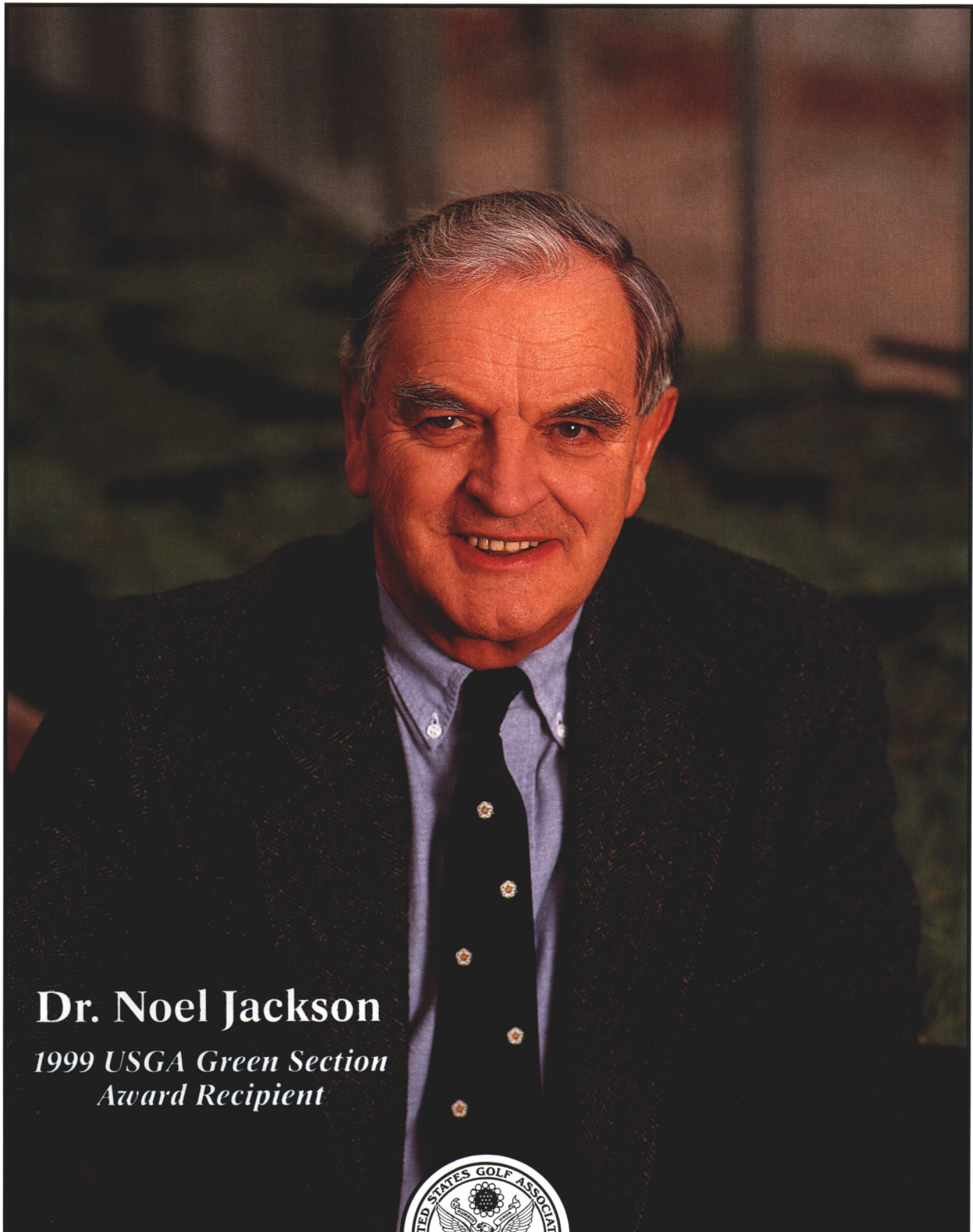


USGA® GREEN SECTION **Record**

Volume 37, Number 3

May/June 1999



Dr. Noel Jackson
*1999 USGA Green Section
Award Recipient*



A PUBLICATION ON TURFGRASS MANAGEMENT

BY THE UNITED STATES GOLF ASSOCIATION®

Cover Photo:
Dr. Noel Jackson
is the 1999 USGA
Green Section
Award recipient.

PHOTO © L. C. LAMBRECT



Bunker maintenance is an often debated topic with many varying opinions. Five Turf Tips were presented on bunker maintenance.



Low-volume sprinklers can be used to leach native soil greens without causing runoff into bunkers and green surrounds. These sprinklers are available from several manufacturers, with application rates ranging from 0.5 to 1.0 gallon per minute and a radius of 12 to 15 feet. See page 26.

USGA® GREEN SECTION Record

1
1999 USGA Green Section Award Recipient — Dr. Noel Jackson

2
Experience Spoken Here

2
Flood Insurance
Filter fabric provides protection against floodwaters. *By Jim Skorulski*

3
Involve Me, and I Will Understand
Accepting input from employees whenever possible can improve morale. *By Darin S. Bevard*

4
Maximizing Available Footage
By midsummer, does your practice range tee look like a battlefield? *By Bob Brame*

5
Practice Makes Perfect
Two helpful ideas for maintaining the practice facility. *By Matt Nelson*

6
Southern Exposure
Using pop-up sprinklers to irrigate steep bunker faces. *By Paul Vermeulen*

8
Organic Facts and Fallacies
The mystical world of growing turf organically and managing pests with biological controls contains a lot of facts and a large dose of fiction thrown in for good measure. How is a golf course superintendent supposed to sort out the facts from the fallacies? *By Dr. Noel Jackson*

12
Bunker Preparation: It Takes More Than a Rake!
Sometimes bunkers need irrigation too. *By Keith A. Happ*

13
Saving Zoller's Dollars
A unique method to reduce bunker contamination. *By Larry Gilhuly*

14
Bunkers: The Right Track
A new bunker construction method reduces sand erosion. *By Patrick M. O'Brien*

15
Stop Bunker Face Erosion!
Perimeter drain lines can reduce bunker face erosion and maintenance. *By Brian Maloy*

16
Deceptive Definition
A little make-believe can go a long way. *By David A. Oatis*

17
It's The Same Game, But How It's Changed!
Constant vigilance helps to keep the challenge and enjoyment in golf. *By Frank Thomas*

22
Irrigation By The Book
A notebook of irrigation blueprints simplifies daily water management. *By Mike Huck*

23
A Sharp Idea
How an old practice is helping to manage new turfgrass varieties.
By Christopher E. Hartwiger

24
A Luxury You Can Afford
A secretary for the superintendent. It's becoming a necessity. *By Stanley J. Zontek*

25
Reels On Wheels
An inexpensive way to optimize workspace in old and new maintenance facilities. *By Robert Vavrek*

26
Flood Your Greens — Not Your Bunkers
Using low-precipitation-rate sprinklers for leaching greens. *By Patrick Gross*

27
May The Force Be With You
An alternative method for incorporating topdressing sand into high-density putting green turf.
By John H. Foy

28
News Notes

30
Turf Twisters

DR. NOEL JACKSON

DR. NOEL JACKSON, a distinguished teacher, researcher, and extension specialist from the University of Rhode Island, has been selected as the recipient of the 1999 Green Section Award. In 1960 the USGA Green Section established its Green Section Award, which recognizes persons for outstanding service to golf through their work with turfgrass. When accepting the award, presented at the Golf Course Superintendents Association of America conference in Orlando, Florida, on February 14, 1999, Dr. Jackson said, "I consider this award to be the crowning honor of 40 years of turfgrass research."

The selection of Dr. Jackson as the 39th recipient represents two firsts in the history of the award: He is the first turfgrass pathologist so honored, and he is the first recipient to be born, raised, and educated outside the United States, having been born in Yorkshire, England, and educated in the United Kingdom.

Dr. Jackson's academic record includes B.S. and M.S. degrees in agricultural botany from King's College, Newcastle-Upon-Tyne, U.K., and a Ph.D. degree in agronomy from the University of Durham, U.K. From 1958 to 1965 he served as a distinguished turfgrass pathologist with the Sports Turf Research Institute in Bingley, England. In 1965 he immigrated to the United States and joined the faculty of the University of Rhode Island, rising to the rank of Professor.

To thousands of golf course superintendents throughout the northern United States, Canada, and northern Europe, Dr. Jackson is renowned for his knowledge of cool-season turfgrass diseases and for his expertise as a turf disease diagnostician. He is highly respected for his prompt and accurate diagnoses and his ability to provide effective and practical disease control recommendations. Throughout his career he has kept close sight of the agronomic factors and their influence on disease activity. His ability to listen, reason, and recommend practical solutions has made him an invaluable ally of golf course superintendents and the golfers they serve. He provides both on-site and lab support as part of his extension program, and he truly enjoys



Dr. Noel Jackson (holding award) with (from left) Matt Nelson, Dave Oatis, and Jim Skorulski, agronomists in the Green Section's Northeast Region.

the close working relationship he has with golf course superintendents.

His academic peers equally admire him for his unique understanding of the relationship between disease and agronomic practices, and for his exceptional knowledge of the taxonomy, biology, and management of turfgrass diseases. Jackson is considered perhaps the finest turfgrass disease diagnostician and is an expert on take-all patch disease and other rhizosphere diseases, anthracnose, yellow tuft, and mycorrhizae of turfgrasses. He helped develop many of the fungicides available today, has authored hundreds of research, extension, and popular articles, and co-authored the seminal work *Fungal Diseases of Amenity Grasses*. This monograph is considered the premier reference on the subject of turfgrass diseases among turfgrass pathologists.

Among Dr. Jackson's greatest contributions has been his unselfish devotion and close personal attention given to his students and to all who ask for his assistance. The classes he teaches are among the most popular at URI, and graduates often remark that his class was one of the most important they took. His enthusiasm in the classroom has attracted many students into the field of turfgrass and golf course management, and he stays in touch with his graduates and follows their careers with interest and support.

He also teaches the highly popular GCSAA seminar *Identification of Turfgrass Diseases*. Another of Dr. Jackson's most acclaimed seminars, *Are We Mowing Our Greens to*

Death?, was so popular that he agreed to have it videotaped to allow golf course superintendents to show it to their course officials. As one supporter said, "Dr. Jackson is never afraid to take a stand on what he thinks is best for the turf, the golf course superintendent, and the course."

Dr. Jackson was instrumental in establishing the Rhode Island Turfgrass Foundation and founding the Rhode Island Turfgrass Conference and Show. He also was very influential in merging the Rhode Island conference with the Massachusetts conference into the New England Regional Turfgrass Conference and Show, drawing more than 2,000 attendees annually.

As a speaker, Dr. Jackson has few peers. His seminar topics and research studies are on the cutting edge of the industry's needs, and his enthusiasm for the topics he presents is infectious. He has the very rare ability to explain complex subjects to any type of audience with clarity and wonderful humor.

A statement from one of his admirers says it best: "Dr. Jackson's vast experience and knowledge in turfgrass agronomy and pathology; his dedication to research, teaching, and extension work; his insight, sense of humor, willingness to share ideas, ability to communicate effectively, and his love for his profession make him one of the most respected men in our industry. Mention Dr. Jackson's name and nearly every New England golf course superintendent, and many golfers, will have a story or instance where Dr. Jackson has had a positive influence in their career, on the golf course, or in their lives."

Experience Spoken Here

February 14, 1999, Orlando, Florida

FOR THE 18TH CONSECUTIVE YEAR the annual Green Section Education Conference was held in conjunction with the Golf Course Superintendents Association of America International Turfgrass Conference and Show.

This year more than 1,000 people attended the Green Section's program on Sunday, February 14, at the Orlando Convention Center. Joe England, Chairman of the Green Section and member of the USGA Executive Committee, welcomed the group, and James T. Snow, National Director of the USGA Green Section, served as moderator for the afternoon's program of 18 speakers who addressed this year's theme, "Experience Spoken Here."

THE BEST TURF TIPS OF 1998

One of the most popular annual features of the Education Conference is the Best Turf Tips. This year, 16 of the Green Section's agronomists reported on some of the helpful ideas and ingenious innovations they came across while visiting golf course superintendents in every part of the country during 1998. The Turf Tips appear throughout this issue.

Flood Insurance

Filter fabric provides protection against floodwaters.

by JIM SKORULSKI

ANY golf course superintendent who experiences a flood event learns to respect the powers of Mother Nature. The extent of turf injury and property damage can be tremendous and cleanup operations immense. Dealing with one flood event in a lifetime is enough for anyone, but imagine facing the challenge two and even three times in a single season!

Such is the case with Bruce Packard, CGCS, at Stockbridge Golf Club in Stockbridge, Massachusetts, where the normally placid Housatonic River meanders through the golf course. Spring runoff from melting snows in the Berkshire Mountains or rain from unusually heavy thunderstorms can cause the river to overflow its banks and flood greens, tees, and fairways on the golf course. Mr. Packard and the

staff have, out of necessity, become very adept at cleaning up the silt and flood debris deposited on the golf course. A simple but ingenious idea also has evolved from the many battles waged against the Housatonic floodwaters. It involves a method to protect submerged irrigation valve boxes from sedimentation and is the basis of this Turf Tip.

Mr. Packard uses DuPont Tyvar spunbond filter fabric, cut to size and installed in the valve boxes, to filter the floodwaters. The fabric is placed on the inner lip of the valve box that supports the lid. The sides of the fabric are folded upward around the edges of the box. The fabric is punctured, allowing for the installation of the fastening bolt that secures the cover in place. The cover is then carefully installed over the fabric,

taking care not to disturb its placement. The filter fabric prevents silt and fine debris from entering the valve box. The fabric is installed in fall prior to the winter months and left in place throughout the season, unless there are mechanical problems with the valve or the fabric is in need of replacing. The use of the fabric has protected the valves and saved significant time with cleanup.

The filter fabric is relatively inexpensive and may be available at your local hardware store. It is easily cut to size with a utility knife or scissors to fit the dimensions of the valve boxes on your golf course. Mr. Packard and his staff have prepared and installed the fabric for nearly 200 boxes in two working days.

Flooding will continue to create havoc on golf courses and maintenance operations. The high costs associated with the damage and cleanup created by the floodwaters may be unavoidable. However, this simple and inexpensive idea provides some degree of protection to the irrigation valve boxes and should eliminate one facet of a difficult cleanup.

Filter fabric is installed on the lip of the irrigation valve boxes and folded upward around the lid to prevent sediments from entering the submerged valve box.



JIM SKORULSKI is an agronomist in the Northeast Region, where he visits golf courses primarily in New England and upstate New York. His office is based in Palmer, Massachusetts.

Involve Me, And I Will Understand

Accepting input from employees whenever possible can improve morale.

by DARIN S. BEVARD



The crew gained valuable hands-on experience when they cleaned up the hillside adjacent to the sixth green and also installed brick planters, which improved the aesthetic quality of the hole (McCall Field Golf Club, Upper Darby, Pennsylvania).

PROPER MAINTENANCE of a golf course depends upon many factors. A good superintendent, an adequate budget, and modern equipment are substantial parts of the equation. However, none of these factors matter if you do not have a well-trained maintenance staff that has a genuine concern for the well-being of the golf course. If crew members care about the facility and take pride in their work, better conditions can generally be attained.

Golf course maintenance revolves around tasks that are repeated on a daily basis. Think of the many hot, dirty jobs that are routinely performed. These tasks can become monotonous over the course of the growing season. As such, crew members can become mired in a state of going through the motions. Attention to detail can suffer and overall playing quality may be reduced. Ultimately, this reflects back upon the superintendent.

As managers, it is important to develop ways to keep the interest and morale of workers at a high level. The challenge is to find an avenue to provide motivation for employees to do their best without using threats of termination or demotion.

Joe Candelore, superintendent at McCall Field Golf Course in Upper Darby, Pennsylvania, has implemented a unique program to keep his employees motivated. The sign hanging over the door of Mr. Candelore's office best summarizes his philosophy. The sign reads, "Tell me, I'll forget. Show me, I may remember. But involve me, and I'll understand." Mr. Candelore uses this philosophy as often as possible in his day-to-day operations, but especially when a special project needs to be addressed.

Mr. Candelore asks his employees how they think a particular problem should be resolved. In return for their suggestions, he may allow an early exit on a Friday afternoon or an opportunity to play a round of golf. He makes it clear that only serious suggestions will be accepted. Many small projects at McCall Field Golf Course have been completed in this manner.

One example of a project where this tactic was employed was an effort to improve the appearance of the hillside adjacent to the sixth green. A housing complex borders the top of the hill. Over time, the area had been littered with various assortments of trash. The goal was not just to clean up the area;

that would be easy. Improving the overall appearance of the entire area was needed.

After Mr. Candelore requested input from his crew, several solutions were considered. In addition to collecting the trash, the decision was made to build brick planters into the hillside. The end result provided a dramatic improvement. What was once a forgotten area was changed into an asset, and the entire crew had a part in it, from start to finish.

Another project involved the construction of a footpath through an area between the sixth green and seventh tee. Foot traffic had worn the area between the two holes to bare soil. Again, the crew helped to develop a plan of action, and a new crushed-brick path surrounded by landscaping beds was installed.

These projects by themselves are not marvels. However, allowing his crew to be involved from start to finish has provided a source of pride and esprit de corps as they go through their daily routines. And, just maybe, it has raised the level of awareness and made someone try a little harder not to miss a strip when mowing or to rake a bunker more carefully by helping them to realize their work matters.

