land, including much of the 1.42 million acres of highway rights of way along the state's 78,000 miles of roads.

A natural appreciation

TxDOT's major goal is to maintain a roadside "native prairie" for each site or region across the state. Ueckert says this reflects the appreciation for aesthetics, wildlife habitat, soil stabilization and watershed values of prairie vegetation as well as the safety concerns for motorists and TxDOT crews. "The public loves to see bluebonnets and other native wildflowers along the roadside," Ueckert notes.

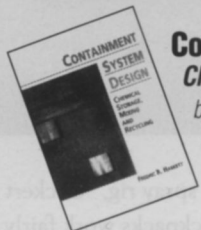
"You can't have a native prairie brimming with wildflowers when it's choked with mesquite," adds McGinty. The conventional control of mowing is not successful, and in fact, mowing makes mesquite worse.

It costs \$18 an acre to mow, and any mowing program must be repeated several times a season. "If you cut it off, mutilate it or burn it, you'll have more of a problem," according to Ueckert. "The plant will change from a single-stem tree plant to a multiple-stemmed shrub." Also, mowing mesquite creates more thorns that are just waiting to imbed themselves in a passing motorist's tire.

It costs just \$7 an acre to apply chemical controls for mesquite on rangeland. The actual finan-

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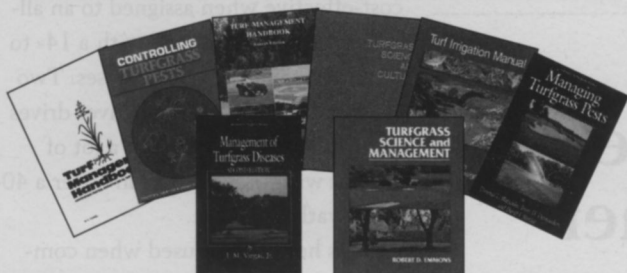
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cial figures are not yet in for median strip applications, but Ueckert and McGinty see sizable savings on the horizon.

Two techniques are being applied under the chemical control program, which uses triclopyr and clopyralid:

1) **The stem spray method.** The lower 12 inches of the plant is sprayed with a mixture of 15 percent triclopyr and 85 percent diesel fuel. "This can be done any time of the year, but it's more effective when temperatures are high," says Ueckert.

2) **The leaf spray method.** Using 0.5 percent triclopyr and 0.5 percent clopyralid, the materials are mixed with 5

Ueckert applies the leaf spray only during the June-September growing season.

percent diesel fuel in water, plus a commercial emulsifier or liquid dish soap. "The leaf spray can only be applied during the growing season—June through September."

The equipment needs are minimal.



Turf 101: hot + humid = disease pressure in the summer

July and August was a rough time for golf course turf across the Midwest this year.

The reason: the summer's "Extreme Environmental Conditions," as reported by turf scientists from the Ohio State University.

Air and soil temperature went way beyond the ideal ranges, for multiple days at a time, putting intense pressure on cool-season root systems. With the root systems weakened, the turf was unable to combat disease pathogens.

Soil temperatures, which are ideal in the 50-60°-range, rose to 100° F at mid-day. According to OSU scientists, bentgrass will not initiate new roots when soil temperatures exceed 90° F.

"High soil temperatures resulted in root decline and no opportunity for root regrowth and recovery," reports OSU.

In heavy rainfall, oxygen was pushed from the soil, and roots were suffocated. Extensive dieback and complete turf failure occurred so suddenly, that according to OSU professors, superintendents were

able to fix complete turf failure to a specific date and time.

Fertilize for winter survival

Richard Buckley, director of Rutgers University's Plant Diagnostic Lab, says it's essential that golf greens and ornamental plants are well-fed for winter.

According to Buckley, most of the drought-related problems he examined took the form of summer patch and anthracnose.

"Summer patch pushed turf to the limit," says Buckley, "and turf wasn't able to meet the transpiration demands necessary for survival."

Unfortunately, trees and new plants are going to show the effect of summer stress, come spring, says Buckley, even if those plants were well-irrigated during and after the heat wave.

"Plants don't respond as well to irrigation as they do to regular rainfall," says Buckley, who says he saw some early leaf drop in areas of Pennsylvania, New York and Connecticut. □

"You can use a \$25 spray rig," Ueckert points out. "The backpacks work fairly well if your brush is dense."

A three-person crew can be highly cost-effective when assigned to an all-terrain vehicle equipped with a 14- to 20-gallon tank with three hoses. Two walk and spray while the driver drives and sprays. "You can cover a lot of ground with those. You can cover a 40-foot swath."

