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Green Side Up!

Contents

January-February 2008 Volume 46, Number 1

1 Green Side Up!

Sodding putting greens can be a viable method of establishment with proper care, good product, and reasonable expectations.

BY MATT NELSON

6 Bermudagrass Freeze Tolerance

Oklahoma State University researchers use laboratory and field evaluations to compare bermudagrass freeze tolerance.

BY JEFF ANDERSON, CHARLES TALIAFERRO, DENNIS MARTIN, YANQI WU, AND MICHAEL ANDERSON

10 Don't Wait Until the Well Runs Dry

Changing water sources: from good to good.

BY TOM WERNER, CGCS

12 Going for the Gold with the Ultradwarf Bermudagrasses

This is part three of an occasional series on bermudagrass putting greens and focuses on surface management and minimizing grain.

BY JOHN H. FOY

16 Cultivating to Manage Organic Matter in Sand-Based Putting Greens

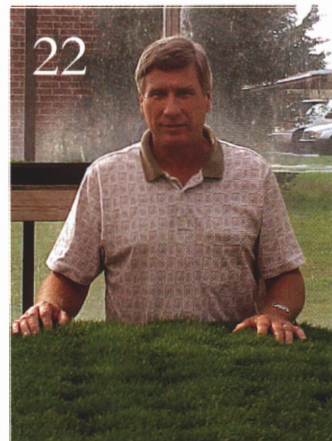
University of Arkansas researchers provide important insight for managing organic buildup on putting greens.

BY JOSH LANDRETH, DOUG KARCHER, AND MIKE RICHARDSON

20 Ski Season

Golf courses provide recreational opportunities throughout the year, even when it snows.

BY MATT NELSON



Dr. Paul Raymer is utilizing the extensive seashore paspalum germplasm collection assembled by Dr. R. R. Duncan to generate new genetic variation through recombination. The University of Georgia holds the largest collection of seashore paspalum ecotypes in the world.

22 Seashore Paspalum: Breeding a Turfgrass for the Future

Work continues at the University of Georgia on the development of this salt-tolerant species.

BY P. L. RAYMER, S. K. BRAMAN, L. L. BURPEE, R. N. CARROW, Z. CHEN, AND T. R. MURPHY

27 Welcomed Mats for Small Practice Tees

Which is better for a small practice tee — artificial turf or bare ground?

BY TODD LOWE

30 Define the Line

A simple mowing strategy to maintain the dimensions of greens and the width of collars.

BY KEITH HAPP

32 Washing Your Cares Away

Gaining an equipment wash rack upgrade as part of the turf management center master plan.

BY JOSHUA CONWAY

34 News Notes

35 2008 USGA Green Section Education Conference and 2008 USGA National & Regional Conferences

36 A Question of Credibility

Don't believe everything the "experts" tell you.

BY CHRIS HARTWIGER

38 Turf Twisters



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Cover Photo

Managing the sod layer with aeration and topdressing is critical to the long-term performance of a putting green.

Green Side Up!

Sodding putting greens can be a viable method of establishment with proper care, good product, and reasonable expectations.

BY MATT NELSON



Quality bentgrass sod will establish quickly when placed on a well-chosen and prepared sand rootzone.

Given the option, most cool-season turf managers would prefer to establish putting green turfgrass directly from seed. Seeding enables turfgrass plants to germinate, establish, and mature in the rootzone selected for the greens. Strong roots will develop in a well-oxygenated sand rootzone, and the developing thatch/mat layer can be integrated with sand during grow-in to avoid layering and maintain optimal soil structure. Surfaces can be prepared during construction and maintained during grow-in with topdressing, grooming, and rolling to provide superior smoothness and playability. Typically, creeping bentgrass establishment from seed requires at least 12-16 weeks of good growing weather for sufficient maturation to tolerate play. Seeding in late summer is preferred, taking advantage of warm soils, cooling nights, reduced disease pressure, and limited

physiological stress for best establishment. When grow-in goes well, greens seeded in mid to late August are ready for play by late May or early June of the next year across most of the northern United States.

At many northerly and higher-elevation sites, however, a limited growing season extends the amount of time required to open seeded putting greens. A longer grow-in may not fit the timeline at higher-end projects dependent upon real estate sales and/or revenue generation. Sod has become increasingly utilized at these types of locations to compress the window between construction and opening.

Winterkill and renovation projects also contribute to the demand for high-quality putting green sod. Replacing putting green turf dominated by annual bluegrass (*Poa annua*) with creeping bentgrass sod significantly improves

turfgrass reliability over the winter. Installing bentgrass sod will not overcome limitations with respect to shade or poor design, but improved resistance to freeze injury can be expected.

Regrassing with improved creeping bentgrass cultivars also may be a viable means of meeting golfer expectations with respect to putting quality and turfgrass performance.¹ Many of the newer cultivars of creeping bentgrass exhibit good tolerance of close mowing, disease resistance, outstanding morphological characteristics, and enhanced overall stress tolerance. In some climates it is a real challenge to meet current golfer expectations for ball roll and consistency with a mix of annual bluegrass and older genotypes of creeping bentgrass due to anthracnose, nematodes, and/or physiological stress.



A long grow-in time does not always fit into a project timeline. Sod provides an opportunity for rapid putting green establishment.

Sod quality and production has evolved considerably in recent years, meeting industry demands for agronomic excellence and superior playability in a short time. This article will address some of the major issues regarding putting green sod selection and establishment for the best opportunity for success. Although the information in this article pertains directly to creeping bentgrass putting green turf, the principles of agronomy should be pertinent to the culture of bermudagrass sod in warm-season climates.

SELECTING THE BEST SOD

Of paramount importance when selecting putting green sod is rootzone compatibility. Sod grown in soil that is finer textured than

the underlying rootzone will likely pose establishment difficulty, as excess moisture held in the sod layer will limit root growth and gas exchange. Creeping bentgrass sod grown in a clay, silt, or loam soil placed on a sand rootzone is practically doomed from the start and should never be considered. Superintendents or project managers should visit potential sod farms and ask for particle size distribution analyses from the top one or two inches (depending upon cutting depth) of the sod rootzone. These test results can be compared with rootzone mix parameters of the putting greens to estimate physical compatibility. If in doubt, seek input from an agronomist, university extension specialist, or a USGA-accredited physical soil testing laboratory.

In recent years, soilless sod has become available in the western United States. This patented technology involves producing creeping bentgrass sod on thin plastic with only enough sand to germinate seed and establish the turf. The risk of rootzone incompatibility may be reduced with this type of sod, although organic matter accumulation must be managed appropriately, a concern with practically all types of bentgrass sod. Sod grown on plastic does not require bottom cutting for harvest; thus, turfgrass roots remain intact although bound in the thatch/mat layer. Producers market the lack of root cutting as a benefit to establishment. Sod produced on plastic can usually be harvested at various widths, since undercutting is not required.

Selecting young sod (less than one year or so) is usually desirable, since thatch will be more manageable. Excess thatch can restrict gas exchange into the rootzone, hold too much moisture near the surface, decrease tolerance of environmental extremes, increase the likelihood of mechanical injury as cutting heights are lowered, and compromise recuperative potential of the turf. About 0.75 inch of thatch or less would be considered desirable when selecting putting green sod.

Cultivar selection can be based upon regional NTEP (National Turfgrass Evaluation Program) trials, regional performance, compatibility with existing turf (if only sodding one or a few greens), player expectations, and maintenance capability. If a major renovation involving sod is to be carried out, most producers will contract to grow the cultivar of choice and, within reason, manage accordingly. Perhaps growth regulator applications and/or topdressing will be

desired, and these practices are feasible provided equipment and costs are identified. Long-distance transport for the sod may require refrigeration to avoid desiccation and damage to the sod.

ESTABLISHMENT TIPS — GREEN SIDE UP!

Anybody who has had the good fortune to have hands-on involvement with major sod projects has heard all the installment jokes, none of which will be repeated here. Jokes and puns aside, however, there are some tried and true tips worth considering when working with putting green sod.

Using big rolls of sod is not necessary for a successful project, but they provide some advantages. Big rolls speed the installation process, which can be advantageous under many circumstances. Fewer pieces of sod also mean fewer seams for potentially smoother surfaces earlier, slightly easier management, and reduced risk of edge desiccation.

The prepared finished grade should be smooth and firm. Ideally, the surface should be firm enough that footprints are less than 0.25 inch deep. Check grades with a digital level and survey equipment to ensure that putting greens have positive surface drainage for water discharge. This point is especially critical where winterkill is an issue; water from melting snow and ice needs to flow off of putting green turf.

When renovating existing greens, cut the existing sod deep enough to remove organic matter from the upper soil profile. Leaving behind excess organic matter compromises soil structure and potentially skews the balance between capillary and non-capillary porosity. Roots from the new turfgrass sod will have a difficult time penetrating thatch or mat layers present in the rootzone. Aggressively cultivating the rootzone of older greens prior to installing sod presents a good opportunity to modify soils with sand for improved physical properties and performance. Conventional or deep-tine aeration both are viable options, depending upon root-



zone properties, and aggressive cultivation prior to sod establishment can enhance success with potentially reduced surface disruption during establishment. Physical testing of existing rootzone parameters prior to renovation and regrassing will provide valuable insight into necessary rootzone modifications.

Install sod as uniformly as possible and, with renovations, pay special attention to grade tie-ins. Offset seams for reduced displacement, mechanical damage, and desiccation. Avoid damaging the prepared finished grade or imparting excess wear on newly installed sod by using plywood to walk on or drive installation machinery.

Once sod is installed, aggressive rolling will firm and smooth the surface. Walk-behind vibratory asphalt rollers or riding one-ton asphalt rollers typically provide best results. Rolling can begin immediately after the sod has been laid and can be repeated every few days during the establishment process. Smoothing the surface limits mechanical damage (scalping) from mowers as height of cut is reduced in preparation for play, and it also helps provide optimal playing quality.

Begin mowing at a reasonable height of cut as soon as possible to avoid scalping and mechanical damage. It is important to begin mowing soon after installation to avoid letting the turf become

Sod grown on plastic may reduce soil compatibility issues and does not require cutting turfgrass roots during harvest.



Using plywood helps to limit wear injury to sod and is a good tip during successful installation.

puffy and to start the process of lowering the height of cut in preparation for the planned opening date. Floating-head, walk-behind mowers equipped with a smooth, out-front roller minimize the potential for mechanical damage. Be diligent with cutting height reductions to prepare the surface for play, but don't hesitate to raise the height of cut in the event of excessive scalping, as mechanical damage can take a long time to recover and may jeopardize the opening date, playing quality, and short- and long-term performance of the turf.

Taking the time to hand topdress the sod seams will limit the potential for mechanical injury, lessen the potential for desiccation of sod edges, and hasten the development of the desired surface smoothness. Green colored sand has worked well for seam topdressing during cool spring weather, as colored sand will absorb more heat and some superintendents report quicker stitching of individual sod pieces. Heavy sand topdressing of the entire sodded green at rates of 250–350 lbs. of sand per 1,000 sq. ft. for the first three to four weeks also will be very important for surface smoothing and preparing the green for play. Integrating sand into the organic matter layer as quickly as possible also will establish sand as the dominant component of the thatch/mat matrix and provide balanced soil structure for good agronomic performance and playability. Physically incorporate sand into the turfgrass canopy by brushing or dragging.

Aerating new sod as quickly as possible has repeatedly demonstrated great results in the field

with respect to vigorous establishment. Aeration can often be conducted within the first week of installation with the proper technique. Small-diameter solid or hollow tines (0.25–0.375 inch) provide good results since the primary objective of early cultivation is to maintain good gas exchange through the sod layer and encourage roots to penetrate into the underlying rootzone. Repeating this procedure once or twice prior to opening the greens is advised since cultivation is typically more difficult to employ once the greens are opened for play. Periodic aeration with small-diameter solid tines or slicing units during the first season will safeguard turf health by promoting gas exchange into the rootzone and preventing sealing that is often a concern on newly sodded greens. Watch for signs of reduced turf vigor, poor recuperative potential, or development of black algae on the surface. These conditions usually indicate insufficient oxygen in the rootzone.

Fertility recommendations vary considerably between new construction and renovation of existing greens. Soil testing is a good place to start. With new construction, pre-plant fertility usually includes a homogenous starter fertilizer application at a rate of around 1 lb. nitrogen and P_2O_5 per 1,000 sq. ft. Good results have been observed where starter fertilizer is augmented with additional controlled-release fertilizer in a balanced formulation of nitrogen, phosphorus, and potassium at 1–2 lbs. each per 1,000 sq. ft.

Pre-plant fertilization rates for existing rootzones will be lower than new construction. Consult with your regional USGA agronomist, soil testing laboratories, and/or university turfgrass extension personnel for best advice at your particular location.

Once installed, relatively modest and frequent applications of complete fertilizer usually provide good results.

IN-HOUSE CUSTOM SOD

Occasionally there is a need to renovate one or more greens at an older golf course not experiencing agronomic problems. The design may be outdated, with excessive slopes for modern green speed or insufficient area to adequately support the volume of play.² Property sales or trades may necessitate relocating a green. In these instances, matching the turfgrass composition and playability with the existing greens is a primary objective. At most cool-season golf courses, this

constitutes a mix of various genotypes of annual bluegrass and creeping bentgrass.

With proper planning, a nursery green can be created utilizing aeration plugs from the existing greens and perhaps a little bentgrass seed.³ Usable sod normally can be obtained in about a year, depending on the growing season, management capability, and nursery location. Similar management protocol will apply as suggested above, and using the best available means to harvest uniform sod will yield the best results.⁴

DETERMINING AN OPENING DATE

Creeping bentgrass putting green sod usually requires at least 4–6 weeks of decent growing weather for adequate establishment to tolerate play. Root growth should be at least a few inches into the rootzone for anchoring and stability, and to take up sufficient nutrients and water for vigorous growth and recovery. Surface preparation needs to be advanced enough to provide good ball roll characteristics and tolerate reasonable mowing without scalping.

Ultimately, reasonable expectations need to be established early on in the construction and renovation process. Opening newly sodded greens too early can jeopardize performance, result in turfgrass failure, and threaten a significant investment. Green speed expectations should be properly balanced with long-term performance during the first few months of playing the sodded greens. Scheduling some time for cultivation and topdressing will safeguard success. Closing one day or half a day per week and providing the turf a chance to recover from wear and stress can make an enormous difference in putting green performance.

Among the best recommendations for managing newly sodded greens is to give the golf course superintendent and green committee sole discretion to close the greens should turfgrass decline or failure become evident. New sod generally does not have the recuperative potential of established turf, and a modest to heavy volume of play can result in rapid and significant decline. A “soft opening” during the first few weeks of play, whereby the greens are played for 3 or 4 days and then rested for 2 or 3 days is often a good way to allow golfers on the greens fairly quickly (4–6 weeks after installation) while still enabling the new sod to establish and mature. Every situation is slightly different, but adopting a fairly conservative approach with

respect to agronomic realities and golfer expectations is advised.