Mr. Candelore will be the first to admit that he has an unusual situation for the implementation of this type of program. He has a solid core of employees, many of whom have been with him for several years. His goal, however, is not unique. It is simply to motivate his employees to do their best. He accomplishes this by involving his staff in decision-making whenever possible and providing some incentive for their input. Getting the staff more involved whenever possible can help them understand the significance of the tasks that are performed.

DARIN S. BEVARD is an agronomist in the Mid-Atlantic Region. He has been with the Green Section since 1996, visiting golf courses in Delaware, Maryland, Pennsylvania, Virginia, and West Virginia.

MAXIMIZING AVAILABLE FOOTAGE

By midsummer, does your practice range tee look like a battlefield?

by BOB BRAME

THERE IS A direct relationship between available tee footage, play volume, and turf quality. Nowhere is this more evident than on a practice range tee. While there is a formula* to correlate size, traffic, and turf quality on a regular tee, it does not apply to a practice tee. There simply is no way to correlate an individual's practice with holes played. However, it is safe to say that most practice range tees are heavily played. Equally, most courses have no option for enlarging usable practice tee footage. This turf tip deals with a few simple ideas to maximize available practice tee footage.

Tom Zimmerman, superintendent and general manager at Elcona Country Club in northern Indiana, has combined three strategies to maintain a high-quality practice tee surface for his membership. These components include: (1) A full-time attendant throughout the summer; (2) a divot filling mix of sand (60%), soil (20%), and peat moss (20%), with perennial ryegrass; and (3) a spool-mount hose coil.

Through a rotation of two employees, an attendant is present from 6:00 A.M. until dark between Memorial Day and Labor Day at the Elcona Country Club practice facility. These employees are part of the pro shop staff, yet their responsibilities involve everything from A to Z, with the exception of mowing and applying pesticides. The prompt filling of tee divot damage and nursing the young plants to maturation are key attendant responsibilities and paramount to the maintenance of a quality practice tee surface. Directly aware of wear patterns and plant maturation, the attendants carefully manage the hitting line with the placement of club racks and ball baskets.

**You need 100 square feet of usable tee footage for every 1,000 rounds of golf played each year. On par 3s, the first and tenth tee, or any tees where irons are normally used, you need 200 square feet of usable tee footage for every 1,000 rounds of golf played each year.*



The hose coil mounted at the back of the practice tee makes it easy for attendants to water seeds and plants as needed, without interrupting practice. When watering is complete, the hose can be quickly re-coiled out of the way.

Although Tom is now the general manager, the joint efforts of the pro shop and maintenance staffs to produce the best possible practice facility have been in place for several years. Courses that view the upkeep of the practice range tee as only the maintenance staff's responsibility are tying one hand behind their back with regard to maximizing available footage.

The practice tee root zone at Elcona is native soil and was originally planted with creeping bentgrass. This is a common combination at courses throughout the North Central Region. The use of a sand, soil, and peat moss combination for divot filling provides much better nutrient and water retention as compared to straight sand. While straight sand topdressing is commonly used to modify the upper portion of a putting green root zone, sand alone does not hold enough moisture and nutrients for quick seed germination

and growth, which are needed in the maintenance of a heavily played tee surface. The 6-2-2 mixture provides a good blend for moisture and nutrient retention, while also offering an enhancement of root zone porosity.

Although originally planted to bentgrass, the present seeding focus is perennial ryegrass. The ryegrass germinates and establishes much more quickly than bentgrass. Since the practice tee is maintained much like a fairway, fungicide applications block disease activity. On heavily trafficked surfaces like a practice range tee, a creeping bentgrass/perennial ryegrass combination allows quick divot damage recovery, while also offering some lateral stolon growth. The contrasting color and growth habits of bentgrass and perennial ryegrass are more than offset by the surface they provide. On a practice range tee the primary goal is a dense grass cover — few golfers would debate turf purity.

Once the attendants have placed the divot mix and perennial rye seed in wear patterns, moisture is vital for germination and growth. The lack of water blocks germination or results in seedling loss. Too much water enhances disease development and turf weakening, not to mention poor playability. The solution is hand watering with a hose that can be pulled out even while members are practicing. To accommodate this need, Tom built a spool-mount hose coil that makes it easy for the attendants to lightly water without interfering with tee usage. When watering is complete, the hose can be quickly re-coiled out of the way.

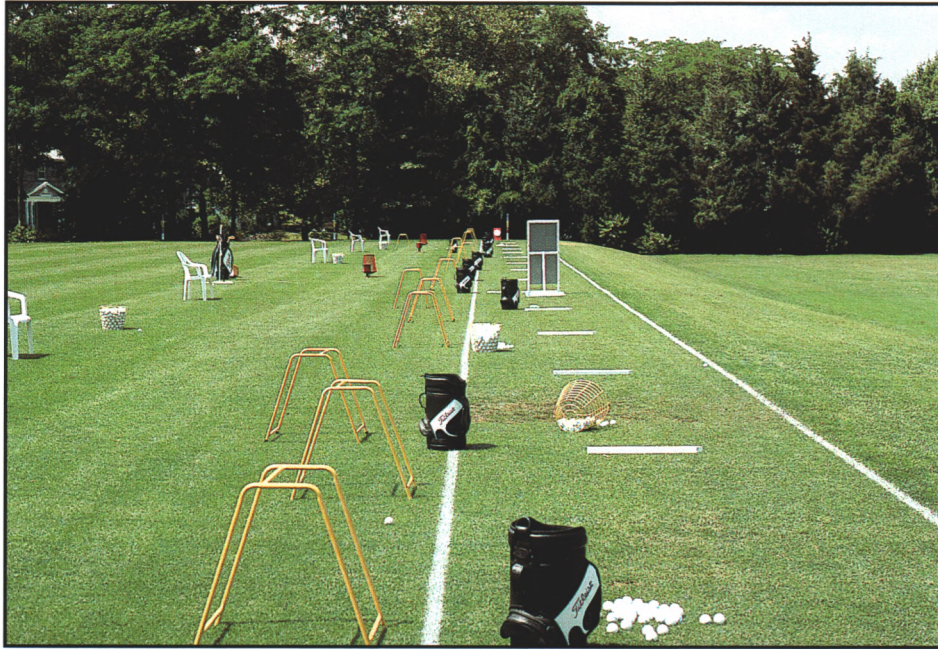
With more and more people playing golf, proper course maintenance is a growing challenge. Give the three strategies being combined at Elcona some thought as you look to *maximize available footage* on your course's practice range tee.

BOB BRAME is the Director of the North Central Region and works out of Covington, Kentucky. He visits courses in Indiana, Kentucky, and Ohio, where the superintendents are full of good turf tips.

PRACTICE MAKES PERFECT

Two helpful ideas for maintaining the practice facility.

by MATT NELSON



The use of turf marking paint, instead of ropes, to designate the hitting area on the practice tee improves presentation, makes mowing easier and more efficient, and improves safety for golfers.



Color-coded yardage posts on the edges of the practice tee give golfers a quick reference to estimate distance to target greens. The colored sections of the yardage posts correspond to the color of the flag on the target greens.

PRACTICE FACILITIES at golf courses across the country seem to be receiving more and more use. This is evidenced, in part, by the increased time spent at practice areas during Green Section Turf Advisory Service visits. Perhaps the American golfer is finally realizing that practice really does improve one's game, or maybe people are finding less and less free time to play nine or 18 holes, but enough time to hit balls for an hour or so. Regardless, the increased use of practice areas has increased the demand on the golf course superintendent to provide acceptable turf and maintain practice areas that simulate golf course conditions as closely as possible. Practice facility upgrades that include increased teeing area, target greens complete with real or artificial bunkers, and short-game practice areas are becoming common, at least at golf courses that have the necessary space.

The primary issue with teeing quality at the driving range is adequate usable teeing space. Even clubs with 1.0-1.5 acres of teeing space sometimes find this to be inadequate and occasionally have to rely on artificial mats. Artificial mats are useful during periods of inclement weather, winter months, or for large outings and should be a part of almost any practice tee, but they are not the same as hitting off of real grass. Without sufficient area, however, golf course superintendents find it impossible to regenerate quality turf-grass since tee marker rotation possibilities become inadequate. In other words, worn areas do not have enough time to recover before they are in use again.

Once sufficient space has been provided at the practice tee, two tips from Harry Bahrenburg, golf course superintendent, and Ken Going, Green Committee Chairman at the Huntington Crescent Club in Huntington, N.Y., may improve the playing quality at your practice facility. Rather than using ropes to delineate the designated hitting area on the practice tee, Mr. Bahrenburg uses white marking paint applied through a wide striping nozzle. A string line is used to insure that the lines are straight. Presentation and delineation are improved as people do not inadvertently or intentionally move the rope. Ropes also present a certain liability as it is quite possible to snag a rope while hitting a little too close and possibly injure oneself or others. It also is much easier to mow the tee without

having to coil and replace the marking ropes.

The hitting stations are separated with a white 2x4 equipped with stakes to hold it into the turf. Bag stands, club scrubs, chairs, and garbage cans also are standard items at the Huntington Crescent Club practice facility. Mr. Bahrenburg changes the six- to eight-foot-wide hitting area once per week and rotates from the front of the tee to the back. The tee is mowed two to three times per week. The worn area is top-dressed, leveled, overseeded, and fertilized lightly with a starter fertilizer to encourage recovery and new seedling establishment. Irrigation is applied as needed to encourage seedling establishment, but Mr. Bahrenburg has found the tee to perform best when kept firm. A combination of perennial

ryegrass and chewings fescue is used at the Huntington Crescent Club, but whatever turfgrass species is best suited to your region should be used on the practice tee. Of the cool-season turfgrasses, perennial ryegrass has the greatest wear tolerance and is the quickest and easiest to establish.

The next tip is the use of color-coded yardage posts placed on either end of the practice tee. These serve as quick reference points for golfers to determine the distance to the various target greens at the practice facility. The color-coded yardage on the post corresponds to the color of the flag placed on the respective target green. The yardage posts are much more convenient than in-ground distance markers and are definitely an improvement over those practice facilities with the standard

100-, 150-, and 200-yard markers without an established reference point on the tee.

As more people are introduced to the game of golf and existing golfers strive to improve their games, golf course superintendents will face an increasing challenge when it comes to maintenance of the practice facility. These two turf tips illustrate that innovative ideas such as these will be required by golf course superintendents across a greater range of the golf course, including the practice facility. As it is often said, nothing can replace experience. After all, *practice makes perfect!*

MATT NELSON "practices" agronomy throughout the Northeast Region, conducting Turf Advisory Service visits in New Jersey and New York.

SOUTHERN EXPOSURE

Using pop-up sprinklers to irrigate steep bunker faces.

by PAUL VERMEULEN

EVERY SPRING tourists by the hundreds of thousands flock to the southern states to soak up the warm rays of the sun. If they are not careful about overindulgence, however, overexposure to the sun and/or failing to apply ample amounts of sunscreen can lead to serious problems. In the short term, exuberant sunbathers can develop first-degree burns and, in the long term, the increased risk of skin cancer and premature wrinkling should be enough to warrant extra precaution.

While not life-threatening to people, the overexposure of turfed bunker faces can lead to serious problems for golf course superintendents. Turfed bunker faces are the steep, grassy embankments along bunker edges that compel golfers to hit a high, lofted club out of a hazard. The best example would be the so-called revetted bunker faces found throughout Great Britain.

Revetted bunker faces are constructed by stacking thick pieces of sod to establish an almost vertical angle. By stacking the sod in this fashion, the turf becomes very difficult to irrigate and, consequently, suffers from drought symptoms long before other areas on the course. When the



To ensure that the sod on steep bunker faces is properly irrigated, sprinkler heads can be installed perpendicular to the embankment. The best models for this application are the low-precipitation mist heads that throw water over a 60° angle on either side.

drought symptoms cannot be taken care of in a timely manner, the turf slowly perishes and the dry soil underneath becomes loose and eventually collapses.

The life expectancy of turfed bunker faces depends greatly on their orientation to the sun. Bunker faces that are exposed to the sun for longer periods due to their southern orientation can dry out and crumble in one to three years time, whereas bunker faces with a northern orientation last up to twice as long.

The rapid deterioration of revetted bunker faces with a southern exposure became a serious issue for John Philp, Links Supervisor at Carnoustie Golf Links in Scotland, as he began to plan maintenance activities for the 1999 British Open. If a solution could not be found, then John and his staff would have to rebuild dozens of revetted bunker faces within the 12-month period before the Open to have the course in tip-top condition. Making such an effort would overwhelm both his staff and his supply of sod, which is grown on site to ensure quality control.

In search of a solution, John began investigating the various sprinkler system designs that have been used to apply supplemental irrigation to steep bunker faces around the world. This investigation led him to two conclusions. First, sprinkler systems that are



Revetted bunker faces are constructed by stacking thick pieces of sod. The life expectancy of turfed bunker faces depends greatly on orientation to the sun.



In preparation for the 1999 British Open, John Philp, Links Supervisor at Carnoustie Golf Links in Scotland, installed an irrigation system along the middle of the south-facing revetted bunker faces. This sprinkler system prevents the sod from developing drought symptoms, which cause the turf to perish and the dry soil underneath to collapse. Through irrigation, the life expectancy of the sod increases by two to three years.

installed along the upper ridge of steep bunker faces tend to miss the target area by throwing most of the water past the turf. Furthermore, they are easily affected by wind and can cause water to pool in the bunker cavity. Second, sprinkler systems that are installed along the lower ridge of steep bunker faces are plagued by frequent mechanical failures because they are either damaged during routine raking and edging or become clogged with sand from repeated explosion shots.

After concluding his investigation, John decided to blaze a new trail and install a sprinkler system along the

middle of each bunker face. To ensure that the water would not miss the target, John positioned each sprinkler head perpendicular to the revetted bunker face. Also, he chose low-precipitation models that only throw water over a 60° angle on either side.

The sprinkler heads were installed during the normally scheduled renovation of each revetted bunker face on the course so as not to overwhelm his staff. Once installed, the new sprinkler heads were then wired into the irrigation system controllers so they could be operated by remote control, as needed. On a typical summer day at Carnoustie

the bunker faces are irrigated for two to three minutes twice a day.

The results have been terrific. So if you are going to expose your south side, John recommends installing a few sprinklers to keep your turf from overheating in the afternoon sun.

PAUL VERMEULEN is the Director of the Green Section's Mid-Continent Region. When he is not playing golf in Scotland, he is responsible for the administration of ten states and focuses his Turf Advisory Service visits in Arkansas, Illinois, Iowa, Kansas, Missouri, and Nebraska.

Organic Facts and Fallacies

The mystical world of growing turf organically and managing pests with biological controls contains a lot of facts with a large dose of fiction thrown in for good measure. How is a golf course superintendent supposed to sort out the facts from the fallacies?

by DR. NOEL JACKSON



Since the 1920s, we have known that organic matter helps produce a healthier soil with higher biological activity.

I WAS RAISED on a small family farm in the north of England and from an early age was exposed to the organic aspects of this farm environment. Memories linger of the seemingly constant attention that dairy cows required to fuel them at one end and remove the milk and very large quantities of excreta from the other. I was never keen on this endless twice-daily routine of milking and soon figured there must be better things in life than shoveling cow manure. A common Yorkshire expression, "Where there is muck, there is money," did not ring true to me, so I chose to study agricultural botany and aspired to a college degree with the prospect of being a kid-gloved advisor or, at the very least, a gentleman farmer.

I obtained the degree, but I did not realize the rest of my goal. Instead, muck (this time in the form of sheep manure) claimed my attention. For two growing seasons, I ministered to sheep, pastured in neatly fenced enclosures. Half of the animals wore

harnesses and appropriate containers to collect their excretory products. The latter were measured, sampled, and analyzed. Changes in soil and plant chemistry and botanical composition were determined from manured and nonmanured plots. So, during two long growing seasons, I developed a respect and even a *feel* for organic manures.

Trained as a pasture grass agronomist, I found the management of fine turf to be a totally alien concept. Maximizing yield from the grass sward was no longer the objective. Instead, one was required to coax agriculturally inferior, low-fertility grasses, bents and fescues, into producing immaculate playing surfaces under the most demanding of playing conditions. Multitudes of mostly unappreciative golfers then gathered in all weathers to beat the hell out of the turf and, after a bad round, registered their complaints.

Prior to World War II, quality putting green turf of desirable species was achieved in the U.K. by fertilizing frugally, manipulating soil pH, watering

sparingly, adopting sound mowing practices, alleviating compaction, addressing thatch accumulation, top-dressing routinely, and applying pesticides very infrequently. By 1958, however, a burgeoning number of agricultural chemicals (fertilizers and pesticides) were finding their way into turf management practices. However, the proven pre-war concepts were still being promulgated at Sports Turf Research Institute (STRI) when my indoctrination into the mysteries of turf management commenced. Natural organics played a large part in the scheme of things, and I was introduced to a world of dried, blood, hoof and horn meal, fish meal, guano, and their ilk.

Ammonium sulfate, super phosphate, and potassium sulfate constituted the major inorganic fertilizers, with few complete formulations available for fine turf use in the U.K. Combinations of these inorganic and organic materials were advocated by the STRI advisory officers, with the formulas and the rates being customized for particular uses. Ammonium sulfate was a pivotal part of the program for maintaining soil acidity and promoting good, competitive growth of the desired bentgrass, which we knew then as *Agrostis tenuis*. Iron sulfate was a common and widely used supplement to this regimen. Omitting the ammonium sulfate and substituting other organic nitrogen sources or going with all-natural organic fertilizers was a demonstrably sure way to wind up with turf full of *Poa annua* weeds, earthworms, and disease.