Less herbicide is used when compared with broadcast applications. "The key thing is that it's low impact" on desirable species and the environment, Ueckert says.

Plans are afoot to augment the ATVs with a speedy device called the "Brush Robot."

"We want to automate this even more," Ueckert reports. "These sensors feel the brush and activate the spray nozzle," he explains. "You're putting the herbicide directly on the target and you have very little contact with wildflowers or prairie grasses."

Best of all are the savings to Texas taxpayers: "Chemical controls will only need to be applied every three or four years." This is a big improvement over multiple mowings that don't even work and result in additional hazards to the traveling public. Says Ueckert: "Instead of growing more thorns, we want to kill them." □

—Terry McIver

Designing from middle tees provides fair test for all golfers

by LESLEE JAQUETTE

In the early days of golf course design, the process usually started from the tournament tees and worked forward. Consequently, shots from the forward tees were more prone to crossing hazards and forced carries. Hitting from a hastily-added women's tee was indeed a trying feat.

The new LPGA International course in Daytona Beach, Fla., breaks with that design tradition. It has been designed completely from the middle tees, and has proven to be a fair test for the best women players. All tee areas, from front

to back, have been carefully designed and placed. Strategically-placed bail-out areas and greens give golfers of every level a challenging and fun golfing experience.

Dr. Jones on call

The LPGA course was designed by Rees Jones, and opened in July of 1994.

Known as "The Open Doctor," Jones has rehabilitated several courses for U.S. Open play, and was recently chosen to remodel Pinehurst No.2—the Donald Ross masterpiece—for the 1999 Open.

The most highly regarded Ross works are his original designs at Haig Point on Daufuskie

Island, S.C. ("Best New Private Course, 1992) and Sandpines in Florence, Ore. (Best New Public Course, 1993).

Pam Phipps, director of golf for the LPGA, says Jones was chosen not only for his expertise, but because he listens. According to Phipps, Jones sought the opinion of several women professionals before he finalized the design.

"What we have created at LPGA International," says Jones, "is a true tournament-caliber course that can also be enjoyed by less-than tournament-caliber players."

Tee area to spare

The intent and scope of the course is evident. Jones uses elevated tees for all five levels to allow for a huge range of player ability, allowing the course to be played from 5,134 to 7,088 yards. Increasingly, the tees are placed in directions and at distances appropriate with the average golfer at each level of play. For example, on No.5, the back tees are raised high enough to permit the better golfers to carry over a wetlands trap. The ladies' pro tee exacts the ability to carry 100 yards over the perimeter of the wetlands. The golf tee forces minimal water contact, and the red tee has no forward water hazard, only wetlands to the sides of the fairway.

"With this method of placement, we find the ladies can hit the same area as the guys off the longer tees," says Phipps. "It's fair—the way it should be."

Every hole allows for a pitch and roll to the green. This spares ground players the threat of landing in Jones's signature bunkers on each side of the greens.

Jones-style bunkers add interest and aesthetics to the course, and make it a great spectator course. Each green has five target areas. If you miss your first putt, the bowls and undulations of



Superintendent Mark Heater says it takes 12 man-hours a day to rake all the traps.

Dormant seeding sprouts quick results in spring

Dormant seeding is the process of planting turfgrass seed when soil temperatures are too low for germination.

Kevin J. Ross, superintendent at Falmouth (Maine) Country Club, has tried dormant seeding and likes the speed of springtime establishment.

"The first step in the seed germinating process is when water is absorbed by the seed," he notes. "The second step is when the seed undergoes a swelling which initiates several biochemical and morphological events. These steps ultimately result in the development of a seedling turfgrass plant.

Because the seed is partially germinated in the fall, it is four to six weeks ahead of spring-planted seed.

Ross suggests dormant seeding might be used in the following areas:

- on divots in tees and fairways at the end of the season. In Ross' part of the country, that is done between November 8-12, based on a test plot experiment he conducted.

- greens and other areas subject to winter kill.

- clubs on a bentgrass fairway conversion program might want to experiment with dormant seeding, suggests Ross.

"The *Poa annua* is at its weakest stage in the spring (if it survives the winter) and dormant-seeded bentgrass can compete very successfully with injured or stunted *Poa annua*," Ross says.

"We have also experimented with spraying Roundup in areas of poa infestation just prior to turfgrass dormancy, then dormant slice seeding bentgrass in these areas and had remarkable success.

