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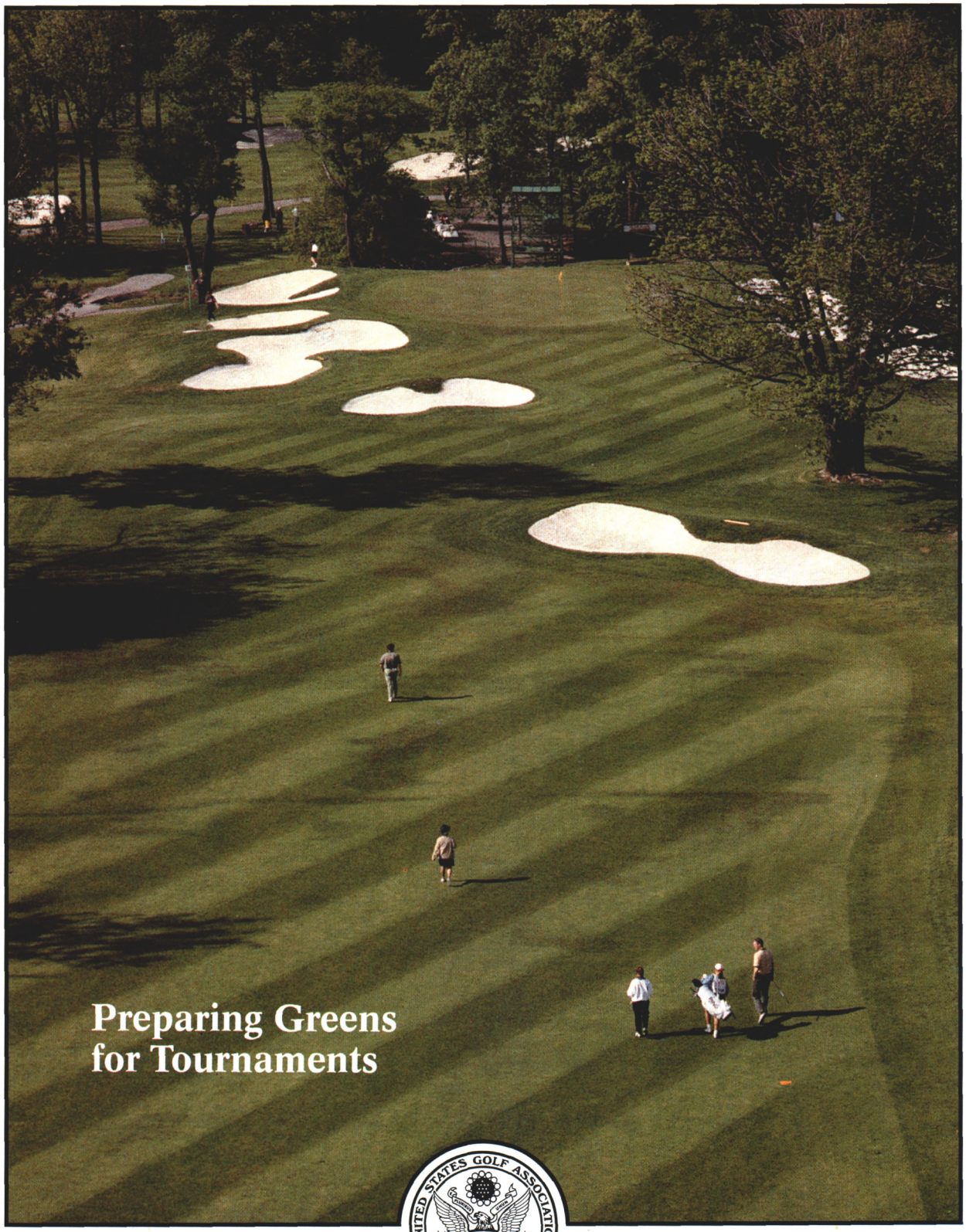

Preparing Greens for Tournaments

A PUBLICATION ON TURFGRASS MANAGEMENT BY THE UNITED STATES GOLF ASSOCIATION®

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Cover Photo: This aerial view of DuPont Country Club (Delaware) demonstrates the importance of attention to detail, good turfgrass, and good preparation.

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A light topdressing program smooths and firms the putting surface. The last topdressing before a tournament should be scheduled 11 to 12 days prior to the event. See page 1.

The need to push water off the green documents less-than-adequate surface runoff. See page 5.

Rolling putting greens produces faster and smoother putting surfaces without the need to lower mowing heights.