An assortment of other organic material — animal, plant, and marine in origin — was available for turf use. Benefits such as enhanced growth, improved soil physical condition, better water-holding capacity, provision of minor elements, etc., were sometimes claimed. The notion of muck and magic was already alive and well! In many cases these organic materials

were subject to composting procedures on the golf course and the well-matured, screened product was then bulked with suitable sand for use as a topdressing. Liberal use of such topdressing has always been a major consideration in the art of greenkeeping.

By the time I came to Rhode Island in 1965, I had developed an abiding interest in turf pathology. What impressed me immediately was the size of the industry overall, the big budgets, the high turf quality expectations, the intensity of the management practices, and the wealth of turf products that were available commercially. American superintendents, no longer greenkeepers, seemingly faced formidable problems in the way of fungal disease, insects, nematodes, crabgrass, heat stress, winterkill, and so on. There were far and away more challenges than their British counterparts ever experienced. On what appeared to me to be ever-accelerating managerial treadmills, they needed every assistance, and commerce was responding with zeal to address all these contingencies.

Synthetic organic fertilizers were coming into vogue during the late 1960s, but one animal waste product, Milorganite, was well established. Aware of this fertilizer before arriving in the United States, I never cease to wonder at the amazing promotional job that the Milwaukee Sewage Commission has done in promoting a product of such indelicate origin. Like other researchers at the time, we were able to demonstrate a reduced incidence of dollar spot, over and above any direct nitrogen effects, when this material was used. We speculated that biological activity was affording the protection.

The concept of disease suppression in turf by organic amendments had surfaced, but further investigation and practical application was still down the road. At that time, pesticides were plentiful, relatively inexpensive, and generally very effective. The heavy reliance on chemical controls began to be challenged in the late '60s and '70s as environmental contamination and public safety issues were raised. Withdrawal of materials from the market and the development of resistance by some pests and pathogens to commercial pesticides prompted a reassessment of control strategies, and shifted attention to biological measures as safer and potentially effective alternatives.

The teeming populations of microorganisms that inhabit the turfgrass

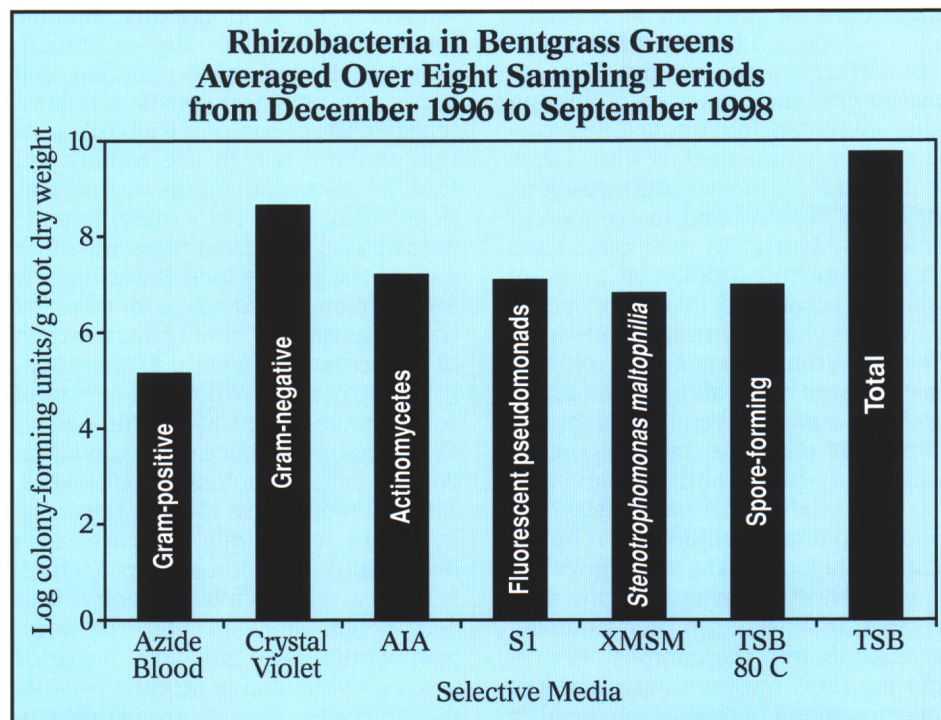
and soil, many as yet unidentified, invariably include pathogenic species that at times are able to incite disease. Disease incidence largely is determined by environmental conditions that can pose stresses that predispose a susceptible host to infection and, at the same time, promote the aggressiveness of the pathogen. Thus, when the pathogen is favored at the expense of the host, disease will likely occur. The microbial population, however, also includes numerous representatives that may improve plant health. Species of fungi, bacteria, and actinomycetes can protect plants from invasion by infectious agents in various ways. They can increase the availability of nutrients and water, and they can generate stimulants to plant growth. Degradation of organic matter, naturally occurring or introduced, fuels these and other interdependent systems in the turf, soil, and thatch. However, the dynamics of the forces involved are very complex and still very poorly understood. The postulated mechanisms whereby beneficial microbes affect disease control include the following:

- Competition for pathogen habitats and survival sites.
- Predation or parasitism of the pathogens.
- Antagonistic and pathogenic impacts on the pathogens.

The old doggerel "Big bugs have little bugs upon their backs to bite 'em, and

little bugs have smaller bugs and so on ad infinitum" seems especially appropriate. So it is a real war down there! The rival troops are battling back and forth trying to gain ascendancy. If the pathogens win, then disease may ensue. Usually, an equilibrium is struck and an armed truce established. However, in some soils it was observed that pathogens always seemed at a disadvantage and seldom infected the host. These were termed "suppressive soils." Their existence has been known for years, especially in soils devoted to cereal growing. Constituents of the soil microbial population suppressive to common take-all, a severe disease of cereals, have now been identified, and they include fungi in the genus *Phialophora* and *pseudomonad* bacteria. Hopes were raised that related take-all patch disease of bentgrass might be controlled by these antagonists. Though laboratory and greenhouse trials using suppressive soil against these diseases were successful, similar trials for take-all patch in actual turf situations generally have failed. In practice, what we do to manage take-all patch is use sulfate of ammonia to reduce pH. In some part this encourages the bacteria that in turn then suppress the take-all pathogens.

The concept that topical amendments, both organic and inorganic, can affect the composition and activity of the microbial biomass has spawned a



Recent surveys of bentgrass putting greens conducted by scientists at Clemson University indicate that there are large numbers and a variety of microorganisms present.

wealth of commercial products and claims of great benefits. Many are hard to prove. One example where the promise has not met the expectations involves topical amendments for nematode control in turf. Soil-inhabiting parasitic nematodes are a common problem on warm-season grasses and an increasing one in the cool Northeast. Nematodes are particularly increasing in our area. Chitin, a constituent of shrimp shells, has been shown over the years to encourage populations of microbial microorganisms that degrade it. Thus, the theory goes that if you have sufficiently high populations of these chitin-degrading bacteria, the organisms then will attack the nematodes and fungi in which chitin also is present. This hopefully results in the death of the pathogen or nematode. Commercial exploitation of this process proceeded, but repeated field trials in our northeast region have failed to show any positive results. An assortment of other products, mostly of plant origin, including sesame meal, neem, molasses, etc., all purported to control nematodes, also have failed. Our reliance on Nematicur, the single registered nematicide, continues, but how long this threatened material will continue to be available remains to be seen.

Composts, on the other hand, are an expanding disease control success story. During the 1970s, growers of containerized plants noticed that few fungal disease outbreaks occurred when composted hardwood bark was included in the potting mix. The disease-suppressive properties of this and other composts, including those prepared from municipal sewage, were confirmed at Ohio State and elsewhere. Dr. Harry Hoitink and his cohorts at Ohio State University have conducted a sustained and productive program over the years, and their pioneer research has given enormous impetus to the utilization of composted organic waste. It was no small achievement to establish suitable composting procedures that eliminate harmful pathogens, both plant and human, and determine the critical parameters that promote natural recolonization by desirable antagonists. The technology has now advanced to where specific suppressive organisms can be introduced successfully into the composting process for their optimum development and subsequent potency. One member of the Ohio team, Dr. Eric Nelson, now of Cornell University, deserves much of

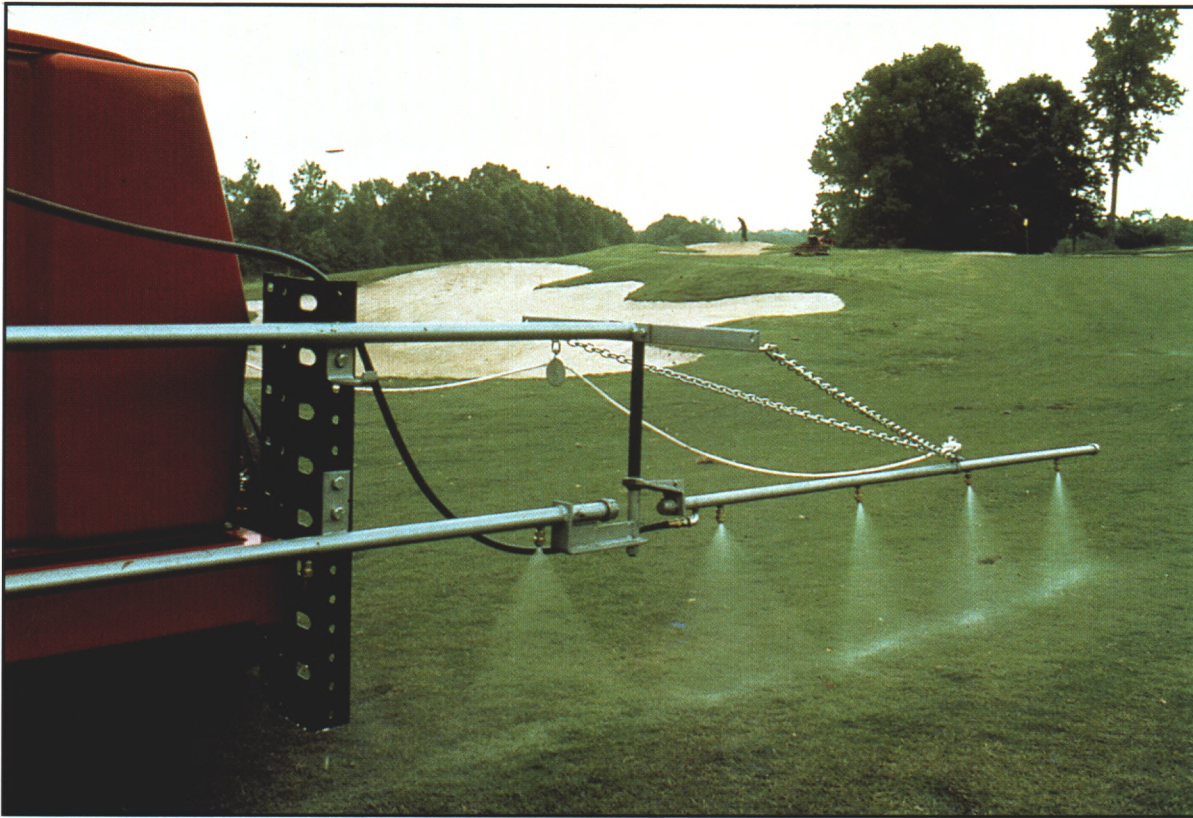
the credit for extending this technology into the field. Another cohort, Dr. Mike Boehm, also now at Ohio State University, is also involved in this area. Both were graduate students of Dr. Harry Hoitink.

Extensive trials at Cornell and elsewhere have confirmed the value of good quality compost from organic waste as a useful source of plant nutrients, and have regularly demonstrated their suppressive activity against a range of turfgrass diseases when used topically or incorporated into the rootzone. The introduction of beneficial microbial populations by suitable composts has obvious application in high sand greens. The latter initially are very low in overall microbial activity and are particularly vulnerable to root diseases like take-all patch and *Pythium* — induced root rot during the first few years of establishment. Inclusion of compost as an organic component in the rootzone mix and subsequently topdressing with the same material should introduce and support beneficial microflora. However, the quality of the compost in terms of physical and chemical properties needs careful attention. There is great variation in the quality of the available products. Analysis for organic matter content, ash content, moisture content, pH, nutrients, metals, and soluble salts should be a standard procedure. Inadequate screening to remove particles of the bulking agent in some compost renders these products unacceptable for fine turf use. This applies particularly to the yard waste materials that are put in many composts. Similarly, repeated use of compost from substrate that contains a high ash residue will lead to an accumulation of fine particles that eventually may impede percolation. However, replacing all or part of the peat, which is particularly low in microorganisms, with compost has the advantage of boosting a wealth of microorganisms early in the establishment period. Will the inclusion of some suitable topsoil do the same? Probably, but the microbial population would include potential pathogens. The soil would also include microbial inoculum which might confer some disease and stress protective properties. Is that a worthwhile tradeoff? It is very debatable. Currently, the compost would have my vote provided it is a proven, quality product because the practical value of mycorrhizal in turf situations to my mind is still unproven.

The economics of putting green rootzone mixes also must be considered. Canadian peat at the moment is inexpensive. In fact, it is a lot cheaper than most appropriate composts. Regardless, with this increasing current attention to compost, it is interesting to speculate how the greenkeepers of old would view these modern developments. They would probably say something to the effect that we have reinvented the wheel. Maybe they didn't know much about the microbiology of their composts, but they knew that topdressing was part muck and part magic — and it worked.

The logical progression in biocontrol is to isolate, identify, and culture any beneficial organisms and then return them in optimum numbers to afford the required protection. Successful techniques have been developed to accomplish the first three of the requirements listed, and numerous microorganisms are now available and undergoing evaluation. While striking results can often be demonstrated in the lab or greenhouse, few have achieved practical success in the field. The major problems lie in the formulation and delivery of optimum amounts of inoculum and, secondly, sustaining that inoculum at sufficiently high populations for beneficial activity to occur. Now, two systems have gone some way in meeting these requirements. Bio-Trek 22G, based on the fungus *Trichoderma harzianum*, was first tested in 1990. Bio-Trek was EPA registered in 1996 for commercial use on turf. Applied twice in the spring and again in the fall when temperatures are in the 50s and 60s, the fungus does become established in the rhizosphere and can supplement the microbial community to reduce soil-borne disease. However, Bio-Trek does not have an effect on foliar disease. Sprayable suspensions of the spores of the fungus have been attempted experimentally to control the latter and they do work. It appears, however, that frequent applications are needed for effective foliar disease prevention (at least once a week), and some fungicides are lethal to *Trichoderma*. They must be avoided.

The second system, the BioJect, involving the bacterium *Pseudomonas aureofaciens* strain TX1, has been developed over the past few years. Very recently, it became the second turf disease bio-control agent with EPA registration. Protocols for practical use have been largely the result of research done by Dr. Joe Vargas. The lethal



Thus far, the success of disease biological control products has been limited due to problems with the formulation, delivery, persistence, and competition from naturally occurring microorganisms. To date, only two disease biocontrol products are registered with the U.S. EPA as pesticides.

effects of exposure to UV light and drying greatly impact these biologicals. I quote Dr. Vargas: "For biologicals to work, they need to be applied almost daily." With respect to the practical application of this BioJect technology, there are happy people and there are some who are particularly unhappy. I think this is an example where the technology has potential but still needs some refinement. It is also a good illustration of what happens when the hyping of unreasonable expectations outpaces the basic science and sound engineering of a product.

Now, I have danced around the topic and avoided any chance of lynching, but the question still arises: What about all those biological or organic products that proliferate each year? How do you separate the good, the bad, and the ugly? Those are not my words. I throw it back to the USGA and to Matt Nelson, USGA agronomist. He posed this question in a succinct and eloquent article entitled "The Microbial World" in the *Green Section Record*. His comments were mirrored closely by Drs. Gail Schumann, Monica Elliott, and Paul Vincelli in their article in *Golf Course Management* magazine entitled "Evaluating New Turf Products." So I leave you with their combined recommendations on the points to raise and the procedures to adopt.

- When you are looking at one of these products, ask the vendor what it is recommended for. Is it just for turf? If it is a general catchall or a universal cure, beware!

- Does the product have EPA registration for pest or disease control? This is your protection against liability, particularly the safety considerations.

- Who was the principal investigator who did the initial research? Was it independent or in-house?

- Where was the research conducted? Was it just in the lab or the greenhouse, or did it go out to the field?

- What was the growing medium? Was it in sand, soil, or compost?

- How were the experiments designed? Did they have good replication and were good comparative treatments included in the trial?

- Were the results statistically analyzed and were the differences statistically significant?

- Has the experiment been repeated over two or three years at different sites and with similar results?

- Have the results been published in a refereed journal? In this publishing process, a reviewer goes through the data and decides whether the material cuts the mustard.

- Watch out for slick pamphlets. They are no substitutes for the information that is provided above.

- If you want to conduct a test of the material, obtain a small sample for use on a small area. Don't go overboard and shell out big bucks. You might be buying a lemon.

- Test products at several locations, replicate the plots in your trials, and put in controls. You must have check plots to compare the treated plots against so you know what is happening. You need at least two years of field data for an accurate assessment. Rate the plots regularly for observable differences — color, disease, stress tolerance, etc.

- Conduct an independent nutrient analysis to eliminate the possible effect of fertilizer response. Some of these products give a great surge of growth, and you don't know why.