Dormant seeding helps Ross out in an area which has a short growing season.

But he cautions superintendents to experiment before using it on a large area of turf. Timing, he says, is essential. □

—Adapted from Seed Research of Oregon's Seed Researcher.



'Water stops' around the course include water jugs, paper cups, trash bins and ice.

the green can wreak havoc with a putt.

Due to the acres of wetlands around the course, most holes are fairly straightforward.

A second 18 holes designed by Arthur Hills will be built starting in January and playable the following year. In contrast to Jones's links style, Hills' design includes more doglegs and large pine trees. Without the dramatic elevated greens and tees and mounds, the Hills course will be contoured but flatter looking.

Managing the LPGA

The new LPGA International is big, beautiful and demanding. Not only for golfers, but also for its superintendent, Mark Heater. With 250 acres of expansive wetlands, 16 miles of curbed cement cartpaths, and bunkers the size of Rhode Island, the course is a maintenance challenge.

Heater's biggest headaches are caused by the weather. Florida's infamous thunderstorms and gusty winds can greatly disrupt the 115 sand traps. The largest sand bunker on the course is 30,000 sq. ft.

Edging the bunkers is a nightmare in itself, Heater notes. Keeping the entire course edged in medium shape requires 100 man-hours a week; the cartpaths require 250 man-hours to edge. A crew

of 25 is divided into thirds, and each third works a 40-hour, five-day shift. Shifts run Tuesday through Saturday; Sunday through Thursday; and Monday through Friday.

An unexpected problem is damage caused by armadillos burrowing for mole crickets. "They wear us out," Heater says. All he can do is chase the critters away and fill in the holes.

Two of Heater's favorite pieces of equipment are a Jacobsen 3810 four-wheel drive mower for mounded areas, and a Soil Reliever deep-tine aerifier that can take whatever punishment the operator can dish out.

A former superintendent at Grand Cypress Resort in Orlando, Heater manages the largest irrigation system in Florida. Using a Toro LTC system, the LPGA course has 2,400 sprinkler heads. In the summer, the system distributes one million gallons of water per night; in the winter, 600,000 gallons a night. Located adjacent to the city's new water treatment facility, the course uses reclaimed water for irrigation. □

Problem-solver extraordinary

by JERRY ROCHE / Editor-in-Chief

Ever wonder why you're in this business? Ever tried putting it into words? Mike Schiller has wondered. He's been able to put his thoughts to words—and rather well, at that.

"Being a Cubs fan and going down to Wrigley Field as a kid, I always watched what the groundskeepers were doing," Schiller remembers. "If you don't mind work and like to be outside, it's a great business. We're kind of urban farmers planting things for future generations. And it's like an addiction. Once it gets in your blood, you can't get rid of it.

"We're not going to get rich, but we're leaving greenspace for future generations."

Schiller—assistant superintendent of parks and planning for Schaumburg, Ill.—likes to solve problems. And with a park system of 100 acres spread over 26 square miles, he runs into plenty of them.

"This business is not static," he observes. "You never know what you're going to do from day to day, or what problems you're going to run into. I like to consider myself a good problem solver. When somebody tells me I can't do something, I

like to find a way to do it. And I like to find new and better ways to do things." It helps that Schiller is blessed with capable employees, "people who can do almost anything." The expertise on hand runs even into the winter months.

"Snow is a top priority in the winter," Schiller notes, "especially at our community centers. I've never seen a crew that does a better job of keeping

sidewalks and parking lots clean and safe."

Schiller's supervisor is Dan Otto, superintendent of parks and planning. Jeff Richards is in charge of landscape construction crews and the horticulture crew, while John Gerker heads up the mowing and trimming crews, and coordinates special events maintenance tasks.

Schaumburg's parks include 40 baseball infields, 13 soccer fields and 60 playground sites. Seven new baseball infields and four new soccer fields are due in 1996. "I kind of watch over the playgrounds," he notes. "Special events are also a high priority. We take care of all the recreation staff's needs."

"We mow about 200+ acres a week. We mow athletic fields two times a week, but the main fields are mowed once a day," says Schiller, who has two associate degrees from Hartford College in Palatine, Ill., and served in the U.S. Air Force where he did much the same as he does today.

The Schaumburg parks department uses 15- and 16-foot gang mowers for productivity's sake, because many areas—including ballfields—are large.