Preparing Your Greens For That All-Important Tournament

Plan ahead by thinking backwards.

by STANLEY J. ZONTEK

NOT EVERY GOLF COURSE hosts the U.S. Open Championship each year. However, almost every golf course does hold some type of important golf tournament. The list of events can be long: a regional or sectional qualifying event; a tournament for charity; a state amateur, junior, or professional event; or that very special member-guest tournament that the golf course prides itself in.

There are a number of practices a golf course superintendent can use to prepare the golf course for that special tournament. It may not be the U.S. Open, but it is just as important to have the course, and particularly the greens, look and play their best. Play away!

Green Speed

Right or wrong, having the greens putt faster for a special golf event is almost always required. Seldom is the regular daily green speed considered adequate. If by chance it is, then skip this section. If it is not, read on.

The challenge for the turf manager is to provide faster green speeds for the tournament without threatening the health of the turf. It is an agronomic over-simplification to think that simply lowering the mowing height will achieve faster greens. Without proper preparation, lowering the height can scalp the turf. Following are some of the practices that are used to accommodate the desire for faster greens. In selecting and scheduling these programs, much depends upon how fast you want the greens to putt, and the time, machinery, and labor available to do this work.

Light Topdressing. A light topdressing program is important in preparing the greens for the tournament. This is where your *planning ahead by thinking backwards* begins. Our experience has shown that a light topdressing

should be scheduled 11-12 days before the tournament. This allows enough time for the topdressing material to settle into the turf and for debris and other loose impediments to be picked up by the greens mower. This timing before the event also allows time for the mowers to be re-lapped or sharpened before the event. Thus, work backwards in scheduling topdressing so the greens will *peak* the days of the event.

How much topdressing should be applied? The key here is to use just enough so that when the material dries, it vanishes into the grass following a light brushing and/or light irrigation. Depending upon a number of factors, such as the type of topdressing and the length of the grass on the greens, rates can range from ½ to ¾ cubic yard of topdressing material per 5,000 square feet. NOTE: Dry topdressing material works best.

After the topdressing has been worked into the grass, lowering the mowing heights can be done more safely. Besides smoothing and firming the putting surface, the topdressing protects the crown, or growing point, of the grass plant so that scalping injury is minimized.

How many topdressings will your greens need? It depends, but if the greens are soft and spongy, several topdressings may be needed. Again, work backwards on your calendar. If you know you should schedule a topdressing application 11-12 days before the event, schedule one or more additional light topdressings on that same schedule.

Double Cutting

Experience has shown that double cutting greens should begin about four days prior to the beginning of the practice rounds (if any). In this way, the greens should putt at the same pace for every day of the event, including the practice rounds.

The question is often asked, "Can I cut the greens once in the morning and once in the evening to achieve the same results?" The answer is, yes, with some explanation. It generally is best to double cut greens in the morning. However, if time, weather, equipment, or the labor situation demands that you divide your mowing schedules between the morning and the evening, then yes, this operation can be split. This is better than not double cutting at all. The gain in green speed by double cutting usually is at least six inches, as measured by the Stimpmeter.

Rolling Greens

There are several types of dedicated machines designed to roll putting greens. Rolling greens produces faster and smoother putting surfaces, even without lowering mowing heights. The key is to roll the greens without damaging the grass or compacting the soil.

Space does not allow for a thorough discussion of all aspects of rolling greens. Suffice it to say, rolling greens is one of the techniques to achieve faster putting green speeds on a temporary basis.

Using soft-bristled brooms to groom the putting surface is one technique used to gently lift runners prior to cutting. The technique is labor intensive, but it's non-abrasive to the grass.

How frequently can greens be rolled? Research and field experience have shown that greens can be rolled regularly a maximum of three times per week. For special events, greens can be rolled regularly daily. If this is done, however, some type of surface aeration should be scheduled on the greens immediately following the event. Green speed gains can be impressive where greens are rolled, and speed increases of 12 to 18 inches are common.

Aeration

One of the most asked questions is, "Can or should greens be aerated prior to an important golf tournament?" This is where a distinction between a televised or major tournament and your course event can be made. For those *very special* and *rare* championships or tournaments, traditional aeration prior to the event normally is not performed unless there is a very good reason to do so. For most regular golf events, do not compromise; as the golf course superintendent, do what you believe the greens need prior to the event to keep the grass on the greens alive for the remainder of the season. Obviously, do not aerate the greens with ⅝-inch hollow tines the week prior to the event. Just make sure you schedule whatever aeration the greens need well in advance of the event so the aeration holes have time to heal.

Today our industry enjoys more types of aeration equipment than has ever been available before. You can aerate greens with ¼- to ⅜-inch (or larger) hollow tines; solid tines; water injection; small, surface, multi-tined aerators; deep-tine aerators; drill aerators; and others. The superintendent can literally choose the technique that fits the needs of the grass and soil on the greens.