- Finally, consider the possible impact of favorable weather, better cultivation, or improved growing environment. Any change in management practice may have produced the effect rather than a response from the product. In this realm, the old adage applies — *let the buyer beware!*

DR. NOEL JACKSON, *Professor of Turfgrass Pathology at the University of Rhode Island, has just the experience and facts needed to help address this question.*

BUNKER PREPARATION: *It Takes More Than A Rake!*

Sometimes bunkers need irrigation too.

by KEITH A. HAPP

STEVE SCHRAW, the golf course superintendent at Hermitage Country Club, Manakin, Virginia, focuses his maintenance efforts on meeting the needs of the members on a regular and consistent basis. Providing an enjoyable, yet challenging experience is paramount, and attempting to deliver these conditions from hole to hole is as important as presenting these conditions from day to day. Steve's Turf Tip centers on bunker maintenance and, specifically, fairway bunker sand preparation. Steve uses an interesting irrigation technique to prepare fairway bunkers for daily play.

Bunker preparation begins well in advance of play. For example, the shape of a bunker greatly impacts playability, performance, and aesthetic appeal. However, the most important final feature that must exist is adequate internal drainage. This feature allows playable conditions to be offered on a consistent basis despite the weather patterns experienced. Sand selection also greatly impacts the short- and long-term performance of these important play features. However, many complaints regarding inconsistent bunker

performance are often a function of poor drainage.

To satisfy membership desires and upgrade the performance of the bunkers throughout the 36-hole facility, Steve began by ensuring that all bunkers had adequate drainage. Next, a sand was selected to provide the playability the membership desired. Finally, the sand was carefully positioned to a uniform depth of 6 inches on the base and 4-6 inches on the faces of the bunkers. To help ensure that sand depth was maintained as desired, a program of hand raking all bunkers was instituted. Mechanical bunker rakes are used only when absolutely necessary. In fact, monthly treatments with cultivator bars are all that is needed.

The hand-raking practices used in the bunkers are specific. Greenside bunkers are raked in the direction of play or toward the center of the green. Fairway bunkers are raked parallel to play or from tee to green. While greenside bunker performance improved significantly, fairway bunker performance, unfortunately, did not. In fact, fairway bunker playability remained a hot topic.

Specific questions were posed to members to pinpoint where corrective measures were needed. These efforts exposed concerns about fairway bunker sand performance. Specifically, during dry weather the sand would become soft and present a difficult playing condition. A cuppy, slightly buried lie would result in spite of the low trajectory of the golf ball when it entered the bunker. Examining the playability of all the bunkers revealed that one particular aspect of turf maintenance provided relief to the undesirable bunker condition. Where adequate irrigation coverage was available, sand performance could be maintained in the desired manner.

With this knowledge in hand, fairway irrigation was modified to provide a method by which to manage and improve fairway bunker sand performance. Irrigation heads were installed so fairway bunker sands could be irrigated on an as-needed basis. In fact, during the summer months, bunker irrigation is performed on a daily basis. A 20-minute cycle proved to be more than adequate while not negatively impacting playability. As an added benefit, the fairway bunkers can now be monitored regularly as to their ability to handle heavy precipitation. If drainage problems occur, corrective measures can be implemented and consistency is ensured.

Course maintenance goals in general and bunker maintenance goals in particular are directly related to the desires of the players. Steve's experience symbolizes the importance of utilizing strong communication strategies to meet the needs of the membership. Maintenance practices can be altered and in fact can evolve to produce effective results. When it comes to bunker preparation, experience speaks here: "It takes much more than a rake."

KEITH A. HAPP is an agronomist in the Mid-Atlantic Region, visiting courses in Delaware, Maryland, Pennsylvania, Virginia, and West Virginia. Keith joined the USGA Green Section Mid-Atlantic staff in 1993.



During the summer months, fairway bunkers are irrigated regularly to help ensure consistent playing conditions. Twenty-minute watering cycles provide the desired effect.

Saving Zoller's Dollars

A unique method to reduce bunker contamination.

by LARRY GILHULY

THE SCENE: Match tied on the 18th hole and both players are in the same greenside bunker.

The Lies: One player's ball lies directly in front of a large stone. The other player's ball lies in the lowest point where excess silt and clay have caused wet sand.

The Players' Attitudes: Both blame the golf course superintendent for their bad lies.

The Players' Answer: Take a playing lesson to avoid bunkers!

The Superintendent's Answer: Reduce or eliminate the bunker contamination problem.

* * *

While this scene is not played out at every course in the U.S., it is often viewed in wet climates at courses that use power bunker rakes, have limited budgets, or have excessive amounts of rock under the bunker sand. Although careful attention to detail during construction, an adequate budget, and hand raking will reduce this problem, it can continue to be a headache despite the best efforts of the maintenance staff. If bunker contamination persists, the next step is often geotextile fabrics. However, these can deter drainage and pose a problem when thin sand exposes the fabric to players or, worse yet, to power bunker rakes that pull the fabric to the surface. The question is then, "Is there a technique that can provide the positive attributes of geotextile fabrics without the negatives?" The answer is yes, if you and the golfers have one key ingredient — patience!

During the construction of a golf course in the early 1980s, construction superintendent John Zoller faced the dilemma of controlling excessive rock from entering the new bunker sand. Rather than use costly geotextile fabrics, his answer was the use of grass grown in the bunker cavities to act as a filter and stabilize the rock. From this initial success, Mr. Zoller transferred this idea to the City of Portland, where he has been the Director of Golf for the past 15 years. Drawing upon his positive experience and exercising patience to assure the long-term results



After the grass inside the bunker receives a non-selective herbicide application, it remains as a natural barrier between the bunker sand and the soil below.

would be positive, Mr. Zoller directed Steve Hoiland, golf course superintendent at the Eastmoreland Golf Course, to start a bunker renovation program in 1993. This successful process of bunker renovation while addressing contamination concerns continues today, with 36 bunkers completed using the following technique:

1. Complete bunker reconstruction.

This work generally is completed during the growing season, with final shaping to avoid rainfall and take advantage of warmer temperatures.

2. Bunker complex seeding. After the entire complex has received final grading, it is seeded with perennial ryegrass at a rate of 10 lbs./1,000 sq. ft. along with appropriate starter fertilizer. Drainage is installed before seeding in extreme situations; however, it generally is included after the perennial ryegrass has matured.

3. Turf maturation. The key to success with this method is allowing the perennial ryegrass time to mature and develop a root system into the soil. These roots anchor rocks more securely and are part of the filter between the soil and bunker sand. At least six weeks is allowed to pass before the next step in the operation. In some cases, the bunkers were used as grass bunkers and opened for play.

4. Drainage installation. If drainage is not completed during the initial construction, it is installed after the turf has grown and is placed in the areas where drainage obviously is needed. With permeable soil, dry

wells are acceptable, while heavier soil requires extended lines out of the bunkers.

5. Establish bunker edges. A sod cutter is used to establish the bunker edges. Generally, two passes with the sod cutter are needed, set at a depth of one to two inches.

6. Elimination of the turf inside the bunker. Once the perennial ryegrass has matured and the edges have been established, the remaining grass can be eliminated with a non-selective herbicide, such as Roundup or Finale. The dead grass remains to provide an organic barrier between the soil and sand.

7. Sand installation. After the herbicide has been given time to enter the plant and the grass shows signs of decline (several days), sand is installed over the bunker to a depth of four to six inches. Players are strictly kept from the bunkers prior to the sand installation phase to avoid herbicide tracking; however, Bivert can be added to reduce this problem.

For the past six years, Mr. Hoiland has had complete success using this method of addressing bunker contamination. He reports that even if the bunkers suffer from washouts during heavy rainfall, the underlying soil does not pose a contamination problem due to the thin organic layer provided by the perennial ryegrass. In addition, when the raking teeth of the power bunker rake enter this area, the mixing of soil into the sand is minimal. He also reports that the annoying task of cleaning rocks from the bunkers is now a thing of the past!

While this method of reducing bunker contamination may not fit every situation, it offers a far less expensive and more practical method to reduce rock and soil contamination. It has saved Mr. Zoller many dollars — it could for you, too!

LARRY GILHULY has been saving golf courses many dollars throughout the western portion of the United States during the past 15 years as the Director of the Western Region and as the current Director of the Northwest Region.

BUNKERS: The Right Track

A new bunker construction method reduces sand erosion.

by PATRICK M. O'BRIEN

MANY golf course superintendents spend tens of thousands of dollars annually for labor to repair sand bunkers after heavy rains. It takes many hours to reposition sand back again on the faces with shovels and mechanical blades. Time spent repairing bunkers is time taken away from other important maintenance practices.

The maintenance staff at The Farm Golf Club, Rocky Face, Georgia, faced a nightmare after every rain event with 82 steep sand-faced bunkers. According to Tim Kennelly, CGCS, it took 60 to 100 labor hours to reposition the sand. After only a few storms and washouts, the bunker sands turned red from the clay that eventually plugged the drainage tile. Plugged lies and muddy sand were a constant headache for the staff, and the membership found the bunker conditions unacceptable.

Several courses in Georgia and the Carolinas have recently renovated bunkers with a new technique called the "Enhanced Bunker Drainage Method." Billy Fuller of Cupp Design, Inc., first came upon this novel idea during his tenure as the golf course superintendent at Augusta National. The unique feature is a 1.5- to 2.0-inch gravel blanket over the entire bunker floor. Water flows through this gravel layer to the drain lines. The movement of sand is practically eliminated.

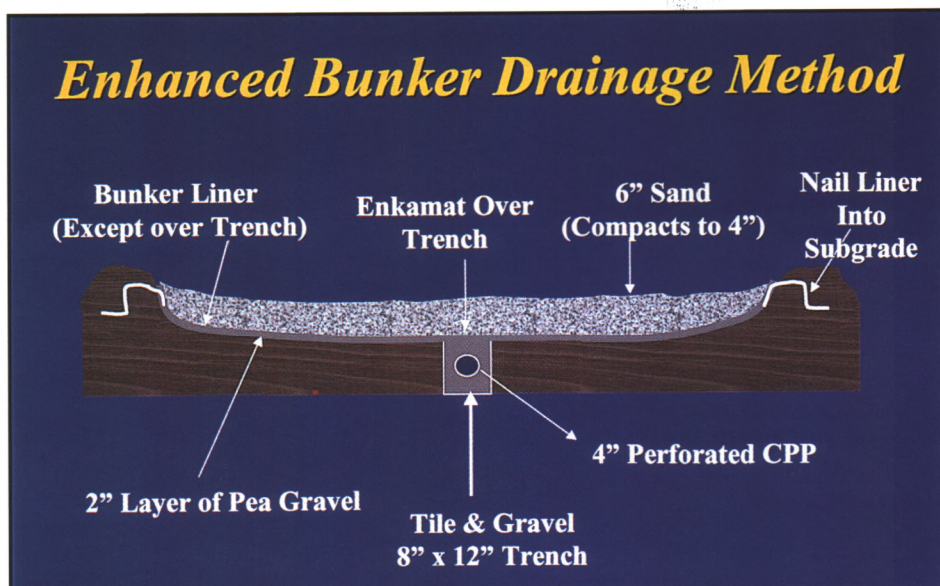
The key construction steps in the Enhanced Bunker Drainage Method are as follows:

1. Regrade the subgrade of the bunker to conform to the general slope of the finished grade.

2. Check the original outfall drainage pipe on the bunker floor to ensure it still functions. Flushing dyed water through the pipe and viewing its exit at the outlet is essential. If this drainage system doesn't work, replace it at this time.

3. Install a new subsurface drainage system in the compacted subgrade and reattach to the old drainage outfall pipe. In most instances, 4-inch smooth-wall perforated plastic pipe works well.

4. Install the gravel blanket to a compacted depth of 1.5 to 2.0 inches over the bunker floor. Washed pea



The "Enhanced Bunker Drainage Method" includes a gravel layer and a liner that allows storm water to reach the drain lines without dragging sand with it.

gravel or crushed stone with a size of $\frac{1}{4}$ to $\frac{3}{8}$ inch is preferred.

5. Install the filter cloth. The 7.5-ounce non-woven Trevira product is the most popular product for this bunker renovation method. Metal staples are used to secure the filter cloth to the bunker floor and edges.

6. Install the plastic edge liner over the filter cloth liner at the bunker sides. Precut the plastic liner to the desired height. Staple the edging into the bunker sidewall.

7. Cut the filter cloth over the drainage lines on the bunker floor and install Enkamat. Placing the Enkamat over the drain lines prevents clogging and insures water flow to the drainage tile.

8. Install the bunker sand to a compacted depth of 4 to 6 inches.

9. Divert surface water away from the bunker (if needed). Any surface water flowing into the bunker can cause minor washouts if not diverted.

This unique building method solves many bunker renovation concerns. The filter cloth is secured with staples on the bunker floor and edges. No tucking of the filter cloth is needed due to the placement of the new plastic edging product. Bunker edging has been simplified with the permanent edge barrier

system, which allows workers to see the edging and avoid damaging the filter cloth while trimming bunker edges. Drainage is maximized with the Enkamat product over the drain lines. Sand is not piled to depths of 2 to 4 feet on the bunker faces anymore. Little or no new sod is required after the renovation in most instances. With proper maintenance, the original bunker design is kept intact for years.

This bunker renovation method is more expensive compared to traditional methods. Costs are similar to building a putting green. Construction is practically all done by hand work and wheelbarrows. The higher cost will be offset by a huge reduction in labor and sand replacement costs. A contractor should be hired to renovate all bunkers, but "if you have 10 or fewer bunkers to renovate, a larger maintenance crew can handle this project," said Kennelly.

Today, we have one solution to remedy the age-old problem of bunker washouts. Using this easy formula can keep your bunkers on the right track.

As Director of the USGA Green Section Southeast Region, PAT O'BRIEN helps keep golf course superintendents on the right track.

Stop Bunker Face Erosion!

Perimeter drain lines can reduce bunker face erosion and maintenance.

by BRIAN MALOY

ONE OF THE most controversial questions asked by Green Committees is, "What should be the most appropriate playing condition for the bunkers?" At the root of the issue is the fact that golfers seldom have similar views regarding the conditioning of the bunkers. For example, some report that they would like the bunkers to be maintained with a firm playing condition so they can bounce the club off the sand and easily extract the ball from the hazard with plenty of backspin. Others prefer a somewhat softer playing condition so they can get their club underneath the ball to extract it from the hazard, with backspin being a secondary objective.

If there is solid middle ground to be found regarding the issue of what is an appropriate playing condition for bunkers, it is that most golfers can agree that they want consistency, a uniform depth of sand, good drainage, and visual appeal. To this end, superinten-

dents dedicate numerous man-hours to raking and redistributing sand on a daily basis. Some even report spending more time manicuring the bunkers than caring for the greens!

In trying to meet the agreed-upon objectives of consistency and uniform depth, golf course crews spend the greatest amount of their time working on steep bunker faces. The reason for this is that sand placed on a steep slope has a gravitational tendency to migrate downhill and, therefore, it must be constantly shoveled back up onto the bunker face. During this endless process the sand is in essence tilled and becomes so soft underfoot that golf balls bury in their own pitch mark after impact. Sound familiar?

One primary force causing the downward migration of sand on a steep bunker face is erosion. When erosion occurs on a repeated basis, the sand also becomes contaminated with sub-grade soil that in turn clogs the

drainage system and reduces the visual appeal of the sand. To reduce bunker face erosion, John Hilton, Superintendent, Prestonwood Country Club in Cary, North Carolina, has fortified the drainage system underneath the sand.

A typical drainage system usually consists of a herringbone pattern of drain lines in the sub-grade of the bunker. Mr. Hilton's new technique takes bunker drainage one step further. When John's crew renovates a bunker, they install an extra drain line along the perimeter to prevent excess water from flowing down the bunker face.

The trench for the extra drain line must be dug manually because steep bunker faces make the use of a mechanical trencher impossible. The trench is dug eight to ten inches deep under the upper edge of the bunker face. After the new drain line is installed and connected to the existing drainage system, the trench is back-filled to the top with pea gravel. Finally, the sand is redistributed in the bunker to a uniform depth of four to five inches using a large material handler, such as the Ty-Crop MH-400.

By immediately capturing the water flowing into the bunker face from the surrounding turfed areas, the sand never becomes completely saturated and the extent of erosion is significantly reduced. John indicates that the installation of extra drain lines has reduced the potential for erosion by as much as 75 percent. Even after heavy downpours, he reports that only a minimal amount of manpower is needed to shovel the sand back up onto the faces of the bunkers.

Golfers will always be disgruntled after they hit their golf ball into a hazard. Installing perimeter drain lines, however, can help minimize the fried-egg lies that prompt players to complain to the Green Committee about the maintenance of the bunkers. This keeps everyone but the wayward golfer smiling after a challenging round of golf.



Installing a perimeter drain line under the edge of steep bunker faces can prevent erosion. During a heavy rain the extra drain line captures water from surrounding turf areas and prevents the sand from becoming saturated.

BRIAN MALOY is an Agronomist for the USGA Green Section Mid-Continent Region, based in Carrollton, Texas.



From the driving range tee, golfers cannot tell the difference between "fake bunkers" and real ones.



A thoroughly compacted sand will support traffic from ball retrieval and mowing equipment.

DECEPTIVE DEFINITION

A little make-believe can go a long way.

by DAVID A. OATIS

THE GAME OF GOLF has never before enjoyed its current level of popularity, and fortunately for all of us, this popularity continues to grow. New courses are being built and the number of rounds played on existing golf courses continues to increase each year. Practice facilities also have enjoyed an increase in popularity, and many of the courses I have visited in the past few years have or are getting ready to implement practice facility improvement programs. Tee expansion is most common, but building short-game practice areas or creating tall berms to contain golf balls and provide better safety and separation also are popular.