"We also do broadleaf weed control, but we can't afford to do much disease control or anything," says Schiller. "It always seems as though one of our guys is out seeding somewhere. We oversee with new grasses and let them grow through it. Then, we try to keep the grass healthy and growing so it can tolerate all the use."

Some of Schiller's recommendations that have worked over the past year:

PROBLEM AREAS: "With 105 sites over 26 square miles, it's hard to see everything. We hope other people will be our eyes. You listen to the public and your recreation staff all the time. You try to serve their needs. If something's not right, people will tell you."

GEESE: "We just bought a puppy—Lucy—and found she's the best way to keep geese away. Each goose leaves behind a quarter-pound (of 'dirt') a day and you can't clean it up because it's greasy and gooky and dirties up athletic fields. The dog won't



Schaumburg's Mike Schiller uses four-day work weeks to keep his employees more productive.

GCSAA announces officer nominees for 1996

Bruce R. Williams has been nominated for the presidency of the Golf Course Superintendents Association of America. The association's 1996 election of officers and directors is scheduled for Saturday, February 10, during its annual meeting at the GCSAA International Golf Course Conference and Show in Orlando, Fla.

Williams is superintendent at Bob O' Link Golf Club in Highland Park, Ill., and is currently serving as vice president of GCSAA.

The nominee for vice president is Paul S. McGinnis, CGCS, of Union Hills Country Club in Sun City, Ariz.

Nominees for secretary/treasurer are Dave Fearis, CGCS, of Blue Hills Country Club, Kansas City, Mo.; and George Renault III, CGCS, of Burning Tree Club in Bethesda, Md.

Six candidates are up for election to two director posts: Paul A. Dermott, CGCS, of Oakdale Golf & Country Club in Downsview, Ontario, Canada; Ken Mangum, CGCS, of Atlanta Athletic Club in Duluth, Ga.; Samuel Snyder VII,

CGCS, of Hercules Country Club, Wilmington, Del.; Robert J. Tillema, CGCS, of Sherwood Forest Golf Club, Sanger, Calif.; Michael Wallace, CGCS, of Hop Meadow Country Club in Simsbury, Conn.; and R. Scott Woodhead, CGCS, of Valley View Golf Club, Bozeman, Mont.

Georgia Turfgrass Foundation earns golf industry support

The Georgia Turfgrass Foundation Trust reports contributions from the state's golf industry associations surpassed \$15,000 for 1995.

"GTFT is truly coming into it's own, with meaningful research and projects that the industry is supporting," says Mark Hoban, GTFT president. For information on tax-deductible donations to GTFT, call GTFT at (404) 975-4123.

Golf course project serves as training ground

Delhi College Golf Course recently added a back nine to its golf course in Delhi, N.Y., and the New York State Turfgrass Association used the project as the focal point for its 10th Annual Golf Course Design and Construction Seminar.

The course construction has served as a training ground for students in Delhi's turf/golf course operations; horticulture; landscape contracting; and landscape architectural technology programs.

According to Dominic Morales, profes-

sor and plant science program director at Delhi College, more than 20 green industry companies have donated equipment, supplies and services in excess of \$200,000 to help finance the project.

cont. from page 11G



Schiller, left, and Eric McMann make over a pitcher's mound with Flexiclay.

hurt the geese, but the geese take flight when they see her."

MORALE: "This summer, the toughest thing was keeping the staff healthy because it was so hot. Went through several hundred gallons of Gatorade. And we let the crews take more frequent breaks, as long as they got the job done."

PRODUCTIVITY: "Our mowing guys are more productive when they can work longer hours on a jobsite, so we're on a four-day work week, 10 hours a day."

PITCHER'S MOUNDS: "We're using a polymer/clay combination called Flexiclay. It holds up well in wetness. Our Eric McMann will rebuild the pitcher's mound in the fall. He says that it takes him one hour to add the Flexiclay and it saves him 50 hours the next summer. It's only \$11 a bag, so it's well worth it." **LM**



TruGreen/ ChemLawn finds a way to reduce callbacks in Houston

As branch manager for TruGreen/ChemLawn in the Houston, Texas area, Charlie Fallis faced a season full of customer complaints about brown patch. Once nights begin to cool off in mid-August, the region's predominantly St. Augustinegrass lawns are highly susceptible to rhizoctonia (commonly known as brown patch).

"I'd say a good 80 percent of our customers' yards have brown patch in them each year," notes Fallis. "The disease starts off as small, brown circles with leaves appearing wet or soaked. As it progresses, the circles get to be the size of a plate and then a trash lid, and it can take over the whole yard. The sheath of the leaf dies and you can just pull the dead grass away. It gets pretty ugly."