When in doubt, do not defer an aeration program solely because of the tournament. Perhaps you can use a technique that produces the least disruption to the putting surface, but do what is best for the grass, the soil, and the long-term performance of the greens. Aeration can be a good practice both to prepare the grass for the event and then, following the tournament, to relieve compaction and rebuild the turf's root system.

Fertility

Grass that is lush, fast growing, and wide leafed is more difficult to prepare for a tournament than slower-growing, finer leafed, *hungrier* grass. But there are both extremes — grass that is over fertilized and grass that is under fertilized. Yes, you can under fertilize grass, especially when trying to achieve faster green speeds! With grass that is under fertilized, there is a tendency to lose density. Ball marks become agonizingly slow to heal, and greens lack density and tend to spike mark more than greens with better turf density.

How can you achieve this balance between lush, dense grass and thin, under-fertilized grass, especially when preparing greens for a tournament? The answer could be by fertilizing the greens, especially in the weeks leading up to the tournament, with a light, *spoonfeeding* putting green fertility program. Typically, this involves the application of a minimum of 1/10th to a maximum of ¼ pound of actual nitrogen per 1,000 square feet, normally using a complete N-P-K fertilizer blend that is sometimes enhanced with iron and other micronutrients. These liquid applications of fertilizer, using the greens sprayer, can be made to the greens on a 7- to 10-day interval beginning at least a month prior to the tournament. Essentially, this replaces granular fertilizers, with their inherent peaks-and-valleys responses, with multiple, light applications of sprayable fertilizers. It allows the superintendent to have better control of the growth of the grass prior to and even after a tournament. You do not want to have a granular fertilizer *release* during the event. Not too much growth, and not too little. Some trial and error may be involved in terms of timing, rates, and individual fertilizer products. Nonetheless, by spraying soluble fertilizers on the grass, you can always add more material if it is needed. With granular fertilizers, once the material is down, it is down. You cannot remove an excess. A spoonfeeding program is another tool, another option, to utilize in preparing your greens for that special tournament.

Surface Preparation

Years ago, another title for this section could have been *controlling grain.* The fact is, the effect of grain on the roll of a ball is overstated today. When putting greens were cut at ¼ inch, especially on bermudagrass greens, the effect of grain was real. With today's greens commonly maintained at 5/32nds of an inch or less, grain simply does not have a chance to develop. Today, when television announcers mention grain, the effect is more likely due to the slope and the contour of the green, not the way the grass plant grows.

Nonetheless, surface preparation is still important. The smoother the ball rolls without bouncing and the truer the ball tracks, the better the putting surface will be for that member-guest tournament or for the U.S. Open Championship.

Some surface preparation techniques have already been mentioned. The act of working light rates of topdressing

Brushing lifts runners so they can be trimmed easily.

material into the grass lifts runners and prostrate leaf blades, which are then cut off. Topdressing also fills small depressions, resulting in a smoother putting surface with less bouncing of the ball as it rolls. Topdressing helps firm a putting surface, which reduces the effects of footprints or other traffic.

Double cutting and rolling are other forms of surface preparation, as are light grooming or vertical mowings. The need for these last two operations is up to the golf course superintendent. If the putting surface is thick and matted prior to the tournament, vertical mowing of the grass, along with light topdressing, will help thin it out.

Mechanical groomers, if not set too deeply, help to groom the putting surface by lifting and cutting the horizontal leaves and stems. Care should be taken not to schedule these operations too close to the event, since the grass needs time to heal. These are abrasive techniques, and they can shock the grass. In my opinion, little should happen mechanically to the grass on the greens the week prior to the event except double cuttings, rollings, etc.

A less-abrasive technique to groom and prepare the putting green surface is to literally broom them. Long-handled brooms with soft bristles can be used to gently lift runners prior to cutting and enhance putting green quality before and even during an event. The technique is labor intensive, but it is perhaps the best surface preparation technique the superintendent can use immediately before and during the tournament. A benefit of this technique versus mechanical grooming is that weak areas in the outer edges of the greens, or on high or low spots, are much easier to avoid with brooms than is possible with machines.

Chemical Applications

This is another area where the superintendent needs to *plan backwards*. The superintendent should avoid having a sprayer out on the course to control disease or insects during the event. Grass that is white with a chemical spray or has a strange odor does not reassure golfers, and it is bad public relations.