There also is an increasing trend to add target greens to driving ranges. This is not a new idea, but the target greens of today are a far cry from the non-descript, shapeless mounds we have all seen. The greens are becoming larger and more elaborate, and they are now frequently embellished with bunkering. In a few instances, I have observed real bunkers installed in ranges, but the results are rarely satisfactory. Balls must be retrieved manually from real bunkers, and this can be quite hazardous if performed when the driving range is open.

The labor to maintain *real* bunkers also is substantial, and time is an ex-

tremely precious commodity, especially when it comes to performing maintenance procedures on a heavily played driving range. The result is that *real* bunkers cannot be maintained properly when they are built on driving ranges, and they usually look messy and unkempt. Using real bunkers to set off target greens is impractical at best.

While I am not sure who created the first *fake* bunker, Hugh Kirkpatrick, golf course superintendent at Westmount Golf and C.C. in Kitchener, Ontario, Canada, has produced the best *fake* bunkers I have observed. They do a fine job of improving definition while having little impact on the maintenance budget.

Fake bunkers must be designed from the tee, and this can be done most efficiently with hand-held radios and either paint or some type of flexible material to outline their shape. Superintendent Kirkpatrick used turf paint, but irrigation hose, reflective tape, or rope all could work well. Once the shapes of the bunkers are outlined, they can be adjusted based on their appearance from the tee. The hand-held radios can save a lot of running.

After the design was finalized, Superintendent Kirkpatrick removed a thick layer (1" - 2") of sod and filled the cavity with a hard-packing limestone

sand. Mr. Kirkpatrick then rolled and compacted the sand to complete the project. An added bonus is that the sod removed from the bunkers can be used elsewhere on the course. The *fake bunkers* look like real ones from the tee, yet are firm enough to easily support mechanical ball retrieval equipment. They do not require raking.

Definition is an important component of the game, clearly adding to its aesthetic appeal. Installing *fake* bunkers on your driving range is a wonderfully simple idea that can enhance the appearance of target greens and add to the enjoyment and value of practice. After all, there is nothing so intimidating as a starkly defined hazard staring you in the face as you prepare to hit a golf shot. Definition is an important component of the game, clearly adding to its aesthetic appeal. Adding *fake bunkers* to your driving range is a deceptive means of improving definition, and the additional feature can be installed without a significant impact on the budget.

DAVID OATIS joined the Green Section in 1988 as an agronomist in the Mid-Atlantic Region and has been the director of the Northeast Region since 1990.

It's The Same Game, But How It's Changed!

Constant vigilance helps to keep the challenge and enjoyment in golf.

by FRANK THOMAS

I HAVE TO ADMIT I don't know anything about nematodes, dollar spot, *Pythium*, or any of the pesticides I've heard about today. I have learned about Milorganite, and I know many people who will no longer lick their golf ball if they find out where it comes from. My focus today is the advances in technology in the game of golf.

Has the USGA lost control over the game through advances in technology? The answer is **NO**. That is the short and long answer.

Life is peculiar in that we want to get rid of all of the obstacles and all of the difficulties in our lives. We work hard to do that. Technology seems to be alive; it bites us back every now and again. This is called the revenge effect.

We want to be able to travel around the country, so we invented automobiles, the most efficient and effective way to transport ourselves. What fol-

lows is we have automobile accidents. So even though this is a marvelous invention, we lose 40,000 people every year in automobile accidents. This is the revenge effect.

We really try to get rid of all obstacles in our lives. Then we gather together a bunch of artificial difficulties, introduce them into our lives, and call it a game. We have this subconscious urge to challenge and evaluate ourselves.

I don't know whether anyone listens to *Prairie Home Companion*, but it is broadcast live on public radio on Saturday evenings. The host is Garrison Keillor, and he talks about his experiences in a place called Lake Wobegone, in Minnesota.

I had a 20-acre lot at Lake Wobegone. I had three acres on the side of this lot that I didn't know what to do with. So I fenced it in with some boundaries and built some hurdles, obstacles, and other little difficulties. As

I was developing it, a friend of mine named Jack came up and asked, "What are you doing?"

I said, "I am developing a course with a bunch of little obstacles and difficulties with the idea of presenting a challenge to those who wish to run it."

Jack said, "That is interesting. Let me see if I can do it. What are the rules?"

"Well, you jump over this one and that one and around the next one, etc." I went through the entire course for him.

He asked, "May I try it?"

I said, "Certainly you may."

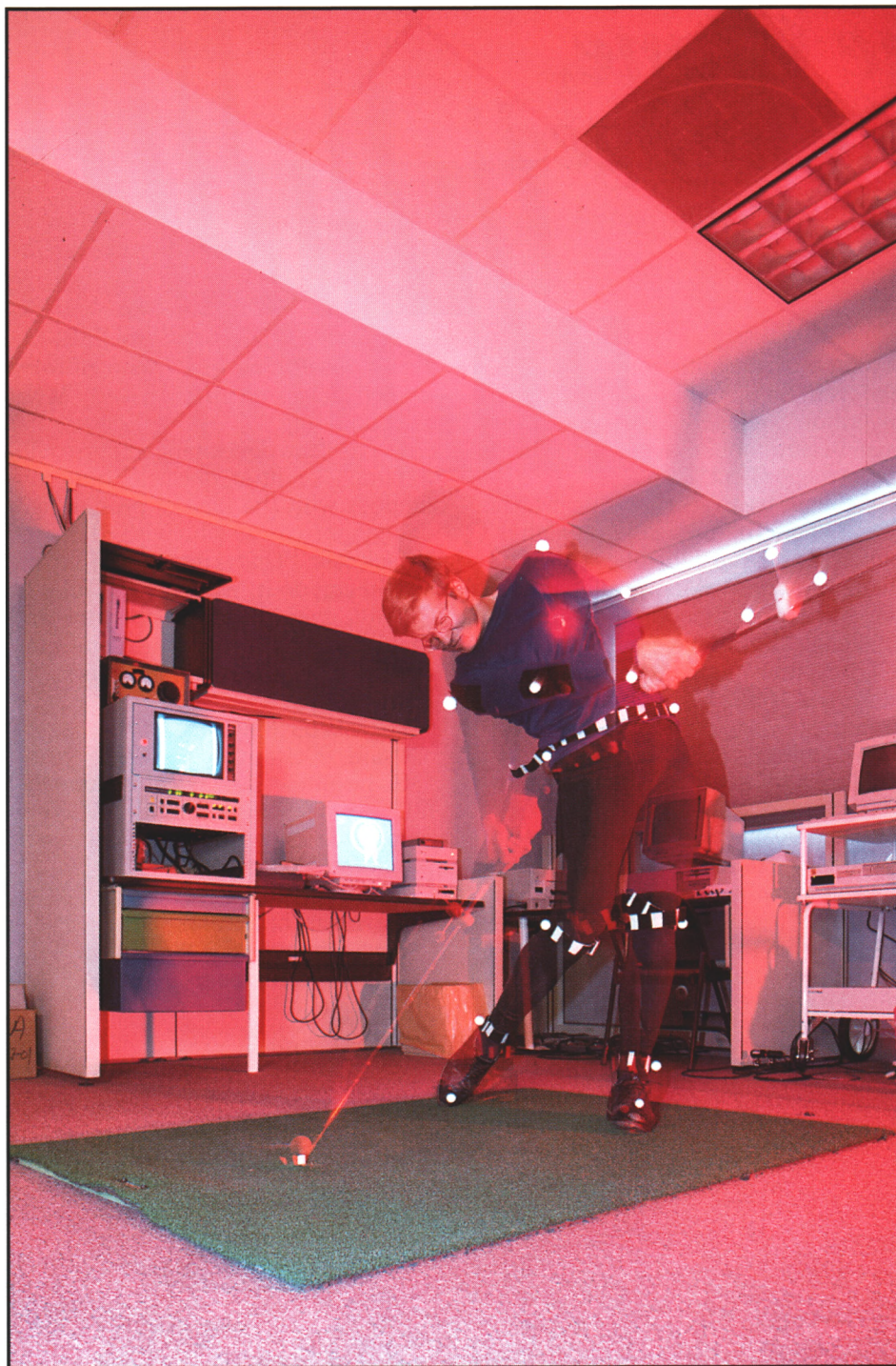
So he jumped and ran all around this little obstacle course I made. When he completed it, he said, "Wow, that was fun. May I do it again?"

I said, "Of course you may."

He came back and looked at his wristwatch and said, "You know, I did that in ten minutes. I am going to try and do it a little faster next time."



The USGA Research and Test Center, Far Hills, N.J.



The Research and Test Center uses biomechanics to understand how playing golf affects the various joints and muscles of the human body.

As he was finishing, some other neighbors came around and asked, "What is going on?" I explained the obstacle course to them, and they asked, "May we try it?" Upon completing the course they said, "This is fun."

Jack had started to improve his technique and reduced his time down to nine minutes and 30 seconds. In the meantime, I had so many neighbors who wanted to get onto my course

that I could not accommodate all of them. So I designed another obstacle course. Eventually, courses were springing up all over the place. Before long, we had hundreds and hundreds of obstacle courses all around the country. Jack and I, along with some others who were involved with me in the development of my course had to write out the rules, and we gave them to all to enjoy this wonderful game.

What happened then was that this game attracted some clothing manufacturers. They said, "We can develop a special line of clothing for this game." From then on there was a special line of clothing that most of the participants bought. After a while, another manufacturer, recognizing the size of the market, decided to design and introduce shoes that were better than the shoes being used. This manufacturer built shoes to improve one's ability to get over the hurdles more easily and around the obstacles more quickly. He was catering to what people seemingly wanted. They were striving to improve their times, so he introduced something that allowed this to happen.

They all were trying to improve their skills and compete with each other. The manufacturer was catering to their wants, but not their needs. Jack put on the new shoes, and sure enough, he broke his record. It was now down to nine minutes — he was very excited that he had finally broken his record. But Jack didn't sleep well that night. He got up in the morning knowing it wasn't anything he did to break the record; it was those darn shoes.

So we called a meeting and identified the problem. What are we going to do about these shoes? Are we going to allow them into this game or not? Jack said, "Why don't you just lower the hurdles, since that is exactly the effect these shoes have on the course?"

The decision was unanimous. We said, "One cannot, under the rules, compete using the new shoes."

Well, the manufacturer went to his lawyer and said, "I am going to sue Frank Thomas because of this decision. I deserve to make a living. I've gone public with my shoe company and will not deprive my shareholders of their income. They should be allowed to enjoy the rewards of any profit that I make."

Technology and Golf

I ask you very sincerely, *what has this world come to?* Let's hold that thought for a while and let me tell you about distance. Distance is something that has been of concern to us for a long time. The USGA is now using technology to control technology. We have been working very hard for a long time to control distance. I have been at it personally for 25 years. I have worked for the USGA and on this problem for a quarter of the time the USGA has been in existence.

With the introduction of the Haskell golf ball (a wound golf ball) in 1898, concerns were developing about distance. One article said that if the USGA doesn't do something soon about the ball, the average drive will be 300 yards. That article was written in 1907. In 1921, we introduced the weight and size restrictions of the golf ball. In 1925, we reluctantly approved steel shafts. In 1930, we decided distance was still a problem, so we changed the weight of the ball to 1.55 ounces. That didn't go down very well with the players, and

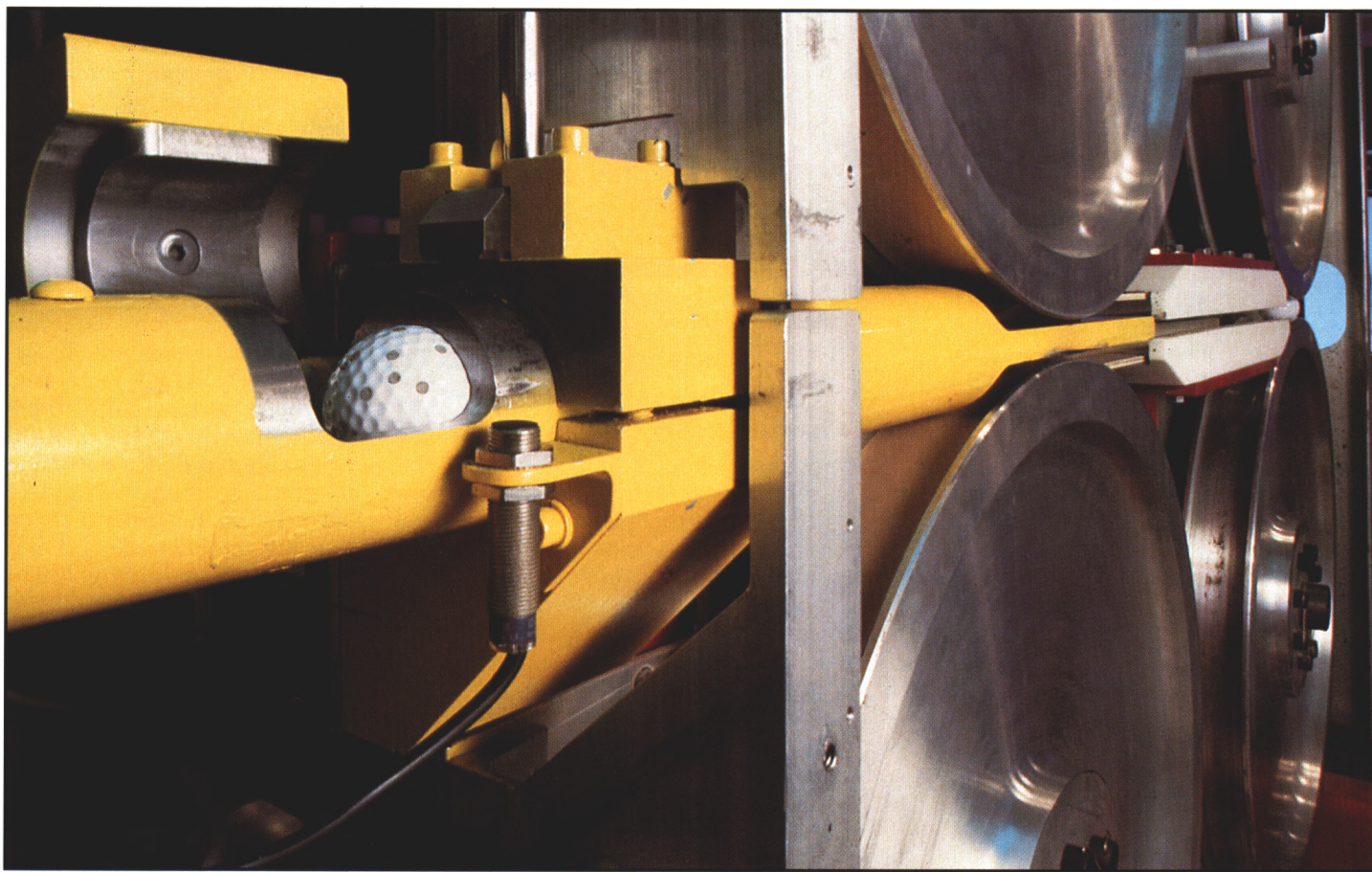
first performance standard for golf clubs. This is known as the spring-like effect standard.

Our objectives are very clear. We want to try and preserve the integrity of some of the great old golf course designs. It is a tough thing to do and I am not too sure if we will be able to do it, but that is one of our objectives. Another reason is to avoid contributing to the increase in the cost of play. If we have to continue to increase the length of the golf course, it is going to cause a problem. We also don't want to con-

bunkers. I don't understand all of this hard work on bunkers. I thought a bunker was considered to be a hazard.

Spring-Like Effect

We don't want to stifle innovation, while at the same time we don't want technology to spoil the game. In that context, let me explain the spring-like effect. This is like a trampoline effect exhibited by some large titanium drivers. Manufacturers have tried to increase the size of the club heads to



A launching device is used to fire a ball for a distance of 70 feet. During the process, scientists are able to identify exactly where the ball is in space at any time in its flight down the range. Using this information and a computer, the carry distance of the golf ball can be simulated.

the next year we changed it back to 1.62 ounces and fixed the size at 1.68 inches in diameter.

In 1942, we introduced the initial velocity standard. At the time, we thought that would finally limit the distance the ball would travel. The weight, size, and initial velocity were limited, and distance was no longer a problem. Unfortunately, this was not the case. In 1975, we worked on and developed the overall distance standard. I used the mechanical golfer "Iron Byron" to launch balls onto a test range. In 1998, we introduced the

tribute to slow play. Most important, however, is to protect that which attracts all of us to this wonderful game. We must protect the challenge.

I don't think we can preserve the game. If we did, we would have to go back a 100 years when the game was considered by some to be at its peak. We would draw up a precise definition of the game and, in so doing, specify exactly what the club would look like and the material it was made of, specify the material and number of dimples for balls, do away with mowers, and we would stop raking

increase the size of the sweet spot. In so doing they had to look for different materials. Steel was not adequate, so they turned to titanium.

They could make the club even bigger with a bigger sweet spot. The object was to make the game a little easier for the average player. The superstars don't get that much of an advantage from the bigger head because they always hit close to the sweet spot. The newer, bigger heads had very thin faces. They had to make the face thin because the size of the head was so big that a thick face would make the club too heavy.

Unfortunately, at this point the face deformed on impact.

The thin faces bend upon impact and recover during those 450 micro-seconds of impact. This gives the ball a little extra kick, which is basically the trampoline or spring-like effect. We evaluate this effect by measuring the rebound velocity of a ball fired at a clubhead. We have now established an SLE (spring-like effect) standard. This particular phenomenon allows a golfer, specifically the elite player, a slight increase in distance, as it does for the rest of us when we make contact with the sweet spot on the clubface.