GREEN SIDE UP!

Sod production methods have evolved considerably in the past decade or so and present viable options with respect to turfgrass establishment on putting greens. Production on construction specification sand, washed sod, and sod grown on plastic have facilitated smoother and more successful projects and can provide championship-level putting surfaces in a previously unattainable time frame. Proper planning, product selection, installation, and construction techniques, and good management make sod a realistic option for putting green turfgrass establishment at new or existing golf courses.



Green side up!
An instant putting green.

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Bermudagrass Freeze Tolerance

Oklahoma State University researchers use laboratory and field evaluations to compare bermudagrass freeze tolerance.

BY JEFF ANDERSON, CHARLES TALIAFERRO, DENNIS MARTIN, YANQI WU, AND MICHAEL ANDERSON

Turfgrass managers spend a considerable amount of time and energy to establish and maintain turfgrasses for aesthetic, environmental, and recreational purposes. Both genetic and environmental components interact to determine how well a chosen cultivar performs in a particular location. An increasing number of fine-textured bermudagrasses are being developed and evaluated for resistance to environmental stresses.

Freeze damage is a primary concern in the northern boundaries of the bermudagrass adaptation zone.

Some years are relatively mild and cause little or no damage, while other winters are sufficiently severe to cause extensive winterkill. The costs, in terms of loss of use and dollars to re-establish turf following winterkill, can be substantial. Therefore, our long-term goal is to develop seed- and vegetatively propagated bermudagrasses with high turf quality and improved freeze tolerance.

A common way to compare relative freeze tolerance of a group of cultivars is to establish them in the field and wait for cold temperatures to sort them out. However, during a mild winter, temperatures may not be cold enough to kill any cultivars of interest, and no progress would be achieved. If evaluations were conducted at a northern or high-elevation location, low tempera-



Regrowth of CIS-CD7 seeded bermudagrass varied after exposure to a range of sub-freezing temperatures.

tures may kill most or all of the bermudagrasses. Therefore, several years of observation may be required to experience temperature conditions that distinguish different levels of freeze tolerance within a group of bermudagrass cultivars. Relying on test winters makes it difficult to repeat studies over time and across climatic locations.

Another factor that comes into play during natural freezes is the nature of the freeze itself. Differences in freezing rate or duration, even with the same minimum exposure temperature, can result in different plant responses.⁴ Whether or not a snow cover is present can have marked influences on plant survival due to insulation effects. Developmental and morphological features also can be factors in winter survival. The presence of rhizomes can contribute to freeze avoidance by being sufficiently deep in the soil profile to avoid temperature extremes. The well-

documented susceptibility of newly seeded bermudagrasses may involve physiological and/or morphological factors such as stolon density.⁶

YEAR-ROUND WINTER INDOORS

Laboratory-based methods to measure freeze tolerance have been developed. One approach has been to acclimate plants naturally in the field, followed by laboratory-based exposure to sub-freezing tempera-

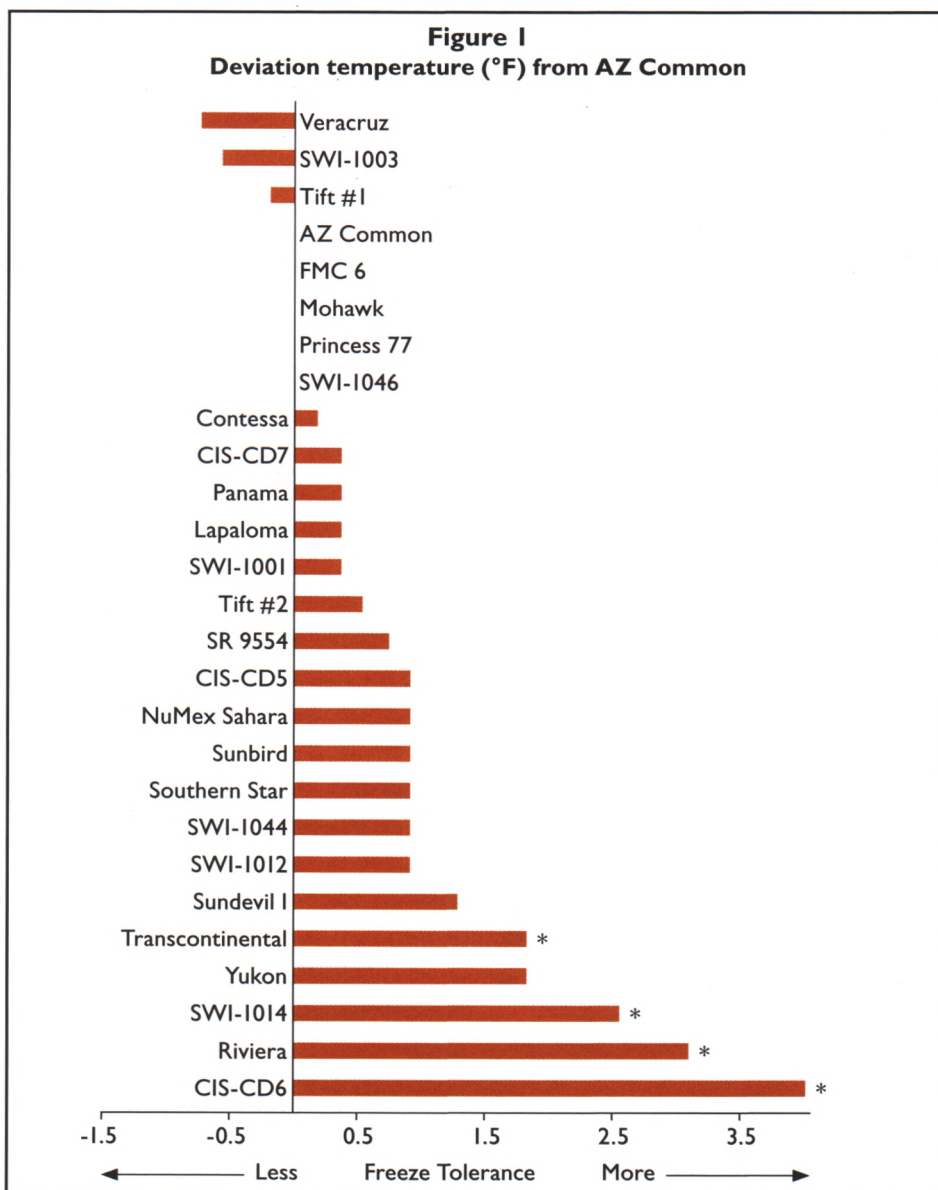
tures. Studies also have been conducted entirely indoors, with plant materials established and acclimated in growth chambers, followed by exposure to a range of temperatures in a freeze chamber. Laboratory-based freeze-tolerance evaluations generally correspond well with field observations and have provided useful information on relative freeze tolerance of turfgrasses.²

Our objective was to quantify freeze tolerance of advanced lines, recently released cultivars, and standard varieties entered in the 2002 National Turfgrass Evaluation Program (NTEP) bermudagrass trial using laboratory-based methods. Standardized, quantitative information on bermudagrass freeze tolerance is vital to scientists to track progress in developing new cultivars. Freeze tolerance data also are beneficial to turfgrass managers selecting turfgrasses for the transition zone.

Bermudagrass plants were established and maintained in growth chambers. For studies with seed-propagated cultivars, seed from the lots used in the 2002 NTEP bermudagrass trial was obtained from the sponsors. Twenty-seven of the 29 seed-propagated entries were included in this study. Experiments with seed-propagated bermudagrasses were divided into five groups. Entries were randomly selected and assigned to groups with Arizona Common included as a standard in each, allowing the potential for comparisons across groups. Vegetative cultivars were propagated from individual phytomers using Tifway as the standard cultivar in each of the three groups. Experiments were conducted on three dates for each group, constituting replications in time, with staggered plantings allowing uniform establishment periods and plant age.

After plants had acclimated to fall-like temperatures, they were trimmed of top-growth and placed in a freeze chamber with a temperature sensor in each pot. The chamber was programmed to slowly cool the plants, allowing them to be removed over a range of temperatures. Ideally, no damage would occur at the warmest temperatures, and all plants would be killed by exposure to the coldest temperatures.

After being removed from the freeze chamber, plants were thawed and returned to the growth chamber to observe regrowth. Non-frozen controls were treated the same, except without the freeze chamber exposure. Evaluating the temperature-survival curve allowed estimation of a T_{mid} value, similar to the LD_{50} (lethal dose for 50% of the subjects) in a toxicity screen. Data were combined into seeded and vegetative types. Performance relative to the standard cultivar (Arizona Common or Tifway) was determined by subtracting the T_{mid} for each cultivar from the T_{mid} value for the standard in that group.

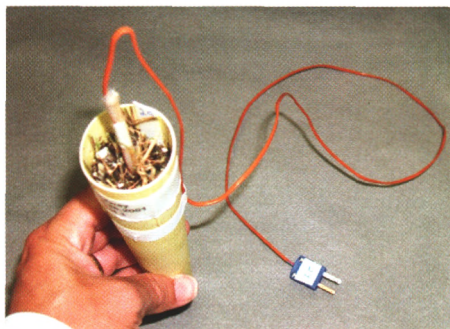


Freeze tolerance of seed-propagated bermudagrasses relative to Arizona Common. Deviation temperatures represent the T_{mid} value (midpoint of the survival-temperature response curve) of the cultivar minus the T_{mid} value for Arizona Common. Cultivars significantly different from Arizona Common are indicated by an asterisk. Adapted from Anderson et al.⁵

CONSIDERABLE VARIATION IN FREEZE TOLERANCE

Seed-propagated bermudagrasses ranged in freeze tolerance from 22.5°F (-5.3°C) (SWI-1003) to 16.3°F (-8.7°C) (CIS-CD6). Even though three cultivars were numerically less freeze tolerant than Arizona Common, none of the three was significantly different. FMC 6, Mohawk, Princess 77, and SWI-1046 were identical in freeze tolerance to Arizona Common. Fifteen cultivars had numerically greater, yet non-significant differences,

in freeze tolerance relative to the standard. Transcontinental, SWI-1014, Riviera, and CIS-CD6 were significantly more cold hardy than Arizona Common. Although Yukon and Transcontinental differed from Arizona Common by the same amount, the difference was not significant for Yukon at the 5% level due to greater variability in data from Yukon. A previous study that included these two cultivars found Yukon to be significantly more freeze tolerant than Arizona Common.¹



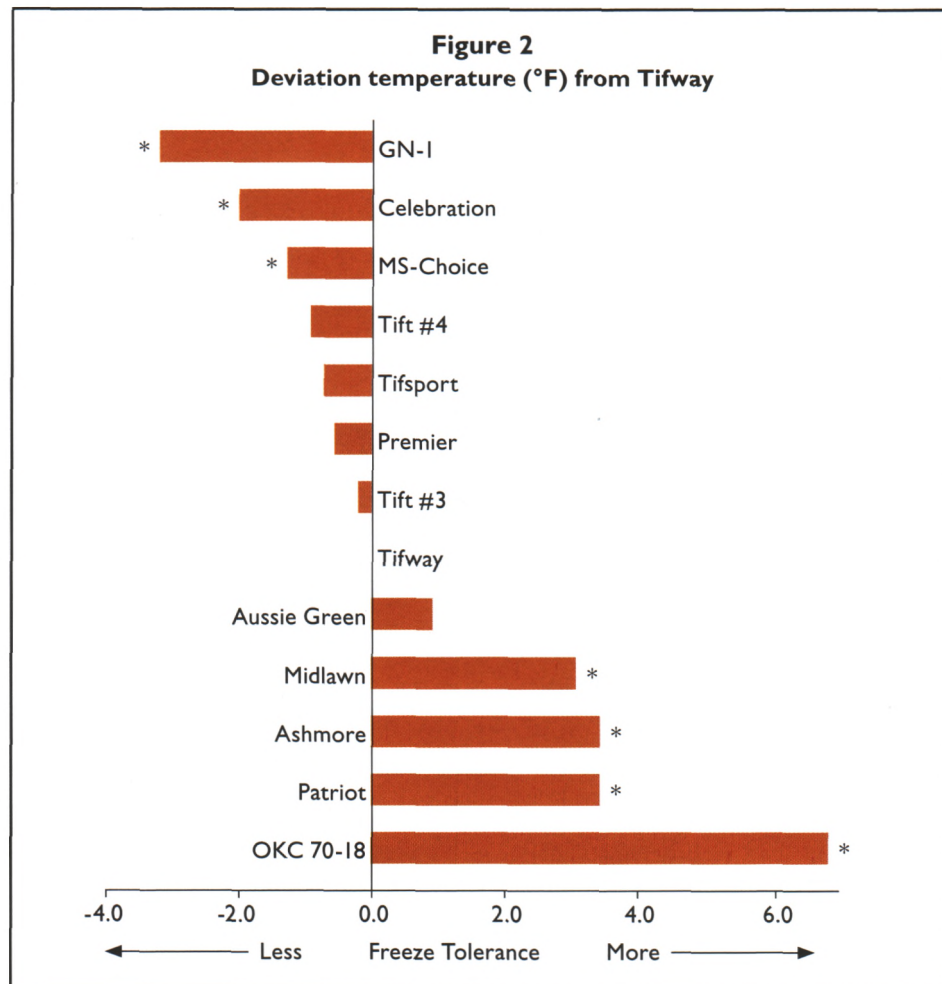
Laboratory-based methods have been developed to measure turfgrass freeze tolerance. Thermocouple temperature sensors are used to measure soil temperatures.



Bermudagrass plants are acclimated to fall-like temperatures, trimmed of top growth, and placed in a programmable freeze chamber to be exposed to sub-freezing temperatures.

Vegetatively propagated bermudagrasses ranged in freeze tolerance from 20.8°F (-6.2°C) (GN-1) to 11.3°F (-11.5°C) (OKC 70-18). Three cultivars, GN-1, Celebration, and MS-Choice, were significantly less freeze tolerant than Tifway. Tift #4, Tifsport, Premier, Tift #3, and Aussie Green had cold hardiness levels similar to Tifway. Midlawn, Ashmore, Patriot, and OKC 70-18 were significantly more freeze tolerant than Tifway.

Freeze tolerance estimates generally corresponded well with previous experience.³ Both Midlawn and Patriot exhibited greater freeze tolerance than Tifway as previously reported.⁴ Greater freeze tolerance of Riviera than Princess 77 is consistent with earlier findings.⁵ In a previous report, we also



Freeze tolerance of vegetatively propagated bermudagrasses relative to Tifway. Deviation temperatures represent the T_{mid} value (midpoint of the survival-temperature response curve) of the cultivar minus the T_{mid} value for Tifway. Cultivars significantly different from Tifway are indicated by an asterisk. Adapted from Anderson et al.⁵

found GN-1 to be significantly less freeze tolerant than Midlawn.³

It is important to distinguish between T_{mid} temperatures determined in the laboratory and air temperatures experienced during a natural freeze. In the laboratory, conditions are set to ensure that plants reach the target temperatures. Critical tissues, such as crowns, of plants in the field will usually be considerably warmer than air temperature due to the thermal buffering capacity of the soil.