Most superintendents have a favorite chemical spray that lasts a long time and controls a broad range of diseases that could occur during the tournament. This spray should be applied, preventatively, a few days before the event so the residual, or length of control, lasts through the days of the tournament. The same rationale exists for insecticide applications. Experience, planning, and common sense are critical in planning pesticide applications so that the turf is disease- and insect-free for the tournament.

Irrigation

Wet greens are soft greens. Wet greens are slow greens. Wet greens footprint. Wet greens have more disease problems. Wet greens are problem greens. Sometimes the golf course superintendent cannot control the amount of water the course receives. Additionally, the golf course superintendent might not be allowed to cut down trees, prune limbs, remove underbrush, or even install a fan in order to improve the grass-growing environment over and around a green. Sunlight and improved air circulation help a green dry out and help the turf to thrive. Suffice it to say, when preparing greens for tournament play, a good green is a dry, firm green.

When possible, hand water greens prior to and through the event. Normally, it is not a good idea to soak greens prior to the tournament or on the days of the practice rounds. Worse yet is to water greens simply to soften them up (usually requested by one segment of golfers). Never intentionally water the approaches or fronts of greens to make the golf course play harder.

Keep perimeter irrigation to a minimum. After all, perimeter irrigation systems that use full-circle sprinkler heads tend to concentrate water in the middle of the greens, where most of the heads overlap. Thus, use the perimeter irrigation system only when necessary, and supplement all irrigation by hand watering the greens, including the collars, mounds, or other *hot spots*.

One final point. Hand watering is too important an operation to delegate to anyone other than your best employees. As with spoonfeeding greens, you can always go back and add more water to an area, but once the soil becomes too wet, it's hard to remove the excess. The goal should be a light, frequent watering program to maintain firm greens without compromising the health of the grass.

Manicuring/Detailing the Golf Course

Space does not allow for all of the details of course manicuring and presentation that can be so important in preparing your golf course for an important tournament. A quick list of items includes: new tee towels, new or freshly painted tee markers, fresh soap and clean water in ball washers, new flags and flagsticks, new hole liners, properly functioning rakes in the bunkers, edged and hand-raked bunkers. Take some extra time just prior to the event to fix non-repaired or poorly repaired ball marks on greens and divot marks on tees and fairways. Also, re-mark water hazards, provide a clean and neat practice tee, blow leaves from greens, tees, and fairways, and make sure your course is well trimmed.

Also consider saving the best hole locations and reserving areas on tees, especially on par-3 holes, so the golfers who play the course will have the best grass on your greens and tees. You should work with the golf professional and/or tournament chairman to save the best putting green and tee locations. Basically, the goal is to present a neat and manicured golf course. This *attention to details* is so very important. These things golfers see when they play your course.

Finally, how about addressing the issue of *going spikeless*, or using alternative spikes for the event? It is amazing to see the difference in putting quality between using the traditional metal spike with the raised metal shoulder and the spikeless or alternative spiked golf shoes. Some traction may be sacrificed on some surfaces and in some situations, just as with metal spikes, but there is no denying that the greens and the quality of the putting surfaces are improved. This is something to consider. Also, it is a very tangible way that golfers can influence, in a positive sense, how the greens on their golf course look and play.

In summary, the reputation of every golf course is either enhanced or hurt by the condition of the golf course during an important golf tournament. Consider the items discussed in this article. Some may be appropriate for your golf course; some may not.

Finally, today's golf course superintendent is an essential member of the team that prepares and presents a golf course to the players and their guests. Be part of this team. Long hours go into the preparation of the golf course for a tournament. And, when invited, enjoy the social aspects of a golf tournament. After all, you deserve it!

STAN ZONTEK *is director of the USGA Green Section Mid-Atlantic Region.*

THE BUILDING BLOCKS OF A SOLID MAINTENANCE PROGRAM

Golf course maintenance is often complex and confusing. How can the superintendent and course officials sort through maintenance issues and prioritize their investment of time and money?

by R. A. (BOB) BRAME

The triplex tire mark depression shows how mowing equipment can affect putting surface quality and demonstrates the impact of mowing height. The wheel mark depressions allow the grass to have more leaf tissue. This slight increase in mowing height produces a fairly clean stand of bentgrass, while the majority of the putting surface is heavily infested with Poa annua.

IN A HIGH-TECH WORLD it often is difficult to sort out golf course maintenance issues. A question often asked on Turf Advisory Service (TAS) visits is, "How do we prioritize our maintenance efforts? We understand your individual recommendations, but how does it all fit together?" This article provides a systematic approach for prioritizing golf course maintenance decisions.

First, it is important to understand the three major components in every maintenance decision: agronomics, economics, and politics. No operation is immune from these three ingredients. However, the importance of each will vary depending upon the personalities at the course and specific maintenance issues. Although it is important to consider individual details of these three categories, they tend to weave together and are impossible to separate.