Since TruGreen/ChemLawn has a free service-call policy, the company lost revenue each fall by having to spot-treat customers' lawns in an attempt to control brown patch. "We used a variety of chemical controls, but we really didn't feel confident we even reduced the disease that much," adds Fallis. "I tried to concentrate on cul-

tural controls, telling customers to control watering, mow at the right height, keep a sharp mower blade and fertilize at optimum levels. But it's hard to get people to follow your advice."

If Jaynes could convince customers to limit watering their lawns in the fall, brown patch occurrence could be reduced dramatically, he says. Cultural controls work hand-in-hand with chemical controls to reduce disease outbreak.

"Brown patch is much worse in our area than farther north," he adds.

One solution

Last year, the Houston branches of TruGreen/ChemLawn used Prostar 50WP fungicide for brown patch control. The company tried the product on a limited basis in 1993 and found that it did a terrific job on brown patch, Fallis says. Used either preventively or curatively, it provided control for 14 to 21 days.

"Prostar is the most effective product we've ever used for brown patch," says Bob Jaynes, TruGreen/ChemLawn field service manager. "I'd say it reduced our callbacks by about 80 percent. [It] works so well that after we treat an area it dries up so effectively that customers are noticing the difference."

Routine lawn care for Houston area TruGreen/ChemLawn customers means seven applications each year. Since preventive disease control costs extra, Fallis and his employees had difficulty selling the service. But now more customers are requesting it.

Other headaches

Other seasonal lawn care challenges in the Houston area include gray leaf spot, Virginia buttonweed and dallisgrass. Though TruGreen/ChemLawn has found effective products to use on the first two problems, there is no registered pesticide to control dallisgrass in St. Augustine turf.

"It's one of those situations where you have to tell your customers they need to pull a few weeds in spite of paying for a lawn service," says Jaynes. "Sometimes they don't like that."

Getting the most out of your mowers

by JERRY ROCHE / Editor-in-Chief

In the last five years, I've seen some of the largest contractors in the country go broke," claims industry consultant Jim Huston. "It's been because they haven't had a handle on equipment costs."

Actually, Huston notes, equipment costs are just one small part of the bigger picture of estimating and bidding jobs, which should be a three-step process.

Phase I costs are those incurred for producing the end product: material, labor, equipment costs and sub-contracting costs.

Phase II costs are "general condition" costs: those required by the job but not part of the finished product

"Phases I and II are direct costs, Phase III indirect costs," Huston contends. "Direct costs are a piece of cake to estimate, but when it comes to overhead, there's a lot of heated discussion."

For instance, how are the costs measured? To what line are they allocated? And how do you, as owner, control them?

"Every cost you have should fit somewhere," Huston says. "Otherwise, you have a leak in your organization." He told landscapers in Louisville, Ky., last summer (during the Power Equipment Expo) that he consulted for one company that had a \$300,000 "leak" per year for 10 years.

Computers are not the total answer, either. "Most of the programs don't understand how complex estimating is," he contends.

Equipment costs

There are three components to equipment costs: acquisition, maintenance

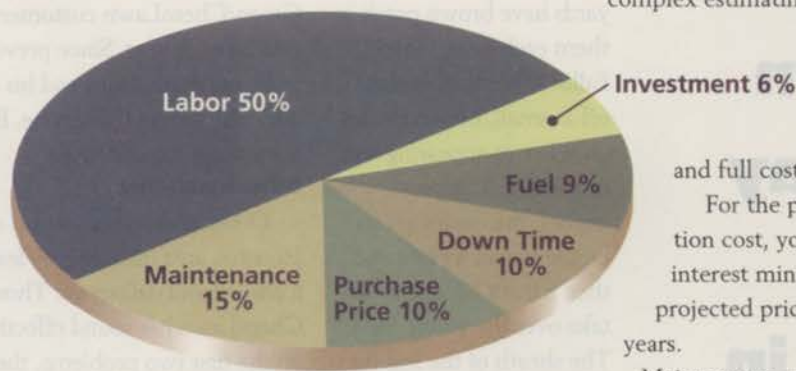
and full costs per hour.

For the purpose of determining acquisition cost, you take purchase price plus interest minus salvage value, divided by the projected price of the piece of equipment in years.

Maintenance costs applied to the estimating process are insurances, lube & oil, tires and other maintenance costs divided by the projected life in years.