Substantial progress is being made by turfgrass breeders to develop seed-propagated and vegetatively propagated bermudagrasses with improved freeze tolerance. Although many factors in addition to freeze tolerance will be assessed in making cultivar selections,

choices are now available with freeze tolerance suitable for areas of the transition zone requiring superior winter hardiness.

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CONNECTING THE DOTS

A Q&A with DR. JEFF ANDERSON regarding the use of artificial freeze testing to evaluate turf for cold hardiness.

Q: Artificial freeze testing seems like a good method to screen turfgrass selections for freeze tolerance, but how often do laboratory freeze-testing methods disagree with field testing? What other factors besides temperature affect field-grown plants that may lead to these differences?

A: Research conducted at several universities has shown that field and laboratory results on turfgrass freeze tolerance are usually in agreement. While there are instances when rankings from field studies do not completely match laboratory studies, there also have been cases when results from one field study do not match another. Different locations could have different environmental conditions before a freezing episode, leading to different patterns of acclimation. It also is possible for a cultivar exposed to one environmental stress to be more susceptible to other stresses.

Q: How long have laboratory freeze-testing methods been used on turfgrasses? Are the methods the same as they were in earlier tests?

A: Laboratory-based methods of freeze tolerance evaluation have been available for many decades. Ongoing research has led to refinements in testing methods, resulting in greater precision and reproducibility. Important refinements include ice nucleation to negate supercooling and monitoring the temperatures of each experimental unit. Use of microprocessor-controlled chambers and precision monitoring equipment has further improved the precision and reproducibility of the testing procedures.

Q: Growing plants in the greenhouse to evaluate survival after subjecting those plants to low temperature seems time-consuming. What additional tests are available that scientists can use to measure tissue viability after freezing that don't take as much time?

A: Viability testing has been a major focus of plant stress studies for many years. Approaches range from whole plant responses to biochemical assays, with each procedure having its strengths and weaknesses. Assays such as electrolyte leakage can be performed much more rapidly than regrowth analysis and have been applied to turfgrasses. When compared, the two procedures are in general agreement. However, there have been instances when electrolyte leakage has either overestimated or underestimated freeze tolerance when compared to regrowth results. One reason may be that freezing stress yields a more gradual electrolyte leakage versus temperature response compared with heat stress, which is very well suited to electrolyte leakage assays. One of the challenges of using electrolyte leakage for freeze tolerance of below-ground structures like crowns and rhizomes is the requirement that tissues be separated from soil/media without introducing artifacts.

Q: In other articles, the bermudagrass germplasm that Dr. Yanqi Wu collected in China has been mentioned. Have you freeze-tested this Chinese collection and/or evaluated its cold tolerance? From your experience, is it likely that the Chinese bermudagrass germplasm will help improve freeze tolerance of yet-to-be-released bermudagrass cultivars?

A: The addition of Chinese bermudagrass germplasm to the Oklahoma State University collection provides additional variability that can be used to develop new stress-tolerant, high-quality bermudagrass cultivars. Characterization of this collection and subsequent progeny for freeze tolerance is a priority and will proceed as funding permits. Based on geographic locations of where these plant materials were collected, there is a high probability that a portion of the collected material contains genes that will make plants suitable for locations that experience cold winters.

Q: How does the "rate of freeze" affect freeze-tolerance measurements?

A: Plant survival during freezing stress is favored by slow rates of cooling. Most studies use cooling rates of about 2°F per hour, similar to natural conditions. The rate of tissue cooling is not always the same as the rate of air temperature decline, especially for below-ground plant tissues. In addition to the buffering effect of the soil, plant temperatures will be moderated by the heat released when soil moisture freezes. Therefore, the rate of temperature change, the temperature minimum, and the duration of the low temperature exposure will all contribute to the intensity of freezing stress.

Q: From your experience, does the maturity of the turfgrass stand impact its cold tolerance? Can superintendents expect seeded bermudagrasses to be less cold tolerant the first winter following seeding, and more cold tolerant in subsequent winters?

A: Although the mechanisms are not fully understood, the long-held belief that seeded bermudagrasses are more freeze susceptible shortly after planting has been reinforced by compelling evidence from research at the University of Arkansas and other locations.

Q: What should superintendents learn as a "take home" message from your work, Dr. Anderson?

A: Plant breeding programs around the country are doing an excellent job in developing new bermudagrass cultivars. It is no longer necessary to sacrifice turf quality to achieve stress resistance. Increased freeze tolerance in fine-textured bermudagrass lowers the probability of winter injury in traditional planting locations. While use can be extended to colder locations, even the most freeze-tolerant varieties currently available will be susceptible to winterkill under extreme conditions.

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EDITOR'S NOTE: An expanded version of this paper can be found at *USGA Turfgrass and Environmental Research Online* (<http://usgatero.msu.edu/v06/n18.pdf>).

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Don't Wait Until the Well Runs Dry

Changing water sources: from good to good.

BY TOM WERNER, CGCS

Even though the old adage goes, “If it ain’t broke, don’t fix it,” sometimes we do not have a choice or must look for other options. This was the case at Shadow Hawk Golf Club and The Houstonian Golf and Country Club in Richmond, Texas, as it pertains to changing water sources.

HISTORY OF THE FACILITY

Both golf facilities are located on the same 470 acres of suburban Houston. They also share one pump station currently fed by well water. Close to 20% of the property consists of lakes, ponds, and wetland areas. The largest lake covers 60 acres and was part of the original property, which was dredged and enlarged during construction. Only the 15-acre lake is fed by well water; all the others rely on surface runoff and can be filled with the irrigation system when levels drop below an acceptable point.

The two wells can supply about half of the maximum flow of 3,800 gallons per minute to the irrigation lake. This lake has a great holding capacity and could supply about one week’s worth of water during peak season before needing to be resupplied. Another advantage is the fact that this lake is higher than the others and is situated next to the largest lake. The height advantage also afforded the architect

with the opportunity to incorporate a waterfall, which is not naturally occurring in the Houston area, but it looks attractive on a golf course.

Up until a few years ago, the thought of changing water supplies was far from anyone’s mind. The facilities were relatively new (opened in 1999) and well water was the logical irrigation source at the time. It was as simple as acquiring a permit and starting the irrigation system. Except for an annual permit fee for both wells, there was no charge for the amount used, unless the clubs exceeded their original allotment.

At the time the courses were under construction, the surrounding area was largely rural, but civilization was creeping in at a rapid pace. Growth in Fort Bend County is largely residential, with the usual amount of retail growth. Residents enjoy the good life in the country and choose to commute to work in the more industrialized nearby Houston area. Within five years, the two courses will be surrounded by subdivisions (there are no houses on the property). These residents will need potable water supplied by underground wells.

A GRADUAL REDUCTION OF GROUNDWATER USAGE

The Fort Bend County Subsidence District oversees the permitting and

monitoring of all underground water in the county. The newly imposed rules state that every entity using more than 10 million gallons of groundwater per year shall use a different water source or face administrative penalties. It is not uncommon for the two courses to use 10 million gallons of water in a week during the growing season. Conversion requirements in our district state that:

- By January 2008, a Groundwater Reduction Plan (GRP) must be filed with the subsidence district.
- By the year 2013, groundwater usage must be reduced to a maximum of 70%.
- By the year 2025, groundwater usage must be reduced to a maximum of 40%.

Developing a GRP is made easy when you have help from the outside. A newly formed organization known as the North Fort Bend County Water Authority (NFBCWA) has since been created, and its mission is to reduce groundwater use in our area. We no longer get our well water for free, even with a permit (\$5,000 annual charge). What got our attention rather quickly was the proposed 20% price increase every year starting in 2008. Annual water costs for our facilities would go from \$40,000 to close to \$300,000 by 2025. That number was a shock to everyone.



Water will be diverted into the pond in the foreground. Multiple ponds can be interconnected for increased storage. Water transfer can be creative and add aesthetic features to the course.

As mentioned earlier, not too long ago the surrounding area was largely rural, and the planned subdivisions were only the dream of future land developers. Effluent water just eight years ago was not an option due to lack of supply. This is not the case any longer, and fortunately the nearest treatment plant is within one mile of the property. In our area, water usage and disposal is managed by a Municipal Utility District, or MUD. MUD district officials approached us and other end users with the proposal to supply non-potable water of the highest

property line and will be metered from there. The distance to the irrigation lake from this point is approximately 700 yards, and the distance will help disperse any solids in the effluent water. It is simply a matter of diverting this water from one lake to the other. Diversion is even easier, as the two lakes are 20 yards from each other. The distance from the diversion spigot to the irrigation intakes is another 150 yards, further aiding in solid dispersal.

The cost of the diversion device (we chose a submersible system) came in at \$25,000 and has since been installed.

of water over time, even with the capital expenditures necessary. Thirdly, we can lock down pricing and availability for 50 years. Lastly, the life of the underground wells will be increased through lower usage.

There are some negatives associated with the use of effluent water. The greatest concern is the quality as compared to well water. Our current management practices will have to be altered in the future and may put a slight burden on the memberships at both golf courses. This burden may come in the form of increased aeration



This photo shows the installation of a submersible diversion pump so another structure is not seen on the golf course. The maintenance of submersible pumps is not difficult.

quality type (TYPE 1). The MUD also needs our water credits as part of the process and must assess a reasonable fee structure to recoup the expense of the pipeline to the property. Once the water gets to the property, the expense of getting it to the irrigation lake becomes the responsibility of the owner.

HOW DOES THE WATER GET TO US?

The process of signing off on this proposal looked good on paper, but other costs needed to be factored in. Fortunately, one of the fingers of the largest lake is situated 30 feet from the property line, so there would be no damage to the property from the pipeline construction. The proposed effluent supply line will come to this

Irrigation heads and valve covers will need to be converted to the non-potable, light purple color at an estimated cost of \$40,000. Some of the fairway heads have already been converted. Permeability testing of the clay lining in all lakes also was performed at a cost of \$10,500.

WHAT HAPPENS NOW?

Actually, nothing has changed yet, and construction of the effluent pipeline has not yet begun, but we are ready when it does proceed. After careful consideration, we decided it best to use at least 70% effluent water (or as much as the supplier can send us) and make up the balance with well water. First and foremost, it is the right thing to do. Secondly, we can reduce the cost

and use of products such as lime and gypsum to maintain soil pH. My impression is that only the most discerning golfers will notice. It will be our task to keep them educated. We have already informed our membership advisory committees of the conversion process. After all, they are the ones who will benefit in the long run.

AUTHOR'S NOTE: I would like to thank James Edgmon, golf course superintendent at The Houstonian Golf and Country Club, and Bill English, formerly with Redstone Golf Management for their help in writing this article.

TOM WERNER, CGCS, is golf course superintendent at Shadowhawk Golf Club.



To compensate for a shallower depth, double verticutting and going over the same area in opposite directions is a common grain and surface management strategy with the ultradwarfs.

The first full set of ultradwarf (Champion) bermudagrass putting greens were planted in Florida in the summer of 1997. The following year, Floradwarf and TifEagle became available and were used on a few courses in Florida and the Southeast. Also in 1998, an On-Site Evaluation of Bermudagrass for Putting Greens project was initiated and sponsored by the National Turfgrass Evaluation Program, USGA, and Golf Course Superintendents Association of America. Subsequently, there has been a steady increase in the use of the ultradwarfs, and today Champion, Mini-Verde, and TifEagle have replaced Tifdwarf as the standard for warm-season turfgrass putting greens.

Although the ultradwarfs are bermudagrasses and there was some preliminary work done as far as their management requirements, as we all know, fine tuning of best management practices occurs in the field over a period of several years. With the ultradwarfs having been in use for ten years, a sound information base now exists for producing consistently top-quality putting green conditioning.

Going for the Gold with the Ultradwarf Bermudagrasses

This is part three of an occasional series on bermudagrass putting greens and focuses on surface management and minimizing grain.

BY JOHN H. FOY

It should be reiterated that every golf course is unique and “there are a lot of ways to skin a cat.” Having visited numerous facilities throughout Florida and having discussed ultradwarf putting green management programs with superintendents from the Carolinas across the Southeast to Texas, there are a number of common denominators. The following is a review of the key surface management practices being used to produce top-quality ultradwarf putting greens.

HEIGHT OF CUT IS NOT THE TOTAL ANSWER

Along with a finer leaf blade and increased shoot density, the ability to tolerate a height of cut of 0.125 inch was one of the primary criteria used in selection of the ultradwarf cultivars. As to be expected, however, heights of cut have been taken lower and lower in an effort to produce very fast putting green speeds. However, just because it can be done does not mean that maintaining the lowest height of cut possible is necessary or even best for providing top-quality

putting green conditioning. Time and again, university research and field experiences have shown that there is a point of diminishing return where no additional increase in speeds is achieved with further reductions in height of cut. It should also be reiterated that the continual practice of maintaining excessively low heights of cut negatively impacts general turf health and increases its susceptibility to disease and nematode pest problems.

Thus, today, an effective height of cut in the range of 0.105 to 0.125 inch is being routinely practiced at the vast majority of facilities where top-quality ultradwarf putting greens are being maintained. Along with being able to provide medium fast to fast putting speeds, the turf has improved disease and environmental stress tolerance. However, during extended periods of inclement weather and in the fall when preparing for the winter, slightly elevated heights of cut need to be maintained.

The higher shoot density of the ultradwarfs compared to Tifdwarf is a positive characteristic as far as smoothness of ball roll is concerned. Yet, this also is something of a negative when it comes to speed because of the additional resistance or friction created. To compensate and maintain fast to very fast putting speeds, lightweight rolling or double cutting are considered necessary and routine practices. These practices typically are employed three or four times per week, but at some facilities they are done on a more frequent basis. Generally, when sustained turf growth is occurring, this is not a problem, but additional care needs to be exercised to prevent excessive wear and damage to the perimeters and collars of greens.

Having sand particles integrated into the turf canopy also aids in reducing ball-to-leaf-blade contact, which in turn helps maintain faster speeds and a smoother, truer ball roll. Thus, frequent but very light sand topdressing is another necessary and routine ultradwarf surface management practice. Throughout the growing season, lightly topdressing on a 7- to 14-day interval is the standard regime. It should further be pointed out that regular sand topdressing plays a dual role and is needed for dilution of thatch and organic matter accumulation in the upper rootzone. While more frequent topdressing than ever before is being practiced, it is also very important to make sure that a sufficient quantity of sand is being applied annually to achieve true dilution. Several factors, such as length of the growing season and nitrogen fertilization rates, need to be considered, but applying between 30 to 50 cu. ft. of sand per 1,000 sq. ft. annually would be suggested as a target.