Politics often can be offset by positive, proactive communication. An article published in the November/December 1996 *Green Section Record* elaborates on the importance of communication in golf course maintenance. When considering agronomics and economics, agronomics should be given the higher billing. Investing in a basic agronomic program pays dividends over the long run and leads to positive economics. This does not mean economics should be thrown to the wind, but agronomics is the vehicle that carries the real payload. Focus on solid agronomics, and when economic

The microenvironment of this site has been improved by a combination of tree removal to improve morning sunlight penetration and installing a fan to maintain surface air movement.

alternatives exist that do not compromise solid agronomic building blocks, cost savings can be safely considered.

So, what are the agronomic building blocks upon which a high-quality maintenance program should be built? There are four: **water management** (drainage/aerification and irrigation), **growing environment** (sunlight and air movement), **mowing** (bench setting, type of mower, and sharpness), and **fertilization**. While these four agronomic building blocks can be applied to all playing surfaces, greens are the heart of any golf course maintenance program.

Water Management

A few years ago a survey of the Green Section staff identified *overwatering* as the most common agronomic pitfall in golf course maintenance. This is not surprising, given the many side issues that tie directly to overwatering. Turf health, playability, and operating costs are a few key factors that are directly connected to water management.

The water management equation includes drainage and irrigation. Since aerification (any type) improves air, root, and water movement in the root zone, aerification/drainage and irrigation should not be considered separately. The equation looks like this: **Water Management = drainage/aerification + irrigation/rainfall**.

Conceding there is little that can be done about rainfall, the importance of drainage/irrigation is brought into focus. There are two basic types of drainage: (1) surface runoff and (2) downward movement of water through the soil. Both are important, but positive surface runoff is vital and emphasizes the importance of proper design. The more directions water can run off a green after a heavy rain, the better. Although it is possible to modify surface runoff after construction, this can be difficult and the results often are inconsistent. If a *bird bath* depression is present on a soil-based green, the possibility of installing a wide and very subtle surface runoff channel should be considered before taking the next obvious step — adding drainage.

A subsurface drainage system, combined with positive surface runoff, achieves the best possible movement of water. It is true that a few courses have been able to install subsurface drainage lines in greens after construction and achieve improved water movement, but the best approach is to build in good drainage during construction. When poor surface runoff is combined with non-existent subsurface drainage, rebuilding should be considered along with the potential value of installing

runoff swales and/or drainage lines. The long-term improvement of turf health, playability, and maintenance costs may justify the cost of rebuilding.

Since aerification improves internal water movement (in addition to other agronomic benefits), it should be viewed as a key maintenance tool. This is true despite the occasional outcry from golfers trying to putt on aerified greens. The frequency of aerification, type of equipment, and processing or removal of cores must be custom-fitted to a course's needs. Recognizing the importance of well-timed aerification, do not allow players to dictate maintenance timing. Any short-term inconvenience will return dividends over the long haul.

Volumes have been written about golf course irrigation. The bottom-line focus should be to maintain ideal soil moisture conditions for the health of the turf. A high-quality irrigation system is an invaluable asset, and labor expense directed toward hand watering is money well spent. Regardless of how good an irrigation system may be, if the intent is to maintain ideal soil moisure conditions, hand watering will occasionally be necessary.

Growing Environment

The importance of positive air movement and direct sunlight to the health of the turf are often overlooked when prioritizing the investment of time and money to build an agronomically solid maintenance program. Yes, many people have heard that trees can cause sunlight and air movement problems, but course officials/owners often do not place enough weight on the negative impact that too many or badly placed trees can bring to agronomic conditioning.

Try to provide the turf at least eight hours of direct sunlight each day, as early in the day as possible. Morning sunlight is the most important for the growth of healthy turf. Remember also to consider the changing angle of the sun with the passing seasons. There is absolutely nothing that can be done to counteract inadequate sunlight, short of opening up the growing environment through tree pruning or removal.

Sunlight is necessary for the photosynthetic process. Air movement is needed to help dry and cool the surface. If trees and/or underbrush are blocking air movement, their presence should be viewed as a direct threat to turf health and the resulting course playability. Oscillating fans can be a very good investment when air movement needs to be improved. First, do any needed tree and/or underbrush removal and then consider oscillating fans as a supplement to further improve air circulation.