"For a pick-up truck," Huston reveals, "equipment costs total about \$3.50 per hour, based on a life of 8,320 hours." For larger equipment like backhoes and tractors, and smaller equipment like mowers, Huston says you should calculate costs by engine running time rather than mileage or life in years. Lifetime maintenance costs for a

Mowing cost per acre or 1,000 sq. ft., of a typical mower used in the green industry, from Mike Bladon, University of Guelph, Canada.



like portable sanitary facilities, drive time, permits, soil tests and dump fees.

Phase III costs are mark-ups. They include sales taxes, labor burden (paid holidays, FICA, etc.); overhead recovery (rent, advertising, etc.); contingency factors and costs; and net profits. These can come to about \$10 per hour for installation jobs and about \$5 per hour for maintenance jobs.

tractor, he says, should run about the cost of a new tractor.

Be careful when calculating mower costs, though.

"A lot of fascinating things are happening in the small engine market," he cautions. "Engine life is very important to track. Equipment costs are extremely dynamic and if you're handling the equipment wrong, it can really increase your costs."

If you calculate equipment costs correctly, Huston notes, it should approximate 60 percent of the cost of renting the same piece of equipment.

Cost per unit

One of the keys to knowing mower costs is the ability to calculate costs per "unit" for a particular mower. The "unit" should be determined by your most common unit of measurement. If you're doing small home lawns, the "unit" is 1,000 sq. ft. If you're doing large landscapes, golf courses or athletic fields, the "unit" is acre.

"In order to save money, but not necessarily cut capital costs, the [mower] must minimize time and labor costs,"

according to an article in the Sports Turf Newsletter written by Mike Bladon of the grounds department at the University of Guelph (Canada).

Considerations he lists:

- ▶ Does it have engine power to cut heavy grasses at high ground speed?
- ▶ Does it have trimming capacity?
- ▶ Does it float to avoid scalping?
- ▶ Does it have adequate traction and side-hill stability?
- ▶ Does it have a sturdy frame construction?

According to Bladon, the biggest cost of operating a mower is labor—about 50% of the total cost of mowing.

Interestingly enough, purchase price comprises just 10 percent of the cost of mowing. Other costs: maintenance, 15 percent; fuel, 9 percent; downtime, 10 percent; investment, 6 percent.

A three-year formula

Ron Lauchnor of Gravely Tractor, speaking at the Louisville Expo a few years ago, came up with the accompanying chart listing "return" for various types of mowing equipment.

Lauchnor calculated acres per hour

by multiplying deck width by cutting speed and dividing by 10. He then extrapolated weekly gross profits from doing 30 typical jobs per week at what you might charge for that job. By subtracting costs (salaries, fuel, insurance, equipment and overhead) such as Huston notes above, Lauchnor comes up with net profits for one week using each piece of equipment. Assuming a 25-week production season, he then calculates a three-year return on the piece of equipment.

As you can see from the accompanying chart, any type of machine can bring you profits, if used properly and kept in constant use.

"If you understand the numbers, they're powerful data when it comes to negotiating," Huston says. "If you're making money now, don't panic—you're doing well. But costs could become a serious issue. Calculate and validate your costs, then compare your bidded costs to your actual costs." **LM**

EVALUATING MOWERS FOR PROFIT

Mower	Initial cost	Acres/Hr.	Jobs/Wk	Fee/Job	Gross/Wk.	Costs/Wk.	Net/Wk.	3-Yr. Return
21" push	\$400	0.5	30	\$15	\$450	\$175	\$275	\$20,625
40" rider	\$3000	1.0	30	\$25	\$200	\$200	\$550	\$41,250
42" rider w/bagger	\$6200	1.4	30	\$30	\$900	\$200	\$700	\$52,500
50" rider	\$3600	1.4	30	\$35	\$1050	\$250	\$800	\$60,000
60" rider (slower)	\$6400	2.5	30	\$60	\$1800	\$350	\$1450	\$108,750
60" rider (faster)	\$8400	3.0	30	\$70	\$2100	\$400	\$1700	\$127,500
72" rider	\$14,500	3.6	30	\$80	\$2400	\$450	\$1950	\$146,250
144" tractor	\$19,500	5.0	30	\$100	\$3000	\$500	\$2500	\$187,500

Acres/Hr. = width x cutting speed x 10
 Jobs/Wk. = if mower is kept busy all week
 Fee/Job = typical fees charged to customers
 Gross/Wk. = Jobs/Wk. x Fee/Job