The turfgrass growth regulator Primo (trinexapac-ethyl) is a very beneficial putting surface management tool with Tifdwarf bermudagrass greens. It was initially questioned, however, if there would be any real benefit to treating ultradwarf greens, given the fact that a very dense turf canopy already existed. Yet, it was quickly found that with suppressing vertical shoot growth, more consistent putting speeds throughout the day and from one day to the next, along with slightly faster speeds, are achieved with adherence to a regular treatment program. This has become a standard, and it should be pointed out that at a lot of courses in Central and South Florida, weekly treatments on

The tools of the trade must be available to the golf course superintendent to maintain ultradwarf bermudagrasses. From left: a triplex unit with carbide-tipped blades for verticutting, rotary spreader for applying dried bagged sand, putting green mower with groomer attachment, and another triplex with brushes.





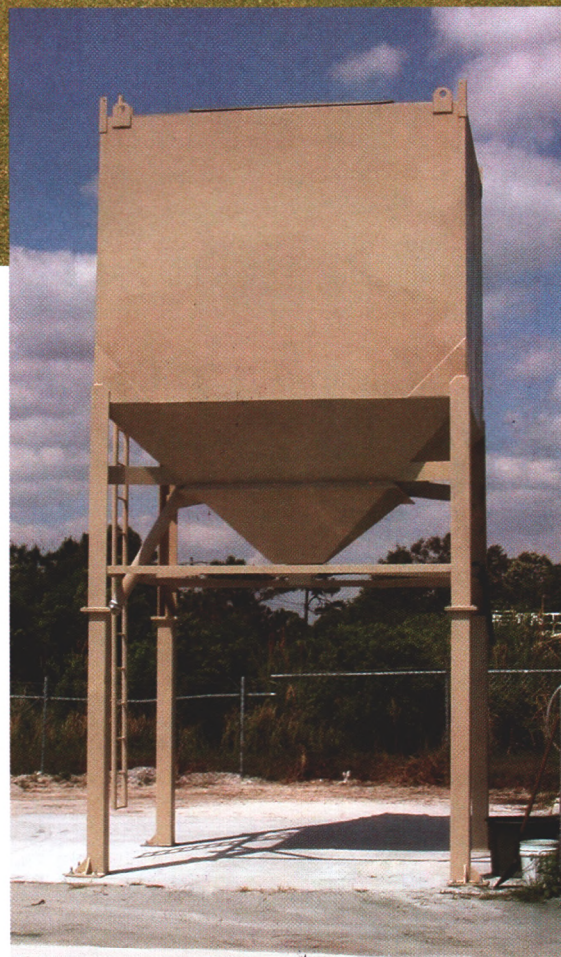
Close-center core aeration followed by removal of the debris and incorporating topdressing sand to backfill the holes is very unpopular with golfers and the maintenance staff. Yet this regime is absolutely necessary and must be conducted at least two to three times per year for controlling organic matter accumulation and compaction so that top-quality surface conditions can be provided the majority of the time.

virtually a year-round basis are being performed. The only time they are stopped is just prior to the arrival of a cold front and when nighttime temperatures of 50 degrees or colder are expected.

GRAIN CONTROL AND SURFACE GROOMING

Due to its stoloniferous growth habit, controlling grain is a major management concern with bermudagrass greens. There is a strong argument today that with intensively managed, closely cut ultradwarf greens, the influence of grain on ball roll has been minimized to the point that this is not a concern for the vast majority of average to high-handicap golfers. Yet, very distinctive grain patterns do occur and are accentuated by more frequent rolling and mowing regimes. Since golf, and especially putting, is highly perceptual based, it is imperative to always try to keep grain to a minimum.

Along with promoting a dense, upright shoot growth character to minimize grain, aggressive



Topdressing with dry sand helps incorporate the material into the dense turf canopy of the ultradwarf bermudagrasses. Sand storage silos are becoming a more common sight at Florida golf courses with ultradwarf greens.

verticutting of Tifdwarf putting surfaces has been a standard practice. This also aids in controlling thatch and organic matter accumulation. Verticutting in this manner every two or three weeks is effective, yet it also results in significant mechanical stress and damage. It has been a standard recommendation to severely verticut Tifdwarf greens with walk-behind units in the early summer and in conjunction with core aeration replications. It was determined fairly quickly, however, that the ultradwarf cultivars do not tolerate severe verticutting and recover very slowly from this abusive cultural regime.

Regular verticutting of ultradwarf putting surfaces, at least every couple of weeks during the growing season, is being conducted at most facilities. However, along with using the new type of blade options that cut rather than rip through the turf canopy, they are adjusted to operate at no more than 0.0625 to 0.125 of an inch below the effective height of cut. The basic philosophy of routine verticutting of ultradwarf putting surfaces has changed from aggressively removing leaf surface area, thatch, and surface organic matter accumulation, to only thinning the turf canopy and grooming an upright shoot growth habit for grain control.

With a shallower depth of penetration with regular verticutting, it has been found that a pronounced difference in the effectiveness of the process occurs when working into the grain compared to going down grain. To compensate for this grain effect, *double* verticutting and going across the putting surface in one direction and then turning around and coming back down the same pass in the opposite direction is needed. As with routine mowing, the direction of attack with verticutting should be changed with each replication. Circle verticutting is another variation being employed at a few courses in South Florida because it also varies the direction of attack into the grain pattern. While adherence to a regular verticutting schedule throughout the growing season is needed, this also needs to be closely monitored and adjustments made to make sure that excessive thinning, mechanical damage, and stress are not exerted on the turf. Furthermore, if more aggressive verticutting is required to alleviate a severe grain problem, this should be restricted to the late spring to early summer when maximum sustained growth is occurring.

In addition to regular verticutting, putting green mower-mounted brushes or groomer



attachments are important management tools. Constantly promoting an upright shoot growth character helps keep grain in check, and with minimizing ball-to-leaf contact, a smoother, truer ball roll and faster putting speeds are achieved. Use of brush or groomer attachments in conjunction with routine mowing is typically performed three to six times per week and in between the routine verticutting replications.

SUMMARY

Although not discussed in this review, very careful and judicious nitrogen fertilization and irrigation are common denominators at the courses where top-quality ultradwarf putting greens are being maintained. Thus, in many respects, ultradwarf and bentgrass putting greens are managed very similarly today. There is no argument that the ultradwarfs require more intensive and careful management compared to what works successfully with Tifdwarf bermudagrass greens. This has been raised as a concern by some because of the additional commitment of time and resources required. However, on the other hand, if top-quality putting green conditioning is desired or expected, this certainly can be achieved with the ultradwarfs, and the results justify the efforts.

JOHN H. FOY is the director of the USGA Green Section Florida Region and has spent more than 20 years helping courses provide the best possible conditions with their bermudagrass greens.

To date, the development of off-type bermudagrass areas in ultradwarf greens has not been a problem, but encroachment of fairway and rough bermudagrass does still occur and must be addressed at some point.

Cultivating to Manage Organic Matter in Sand-Based Putting Greens

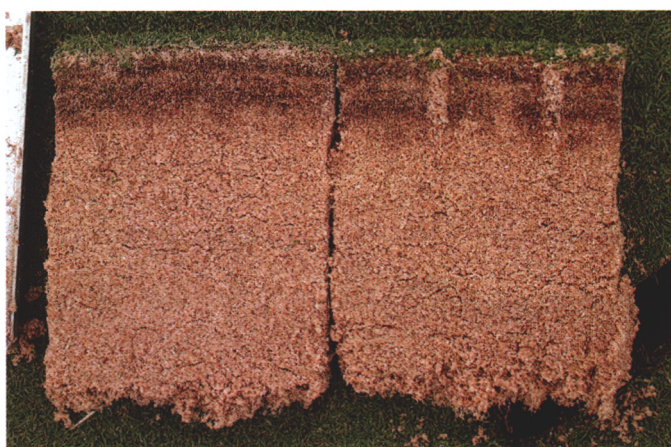
University of Arkansas researchers provide important insight for managing organic buildup on putting greens.

BY JOSH LANDRETH, DOUG KARCHER, AND MIKE RICHARDSON

It is not uncommon for newly constructed creeping bentgrass greens to perform very well during the first few years following establishment, but then decline in subsequent years. This is likely the result of the rootzone physical properties changing over time, especially near the surface where organic matter accumulates. It has been demonstrated that organic matter concentrations greater than 4 to 5% in a USGA rootzone will decrease water percolation through, and air movement into, the rootzone.^{2,3}

Recent cultivation techniques that are effective in reducing organic matter and maintaining desirable rootzone physical properties include aggressive verticutting and core aeration with closely spaced tines. Verticutting equipment such as the Graden GS04 has been demonstrated to aggressively cut channels through surface organic layers in putting greens, removing more organic matter than traditional core aeration treatments. Another recent trend in putting green core aeration is the use of more closely spaced tines, either by retrofitting older aeration units with adapters or through the introduction of new aeration units with closer tine spacing.

A moderately aged USGA putting green typically has desirable physical



Although verticutting treatments (left) removed more surface organic matter, plots that were core aerated (right) recovered significantly faster.

properties throughout the profile, except near the surface where organic matter has accumulated. Under such conditions, an aeration tine needs only to be long enough to completely penetrate and remove cores from the organic matter layer. Longer tines would only result in excess sand debris being pulled to the surface, increasing the labor required to remove the debris and the amount of sand needed to backfill aeration channels.

The objective of this research was to determine the effects of various aggressive verticutting and core aeration treatments on surface organic matter removal from a sand-based putting green.

CULTIVATION EXPERIMENTAL METHODS

A two-year experiment was initiated in the spring of 2003 at the University

of Arkansas Research and Extension Center (Fayetteville, Ark.) on a one-year-old Penn G-2 creeping bentgrass putting green built according to the USGA method of putting green construction.^{1,4}

Cultivation treatments were applied using either a Graden verticutter or a Toro greens aerator in the spring and fall of each study year. Verticutting treatments were made to a 1-inch depth to ensure complete penetration through

the thatch/mat layers and included varying blade widths (1, 2, and 3 mm). Core aeration treatments included various combinations of tine spacing (1.25 × 1.50 or 2 × 2.5 inches), tine diameter (.25 or .50 inch), and tine penetration depth (1.5 or 2 inches). Cultivation treatments were made to individual plots measuring 5 × 20 feet, and each treatment was replicated four times.

ORGANIC MATTER REMOVAL

All of the verticutting treatments removed more surface organic matter than any of the core aeration treatments (Figure 1). The 3 mm verticutting treatment removed more than four times the amount of organic matter than each core aeration treatment. There was not much difference in

organic matter removal between the 1 and 2 mm verticutting treatments; however, they only removed about half the organic matter compared to the 3 mm treatment. Turf managers with sand-based rootzones very high in organic matter content should consider aggressive verticutting to remove excessive organic matter near the rootzone surface. Among the core aeration treatments, the larger-diameter, closely spaced, deeper-penetrating treatment removed the most organic matter.

Although core aeration was not as effective as verticutting in removing large amounts of organic matter from the rootzone, it was more efficient in completely penetrating through the organic matter layer without bringing excess sand to the surface, especially those treatments with shorter tines.

TURFGRASS RECOVERY AND QUALITY

Turfgrass recovery evaluations following cultivation are summarized in Figure 2. Cultivation channels healed over more quickly for core aeration treatments compared to the verticutting treatments. The time required for the verticutting treatments to heal following cultivation was nearly 60 days, approximately twice that necessary for turf that was core aerated. Many of the verticutting channels had partially closed, making it difficult to fill the channels with sand and smooth the surface.

Aeration holes created by coring treatments were less prone to collapsing and were more completely filled with topdressing sand, creating a smoother surface that hastened recovery. In all plots that were core aerated, the amount of topdressing sand that was incorporated back into the turf canopy was greater than 100% of the volume of the debris that was removed during cultivation. In contrast, only 70% of the volume of cultivation debris could be incorporated back into the canopy as topdressing sand for turf that was verticut.



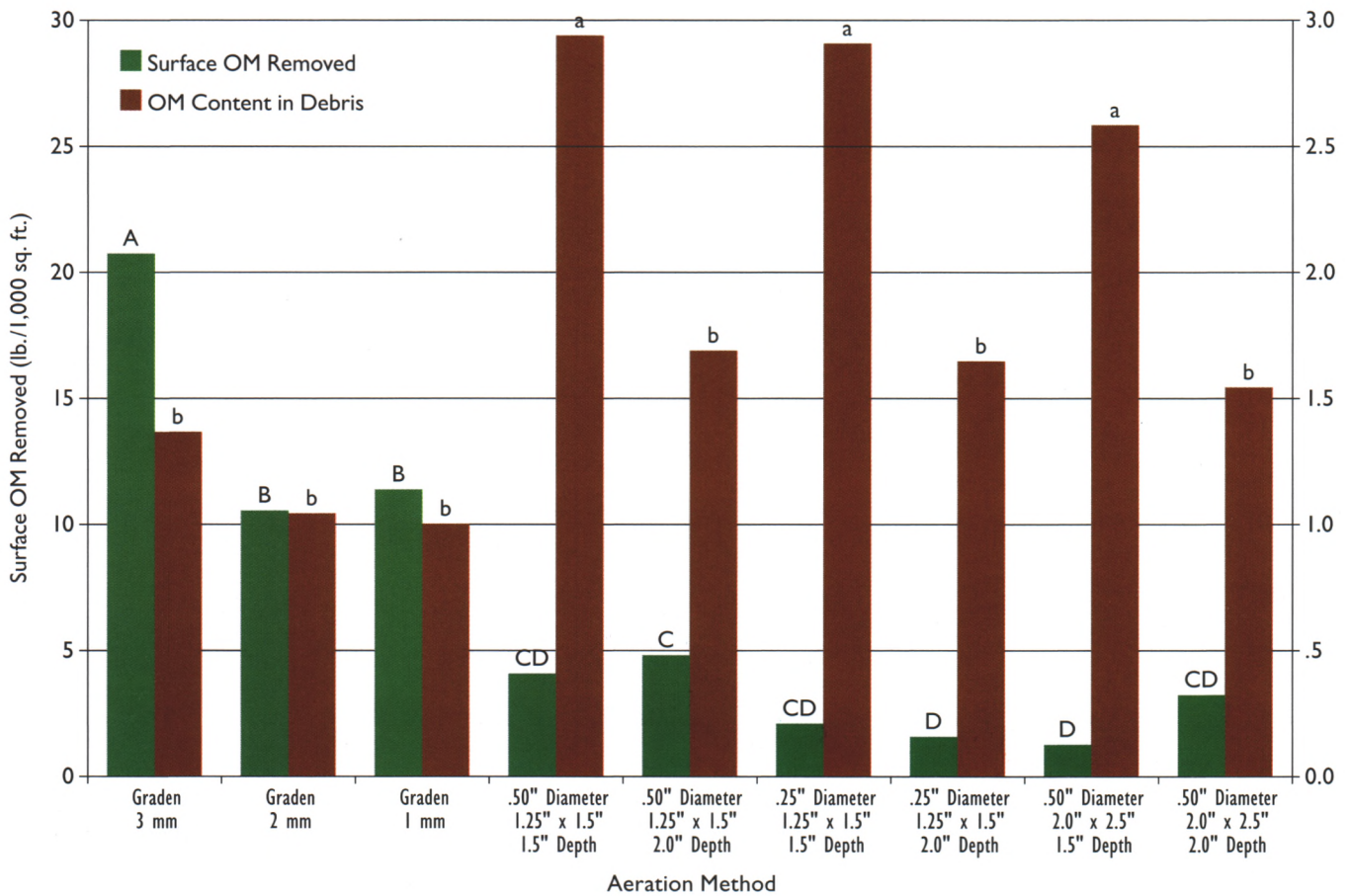
Once the cultivation treatment debris was collected, sand topdressing was applied and brushed into the turf until the cultivation channels were filled.