We set the standard, and believe it or not, we now have somebody who says, "You are limiting my right to make a living and the interests of my shareholders' need to be protected. If you disapprove my club, I'm going to come after you legally." Déjà vu, Lake Wobegone.

We are going to stand firm because here is somebody who really doesn't get it. We are protecting the challenge that the game offers. We are protecting the needs of golfers. We are not going to let somebody spoil this game.

Overall Distance Standard

I developed the overall distance standard in 1975. It was my first major project when I joined the USGA. The launching device I used was a mechanical golfer, Iron Byron. Now we have become much more sophisticated in understanding those properties of a golf ball that contribute to the way it flies.

We fire a golf ball indoors for a distance of 70 feet. We are able to identify exactly where the ball is in space at any time in its flight down the range. From these measurements we can calculate the lift and drag properties of the ball. Using the computer and this information, we can simulate the carry distance or how far the golf ball is going to go. The distance standard is an overall distance, so we take into account the bounce and the roll as well.

Superintendents can grow grass practically anywhere today, and now we can even control the turf's bounce and roll conditions. I would like to see some sort of recommended standard of what the turf should be with regard to the softness and the length of turf, specifically for fairways. We now have turf conditions that are almost perfect, and we keep striving for shorter and more manicured fairways. This bothers me.



The USGA Research and Test Center is using science to control new equipment technology to protect the challenge of the game.

Golf Clubs and Balls

We now have about 2,000 golf balls on our conforming list, and last year I made rulings on 715 different clubs. Every year we get a new batch of interesting clubs. For example, the air wood is a club with a little valve in the back of the grip, with a hollow shaft and a hollow head. What you do is pump it up with 90 psi and it is meant to give you 20 extra yards. The problem is it leaks a little, and on the way to the golf course you need to take your clubs to the gas station to fill them up.

We also get putters with mirrors. I had one the other day that had a 45-degree angled mirror you looked in with your left eye to see not only the ball, but also the flag. With the second mirror, you look only with the right eye. It takes about 15 seconds to get that thing lined up, and when you do, you don't dare move it.

To play the game of golf, some say you have to keep your head still. We recently had dark glasses submitted with a small, clear, horizontal strip right in the middle of the left lens and a vertical clear strip on the right lens. The idea is to line up the ball by looking through the clear section with each eye. You can't move your head again, otherwise you lose sight of the ball.

Another submission was the putter wipe to substitute for cleaning the face

of your putter on your sock or pants. You remove a toe spike from your shoe and before replacing it, attach a plate, which is angled and has some bristles protruding forward from the plate. You can't walk very well with this thing attached to your shoe, but at least you have clean pants.

Frank's Golf Bag

Why do we all believe in magic? We believe that a new club is going to improve our game. Year after year, we buy a new driver believing it is going to hit the ball 20 yards further. If that was true I should be driving the ball about 395 yards now after the four new drivers I purchased recently. It is the placebo effect. With a new club, we swing properly with good results; we are convinced this club is working for us. We paid \$800 for it and we are not about to accept anything but an improvement in performance.

I made decisions on 715 clubs last year, and as a result people believe I must have the best equipment. Wherever I go people try to look in my bag. This is annoying, so I am going to tell you what I do have in my bag. I've got the new double-faced driver, which gives me the maximum spring-like effect. I have the condor armor-piercing coating on my three wood. I have a seven wood because Johnny Miller says if you've got the seven wood you don't need any long irons.

My irons range from a four to the pitching wedge, and they are made of a liquid metal. Have you ever heard of liquid metal? Well, it is the newest thing out there, and I can tell you that these irons are perimeter weighted and I am enjoying them very much. My wedge is the Check-Mate wedge. This has five carats of diamond dust stuck to the face. I spin the ball so much with this wedge that I approach all of the greens from the back.

I am thinking very seriously of getting the Yipper Chipper. It's the new long-shafted chipper. I have the Optic Z putter — this is one putter head welded on top of another putter and it literally looks like a Z.

My shoes have Turf Grippers on the sole. They don't call them shoes anymore; they call them launching pads. I use Eco tees made of fertilizer. A recent purchase of mine is the Q-Ray band. It sorts out electrical charges in your body to solve all of your problems. I am also trying magnetic shoe inner soles. Most recently, I've acquired some of those

dark wrap-around glasses because you can read the greens a lot better.

Statistics

We have been collecting statistics for some time, and I think you would be surprised as to what we have found. The average stats for the PGA Tour regarding greens in regulation and accuracy haven't changed much from 1968 to 1998.

While greens are improving, the number of putts per round experienced a fairly significant decrease. Today, greens are almost perfect and since 1990 things have leveled out fairly well.

From 1968 until 1994 we have had an increase in average driving distance of about one yard every four years. In the last four years, we have had an increase of eight yards; I think this is something to do with equipment. It is not the natural progression we have seen for the last 27 years. I hope that we will be able to halt this trend by introducing the spring-like effect standard.

With statistics you have to be careful because many people read and interpret them incorrectly. There was a report recently about how 90% of all automobile accidents happen within 20 miles of your home. When my neighbor read this he decided to move.

Let me conclude by saying I think the answer to the question "Has the

USGA lost control?" is "absolutely not." We are moving ahead rapidly using technology to control technology. We understand why people play the game of golf. We respect the game and we are going to protect the challenge.

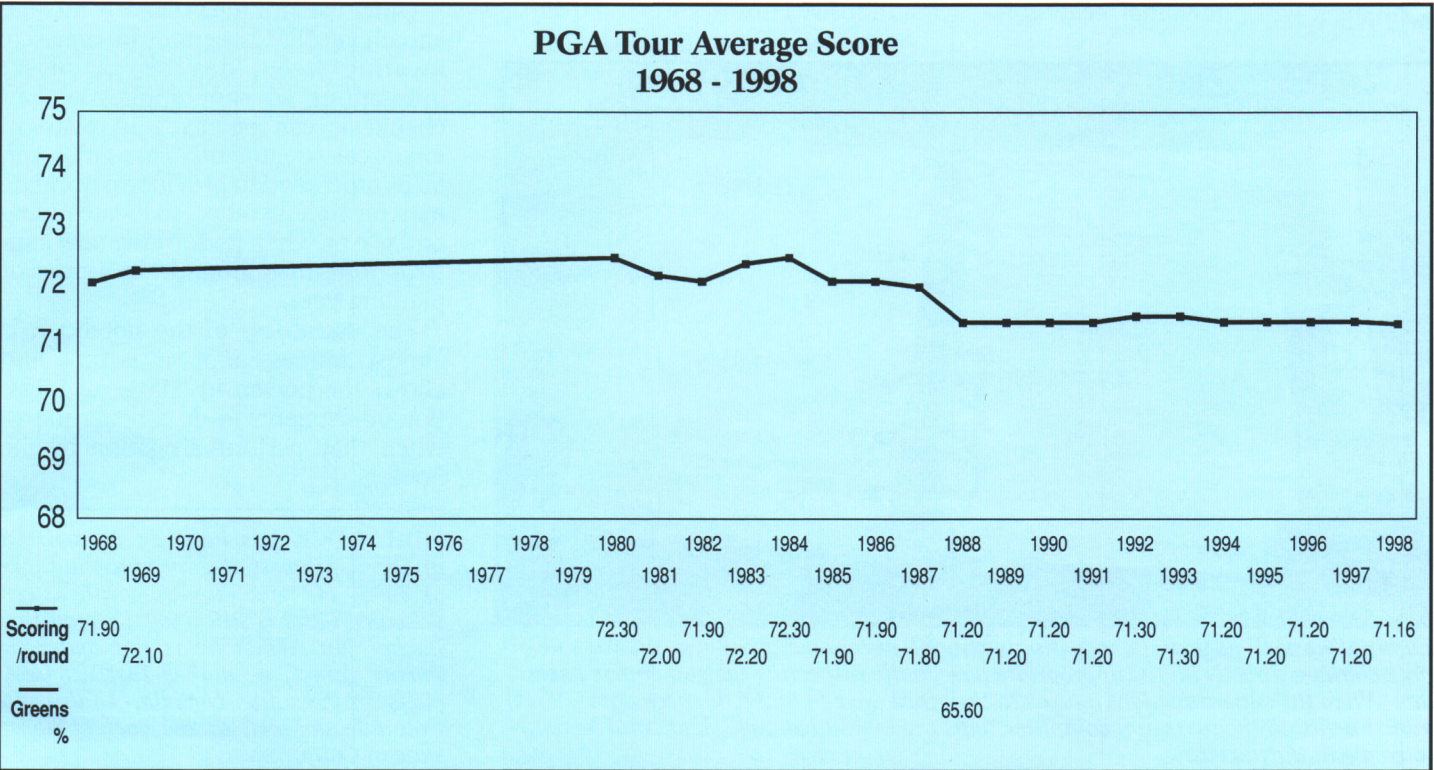
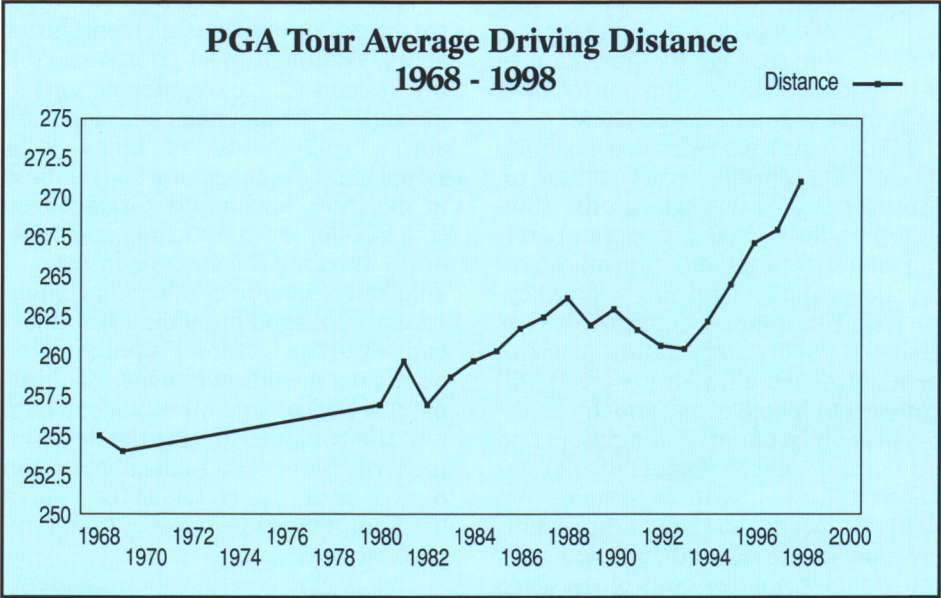
We have recently adopted the first performance standard for golf clubs. We are working on a more sophisticated standard for golf balls. We are not trying to stifle innovation specifically for the average golfer.

Through the biomechanics study, we are learning more about how the

body's flexibility and strength affect performance and how to prevent injury. We also are learning more about the mental side of the game.

I think we are doing a lot, and this is only in my area. We believe that all of the above will allow golfers to enjoy the game more and for a longer time in their lives.

FRANK THOMAS is the Technical Director of the USGA Test Center. He joined the USGA in 1974.



Irrigation By The Book

A notebook of irrigation blueprints simplifies daily water management.

by MIKE HUCK

OVER THE PAST 20 YEARS the personal computer has significantly changed how golf course irrigation systems are managed. No longer must the superintendent, assistant, or irrigation technician visit every satellite controller throughout the golf course in order to make minor run-time adjustments. It is now possible for one individual to manage the operation of thousands of stations from one location with these computerized systems.

Modern systems offer the flexibility of globally adjusting every station on the property as a single group, fine-tuning an individual station, or operating the system via radio from anywhere on the property with just a few keystrokes. This increased control also has changed golfers' expectation levels of being provided a uniformly green golf course that is void of wet and dry spots!

This combination of computers and increasing player expectations has affected how irrigation systems are designed. Many new irrigation systems are now designed and installed with individual sprinkler control. Systems in the past would average 400 to 600 stations to control 1,500 to 2,400 sprinklers, with individual head con-

trol. In comparison, today these same systems now have 1,500 to 2,400 stations. Each sprinkler on every green, tee, fairway, and even in the rough now is becoming a controllable station to offer the ultimate in control capabilities to minimize wet and dry areas.

This increased level of control has led to additional management headaches. Although most computer control systems utilize weather stations to monitor environmental conditions and automatically adjust run times, occasional manual changes are still required to fine tune and adjust for localized soil, shade, or microclimatic conditions. Tracking the stations in need of adjustment can be cumbersome when several thousand individual sprinklers come into the picture. Pinpointing the exact area or station in need of adjustment is critical, and inputting bad data into the computer means the development of, as opposed to the elimination of, wet or dry spots. Or, as they say in the computer industry — *garbage in, garbage out!*

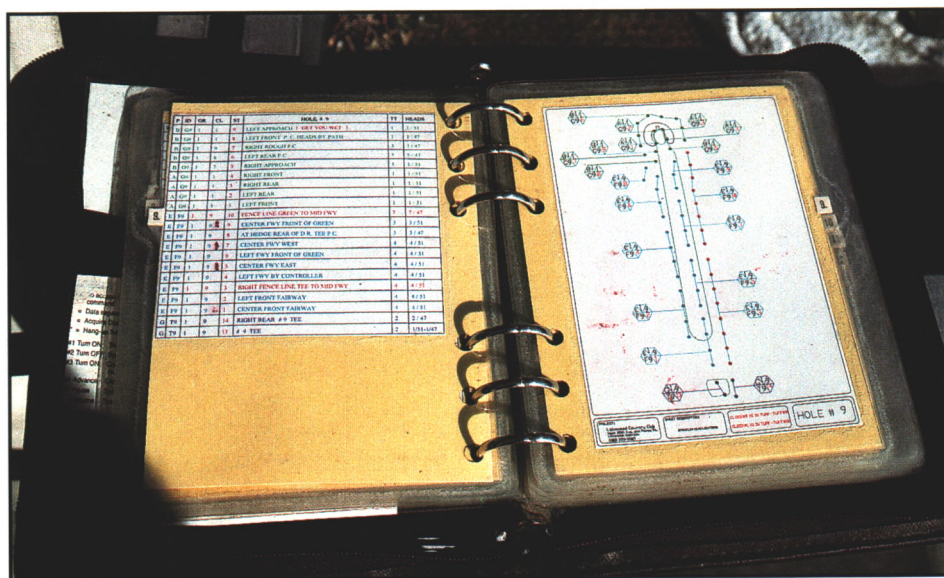
This is why several superintendents in the Southwest, such as Kent Davidson, CGCS, and Bert Spivey, CGCS, from the Industry Hills Resort Golf Courses

in the City of Industry, California, and Chris Swim from the Lakewood Country Club, Lakewood, Colorado, practice irrigation by the book. Each has developed a special irrigation notebook to better manage his day-to-day watering requirements. The irrigation blueprint has been reduced to conveniently sized individual pages that correspond with field controller stations. Each station is referenced to its corresponding computer assignment, so when a problem area surfaces, it can quickly be identified for adjustment or repair.

Bert and Kent use their irrigation books for both spot watering via their hand-held radio controllers and for noting daily station adjustments in the computer program. Chris took his irrigation notebook system one step further by laminating each page. This allows him to use dry markers to note directly on the page any areas in need of attention as he inspects the course each morning. He can then return to the irrigation computer and make any necessary adjustments, wipe the page clean, and be ready to go again the next day.

Other uses for the notebook include enhancing IPM programs by precisely locating weed, disease, or insect infestations so spot applications of chemicals can be made in place of large-scale treatments. Pages also can be photocopied to provide an accurate map for staff members to locate piping and wiring when performing new construction, installing drain lines, or planting trees.

The usefulness of the notebook is almost limitless as it saves time and allows the person in charge of irrigation adjustments to do a better job — when they perform irrigation by the book.



Laminating each page of the irrigation notebook allows using dry-type markers to note changes directly on the appropriate page while inspecting the golf course each day. When the superintendent returns to the office, he can make the necessary adjustments on the irrigation computer, wipe the laminated page clean, and be ready to go again the next day.

MIKE HUCK has been an agronomist in the Southwest Region since January of 1995. He grew up in southeastern Wisconsin and is still a loyal Green Bay Packer fan. When he is not watching Packer games, he makes Turf Advisory visits in Arizona, Nevada, Utah, and Colorado, as well as his current home state of California.

A SHARP IDEA

How an old practice is helping to manage new turfgrass varieties.

by CHRISTOPHER E. HARTWIGER



Dethatching removes organic matter and improves oxygen flow to the rootzone.

SOMETIMES new challenges can be overcome with old solutions. The advent of high-density bentgrass and bermudagrass varieties is raising the level of putting quality on putting greens throughout the country. However, there is a price to be paid to meet this higher standard because many of these varieties require a more intensive maintenance program.

Paul Jett and Jeff Hill at Pinehurst Resort and C.C. (Pinehurst, N.C.) have found dethatching to be an extremely important part of the management program for the G-2 bentgrass greens on Courses #2 and #8. The G-2 bentgrass has an extremely fine texture and requires exceptionally low mowing for optimum playability. They have concerns about rapid accumulation of organic matter in the upper portion of the profile as well as the incorporation of sand topdressing into the canopy. They have found that routine dethatching of the greens successfully addresses both of these concerns.

Evolution of a Sand-Based Putting Green

From the moment that grass is established on a sand-based putting green, the physical properties of the soil in the upper portion of the profile begin to change. Organic matter in the form of old roots and other plant matter accumulates, which can alter the balance of pore space. Typically, more capillary pore space is created at the expense of larger macropores. Since the capillary pore space contains water virtually all the time, soil oxygen and infiltration rates decrease.