Mowing

This building block has three subcomponents — type of mower, blade sharpness, and bench setting. There are many greens mowers to choose from. The first decision is whether you want a triplex or walk-behind unit. Walk-behind units normally produce a better quality of cut, with less stress on the turf. However, many courses continue to achieve acceptable results with triplex units. There are differences among mowers within each of the two major categories (triplex walkers), including such factors as weight, width, and type of mowing head. The types of rollers and blades, as well as their sharpness, also will impact mowing quality. It is very important to match the correct mowing equipment with a course's needs.

The bench setting, which affects the amount of leaf tissue available to absorb sunlight, obviously impacts plant health. Lower mowing heights may produce faster green speeds, but they weaken the plant and reduce turf dependability. Defining what is too low for healthy, dependable growth is related to the turf species and variety being maintained. There are limits to agronomically sound mowing heights and the resulting green speeds, despite cries from some golfers for faster and faster surfaces.

Fertilization

Fertilization is as important to the grass plant's health as how we eat is to ours. We have the luxury of choosing what we eat (some choose better than others), but a grass plant must live or die with what we provide. The first step is annual representative soil testing. Carefully monitoring soil chemistry, year after year, makes it possible to fine-tune fertilization treatments. Tissue testing, at this point, may confuse and unnecessarily complicate putting green fertilization.

An article published in the March/April 1995 *Green Section Record*, titled "A Practical Approach to Putting Green Fertilization," provides a guide for fertilization in the north and central parts of the country. Plant feeding requirements vary with species, variety, location, soil chemistry, traffic, weather conditions, and other factors. Yet, proper fertilization is essential to plant health.

Conclusion

A solid foundation in the areas of **water management, growing environment, mowing**, and **fertilization** enhances all other golf course maintenance efforts. Conversely, you cannot compensate for limitations in one or more of these areas by using fine-tuning strategies, which include pesticide application programs.

Keep the focus.

BOB BRAME *is the Director of the Green Section's North Central Region. He is responsible for the administration of nine states and focuses his TAS visits in Ohio, Indiana, and Kentucky.*

A Key for Prioritizing the Focus of a Golf Course Maintenance Program

- Putting surfaces are the most important areas on a golf course. The ranking of tees, fairways, bunkers, roughs, and other areas will vary.
- Consider the three main components of every maintenance decision: (1) agronomics, (2) economics, and (3) politics.
  - Proactive, positive, creative communication helps offset politics. Invest as much time in communicating as agronomics.
  - Solid agronomics safeguards long-term economics. With the focus on building an agronomically solid foundation, economic choices will be much clearer.
  - Agronomically, invest your first dollar and all your best efforts in:
    1. **Water Management** (Drainage/Aerification and Irrigation),
    2. **Growing Environment** (Sunlight and Air Movement),
    3. **Mowing** (Type of Mower, Sharpness, and Bench Setting),
    4. **Fertilization**.

FAIRWAY TO THE FUTURE

Course renovation does not always have to be painful.

by BO LINKS

YOU SAY you want a revolution? Ever been in a feisty mood, ready to rub your hands together and stir up some mischief? Not just a little bit of mischief, mind you, but real trouble, as in Big *T*, which rhymes with *C*, which stands for *controversy*? The recipe is relatively simple, and when properly followed, it can ignite a civil war, pit family against family and, if things really get cooking, probably sever a few long-standing friendships. Here's what you do: Step 1 — Attend your club's annual meeting. Step 2 — Rise to make a motion. Step 3 — Move that the golf course be remodeled.

Don't worry about whether the motion passes. The debate alone will do enough damage to satisfy the sternest shrapnel-tested combat veteran.

Why is this so? Because club members hold their home course as close to their hearts as one of their children. And just as with a wayward child, the average member will leap at the chance to take a little corrective action if given the right opportunity. The problem is that, oftentimes, club members cannot — and do not — agree on what needs to be done. Hence the debate, the controversy, the civil war.

It doesn't have to be that way. A host of good things can flow from a properly conceived and well-executed remodeling job. For openers, how about greens that drain correctly and are playable the day after a heavy rainfall? Or bunkers that have consistent, playable sand? Or approach shots that are properly framed, inviting players of all abilities to test their skill? Or tees that are level and pointed in the right direction? You can have all of this and more. The only trick is securing membership approval and then getting the job done right.

The issues relating to course remodeling are as many as they are complex. We've all heard the horror stories as well as the grumbling that accompanies them.

"They said it would take nine months, but it took two years and our new greens are as bumpy as an alligator's hide."

"Why did you install that bunker?"

"Why did you remove that bunker?"

"Why did you make such a mess?"

"Why did it cost so much?"

Heard enough? Well, relax. These are the easy questions, folks.

Although we do hear horror stories and we must often confront hard inquiries, we don't hear enough about the jobs that go well. You know, those believe-it-or-not tales of construction jobs that come in on budget and ahead of schedule. Yes, it has happened. And it can happen to you if you approach the issue properly and prepare accordingly.