The Graden GS04 verti-cutter is capable of cutting channels through the surface organic layer of putting green rootzones.



This greens aerator has been retrofitted with tine adapters allowing for a tine spacing of 1.25 x 1.5 inches.

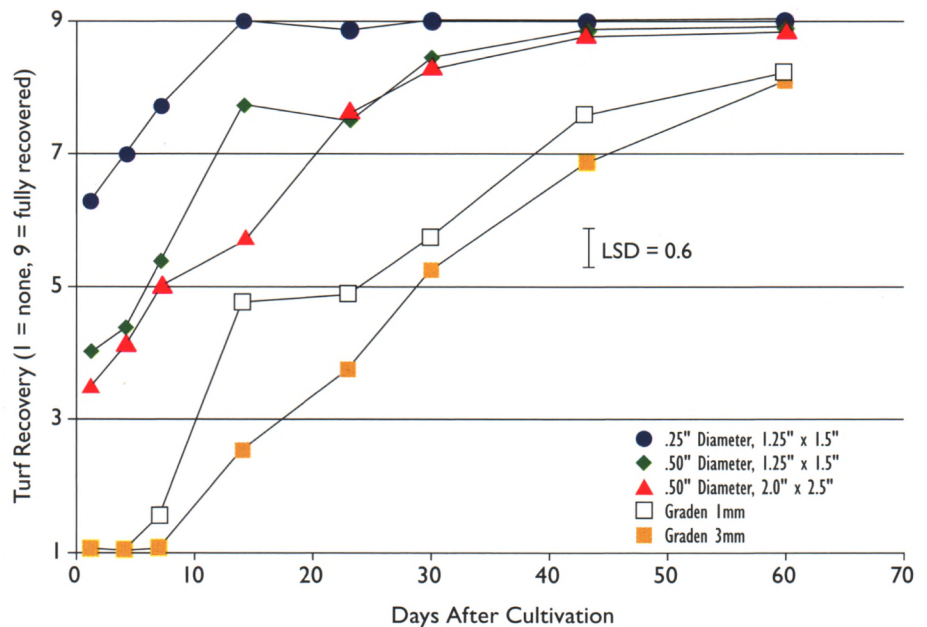
Figure 1
Comparisons of the amount of organic matter removed by various aeration methods



Surface organic matter removed and percent organic matter in the cultivation debris as affected by cultivation treatment. Data collected May 21, 2003, in Fayetteville, Ark. Within evaluations, treatments with bars sharing a letter are not significantly different.

Turfgrass recovery from cultivation as affected by cultivation treatment. Data collected September through November 2003 in Fayetteville, Ark. Error bar represents least significant difference value between treatments within a single evaluation date.

Figure 2
Turfgrass recovery ratings following various aeration treatments



Among core aeration treatments, recovery time was affected predominantly by tine diameter. Turf cored with .25-inch-diameter tines recovered in 14 days, about half the time of turf treated with .50-inch tines. Neither tine depth nor tine spacing affected turf recovery in this study. Consequently, a turf manager can use a closer tine spacing to affect a larger percentage of the putting surface without affecting recovery time. A shallow tine is preferable to a deeper tine, since less debris is brought to the surface, and the amount of organic matter removed and recovery time are equivalent.

After three sets of cultivation treatments and 14 months after the study was initiated, aggressive verticutting was most effective at minimizing organic matter content in the surface inch of the rootzone (Figure 3). Although all of the closely spaced core

aeration treatments resulted in lower surface organic matter content than the control, differences were slight and not statistically different after three sets of treatments.

Verticutting treatments were more aggressive and effective at removing organic matter from the surface inch of the putting green rootzone than core aeration treatments. However, the verticutting treatments removed a disproportionately large amount of debris and recovered more slowly. Therefore, aggressive verticutting may be most useful when a large amount of organic matter must be removed at once and recovery time is not a primary consideration. Core aeration with closely spaced tines may provide more general surface organic matter maintenance for putting greens that must return to a high level of quality shortly following cultivation.

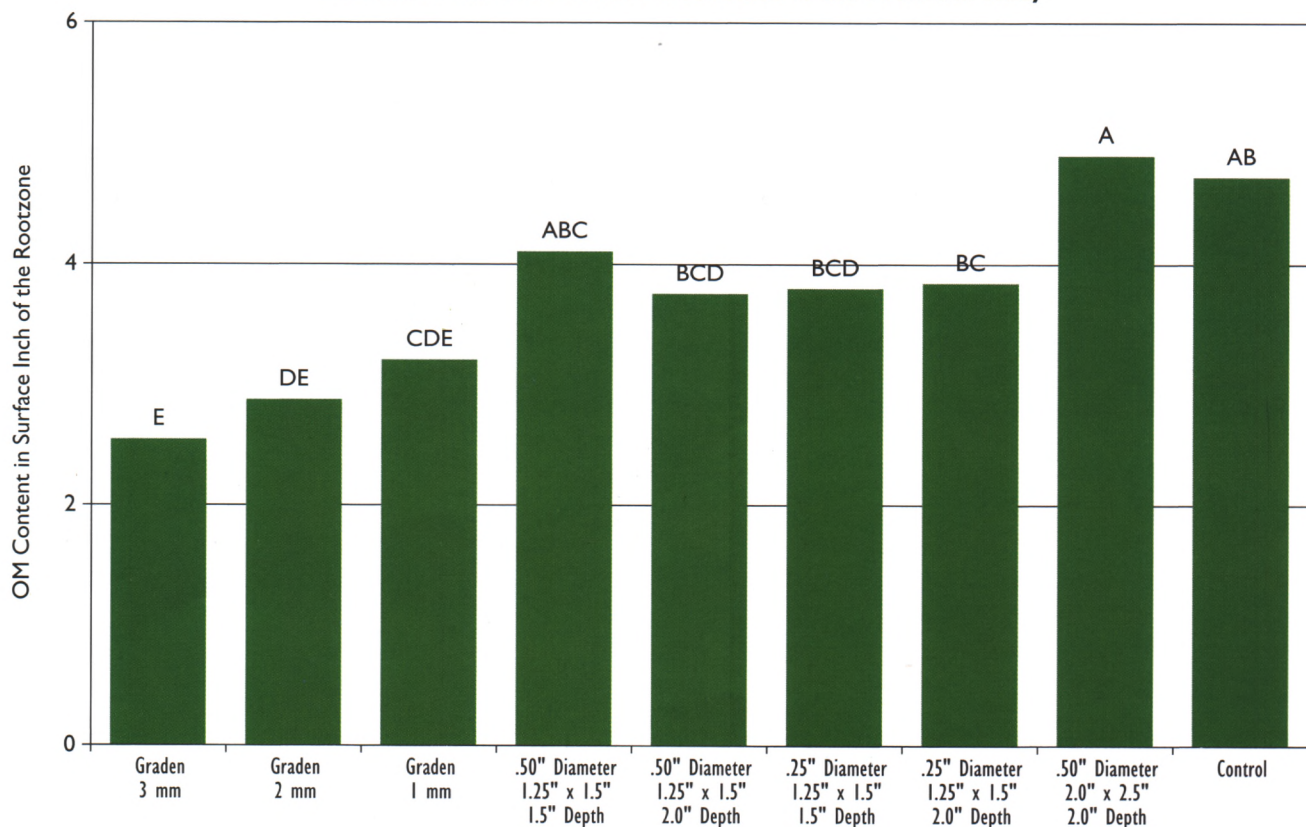
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EDITOR'S NOTE: An expanded version of this paper can be found at *USGA Turfgrass and Environmental Research Online* (<http://usgatero.msu.edu/v06/n19.pdf>).

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Figure 3
Comparisons of organic matter in the upper one inch of rootzone after three sets of cultivation treatments in the 14-month study



Organic matter content in the surface one inch of the rootzone as affected by cultivation treatment. Data collected June 21, 2004, two months after the third set of treatments was applied. Treatments with bars sharing a letter are not significantly different.

Ski Season

Golf courses provide recreational opportunities throughout the year, even when it snows.

BY MATT NELSON

Golf courses are valuable community assets in many ways, providing open space within urban communities and an important component to landscape conservation. In addition, they can provide valuable sources of wildlife habitat and filter storm water. Turfgrass has been shown to mitigate air pollution, reduce noise and glare, provide a cooling effect, and sequester carbon from the atmosphere. Golf courses also contribute to the social and economic fabric of communities. Sales revenue, real estate enhancement, employment opportunities, and support of the local service industry all can be linked to golf. Numerous golf facilities host weddings, meetings, or retreats, provide a venue for high school cross-country meets, or provide educational opportunities for youth. Across much of the northern U.S. and Canada, golf courses also are a perfect venue for Nordic skiing. With a few considerations, premiere Nordic skiing conditions can be offered with minimal risk to the turf and playability of the golf course the next spring.

The key to good Nordic skiing on the golf course without compromising turf or playing quality is a reasonable plan. Among the most important considerations for skiing on the golf course is to select appropriate routes for trails, and keep skiers on them. Grooming designated Nordic ski trails with dedicated implements that establish a track is best. This trail helps prevent skiers from going just anywhere across the golf course and allows the turf manager to designate the most appropriate skiing locations. Snow machines with tow-behind grooming attachments are widely used at reasonable cost. These

units typically are easy to operate and establish a good surface for both classic and skate skiers. Some facilities have invested in more elaborate grooming equipment, which is considerably more expensive, if they are a destination Nordic skiing site with prolonged snow cover.

Ski trails should not traverse greens, tees, landing areas, or other sensitive areas of the course. Spring green-up is usually a few weeks late beneath groomed trails, and using roughs wherever possible is advised. Solid-tine aeration of turf under the trail system in early spring can help increase soil temperature and stimulate earlier growth. Groomed ski trails of compacted snow can create a physical barrier to rodent movement beneath the snow pack and help prevent meadow voles and other undesirable animals from migrating from native

habitat onto the maintained turf and causing damage. A well-placed trail system may therefore be beneficial by reducing turf damage from feeding animals. Also, snow mold rarely forms under the groomed trails.

Groomed trails also may create a barrier to surface drainage, so be aware of the possibility of impounding water and subjecting underlying turf to freeze injury. Again, careful route selection can minimize the potential for this type of injury. Once snow begins to melt, trenches may need to be cut across the trails to allow for drainage.

Grooming can start when an appropriate amount of snow has accumulated, usually a minimum of 6 to 12 inches. Before grooming, packing the trails with a rubber-tired skid steer or similar unit can be beneficial. Slush is not recommended for grooming, and if



Winter activities can showcase the golf course as a year-around community asset.



Snow machines with tow-behind grooming attachments are an affordable and efficient method of grooming Nordic ski trails on golf courses.



Sophisticated trail grooming units are employed on golf courses at destination Nordic skiing sites like Sun Valley, Idaho.

insufficient snow cover exists, direct injury to the turf could result. Most facilities that are serious about skiing and striving to provide the best conditions will groom several days per week, if not daily.

Cart paths may not be the best location for ski trails if the paths need to be cleared in the spring for access to the greens and tees for snow removal. Asphalt and concrete also will not hold the snow as well, and melting or breakup of the snow pack is more likely.

Golfers need to be aware that grooming ski trails will likely result in reduced visual quality for a few weeks in the spring, as the turf under the trails will take extra time to recover. If the trails are properly located (out of play), the impact will be minimal and short lived. If skiing is allowed at your golf course, formulate a good plan for

traffic management and safeguard the most sensitive playing surfaces. Investing in some type of grooming equipment is advised to provide the best skiing and to control traffic.

Nordic skiing is a popular sport that provides some revenue in the form of trail passes to golf facilities that provide public access and offer concessions. This winter alternative could prove to be a viable use of a golf facility, enabling both golfers and staff to get a little winter exercise. And unlike most golfers, just about anyone can get around 18 holes in less than four hours on skis.

As senior agronomist in the USGA Green Section's Northwest Region, MATT NELSON enjoys the spectacular turf uniformity observed when two feet of snow is present.



Groomed ski trails may delay spring green-up of turf by a few weeks, thus proper location to minimize interference with play and presentation is critical.

Seashore Paspalum: Breeding a Turfgrass for the Future

Work continues at the University of Georgia on the development of this salt-tolerant species.

BY P. L. RAYMER, S. K. BRAMAN, L. L. BURPEE,
R. N. CARROW, Z. CHEN, AND T. R. MURPHY



Seashore paspalum, the grass originally billed as “only a niche grass” for use on salt-affected sites, is now gaining popularity and becoming the turfgrass of choice on many new golf course installations where salt and irrigation water quality are not primary issues. The University of Georgia Breeding Program is now recognized as a major contributor to the recent success of seashore paspalum as a turfgrass species.

Challenges associated with salinity have become increasingly more prevalent in managed turfgrass over the past 10 years. Water conservation strategies that include non-potable, alternative irrigation sources such as recycled water, storm water, saline groundwater, and seawater blends have been a primary contributor. Many of these alternative water sources contain higher

salt levels than traditional irrigation waters.

The trend for use of more salt-laden irrigation waters on turfgrass sites is expected to continue and to further increase interest in developing more salt-tolerant grasses. These trends have created the need for a high-quality turfgrass that can tolerate stresses associated with salt-affected sites and even irrigation with brackish water.

WHY SEASHORE PASPALUM?