Managing the physical properties of the soil in the upper portion of the pro-

file is essential to maintaining healthy bentgrass through the summer months. Physical removal of accumulated organic matter and the incorporation of topdressing are the two primary means of accomplishing this goal. These practices are even more vital in managing the new high-density bentgrass and bermudagrass varieties.

The Dethatching Process at Pinehurst

At Pinehurst, Mr. Hill and Mr. Jett use the Graden Vertical Mower to dethatch the G-2 bentgrass greens on Course #2 and Course #8 every six to eight weeks. A deeper setting is used for organic matter removal and a shallower setting is used to create channels for topdressing incorporation. The unit is gentle on the turf and complete recovery occurs within a week, regardless of the depth used. Mr. Hill and Mr. Jett believe aggressive dethatching removes more organic matter than core aeration, with less recovery time.

Light, frequent topdressings are essential to help maintain good porosity, firmness, and dilute the accumulation of organic matter. However, sometimes the turf canopy on some of these varieties is so dense that the larger particles are not readily incorporated. If the mowers are removing the larger sand particles, the benefits associated with light topdressings are not realized. Mr. Jett and Mr. Hill have found a light dethatching can be used to open up the canopy for easier incorporation of sand topdressing.

The cleanup process requires two easy steps. First, snow shovels are used to push the removed material to the edge of the green for easy pickup. Next, crew members with backpack blowers blow any remaining material off the greens. After rolling and/or mowing the next day, the greens are back in play with minimal disruption.

Using This Tip at Your Golf Course

The physical removal of organic matter and frequent topdressings are more important than ever before when managing a new high-density bentgrass or bermudagrass variety. While some

organic matter is essential to provide wear tolerance, too much will place the greens at risk for problems during periods of high heat and humidity. Paul Jett and Jeff Hill have found dethatching to be a major key in addressing this concern and a means to help provide players with outstanding conditions throughout the year. However, dethatching is a process that can be beneficial to older golf courses with sand-based putting greens. This practice can help remediate situations where the excessive accumulation of organic matter is hindering the performance of the greens.

The first step in implementing a dethatching program is acquiring a piece of equipment that can handle the job. Ideally, select a unit that can cut two inches deep into the profile without any difficulty or major disruption to the canopy. Generally, verticutting reels on triplex mowers are not an option because they will not cut deep enough into the profile.

The next step is to set a dethatching schedule that is appropriate for your golf course. Keep in mind that optimum times for dethatching bentgrass and bermudagrass greens will vary. Identify whether your objective is to assist in the incorporation of topdressing or organic matter removal. Aggressive dethatching should be performed during the period of peak growth to avoid stress and minimize the recovery period of the turf. A shallower setting is more desirable for the incorporation of sand topdressing.

Golfers' expectations and superintendents' skills continue to raise the standard of putting quality. Using this sharp idea at your golf course will benefit the greens agronomically and will give you a head start in meeting those rising expectations.

CHRISTOPHER E. HARTWIGER uses his well-honed skills as an agronomist in the Southeast and Florida Regions. He makes Turf Advisory Service visits in Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Florida.

A Luxury You Can Afford

A secretary for the superintendent. It's becoming a necessity.

by **STANLEY J. ZONTEK**

HOW MANY businesses do you know with an operating budget in excess of a quarter million dollars per year or more that do not have secretarial support? Maintaining a golf course is a business, and there are increasing demands on golf course superintendents for their time. All too often, superintendents spend time in the office doing routine office work instead of being out on the golf course supervising employees and ongoing maintenance projects.

This turf tip is inspired by three different golf course superintendents who maintain three different categories of golf courses. In each case, the superintendent employs a full- or part-time secretary.

Case Study #1

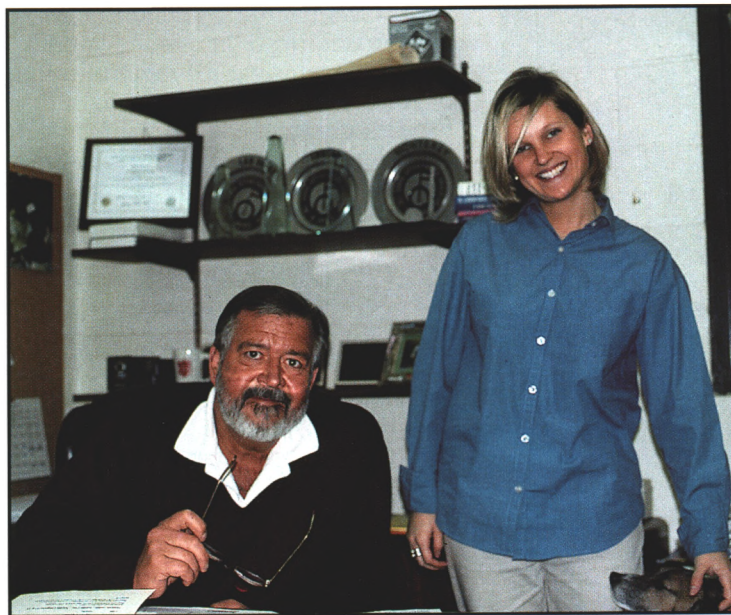
S. Daniel Pierson, CGCS, is the golf course superintendent at Wilmington Country Club in Wilmington, Delaware. His course is a 36-hole private facility. Beyond the 36 holes of golf, Dan is responsible for maintaining 20 tennis courts, the clubhouse grounds, tree and sod nurseries, and supervising ongoing golf course renovation projects.

To Dan, having a full-time administrative assistant is not a luxury; it is a necessity. With an operating budget in excess of \$1.5 million and 50 employees in the summer and 28 in the winter, having an office manager allows Dan to supervise all aspects of his job while delegating the routine paper work.

Dan says, "My most important employees are my managers, mechanic, and Dede Houston, my secretary. Dede, as is probably the case with most operations of this nature, truly is our office manager and coordinator. Come to think of it, let's put Dede as number one!"

Case Study #2

Stephen Potter, golf course superintendent, maintains Woodholme Country Club in Pikesville, Maryland. His course is an 18-hole private facility with an operating budget in excess of \$750,000. The goal at Woodholme Country Club is to provide the members and their guests with a quality



Dan Pierson and his secretary, Dede Houston, work as a team at Wilmington Country Club (Delaware). This is a big operation requiring a tremendous amount of administrative time, which can best be done by an office manager.

experience at all levels — out on the golf course, in the clubhouse, on the tennis courts, and at the swimming pool. For Steve, his full-time secretary, Chrissy Green, frees his time so that he can do what he feels he does best, maintain the golf course.

Says Steve, "There are so many telephone calls, sales calls, letters, and reports to write that I would go crazy without Chrissy. As time goes by, I have begun to appreciate that without this administrative help, the workload this job demands would result in my spending more time in the office, both during the day as well as the evening; this is time better spent with my family."

Case Study #3

The final example is from David "Ben" Abel, superintendent of Glenrochie Country Club in Abingdon, Virginia. While the demands of the superintendent's job seem to be ever increasing, budgets in rural Virginia are much more modest. The operating budget for Glenrochie Country Club barely exceeds \$380,000. Nonetheless, Ben can afford a part-time secretary.

How can a golf course with such a modest operating budget afford even a part-time secretary? "Lisa frees me up to spend my time out on the golf

course where I can make the best use of my club's money. While she works only five hours per day, this is when I need her the most to answer the telephone, do time cards, sort mail, organize the office, and work on the computer. She even improves my morale! I am never behind administratively."

"At first, I was not sure I could justify the expense of her position. Now, I would never eliminate it. Having a secretary is not a luxury; it is a necessity." This became readily apparent when Lisa Johnson resigned. Says Ben, "In the interim between her leaving and my hiring Susie Clatterbuck, I had to do their work. It really showed the value of their position at Glenrochie Country Club."

In order for today's golf course to be effectively managed, the superintendent needs help, and that help often-times is an administrative assistant. It is not a luxury anymore; it is becoming a necessity.

STANLEY J. ZONTEK is the Director of the Mid-Atlantic Region, visiting courses in Delaware, Maryland, Pennsylvania, Virginia, and West Virginia. Stan has served as Director of both the Great Lakes and Northeast Regions, and joined the Green Section staff in 1971.

REELS ON WHEELS

An inexpensive way to optimize workspace in old and new maintenance facilities.

by ROBERT VAVREK

A COMMON DENOMINATOR among the more highly regarded golf courses across the country, regardless of the operating budget, is a spotless, efficient maintenance facility. A safe, well-organized workplace and clean, properly adjusted equipment are often the prerequisite to superior playing conditions on the course.

A neat and organized maintenance facility also can have a subtle but significant influence on even the part-time, seasonal employees. Keeping the shop clean encourages the crew to keep the course clean. After all, why would a part-timer running the string trimmer even consider picking up twigs, cigarette butts, or a scrap of paper when the center of maintenance operations resembles a junkyard? This Turf Tip describes a simple and inexpensive way to keep the shop clean and maximize workspace.

Pat Shaw, a Wisconsin superintendent located at The Bog, noticed that the mechanic's large, heavy tool storage box was conveniently mounted on casters. The ability to easily move an unwieldy toolbox maximized the

mechanic's limited workspace and improved productivity. Why not take a good idea one step further and install casters beneath workbenches, storage bins, racks of shelving, tables, and other objects?

This concept of rolling storage was further modified and improved by his brother and fellow superintendent, Charlie Shaw, at Naga-Waukee Golf Course during the construction of a new maintenance facility. One of the more unique uses for casters is on the large wooden racks used to store extra sets of mowing and verticut reels. They're also used on several other large sets of multiple-shelf racks that store walk-behind rotary mowers, Flymos, and other relatively small maintenance equipment. Again, the combination of rollers and multiple shelves on these storage racks maximizes the storage space in the shop and eases the difficult task of keeping the workspace clean and organized.

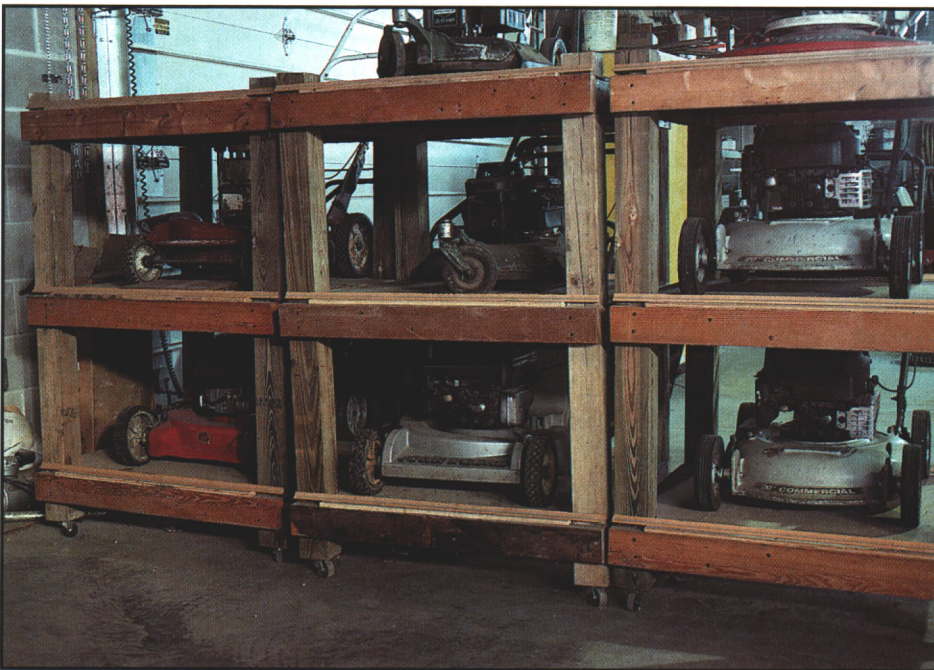
Both superintendents experimented with the use of casters that can be locked in place with a lever-type of friction brake, but on a rough, relatively

level surface, a brake was not necessary. A heavy rack of equipment on casters has little potential to roll around without a strong push due to a substantial amount of weight over the wheels and a fairly wide wheelbase that tends to compensate for an uneven surface. Brakes, however, would be a good option on a storage rack placed on a smooth graded floor, for example, where the floor is graded towards a central drain grate or a collection sump.

The advantages of using casters under storage racks can be realized at the most modern maintenance facility as well as many smaller golf courses that, unfortunately, still operate out of a maintenance "barn." Storage space is always at a premium in the maintenance facility.

Superintendents are employing more push-behind rotary mowers and other small, highly maneuverable grooming units to maintain steep bunker banks, steep green banks, and other severe architectural features that are commonplace in many contemporary course designs. Steep bunker and green banks are challenging features that are visually appealing, but they are difficult or impossible to maintain with standard triplex or rotary trim mowers. Multi-shelf racks are ideal for stacking and storing small mowers that would otherwise occupy a considerable amount of valuable floor space.

Golfers expect and demand nothing but the highest quality playing conditions on greens, regardless of the operating budget. Consequently, more and more intensive maintenance operations such as light frequent top-dressing, grooming, and vertical mowing are becoming standard operating procedures on nearly all courses. These techniques can be performed much more efficiently when extra sets of sharpened reels are readily available to the mechanic to use at a moment's notice. Rolling racks of reels make this possible and practical.



Mounting swivel casters under multi-shelf storage racks will optimize the workspace in any size maintenance facility.

BOB VAVREK is an agronomist who rolls through the western portion of the North Central Region: Michigan through Montana.

Flood Your Greens — Not Your Bunkers

Using low-precipitation-rate sprinklers for leaching greens.

by **PATRICK GROSS**

EXPERIENCED superintendents agree that the most critical part of putting green management is controlling water applications. It takes a delicate touch and good judgment to manage irrigation, especially on native soil greens. Now that more and more courses are using effluent water, there is increasing concern about salinity in the soil. Controlling salinity requires periodic leaching, but applying the necessary amount of water to leach salts from native soil greens is difficult because most golf course sprinklers apply water too fast for adequate infiltration and percolation through the rootzone. The result is washed-out bunkers and excessively wet conditions around the greens for several days. Successful leaching on native soil greens requires the long, slow application of water to allow infiltration and percolation through the rootzone without runoff to adjacent areas. Two superintendents in Southern California found effective ways to leach salts without making a mess of the bunkers and surrounding areas.

Stephen McVey at Virginia Country Club in Long Beach, California, has 11 soil-based greens with a 5-inch sand cap from years of core aeration and topdressing. The greens are irrigated with effluent water, and controlling salinity accumulation is a major concern during the summer and fall. Stephen monitors the greens on a weekly basis with a portable electroconductivity meter, and leaching cycles are scheduled when salinity readings reach 2.7 dS/m. To avoid flooding the bunkers and green banks, the maintenance staff sets up three to four impact sprinklers on a roller base that are placed around the perimeter of the green in the late afternoon. The impact sprinklers apply water at approximately 10 gallons per minute, which is almost half the precipitation rate of the existing putting green sprinklers. The

sprinklers are connected to a hose and nearby quick coupler with a flow control valve on top. Each sprinkler is tested and the arc adjusted so that water is only applied to the greens. A maintenance staff member returns in the early evening to turn on the sprinklers. Water is applied during the night for six to eight hours, and the sprinklers are turned off approximately one to two hours prior to mowing the next morning.

Jay Jamison, superintendent at Elkins Ranch Golf Course in Filmore, California, uses a slightly different method. Jay also has salinity problems on his 15 clay-based greens. Since the water infiltration rate is very limited, Jay uses a series of micro-spinner sprinklers that apply water at a very slow rate. The micro-spinners are available from a variety of suppliers with application rates ranging from 0.5 to 1.0 gallon per minute. The small sprinklers are attached to a ½" × 6" schedule 80 nipple and inserted into a ½" sled available through Spears Irrigation Products. Each sprinkler assembly is interconnected with 15-foot to 18-foot lengths of flexible ¾" polyethylene tubing and attached to a nearby quick coupler with a pressure-reducing valve to limit the pressure to 20 psi. A single line of nine or ten micro-spinners is placed on the green in the late evening. The affected greens are watered for eight hours or more during the night and the micro-spinners are shut off one to two hours prior to mowing the next morning. The cost of setting up a micro-spinner system is only \$3 to \$4 per section.

The key to successful leaching on native soil greens is to match the water application rate with the infiltration of the soil to avoid runoff into adjacent areas. A one-hour or two-hour irrigation cycle with regular irrigation heads is usually not enough water for effective leaching and often creates wet, soft

surface conditions on the green and surrounds for several days. A slow and steady leaching cycle for six to eight hours fills the entire rootzone and allows the force of gravity to break the soil tension and effectively flush salts and excess water. Air is drawn into the rootzone as the water drains, which creates drier surface conditions. To get comfortable with this procedure, it is always recommended to do a test on a practice putting green or nursery to get an idea of exactly how long water must be applied for effective leaching. Some courses find it necessary to leach greens over two successive evenings by scheduling a heavy irrigation cycle one night followed by leaching with low-precipitation-rate heads the subsequent night.

Other tips for managing salinity on native soil greens include:

- Monitor salinity on a weekly basis and leach the greens when readings approach 2.7 dS/m.
- Spike the greens in several directions prior to leaching to break through any surface crust and aid in water infiltration.
- Leaching salts also leaches fertilizer. Be sure to schedule appropriate applications of nitrogen and potassium two to three days after leaching.
- Successful leaching must go hand in hand with programs to improve drainage.

If you are trying to leach native soil greens with standard golf course irrigation heads, you are probably applying water too fast and getting undesirable runoff into bunkers and adjacent areas. Using low-precipitation-rate sprinklers to leach greens is an effective way to flood your greens without flooding your bunkers.