At Lake Merced Golf and Country Club in Daly City, California, a complete remodeling job was accomplished without a hitch, with far more accomplished than even the most rabid backers of the project could have imagined.

The actual construction at Lake Merced took approximately 90 days. The financial package was such that every member could afford the assessment. And in the end, a good golf course was transformed into a truly extraordinary one. By the time the project was two-thirds finished, even those members who had voted against doing the work had come on board as enthusiastic supporters.

Doing the Job Right

But all of this begs the most important issue. How do you get this accomplished? To begin with (and to quote those athletic wear ads), get real. Lake Merced was not remodeled on a whim. This wasn't the case of a member or small cadre of players wanting to change the course to suit their own agenda. Quite to the contrary, Lake Merced's remodeling grew out of a serious deterioration of putting green root structure and poor drainage in and around the green complexes. Once the club investigated the problem and decided to correct it, knowledgeable members soon realized that the economies of scale dictated that they take advantage of a unique opportunity to repair other problems that, while not as serious as the condition of the root structure and drainage, had long cried out for amelioration. In short, the club confronted an agronomic crisis and chose to solve it in comprehensive fashion. And they did it within budget. And on time.

The formula used at Lake Merced is a textbook example of how to do the job right. In reviewing the history of the remodeling at Lake Merced, we can learn several rules that should guide any golf course confronting similar problems or contemplating similar work.

Analysis Instead of Paralysis

One point to be made at the outset is that many good to great courses — and many average ones, too — have serious agronomic problems. Not because there is anything inherently wrong with the layout or because there has been any failure of performance by the maintenance crew. The plain and simple fact is that golf courses change over time. Every day there is growth and death; trees die, roots impede nearby putting greens, limbs fall, fungus spreads, old soil compacts. Let's face it, nothing is forever, and even golf courses need some corrective surgery now and then. So rule one is, always be aware of the agronomic profile of your golf course. There are several ways to do this, but perhaps the most economical and efficient is to take advantage of the USGA's Turfgrass Advisory Service (commonly known as TAS). Under this program, USGA agronomists visit your course and advise you as to the status and needs of the playing surface. In the case of Lake Merced, it was time and money well spent.

At Lake Merced, we first learned of the problems with our putting green root structure while preparing the

Lake Merced's number three hole is a 185-yard par 3. By rearranging the bunkers during renovation, the bunkers were eliminated on the far side of the green and well short of the green. These bunkers had served only to penalize the high-handicapper playing the course. The temporary greens, built for golfers' play during construction, were quite good and kept the golfers happy during the construction process.

course for the 1990 U.S. Junior Amateur. "When the USGA cored our greens and showed us the turf samples, it verified what I had been saying for some time," comments Superintendent Lou Tonelli. "We had a 'black layer' beneath the surface. None of our members could see it and many of them thought everything was fine because we were able to limp along and produce good putting surfaces through the use of appropriate fertilizers and an awful lot of overtime labor. But our greens had become drug addicts and they couldn't exist for long if they stayed dependent on chemicals for survival."

What caused the problem? "Our course was originally constructed in the early 1920s. It was a tremendous track, but it had to be rebuilt in the mid-'60s," states Tonelli. "The work had to be done because an interstate freeway took away the heart and soul of the original layout. When the greens were rebuilt back then, they used loam over the drains. It was a formula for disaster and it caught up with us after 30 years.

"The loam compacted and trapped water before it ever got to the drains," continues Tonelli. "We had stagnant water beneath the surface and anybody with any brains knows you can't grow grass in stagnant water. Our root structure was only about a half-inch deep. To compound the problem, we had to battle nematodes. With a shallow root structure, it was only a matter of time before disease won the battle and overtook the grass. Our greens were virtually defenseless. We had to do something or risk losing them."

Once the condition of the greens had been diagnosed and the evidence was collected, the next task was to educate club officials as to the seriousness of the problem. That process took about two years. Lake Merced's Greens & Grounds Committee learned what was needed and began passing its knowledge to the full Board of Directors and other members as well.

Within five years of the problem first surfacing, many — but not enough — club members were aware of the existence of the troublesome black layer and the need to correct the conditions that caused it. That's when things got dicey.

A proposal was made to remodel the golf course and cure the problem. Meetings were held and debate raged; no member could get a drink in our clubhouse bar without confronting the hard questions: Did we really need the work? What would it cost? Who

would do it? How long would it take? What would the finished product look like? The controversy created by the remodeling issue gave pause to everyone, particularly to the project's most fervent backers; they soon realized that if the matter were put to a vote, they would lose, and soundly. They wisely backed off and regrouped. Yet in that early setback, the proponents of the remodeling project learned a valuable lesson: Make sure every single club member is informed *before* laying the issue on the table.