Seashore paspalum (*Paspalum vaginatum*) is a warm-season perennial grass that is particularly well adapted to moist and salt-affected areas common in coastal regions. It tolerates sandy and infertile soils, high salt concentrations, and occasional inundation by seawater, as well as waterlogged conditions. It also has many morphological characteristics that make it desirable as a turfgrass. It



Promising experimental lines are grown in small replicated field plots where they are mowed and managed similarly to golf course fairways. In this preliminary trial, 37 seashore paspalum experimental lines are compared to commercial varieties for turf quality, density, texture, color, seed head production, and other important traits.

produces both stolons and rhizomes, has an intermediate to fine leaf texture, an attractive dark green color, good density, and good tolerance to low mowing. Seashore paspalum is considered to be the most salt-tolerant warm-season turfgrass species and also holds great promise for reclamation and soil stabilization of unmanaged salt-affected sites.

UNIVERSITY OF GEORGIA BREEDING PROGRAM

The first seashore paspalum breeding program was initiated by Dr. R. R. Duncan in 1993 at the University of Georgia Griffin Campus. The potential of seashore paspalum as a species that could potentially meet the future needs of the golf course industry as a high-quality salt-tolerant turfgrass was quickly recognized. During the mid-1990s, the USGA and the University of Georgia (UGA) entered into a joint project to develop seashore paspalum as a turfgrass species suitable for use on golf courses with salt-related problems.

Dr. Duncan led the paspalum breeding program until his retirement in 2003, when Dr. Paul Raymer assumed leadership of the program. During his 10-year tenure with this program, Dr. Duncan assembled a collection of ecotypes from around the world and began an intensive program to assess the turf traits and genetic potential of this species as a turfgrass. Working closely with Dr. Bob Carrow and other turf scientists, a series of management studies also were undertaken to determine proper management protocols for this new turf species.

The University of Georgia seashore paspalum breeding program is now recognized as a major contributor to

the recent success of seashore paspalum as a turfgrass species. Thus far, this program has focused on development of cultivars suitable for use by the golf course industry and has released three cultivars. Dr. Duncan released two cultivars, SeaIsle 1 for use on fairways and tees and SeaIsle 2000 for use on greens prior to 2003.

The most recent UGA release, SeaIsle Supreme, was licensed to sod producers in 2005 and is touted as a cultivar suitable for course-wide use (Table 1). SeaIsle Supreme has better salt tolerance than the previous releases and should be well suited for use as a fine turf in environments where salt is a problem for other turfgrasses.

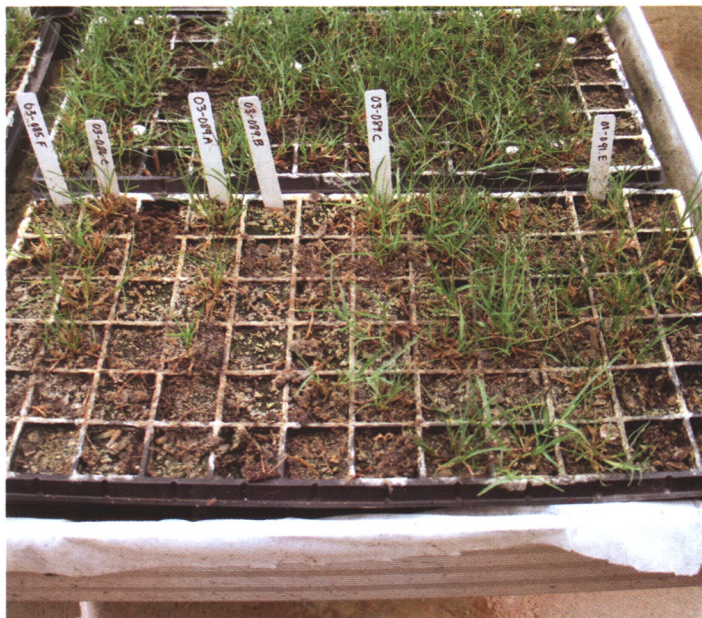
SeaIsle Supreme is a low-growing and rapidly spreading semi-dwarf type that tolerates a wide range of mowing heights and still maintains good turf density and quality. This property makes SeaIsle Supreme attractive as a grass that can be used on all parts of the golf course, from roughs to fairways to tees and greens. SeaIsle Supreme also has an extremely vigorous spreading growth habit that aids in rapid establishment, grow-in, and recovery from maintenance challenges. Thus far, SeaIsle Supreme licenses have been granted to five domestic growers, and it is being marketed aggressively internationally.

CURRENT BREEDING EFFORTS

The current breeding program is an interdisciplinary effort with strong collaboration from a host of turf scientists, including Drs. Kris Braman, entomologist; Lee Burpee, plant pathologist; Bob Carrow, stress physiologist;

Table 1
UGA-Developed Seashore Paspalum Cultivars

Cultivar	Propagation Method	Year Released	Marketer	Applications
Sealsle 1	Vegetative	2000	Sealsle Growers	Tee to green and sports turf
Sealsle 2000	Vegetative	2000	Sealsle Growers	Tee to green
Sealsle Supreme	Vegetative	2005	SI Supreme Growers	Tee to green and sports turf



(Above left) Each year thousands of unique individual plants are grown in the University of Georgia greenhouse. Plants are hand-trimmed, and undesirable plants are eliminated prior to screening for salt tolerance. (Above right) Seashore paspalum individuals can vary greatly in salt tolerance. Each year thousands of individual plants are screened for salt tolerance in the greenhouse. Individuals in the plant tray in the foreground appear less salt tolerant than those in the tray in the background. Note the salt accumulation on the edges of the tray.

Zhenbang Chen, molecular biologist; and Tim Murphy, weed scientist. Our primary objectives are to further improve salt tolerance, insect resistance, and disease resistance, as well as to improve weed management strategies and develop molecular tools to support breeding.

SALT-TOLERANCE SCREENING

Previous research has demonstrated that seashore paspalum ecotypes vary greatly in their salt tolerance, ranging from no better than the best bermudagrass hybrids to highly salt tolerant. Therefore, it is necessary to screen potential seashore paspalum cultivars prior to their release to document and ensure that they have high levels of salt tolerance. The existence of salt-tolerant plants (halophytes) and differences in salt tolerance among genotypes within plant species indicates that there is a genetic basis to salt response. Furthermore, genetically controlled variability for salt tolerance among genotypes infers that it may be possible to further improve salt tolerance of this species through breeding and selection.

A prerequisite for the development of new cultivars with improved salt tolerance is an efficient and effective salt tolerance screening method suitable for evaluation of large numbers of breeding lines. Such a screening method has been developed at the University of Georgia. This screening technique is now being used as part of the breeding program to attain even higher levels of salt tolerance in future releases.

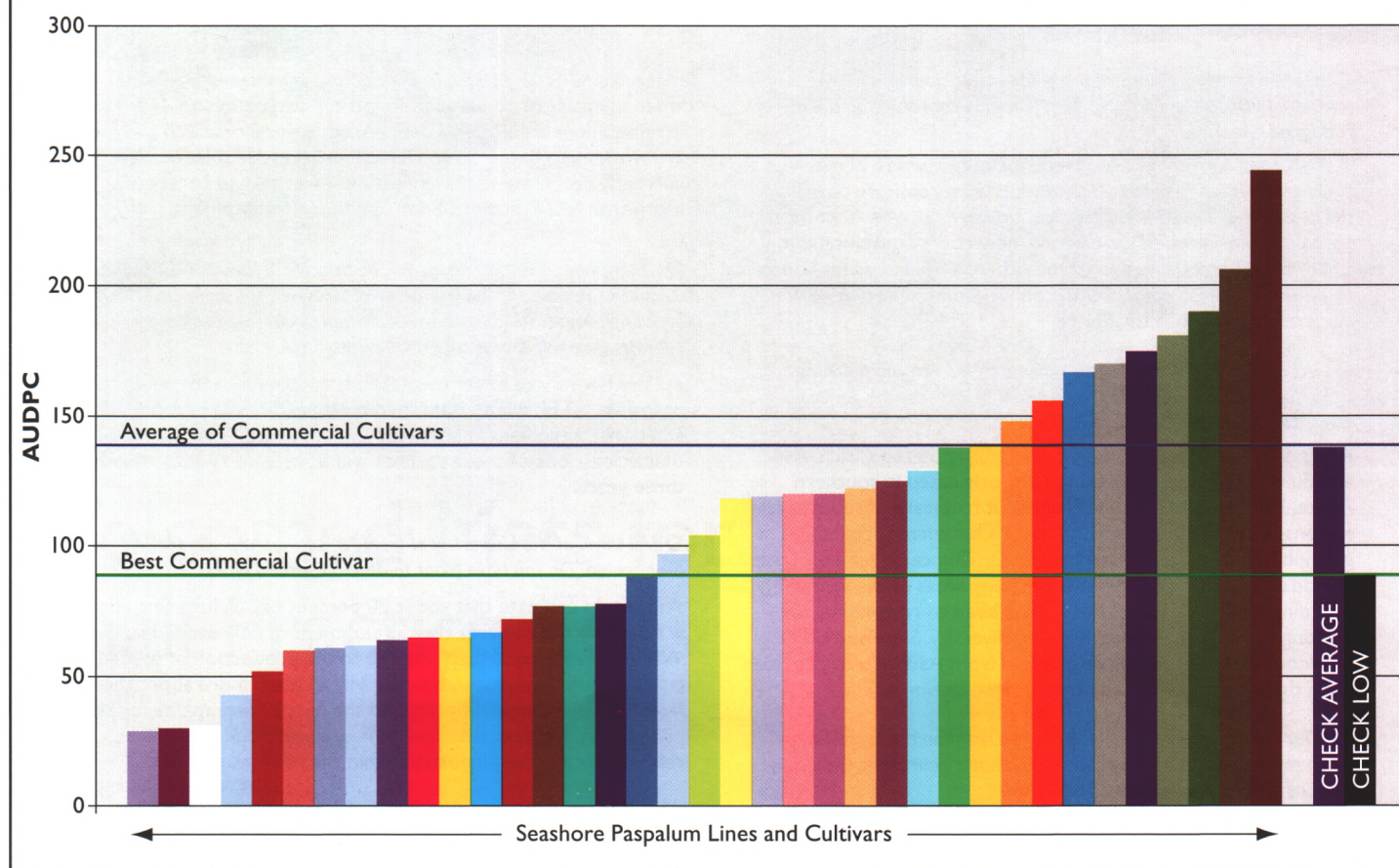
The germplasm base for the University of Georgia paspalum breeding program is the largest and most diverse collection of seashore paspalum ecotypes in the world. A traditional breeding approach based on hybridization is now being used to generate new genetic variation through recombination. Each year more than 6,000 individuals also are screened for salt tolerance in the greenhouse. Salt-tolerant individuals are transplanted to field plots for further evaluation of turf quality and dollar spot resistance. This approach allows efficient evaluation of large numbers of individuals for important traits and should insure continued improvement in turf quality, disease resistance, and salt tolerance in future cultivar releases.

CULTIVAR IDENTIFICATION

Differentiating seashore paspalum cultivars has been a challenge since most cultivars used commercially are morphologically very similar. The ability to accurately identify cultivars is useful in protecting intellectual property and provides an extremely useful tool for verifying the identity of cultivars and confirming off-types during the certification process. Amplified fragment length polymorphism (AFLP) is currently the most commonly used method for DNA fingerprinting. Simple sequence repeats (SSR) are growing in popularity and can be used in conjunction with AFLP for genotype identifications.

We have used AFLP and SSRs to fingerprint the most commercially available seashore paspalum cultivars as well as all accessions in the USDA germplasm collection. The use of AFLP banding patterns has already proven to be useful as a new tool in resolving a number of industry issues related to cultivar identity and to quality control (identification of off-types) within our commercially released cultivars.

Figure 1
Seashore paspalum lines and commercial cultivars compared for disease progress when artificially inoculated with dollar spot fungus



Thirty-seven experimental seashore paspalum lines and five commercial cultivars were compared for disease progress when artificially inoculated with the dollar-spot fungus. Disease severity ratings were taken weekly for seven weeks after inoculation and used to compute the area under the disease progress curve (AUDPC). Higher values indicate higher disease levels. Of the 37 experimental lines tested, 17 lines had dollar-spot ratings below the best commercial cultivar, indicating good potential to improve the disease resistance levels of future releases.

DISEASE RESISTANCE

Currently, the disease susceptibility of seashore paspalum cultivars is largely unknown. Although this new turfgrass is best adapted to coastal areas of the tropics and sub-tropics, it is now being commonly used in more inland areas where fungal diseases may be a significant problem. Dollar spot caused by *Sclerotinia homoeocarpa* and large patch (brown patch) caused by *Rhizoctonia solani* are likely to be major fungal diseases impacting seashore paspalum turf quality. A preliminary disease screening conducted at Griffin during the fall of 2004 indicated considerable genotypic variability for dollar spot resistance among eight standard cultivars evaluated.

Screening for dollar spot resistance has become part of the routine evaluation protocol for our breeding program. Each year, approximately 2,000 individuals in the single-plant evaluation nursery are artificially inoculated in mid-September with the dollar spot fungus by Dr. Lee Burpee, UGA turfgrass research plant pathologist. At approximately one month after inoculation, all plots are rated for dollar spot symptoms. Disease resistance of all selected individuals is also later confirmed in replicated field plots. All UGA breeding lines entered in advanced, regional, and NTEP turf field trials are compared to standard commercially available cultivars in replicated field disease evaluations.

SUMMARY

UGA-patented cultivars have been well accepted by the turf industry both domestically and internationally. The grass that was originally billed as a "niche grass" for use on salt-affected sites or where irrigation with brackish water was necessary has suddenly become the turfgrass of choice on many new course installations where salt and irrigation water quality are not issues.

Marketers of paspalum cultivars boast a host of superior traits, including multiple stress resistance and reduced requirements for water, fertilizers, and pesticides. The paspalum traits that seem to be the most critical to course owners and superintendents are the

CONNECTING THE DOTS

A Q&A with DR. PAUL RAYMER regarding the University of Georgia's seashore paspalum breeding program.

Q: Do you know of many instances where golf courses have been renovated using seashore paspalum following conversion to the use of reclaimed water?

A: Yes, I am sure there are several instances where conversion to reclaimed water has led to renovation using seashore paspalum. Perhaps a more common situation, however, is where seashore paspalum is prescribed for use on a new course development, either because reclaimed or some other salt-laden water source is to be used or it is projected that conversion to alternative water sources may occur in the future.

Q: Where did seashore paspalum come from? Are you planning collection trips to those areas in an effort to increase the genetic diversity of your breeding stock?

A: *Paspalum vaginatum* is considered indigenous to Africa, Asia, and Europe, and it is believed to have originated in southern Africa. It is now distributed throughout tropical and sub-tropical regions of six of the seven continents. Our current collection of germplasm was largely assembled by Dr. Duncan over a ten-year period and contains ecotypes from many areas of the world. My breeding program's focus thus far has been to recombine our existing germplasm to generate new diversity. Since the UGA collection contains very little material from Asia, adding ecotypes from the Pacific Rim would be my top collection priority.