Costs/Wk. = labor, fuel, insurance, maintenance, overhead
 Net/Wk. = Gross/Wk. — Costs/Wk.
 3-Yr. Return = Net/Wk. x 75 (based on 25-week season)

Managing turf for maximum root growth

by R.N. CARROW, Ph.D. / University of Georgia

MANAGING FOR BETTER ROOTS

WHAT TO DO

HOW TO DO IT

- 1) *Select species/cultivars with the best rooting potential* . . .examine use, soil properties, management regime
- 2) *Promote maximum net carbohydrate production:*
 - optimize leaf area** . . .mow as high as feasible
limit wear damage
control disease and insects
 - optimize leaf chlorophyll content** . . .avoid deficiencies in N, Fe, Mn, Mg, S
correct conditions that promote leaf color
loss such as waterlogging, low soil oxygen or prolonged drought stress
 - promote good light conditions** . . .remove excess clippings
prune lower limbs of trees and selected crown branches
- 3) *Avoid depletion of carbohydrates* . . .avoid excessive nitrogen application
- 4) *Correct soil physical conditions.*
 - high soil strength** . . .cultivate
modify with peat
modify soil with gypsum on sodium-affected soil
 - low soil oxygen** . . .cultivate
provide surface and subsurface drainage
 - soil layers** . . .cultivate
 - water deficits** . . .irrigate
increase water-holding capacity with organic matter
 - keep soil temperatures moderate** . . .irrigate
 - maintain dense turf** . . .mow as high as feasible
 - modify cold soil in spring** . . .assure proper drainage
cultivate
- 5) *Correct poor soil chemical conditions.*
 - acid, high aluminum soil** . . .lime
 - very alkaline soil** . . .if no free CaCO_3 exists, use S, H_2SO_4 or acidic N carriers
 - infertile soil** . . .fertilize, especially with N, P and K
 - avoid toxins** . . .limit excessive use of some herbicides
limit soil amendments with heavy metals
do not overuse micronutrients
 - cure salt-related problems** . . .cultivate or add gypsum or sulfur to improve drainage or use an alternate water source, depending on source of problem
- 6) *Correct poor soil geological conditions.*
 - root-feeding insects** . . .take chemical and biological control measures
 - root diseases** . . .make appropriate cultural and chemical preventive and control treatments
 - nematodes** . . .use chemical controls
 - thatch** . . .mechanically remove
promote microbial degradation

Roots are very important to successful turfgrass culture. Their five main functions are:

1) **Anchor:** a very basic role when the cleats of football players tear up large pieces of turf, or a golfer's iron shot pulls up a large divot from a golfer's iron shot, or sod easily lifts after grubs have damaged roots.

2) **Absorb and translocate water:** necessary for the cells to maintain biological functions and turgor pressure, and for transpirational cooling.

3) **Absorb and translocate nutrients:** for producing thousands of enzymes, carbohydrates, lipids and other compounds used in growth and development.

4) **Synthesize and transport certain hormones:** like cytokinins, gibberelins and abscisic acid.

5) **Sink for carbohydrates produced in the shoots:** roots depend on carbohydrate production via photosynthesis for their growth.

Root characteristics

Root systems are dynamic. Seasonal weather conditions trigger hormonal changes in turfgrass plants, resulting in growth cycles. Management practices to achieve maximum rooting must be timed to take advantage of the natural periods of rapid growth.

Scientists have identified the maximum rooting depth capability of different grasses under ideal conditions, which is important for knowing a grass's genetic potential to produce a root system when there are no limiting factors. Breeders now know that it is possible to breed or select for deeper-

rooted grasses within species.

Root hairs, which differ dramatically with species and cultivars in sand or water, greatly increase the root surface area for nutrient and water uptake.

Normally, live roots are water permeable, but they may become partially impermeable under low soil oxygen. These roots are less functional. Also, as roots age, some of the cells can die. On a large scale, it's called root dieback. Dead or partially dead root tissues take up less nutrients and water.

Roots usually live six months to two years, depending on the species, management conditions and environment. For example, certain spring climatic conditions can "prune" bermudagrass roots.

Finally, mycorrhizal relationships such as the influence of micro-organisms on roots may enhance water and nutrient adsorption.

Root limiting factors

Why does a bermudagrass exhibit a rooting depth of a few inches on a particular site when it has the genetic potential to develop a root system several feet deep?

Shoot factors—Factors that can limit actual rooting to much less than the genetic potential are either shoot-related (above ground) or soil-related.