PAT GROSS is the Director of the Southwest Region, serving the states of Arizona, California, Nevada, Utah, and Colorado.

May The Force Be With You

An alternative method for incorporating topdressing sand into high-density putting green turf.

by JOHN H. FOY

TOPDRESSING of putting green surfaces is a standard practice today. Frequent and light topdressing treatments throughout the growing season aid in thatch management and also help provide a smooth, true ball roll and medium to fast putting speed. While there are exceptions, straight sand topdressing programs are most commonly used with putting greens.

With Tifgreen (328) and Tifdwarf bermudagrass based putting surfaces, incorporation of medium to coarse sand particles has not been a major problem because of their relatively open growth habit and the higher heights of cut normally maintained. However, the incorporation of topdressing sand into the turf canopy has been an issue with bentgrass and *Poa annua* putting surfaces for many years. This has become even more of an issue with the newer high-density bentgrasses that are being maintained at a height of cut of $\frac{1}{8}$ inch or lower. With the development of new bermudagrass cultivars such as Champion, Floradwarf and Tifeagle, southern golf course superintendents now have to deal with this same problem. These new cultivars all have significantly greater shoot densities compared to the old standards and also need to be maintained at a height of cut of $\frac{1}{8}$ inch the majority of the time. As with the new bentgrass varieties, these bermudagrasses have a faster rate of thatch accumulation. Thus, adherence to a frequent and light topdressing program is even more critical.

The bane of golf course mechanics and equipment managers is the damage that occurs to mowing units following topdressing treatments to putting surfaces. Even at courses that have the luxury of a backup set of sand reels that can be used until the topdressing works into the turf, additional time and money are consumed with reel maintenance operations.

At the Jupiter Island Club in Hobe Sound, Florida, complete reconstruction of the putting greens and conversion to Tifeagle bermudagrass was conducted over the summer of 1998.

The course was reopened to member play in the mid-fall, and the greens have received rave reviews as far as their smoothness, speed, and lack of grain. Yet, during the final stages of the grow-in and following the reopening of the course, it became apparent that adjustments were needed in the topdressing process to better incorporate the sand into the turf canopy.

As long as time was available, light verticutting or turf grooming could be used to open up the turf canopy prior to dustings of topdressing sand. Then, standard brushing operations were adequate for incorporating the majority of the sand.

However, during the winter play season in Florida, time for accomplishing maintenance practices is a precious commodity. Also, during the winter months, when the base bermuda is not actively growing, care must be exercised in the amount of mechanical stress and injury exerted on the turf. Adjustments in the topdressing program were tried, including the use of a dried and bagged topdressing sand, application with rotary spreaders, and then working the sand in with triplex-mounted vibratory rollers. This process has worked quite satisfactorily, but the time required and cost could be issues at some courses.

In discussing this topdressing dilemma one afternoon with Rob Kloska, golf course superintendent, and Richard Weixler, head mechanic at Jupiter Island, Richard offered the suggestion of blowing the topdressing sand down into the turf's surface with hover-type mowers. These mowers have been used extensively on Florida golf courses for maintaining steeply sloped bunker perimeters, lake banks,

and other areas. Their popularity, however, has declined a little bit over the past few years because of the reduced quality of cut provided by the string head attachments compared to the metal blade setup. The change to the string head setup has been dictated by insurance companies because of personal injury concerns.

Richard's thought was that the cushion of air that supports these mowing units could be used to force the topdressing sand into the turf canopy. A few days after our initial discussion, it was given a try on the practice chipping green at Jupiter Island Club and found to work very well. Regardless of the topdressing rate, a very high percentage of the sand was worked into the canopy. It was also noted that by methodically working the hover mowers across the putting surface, it was possible to push some of the very coarse sand particles off the putting surface completely. Furthermore, the forced air helped dry out the sand.

Finally, during periods of intense environmental stress, causing additional damage and wear on the turf cover with brushing or drag-mat operations to incorporate topdressing sand can be a concern. Using the forced air of the hover mowers to work the sand in is far less abrasive and also further reduces vehicle traffic on the putting surfaces. So, the next time you are faced with a problem of working topdressing sand into the turf surface, you might want to take the *Star Wars* approach and "May the Force Be With You."

JOHN FOY's "force is with him" in Hobe Sound, Florida, where he directs the Green Section's Turf Advisory Service.



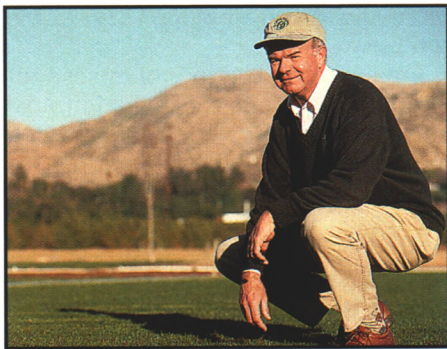
Incorporation of topdressing sand into the canopy of the new high-density bentgrasses and bermudagrasses can be a problem. The hover-type mower is an effective and efficient tool for forcing the sand down into the turf.

Piper and Oakley Award Inaugurated

Four volunteers recently received the newly created Piper and Oakley Award from the USGA Green Section.

Dr. Charles V. Piper and Dr. Russell A. Oakley were among the earliest scientists to conduct studies in the fields of turfgrass science and golf course management, and they served as the first Chairman and Co-Chairman of the USGA Green Section. They were men of great character, keen vision, and remarkable achievement, whose contributions to the improvement in early greenkeeping methods cannot be overstated. The Piper and Oakley Award was established to recognize others who have so generously contributed to the programs and activities of the Green Section of the United States Golf Association.

Three of the recipients have been long-term members of the USGA's Turfgrass and Environmental Research Committee. They have been instrumental in guiding a research program that has funded more than 150 research projects since 1983, at a cost of about \$17 million to the USGA.



Dr. Vic Gibeault



Dr. James Watson

Dr. Vic Gibeault, a turfgrass extension specialist at the University of California-Riverside, served the committee through his keen ability for planning and communications. He was a member of the committee from 1985 through 1997.

Dr. Paul Rieke is a professor of turfgrass soils at Michigan State University and has contributed immeasurably in the fields of soils and turfgrass fertility. He has served continuously on the Turfgrass and Environmental Research Committee since its inception in 1982.

Dr. James Watson also has served on the committee since 1982. Dr. Watson was a vice-president of the Toro Company for many years and the first scientist to receive a Ph.D. in turfgrass science. He has brought to the committee expertise in grass improvement and water issues in the game of golf.

Dr. Arthur Weber, a member of the USGA Green Section Committee since 1984, has enthusiastically championed environmental stewardship in golf and written numerous articles on a variety of topics for the *USGA Green Section Record*.



Dr. Paul Rieke



Dr. Arthur Weber

Physical Soil Testing Laboratories*

The following laboratories are accredited by the American Association for Laboratory Accreditation (A2LA), having demonstrated ongoing competency in testing materials specified in the USGA's Recommendations for Putting Green Construction. The USGA recommends that only A2LA-accredited laboratories be used for testing and analyzing materials for building greens according to our guidelines.

BROOKSIDE LABORATORIES, INC.

308 S. Main Street
New Knoxville, OH 45871
Attn: Mark Flock
(419) 753-2448 • (419) 753-2949 FAX

EUROPEAN TURFGRASS LABORATORIES LIMITED

Unit 58
Stirling Enterprise Park
Stirling FK7 7RP Scotland
Attn: John Souter
(44) 1786-449195
(44) 1786-449688 FAX

N. W. HUMMEL & CO.

35 King Street, P.O. Box 606
Trumansburg, NY 14886
Attn: Norm Hummel
(607) 387-5694 • (607) 387-9499 FAX

LINKS ANALYTICAL

22170 S. Saling Road
Estacada, OR 97023
Attn: Michael S. Hindahl, Ph.D.
(503) 630-7769

THOMAS TURF SERVICES, INC.

1501 FM 2818, Suite 302
College Station, TX 77840-5247
Attn: Bob Yzaguirre / Jim Thomas
(409) 764-2050 • (409) 764-2152 FAX

TIFTON PHYSICAL SOIL TESTING LABORATORY, INC.

1412 Murray Avenue
Tifton, GA 31794
Attn: Powell Gaines
(912) 382-7292 • (912) 382-7992 FAX

TURF DIAGNOSTICS AND DESIGN, INC.

310-A North Winchester Street
Olathe, KS 66062
Attn: Chuck Dixon
(913) 780-6725 • (913) 780-6759 FAX

*Revised March 1999. Please contact the USGA Green Section (908-234-2300) for an updated list of accredited laboratories.



USGA PRESIDENT
F. Morgan Taylor, Jr.

**GREEN SECTION
COMMITTEE CHAIRMAN**
C. McD. England III
P.O. Box 58
Huntington, WV 25706

EXECUTIVE DIRECTOR
David B. Fay

EDITOR
James T. Snow

ASSOCIATE EDITOR
Kimberly S. Erusha, Ph.D.

DIRECTOR OF COMMUNICATIONS
Marty Parkes

©1999 by United States Golf Association®

Subscriptions \$15 a year, Canada/Mexico \$18 a year, and international \$30 a year (air mail).

Subscriptions, articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, Golf House, P.O. Box 708, Far Hills, NJ 07931.

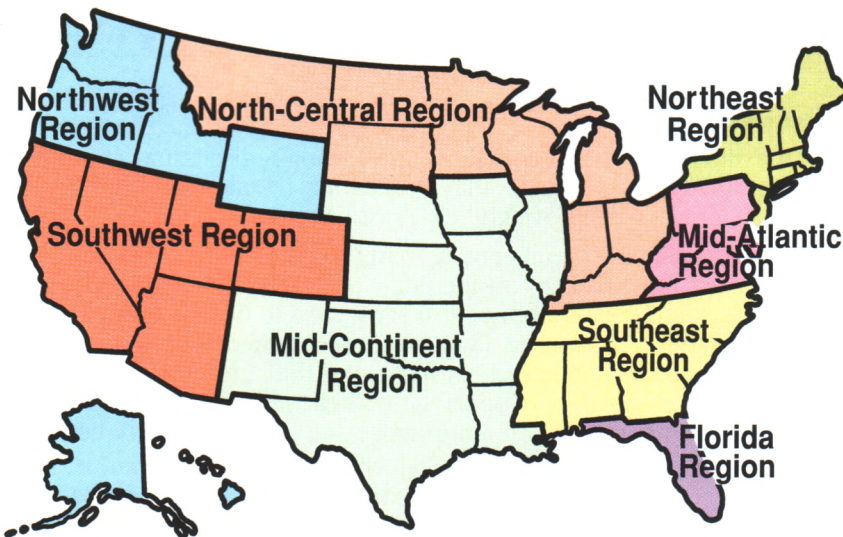
Permission to reproduce articles or material in the USGA GREEN SECTION RECORD is granted to newspapers, periodicals, and educational institutions (unless specifically noted otherwise). Credit must be given to the author, the article's title, USGA GREEN SECTION RECORD, and the issue's date. Copyright protection must be afforded. To reprint material in other media, written permission must be obtained from the USGA. In any case, neither articles nor other material may be copied or used for any advertising, promotion, or commercial purposes.

GREEN SECTION RECORD (ISSN 0041-5502) is published six times a year in January, March, May, July, September, and November by the UNITED STATES GOLF ASSOCIATION®, Golf House, Far Hills, NJ 07931. Postmaster: Address service requested — USGA Green Section Record, P.O. Box 708, Golf House, Far Hills, NJ 07931-0708.

Periodicals postage paid at Far Hills, NJ, and other locations. Office of Publication, Golf House, Far Hills, NJ 07931.

Visit the USGA's Internet site on the World Wide Web. The address is:
<http://www.usga.org>

Turfgrass Information File (TGIF):
<http://www.lib.msu.edu/tgif>
(517) 353-7209



GREEN SECTION NATIONAL OFFICES:

United States Golf Association, Golf House
P.O. Box 708, Far Hills, NJ 07931 • (908) 234-2300 • Fax (908) 781-1736

James T. Snow, *National Director*
Kimberly S. Erusha, Ph.D., *Director of Education*

Research:

P.O. Box 2227, Stillwater, OK 74076 • (405) 743-3900 • Fax (405) 743-3910
Michael P. Kenna, Ph.D., *Director*

Construction Education Programs:

720 Wooded Crest, Waco, TX 76712 • (254) 776-0765 • Fax (254) 776-0227
James F. Moore, *Director*

REGIONAL OFFICES:

Northeast Region:

P.O. Box 4717, Easton, PA 18043 • (610) 515-1660 • Fax (610) 515-1663
David A. Oatis, *Director* • Matthew C. Nelson, *Agronomist*
1500 N. Main Street, Palmer, MA 01069 • (413) 283-2237 • Fax (413) 283-7741
James E. Skorulski, *Agronomist*

Mid-Atlantic Region:

P.O. Box 2105, West Chester, PA 19380-0086 • (610) 696-4747 • Fax (610) 696-4810
Stanley J. Zontek, *Director* • Keith A. Happ, Darin S. Bevard, *Agronomists*

Southeast Region:

P.O. Box 95, Griffin, GA 30224-0095 • (770) 229-8125 • Fax (770) 229-5974
Patrick M. O'Brien, *Director*
4770 Sandpiper Lane, Birmingham, AL 35244 • (205) 444-5079 • Fax (205) 444-9561
Christopher E. Hartwiger, *Agronomist*

Florida Region:

P.O. Box 1087, Hobe Sound, FL 33475-1087 • (561) 546-2620 • Fax (561) 546-4653
John H. Foy, *Director*

Mid-Continent Region:

P.O. Box 1130, Mahomet, IL 61853 • (217) 586-2490 • Fax (217) 586-2169
Paul H. Vermeulen, *Director*
4232 Arbor Lane, Carrollton, TX 75010 • (972) 492-3663 • Fax (972) 492-1350
Brian M. Maloy, *Agronomist*

North-Central Region:

P.O. Box 15249, Covington, KY 41015-0249 • (606) 356-3272 • Fax (606) 356-1847
Robert A. Brame, *Director*
P.O. Box 5069, Elm Grove, WI 53122 • (414) 797-8743 • Fax (414) 797-8838
Robert C. Vavrek, Jr., *Agronomist*

Northwest Region:

5610 Old Stump Drive N.W., Gig Harbor, WA 98332
(253) 858-2266 • Fax (253) 857-6698
Larry W. Gilhuly, *Director*

Southwest Region:

505 North Tustin Avenue, Suite 121, Santa Ana, CA 92705
(714) 542-5766 • Fax (714) 542-5777
Patrick J. Gross, *Director* • Michael T. Huck, *Agronomist*

TURF TWISTERS

USE RULES

Question: At our golf course we are having a discussion about pull-carts. What are your recommendations regarding where pull-carts may or may not be taken and the suggested physical characteristics for pull-carts (i.e., width of wheels, weight, etc.)? (California)

Answer: To simplify policy, many courses enforce the same rules for pull-carts as for riding golf carts, i.e., carts must be kept on the paths or at least 30 feet away from all tees and greens. The reason is that the tees and greens are the most sensitive and heavily trafficked areas on the golf course. Since pull-carts are smaller and more easily maneuvered, golfers tend to bring them onto the tees, pull them in the narrow gap between greenside bunkers and the putting surface, and even park them on the edge of the greens. Wear patterns develop as the pull-carts repeatedly trample the same place. Rules for these carts should take into account common sense and good course etiquette. Consider the following:

- Pull-carts should have wide wheels (approximately 4" or more). The heavier battery-operated carts are fine as long as they have relatively wide wheels to displace the weight.
- Pull-carts should be kept a reasonable distance from greens and tees, and they should never be parked on the tees or greens. Fifteen to 30 feet is normally sufficient.
- To prevent turf damage and rutting, pull-carts should never be pulled across excessively wet areas.
- Pull-carts should be directed around greenside bunkers and should never be taken in the narrow gap between the green and surrounding bunkers.

TO CALIBRATE

Question: During the summer months, I often find it necessary to hand water localized dry areas on the greens. I also have noted that these areas are in the same location year after year. While in some cases the need for extra water can be attributed to the slope of the putting surface, the vast majority seem to be located on mostly level ground. Do you think the application of a wetting agent would be helpful? (Illinois)

Answer: Wetting agents can be very helpful in the fight against localized dry spots, but before making the first application, it may be time to check the water distribution pattern of the irrigation system. If the sprinkler heads are improperly spaced, some areas may be getting too much water and others too little. Also, don't be fooled by eyeballing the irrigation system. Worn nozzles can cause uneven water distribution even though the sprinklers are covering from head to head. The easiest way to check the water distribution pattern is to place plastic cups on 5-foot centers across the entire surface of a green and turn on each sprinkler for at least 15 minutes.

THE COMPETITION

Question: My kikuyugrass fairways tend to scalp every year around the middle of July. I'm mowing five days a week and keeping the cutting height up around $\frac{5}{8}$ ". Is there anything else I can do to prevent scalping? (California)

Answer: Kikuyugrass has a very aggressive growth rate and will seem to jump out of the ground overnight in midsummer. Scalping tends to be worse in drought-prone areas, so aerification and spot watering are important programs during the summer. Another effective program is to gradually increase mowing heights throughout the growing season. For example, you can begin mowing at $\frac{7}{16}$ " in April and May as the grass breaks dormancy, then increase the cutting height $\frac{1}{16}$ " each month to a final cutting height of $\frac{3}{4}$ " in October. This maintenance program not only helps reduce scalping, but also builds additional pad on the fairways going into winter.