Q: Our Green Section agronomists often mention the "wow factor" when referring to seashore paspalum. What is your response to this term as it describes seashore paspalum?

A: As I understand it, the "wow factor" is related to the overwhelming beauty of a well-maintained paspalum golf course. I do believe that the terminology does accurately describe the emotion you feel the first time you step onto a well-maintained seashore paspalum course. WOW. Major contributors to the "wow factor" are brilliant green color, desirable soft texture, and to some extent the pure novelty of paspalum turf. Without a doubt, some course owners are using paspalum and its ability to create the "wow factor" as a way to distinguish their courses from their competitors'.

Q: Although mature seashore paspalum is very salt tolerant, are there special precautions that superintendents need to be aware of during establishment?

A: This is an excellent point. Even though mature seashore paspalum turf is very salt tolerant, we recommend that the

cleanest water possible be used during establishment because salts can greatly reduce root growth and slow establishment. Both the soil and irrigation water should be tested prior to establishment. Saline or sodic soils may require aggressive tillage and amendment prior to planting. Irrigation water thresholds during establishment are not well defined, but several research programs are working to better define limits during establishment. We currently recommend that irrigation water should contain no more than 2,000 ppm TDS for optimum establishment.

Q: Your paper describes *Sealsle 1*, *Sealsle 2000*, and *Sealsle Supreme* as cultivar releases of the University of Georgia's seashore paspalum breeding program. Do you have additional about-to-be-released cultivars that golf course superintendents can expect?

A: We have three experimental lines entered into the seashore paspalum NTEP trials established during 2007. We have an additional three lines in advanced evaluations in Georgia. I expect that at least one of these six lines will be released within the next three years.

Q: All three of the University of Georgia cultivars are vegetatively propagated. Do you have plans to develop seeded types?

A: I would estimate that about 20 percent of our breeding effort is now directed towards the development of new seeded cultivars. We still have a lot to learn related to the production of seeded cultivars and have research underway to learn more about the factors that control flowering and the best environments for seed production. I expect that several new seeded cultivars will be released by the seed industry within the next year or two.

Q: How much of an impact do you think improved seashore paspalums will have on the golf course industry, and will they expand beyond the niche grass description?

A: I believe that seashore paspalum has already had a significant impact on the golf industry. The availability of this grass has made it possible to build new golf courses on some of the most striking coastal venues around the world where it was not possible before because of salt-related issues. Somewhat surprisingly, the use of seashore paspalum has already expanded beyond that of a niche grass as evidenced by its frequent use on many new courses where salt and irrigation water quality are not issues. Decisions to use seashore paspalum on these venues are most likely driven by its uniqueness and exceptional quality and beauty. Although I expect the use of seashore paspalum to continue to increase, I do not expect it to displace bermudagrass as the dominant warm-season turfgrass species anytime soon.

ability to retain color during the winter months, better ball support, and the overwhelming beauty of a well-maintained paspalum golf course.

The rapid growth in global popularity of the latest generation of seashore paspalum cultivars far exceeds early expectations. It is now safe to state that seashore paspalum has finally earned a spot on the list of recognized

turfgrass species. This seashore paspalum breeding program is well positioned to meet many of the future challenges of the golf course industry.

EDITOR'S NOTE: An expanded version of this paper can be found at *USGA Turfgrass and Environmental Research Online* (<http://usgatero.msu.edu/v06/n21.pdf>).

P. L. RAYMER, PH.D., *Professor of Crop and Soil Sciences*; S. K. BRAMAN, PH.D., *Professor of Entomology*; L. L. BURPEE, PH.D., *Professor of Plant Pathology*; R. N. CARROW, PH.D., *Professor of Crop and Soil Sciences*; Z. CHEN, PH.D., *Research Scientist of Crop and Soil Sciences*; and T. R. MURPHY, PH.D., *Professor of Crop and Soil Sciences*; University of Georgia, Griffin Campus, Griffin, Ga.



Welcomed Mats for Small Practice Tees

Which is better for a small practice tee — artificial turf or bare ground?

BY TODD LOWE

The popularity of golf has grown to the point that, not only do most golfers know the names of top golfers like Tiger Woods, we also know the names of instructors like Butch Harmon and David Leadbetter. These instructors are popular on the Golf Channel, teaching various techniques on everything from straightening a slice to achieving greater distance. Practice makes perfect and, in the attempt to attain perfection, more golfers practice now than ever before.

Unlike Tiger Woods, though, turfgrass species are not machines and suffer from the wear and tear of daily play. Increased foot traffic and iron shots take their toll on practice tees, which become especially weakened during peak seasons. Reestablishing turf by seed or from surrounding vegetation is necessary to fill in thin areas and provide proper cover. If adequate time is not allowed in between

these intervals, practice tees remain thin or, even worse, bare.

Practice tee size averages between 30,000 and 75,000 square feet, depending on the amount of usage. Large tees provide appropriate turfgrass recovery, and a mistake of many golf courses is installing small practice tees that remain excessively worn. The obvious solution is to increase the teeing area, but this may not be possible on some courses due to inadequate space. A possible solution to improve turfgrass recovery and overall aesthetics is installing artificial teeing surfaces.

Artificial surfaces can be used to alleviate some of the stress from routine play by alternating them into the regular tee rotation as needed. Also, unlike turfgrasses, artificial turf does not suffer from environmental stress and can be used during rainy weather or during winter months on northern courses.

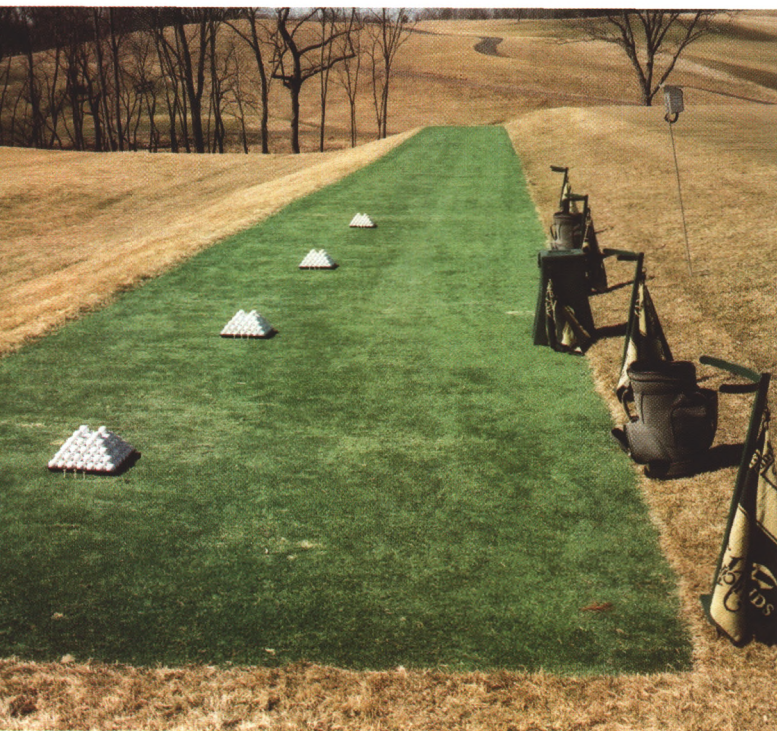
There are various types of surfaces available, but most courses prefer low-

maintenance mats that do not require topdressing with sand or crumb rubber. Surfaces with long fibers are more realistic but require intensive maintenance. These surfaces also must be buried in the ground, and replacing them is difficult. A concrete foundation should be installed below the mats so that the teeing surface does not become unlevel and aesthetically unappealing. Some courses partially enclose these artificial teeing areas to protect golfers from the elements and provide shade.

Some members do not welcome the use of artificial turf because it does not simulate the feel of golf course turf, but then again, neither does bare ground. Golfers must realize the impact of increased stress on small tees and see the long-term benefit of these artificial mats.

TODD LOWE is an agronomist for the Green Section's Florida Region.

Use of practice tees has exploded in recent years. Artificial teeing surfaces are viable alternatives to natural turf and are available in a wide variety of shapes, sizes, materials, and costs.



Newer artificial mat designs provide a more realistic feel, but they require more upkeep. Some can be easily removed for maintenance.





The shape of this mat allows it to be rotated to help spread wear over the surface.

Define the Line

A simple mowing strategy to maintain the dimensions of greens and the width of collars.

BY KEITH HAPP

Putting surfaces are the most intensely maintained turf on the course. In most instances, greens are mowed at least daily, with some course managers choosing to double or even triple mow greens to prepare for play. This exposes greens to a high level of mechanical stress/activity and increases the chance of altering the size of greens and the width of collars. While operators are trained to make a conscious effort to maintain a distinct line of demarcation between the green and collar, over time the size and shape of the putting surface can change. There is an additive effect when the employee intentionally mows inside the collar/green interface to avoid causing damage. It is important to

have a defined interface between the green and the collar so the golfer knows if any part of a ball is touching the putting surface. Under the Rules of Golf, a player can mark, lift, and clean the ball during play of a hole when a part of the ball lies on the putting surface.

John Shaw, CGCS, superintendent of Valley Brook Country Club in McMurray, Pa., is aware of the importance of maintaining his course's architectural integrity as well as the size and shape of his greens and collars. He experimented with a strategy that would allow his crew to mow the putting greens and collars of his 27-hole operation in a very consistent manner. His ultimate goal was to

maintain the size of each green and achieve standardized collar width from hole to hole.

Each spring John begins by reviewing with each employee how the greens and collars are to be mowed. The putting surfaces are cut with walk-behind mowers, and John makes two special requests of the operators. First, it is a must that the baskets be emptied prior to making the outside pass around the outer edge of the green. Secondly, operators are instructed to mow 6 inches inside of the collar/putting surface interface.

All of the collars are mowed with a single triplex. This in itself is not unique, but the way the machine is set up is. One of the cutting units is set



A triplex mower is set up to maintain the collar. One of the cutting heads is set at putting green height. This technique allows the collar to be sustained at two cutting units wide.



Each spring John Shaw begins the season by reviewing with each employee how the greens and collars are to be mowed.



John Shaw instructs his employees to complete the cleanup pass six inches inside of the collar/putting surface interface.

at putting green height and the other two are set to collar height. This setup allows the collar width to be easily maintained. Rather than the operator focusing on the edge of the green/collar, the operator uses the edge of the intermediate cut of rough/collar as a guide. The width of the collar, which is two cutting units of a triplex, does not vary. As a secondary control factor, a wire is positioned in the soil along

the outer edge of the collar. A metal detector can be used if necessary to check this reference point if any questions arise concerning green shape or size.

John's management process for this particular area of the course has been in place for several years and has met with great success. Clean, clearly defined putting surfaces and collars are being produced in a consistent manner.

If you are having trouble with this particular element of course setup, give John's strategy a try.

KEITH A. HAPP is a senior agronomist in the Mid-Atlantic Region visiting courses in the states of Delaware, Maryland, Virginia, Pennsylvania, and West Virginia. His regional office, located in the Pittsburgh, Pa., area, brings him closer to the western portion of the Mid-Atlantic Region.

Washing Your Cares Away

Gaining an equipment wash rack upgrade as part of the turf management center master plan.

BY JOSHUA CONWAY



Failing drains and stagnant water plagued Prairie Dunes Country Club's wash pad before the upgrade.

Prairie Dunes Country Club is an 18-hole, links-style golf course located in Hutchinson, Kansas. Built in 1937, 225 acres of the club's 334.5 acres are managed as prairie grassland habitat.

Superintendent Stan George had long felt the club needed a new wash rack system. The old wash pad consisted of two hoses on a 400-square-foot, irregular concrete base. Constructed from concrete left over from past projects, the uneven surface caused the accumulation of rinse water on the pad itself. In addition, the drains were failing, allowing unfiltered rinse water to stagnate above ground and potentially degrade groundwater.

Despite the inadequacies of the wash pad, George found himself in a situation many superintendents would find

familiar; the club did not feel that it could allocate the funds to upgrade the system. His opportunity to push for the project finally came when the club decided to build an addition onto the Turf Management Center in preparation for the 2002 US Women's Open. He initially proposed the wash rack as a stand-alone project, which was rejected. Finally, through several years of planning, convincing, politicking, and allocating funds, George finally

ensured the master plan would include a new wash rack area. The entire Turf Management Center upgrade, which included the addition of 5,000 square feet of offices, meeting room, locker rooms, equipment storage, and the new wash rack, began in January 2001 and was completed in May 2001.

The Turf Management Center addition was designed to create a U shape, with the wash rack located in the courtyard between the two portions of



the building. This wash rack position ensures that every piece of equipment passes through the area prior to entering the buildings, making equipment washing more efficient. Surrounded on three sides and covered with a roof, the 2,400-square-foot area also provides extra equipment storage when needed, such as during the Women's Open.

water separator tank, much like a septic tank. The filtered water is discharged into a leach field.

Staff blows off equipment with a backpack blower and collects the dry clippings. Clippings that are washed off are allowed to dry overnight for easy removal from in front of the screens, shoveled into two five-gallon buckets, and brought to the compost

its place, he would install another full-length screen instead of the one-third width pre-screen that is incorporated in the bumper. "I have found that this pre-screen performs unsatisfactorily compared to the full-width screen behind it," he says. Except for this one minor detail, the staff has been extremely pleased with the operation, traffic flow, location, and results of the



The redesigned and greatly improved wash pad at Prairie Dunes Country Club provides adequate collection and filtering of wash water.

Originally based on a wash rack system George saw at Pinehurst, the club slightly changed the initial architectural plan to meet their specific needs. The original design called for four wash stations that drained to a collection/filtering system. Instead, the club moved the collection system into the center of the courtyard and doubled the number of wash stations. Each of the eight stations has a separate hose supplied from the irrigation system; a backpack blower, pail, and shovel for clipping removal; and a "safety stick" (mandatory for adjusting reel parts during cleaning rather than using hands).

The design of the system is quite simple. The concrete pad is slightly sloped to enhance rinse water and clipping movement into the collection pit from both sides. Rinse water is double screened to collect clippings before passing through a buried oil/

pile. The wash rack's proximity to the maintenance building creates an incentive for the maintenance staff to clean the pit daily, or unpleasant odors will become prevalent.

Originally, the pit area was created to be large enough that a skid loader could be driven down into the sloped pit to remove clippings. Although this is possible, the staff does not attempt this procedure any longer because they felt uncomfortable with the close proximity of the loader to the irrigation line (located above ground and attached to the safety railing). Additionally, they found it to be unnecessary due to the small amount of clippings to be removed if one is diligent about removing them daily.

If they were to do this project over, George said he would remove the concrete bumper installed just prior to the screening that was designed to protect the screens from the loader bucket. In

new wash rack facility. Aside from removing screened clippings regularly, ongoing maintenance also has been minimal.