Maintaining old roots and growing new ones depends on net food (carbohydrate) production in green shoot tissues by photosynthesis.

Roots get carbohydrates for growth only if enough are

manufactured for cell maintenance and shoot growth.

Anything that decreases photosynthesis or increases respiration will eventually reduce root growth; if severe, roots can die.

Anything that reduces leaf area—close mowing, leaf-feeding insects, and diseases—reduces rooting. It also tends to cause a temporary increase in respiration.

Chlorophyll, the light-absorbing pigment, is also necessary for photosynthesis. Low chlorophyll (a yellow plant) is often a result of:

- ▶ deficiencies of nitrogen, iron, manganese, magnesium and/or sulfur;

- ▶ low soil oxygen through compaction or waterlogging, drought stress, and burn from some pesticides and nitrogen sources.

If any of these conditions persist for more than a few days, root growth is likely to be impaired.

Because light is also needed for photosynthesis, anything that covers the leaves, such as excess clippings or shade, hinders rooting.

Persistent drought stress, which can cause leaf stomata to close and reduce CO₂ uptake, will also slow photosynthesis and retard rooting potential.

Above-ground factors—Mechanical, disease or insect injury can increase respiration rate, which causes greater use of carbohydrates and less root growth.

Higher temperatures, which also increase respiration and carbohydrate deple-

tion, are a major contributor to root deterioration of cool-season grasses during the summer.

Soil factors—Many soil conditions can limit rooting:

- 1) Each species has a genetic-based tolerance for factors like low soil O₂, high aluminum and mechanical strength. But breeders can develop cultivars with broader tolerance. For example, more aluminum-tolerant tall fescues could be developed for very acid, high-aluminum situations.

- 2) Within the genetic tolerance range, management practices can often correct a specific limiting factor. For example, cultivation can

improve low soil O₂ and/or high mechanical strength.

Broader genetic tolerance and management to correct or prevent a poor soil condition can improve rooting.

To choose cultural approaches on your site, identify the specific soil-based factors that actually inhibit rooting. To be successful, know your soil's properties and be able to evaluate each soil in terms of the physical, chemical and biological characteristics. □

—This article, condensed from the "Georgia Turfgrass Association News," is used with permission of the author and the Georgia Turfgrass Association.

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6 quick rules for diagnosing plant problems

by JAMES CHATFIELD / Ohio State Extension Service

Diagnosing plant problems is difficult and requires discipline and diverse knowledge. Yet everyone wants an instant and simple answer, not to mention an inexpensive and certain solution.

Is there a sure fire way to make diagnosis easy? Not really. But the following rules will lead to improved diagnostic success:

Rule 1: Know your plants.



Normal fall color on larch, a deciduous conifer. If you do not know it loses its needles each year, this would appear alarming.



Oak leaf blister: it looks serious, but rarely is significant to plant health.

Sometimes a homeowner cuts down a larch or bald cypress because he or she doesn't realize that these are deciduous conifers that drop needles in the fall. Likewise, a homeowner may notice brown needles on their white pines and believe the trees are diseased when, in fact, they're healthy. As horticulturists, not only do you know a larch from a pine (that's not too tough), but you know that loss of third-year needles is typical of white pine.

Another example that's not that uncommon is the severe yellowing between veins of the leaves of the pin oak. This may or may not be due to unavailability of iron in alkaline soil. But you know that that's a good place to start your diagnosis.

Certain plants are almost known by certain problems, such as black locusts in late summer skeletonized by locust leafminer adults, or sycamores with clusters of browned leaves and twig dieback, accompanied by leaf drop in June. They could be infected by sycamore anthracnose.

Finally, if you know your plants and where they should be placed, you will have an idea why taxus in a low, wet area is turning off-color and browning. Or why a European birch in the Midwest heat is losing upper branches from bronze birch borers.

Good diagnosis begins with plant knowledge.

Rule 2: Look for patterns.

First, determine the range of plants affected. If widely different species are damaged, it's unlikely that the problem is an infectious plant disease. Most disease-causing fungi and bacteria affect a limited number of plant types. If all the trees and shrubs in an area are dying, the problem is more likely environmental or cultural.

Check to see if problems are more widespread in low areas where poor drainage may be the key factor. Ask whether soil was disturbed by construction—trenching, soil grade changes, soil compaction. If contamination or overdoses of a pesticide are suspected, review what properties were sprayed and in what order. (If the problem is contamination of a hose line with a fertilizer or herbicide, the first properties sprayed should show the greatest damage.)