Although the final cost was incorporated into the construction of the entire facility, the approximate cost of the wash rack was \$30,000. From the members' perspective, although most do not visit the Turf Management Center (even during several open houses), those who do visit are impressed with the professional appearance and neat storage areas, and they appreciate the wash rack as one way to care for their significant investment in equipment.

JOSHUA CONWAY is the Education and Communications Manager for Audubon International. He can be contacted at jconway@auduboninternational.org. For more information on the Audubon Cooperative Sanctuary Program for Golf Courses, call (518) 767-9051, extension 12.

News Notes

ZONTEK RECEIVES AWARD



From left: Dr. David Silvia, head of the Penn State Department of Crop and Soil Sciences, Stan Zontek, and Dr. Pete Landschoot, professor of turfgrass science in the department.

Stanley Zontek, director of the USGA Green Section's Mid-Atlantic Region, was awarded the Department of Crop and Soil Sciences Outstanding Alumni Award for 2007 from Penn State University. Stanley graduated from Penn State in 1970, and shortly afterward he was hired by the USGA as an agronomist in the Northeast Region. He went on to become director of the Northeast Region in 1976 and later became director of the North Central Region from 1980 to 1985. In 1985 he was appointed director of the Mid-Atlantic Region, where he has worked ever since.

In presenting the award, Dr. Pete Landschoot noted, "The reason for giving Stanley this award is for his unending efforts to help thousands of golf course superintendents all over the world with their everyday problems and sometimes with huge career-changing challenges."

MID-ATLANTIC REGION GREEN SECTION COMMITTEE MEETING



Members of the Green Section Committee in the Mid-Atlantic Region met on October 30, 2007, at Old South Country Club in Lothian, Maryland. USGA Green Section staff members from the Mid-Atlantic Region updated the Committee on Green Section activities, including the Turfgrass and Environmental Research Program, Turf Advisory Service, future USGA championships in the region, and other topics. These meetings provide an opportunity for staff and Committee members to exchange ideas to maintain and improve the perception of the Green Section in the Mid-Atlantic Region and beyond.

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 Main Street, New Knoxville, OH 45871

Attn: Mark Flock

Voice phone: (419) 753-2448

FAX: (419) 753-2949

E-Mail: mflock@BLINC.COM

Dakota Analytical, Inc.

1503 11th Ave. NE, E. Grand Forks, MN 56721

Attn: Diane Rindt, Laboratory Manager

Voice phone: (701) 746-4300 or (800) 424-3443

FAX: (218) 773-3151

E-Mail: lab@dakotapeat.com

European Turfgrass Laboratories Ltd.

Unit 58, Stirling Enterprise Park

Stirling FK7 7RP Scotland

Attn: Ann Murray

Voice phone: (44) 1786-449195

FAX: (44) 1786-449688

Hummel & Co.

35 King Street, P.O. Box 606

Trumansburg, NY 14886

Attn: Norm Hummel

Voice phone: (607) 387-5694

FAX: (607) 387-9499

E-Mail: soildr1@zoom-dsl.com

ISTRC New Mix Lab LLC

1530 Kansas City Road, Suite 110

Olathe, KS 66061

Voice phone: (800) 362-8873

FAX: (913) 829-8873

E-Mail: istrnewmixlab@worldnet.att.net

Sports Turf Research Institute

hyperlink to www.stri.co.uk

St. Ives Estate, Bingley

West Yorkshire BD16 1AU

England

Attn: Michael Baines

Voice phone: +44 (0) 1274-565131

FAX: +44 (0) 1274-561891

E-Mail: stephen.baker@stri.org.uk

Thomas Turf Services, Inc.

2151 Harvey Mitchell Parkway South, Suite 302

College Station, TX 77840-5247

Attn: Bob Yzaguirre, Lab Manager

Voice phone: (979) 764-2050

FAX: (979) 764-2152

E-Mail: soiltest@thomasturf.com

Tifton Physical Soil Testing Laboratory, Inc.

1412 Murray Avenue, Tifton, GA 31794

Attn: Powell Gaines

Voice phone: (229) 382-7292

FAX: (229) 382-7992

E-Mail: pgaines@friendlycity.net

Turf Diagnostics & Design, Inc.

613 E. First Street, Linwood, KS 66052

Attn: Sam Ferro

Voice phone: (913) 723-3700

FAX: (913) 723-3701

E-Mail: sferro@turfdiag.com

2008 USGA Green Section Education Conference

Friday, February 1, 2008
Orange County Convention Center
Orlando, Florida

TAKING CARE OF BUSINESS: OPPORTUNITIES TO ENHANCE FACILITY AND PROFESSIONAL GROWTH

9:45-9:55 a.m.

Customer Service from the Agronomic Side

Christopher Hartwiger, Southeast
Region senior agronomist, and
Patrick Gross, director of the
Southwest Region

*Two seasoned agronomists share customer
service examples from the collective travels of
the USGA Green Section agronomists.*

9:55-10:25 a.m.

Golf Across Generation and Gender

Patrick Shea, Esq., principal of Patrick
A. Shea, P.C., Salt Lake City, Utah
*The golf course management team has an
important overall stake in making the course
welcoming to all golfers.*

10:25-10:55 a.m.

The Ogre, the Donkey, and the Princess

Dave Chag, general manager,
The Country Club, Chestnut Hill,
Mass.

*Teamwork is what it's all about to
successfully coordinate all departments
at the golf facility.*

10:55-11:05 a.m.

Presentation of the 2008 Green Section Award

11:05-11:35 a.m.

Cultivating Excellence — Growing the Club from the Inside Out

Barbara Jodoin, general manager/COO,
Pinetree C.C., Kennesaw, Ga.

*How does the operating strategy of a club
create success? Can it really be this simple to
achieve extraordinary results at your golf
course or business? Your place in the plan to
cultivate excellence.*

11:35-11:45 a.m.

Customer Service from the Agronomic Side

David Oatis, director, Northeast
Region, and Larry Gilhuly, director,
Northwest Region

*Agronomists share more examples gathered
from the collective travels of the USGA
Green Section staff.*

2008 USGA NATIONAL & REGIONAL CONFERENCES

National Conference

February 1 Orange County
Convention Center
Orlando, Florida

Florida Region

February Course Official Seminars
TBA

Mid-Atlantic Region

February 25 Radisson Hotel/Expomart
Monroeville, Pennsylvania
March 11 DuPont Country Club
Wilmington, Delaware

Mid-Continent Region

March 20 Lakeside Country Club
Houston, Texas

Northeast Region

March 4 Rhode Island
Convention Center
Providence, Rhode Island
March 13 Oak Hill Country Club
Rochester, New York
March 27 Wheatley Hills Country Club
East Williston, New York

Southeast Region

March 11 Ballantyne Resort
Charlotte, North Carolina

Northwest Region

March 4 Peaks and Prairies
Helena, Montana
March 7 Sand Point Country Club
Seattle, Washington
March 10 Portland Golf Club
Portland, Oregon
March 11 Lakewood Country Club
Lakewood, Colorado
March 13 The Country Club
of Salt Lake City
Salt Lake City, Utah
March 31 Hapuna Resort
Kamuela, Hawaii
April 1 Lihue Convention Center
Lihue, Hawaii
April 2 Mid-Pacific Country Club
Kailua, Hawaii
April 3 King Kamehameha Golf Club
Wailuku, Hawaii

Southwest Region

January 21 Old Ranch Country Club
Seal Beach, California
March 10 Claremont Country Club
Oakland, California
March 11 TBA
Nevada
March 17 TBA
Arizona

North-Central Region

January 15 Indianapolis
Convention Center
Indianapolis, Indiana

A Question of Credibility

Don't believe everything the "experts" tell you.

BY CHRIS HARTWIGER

Maybe the comments are made to jolt sleepy golf fans from an afternoon nap. Maybe the comments are designed to start a wave of misinformation to drive golf course superintendents over the edge. Or maybe today's television golf announcers have not done their homework. In any event, TV golf fans, our beloved golf announcers are weaving inaccurate agronomic information into their otherwise insightful analysis.

Here is the problem. Bad information undermines credibility. Below are a few gems I personally have heard over the airwaves, along with my corrections. These are summaries and not direct quotes because I did not think to write them down at the time. I wish I had.

Example 1: The difficulty with foliar-fed rough. *The rough at this US Open venue is going to be particularly difficult this week because it is foliar fed with nitrogen. This foliar-fed rough is so thick it will wrap around your club and . . .*

The problem with this theory isn't whether the rough was fertilized via a foliar (liquid) nitrogen source or a granular nitrogen source. It implies that grass fertilized with nitrogen via a foliar treatment is somehow more difficult to play a golf shot from than grass fertilized via a granular treatment. Heavily fertilized, tall grass is going to be difficult, regardless of the nitrogen source.

Example 2: A new hybrid. *He doesn't have much of a shot at all. His ball is in the thick fine fescue bermudagrass rough.*

Perhaps this announcer did not have his morning cup of coffee. Fine fescue bermudagrass does not exist. Maybe he was confused because the golf course

in question had bermudagrass rough and tall fescue planted under the trees. Where fine fescue bermudagrass came from is anyone's guess.

Example 3: Grain on the brain. *The grain breaks toward the setting sun. The grain runs to the water because that's what the grass wants. The grain runs toward the ocean.*

Does grain or a general orientation of grass exist? Yes. Can it influence putts or golf shots? Yes. Does it break toward a body of water, the sun, a planet, or a statue all the time? No. Most of the time the grain is oriented with slope.

Example 4: A sandy tale. *This sand is great. It is manufactured and the members had it shipped halfway across the country because it is so difficult to play from.*

If you must know the truth, the perceived quality of sand is inversely proportional to its proximity from the club, particularly if other top clubs use it. The farther it must be shipped and the more expensive it is, the better it must play. Top private clubs do not select sand because it is difficult to play from.

Example 5: Dart boards. *The creeping bentgrass putting greens are soft in August because the superintendent had to put extra water on them to keep them alive.*

Wrong answer. The creeping bentgrass putting greens are soft because the root system has died back. The once-live roots that anchored the plant are swollen with water and in varying states of decomposition. This is why the putting greens are soft.

I like most TV golf announcers and it is unfortunate they miss the mark on so many topics related to agronomy. It is frustrating when they take basic

information, much of it provided to them, and start developing their own theories. The announcers don't realize it, but their comments have implications among the rank and file golfers, too. They take these theories back to their home courses and often add their own twist. "Our bentgrass greens are soft in August because the superintendent overwaters . . . We picked the wrong sand for our bunkers because it wasn't manufactured . . . Our greens don't putt well because they are grainy."

Imagine for a moment if correct information was disseminated from TV commentators: "The greens this week are soft because bentgrass roots die in the heat . . . The rough is so tough because it was fertilized and the mowers were raised . . . All grass on greens has grain and the key is to determine which way it is growing." This would be great information for golfers to take back to their home courses.

There are two paths out of this mess. The first one is to hope that commentators will reach out to the most trusted source of excellent information, the local superintendent. Unfortunately, hope is not a good plan, particularly when some of the offending announcers have a long rap sheet of getting it wrong. A second approach would be to put someone with agronomic expertise in the booth. What a novel idea! This announcer would get it right the first time and would be a source of reliable information for fans and colleagues. Instant credibility!

CHRIS HARTWIGER is a senior agronomist in the Green Section's Southeast Region.

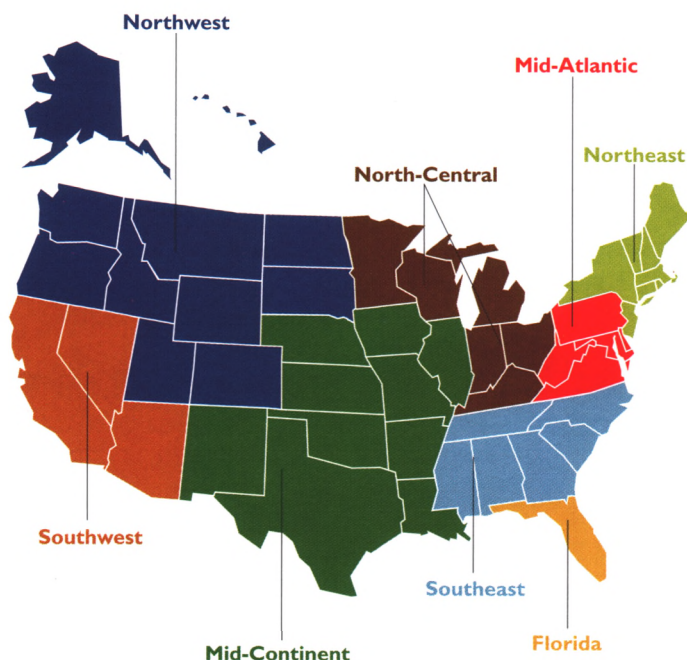


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Turf Twisters



Q: My course has made a commitment to increase core aeration and surface top-

ressing. Any suggestions on how we can monitor our progress? (Ohio)

A: Visual ongoing inspection of the profile is important to ensure that there is no layering, which in this case suggests topdressing rates that are out of sync with turf growth and aging. In addition, representative physical analysis tests every couple of years can be used to quantify aeration versus capillary pore space, along with the percentage of organic matter. Cross comparing future tests helps quantify progress or the lack

thereof. Over time there also should be a marked improvement in turf health/dependability. Finally, a Turf Advisory Service visit each year provides an outside perspective of the above factors (visual monitoring, physical analysis, and improved quality/dependability).

Q: I am the golf professional at a private club, and I'm looking to purchase ball mark repair tools to hand out to the membership to help maintain our greens. Which tool is the best at repairing with little damage while still being cost effective?

tive to the club? Do you have any suggestions or advice on the proper tool? (Michigan)

A: The USGA does not evaluate or recommend brands of ball mark repair tools. Almost all of them

can be used effectively if golfers are shown how to use them correctly. There are several different types of ball marks, depending on the grass type, rootzone mix, soil moisture content, ball trajectory, and spin rate as it hits the green, etc. The

best thing you can do is to show your golfers how to repair the various types of ball marks with whichever tool you decide to go with. Generally speaking, expensive ball mark repair tools aren't any better than inexpensive tools.

Q: Our driving range tee remains in thin condition during the peak golfing season. What can we do to maintain dense turf coverage on our practice tee?

A: Practice teeing grounds receive a significant amount of play during the peak golfing season. Unless there is adequate teeing area to disperse play, the turf struggles to recover from continual

divot removal. Obviously, enlarging the tee area would be the best solution, but if this is not possible, several practices can be implemented to optimize turf recovery. Use as much teeing area as possible before shifting teeing lanes (see diagram). An artificial turf surface can be utilized between tee stall rotations to allow increased turf recovery. There have been advancements over the

years in playability, and the newer artificial tee mats are more realistic. Lastly, your club could limit the number

of golf balls given to each golfer to limit the divots taken and improve turf density.