One goal of the renovation process was to integrate the bunkers . . .

Do the Homework and Present a Complete Package to the Membership

The Greens & Grounds Committee and the Board of Directors went back to work and did some more homework. "One thing we realized," comments Dr. Merton Goode, who was one of the board members actively promoting the remodeling project, "is that our full membership simply did not understand that this work was not a frill or a whim. It was something we absolutely had to do in order to save our golf course. We had to make the case, and once we did, the issue easily gained the support of the entire membership. The facts really brought us together."

One technique Dr. Goode and his small committee utilized was to target literally every member in the the club and arrange for small sessions where people could be taken out on the course, shown turf samples, and allowed to see the problem in practical terms. Members came to learn that with better drainage, the course would be playable after a heavy rainstorm, as opposed to having to wait a week or more for soggy greens to dry out. Others could see how proper drainage would eventually, and substantially, reduce maintenance expenses.

"We knew the issue was not about us," observed Club President Stan Friedman. "It was about our children and grandchildren. Although we restored a historical look and feel to our golf course, what we really did was build a fairway to the future so generations yet unborn will be able to enjoy our facility."

When it came time to take a second vote, a complete plan was placed before a membership that was ready to receive it. Financing was arranged so that there were a variety of packages available; if members wanted to pay the assessment at once, they could do so, but they could also defer payment under several monthly payment options. If a member withdrew from the club before completing payment of the assessment (or prior to completion of the work in the case of a member who paid in full at the outset), he could get a pro-rata refund for his unused assessment. In short, money was removed from the debate. The only issue left was whether the work should be done.

Playing Through

Our superintendent and his crew built *a course within the course* so members, particularly older members, would be able to play an executive course while the reconstruction work was being done. This arrangement worked beautifully, as no one was prevented from enjoying a regular weekly game. Indeed, the *temporary greens* were of such quality that when Superintendent Lou Tonelli aerated them, several members asked him jokingly why he hadn't cut temporaries for the temporaries. It was the ultimate compliment.

Economies of Scale

As the plan took shape, it originally consisted of remodeling all 18 greens and every bunker on the golf course. Although first consideration was given to dividing the work and doing six holes at a time, the club quickly opted to take the plunge and do everything at once. "We wanted uniform putting greens," stressed Dr. Goode. "The only way to ensure that was to do them all at once."

Soon the club realized something else. It was possible to incorporate several additional jobs into the program at marginal cost. For example, a decision was made to regrade all tee complexes and elevate the majority of them for better visibility. In addition, several improvements were made to the irrigation system, including installation of computer controls for individual sprinkler heads, and the installation of special sprinkler heads around the greens to ensure proper watering. "If we had done this work separately," remarked Dr. Goode, "it would have cost us ten times what we ended up

. . . into the golf course to add to the continuity of the course.

spending and we would have had to rip up our golf course again to do it. In essence, we got three jobs in one."

How long did it take? At Lake Merced, the first cut of dirt was made on August 6, 1996. The last cut was made on November 24, just before Thanksgiving. That's 110 days, but the total requires a bit of analysis. The original goal of new greens and bunkers took only 78 days to complete. The extra time was allotted to the complete regrading of four fairways, the reconstruction of all 18 tee boxes (four sets of tees for each hole), and miscellaneous work on the irrigation system. The bottom line is that the membership got a new facility in about three-and-a-half months.

There was some rain toward the end of the job that resulted in a week of cleanup work. "The job was completed before the rainy season," says Dr. Goode, "and the most compelling apsect of the onset of winter was that our new greens were bone dry the day after getting hit with an awful lot of water." By the time winter had actually come to the Bay Area, the seeded areas were covered with new growth and had roots in place to prevent a washout, and sodded areas were well on their way to knitting together. Because of improved drainage, there was no standing water on any of the greens or in any of the bunkers.

"We cored some of our new greens 30 days after seeding," beamed Superintendent Tonelli, "and we could see a four-inch root structure. That means that in the first month we got roots that were *eight times* deeper than our old greens that had been there for 30 years. It was the best validation we could have hoped for."

In order to maintain the highest-quality putting surfaces, the club will require players to wear spikeless golf shoes. "The spikeless alternative is the future," says Goode. "Those of us who have tried them know they provide enough traction, and at the same time allow us to have greens without spike marks. By taking this step, we also can open our course at the earliest possible date and know that we're not tearing up the course which took so many talented hands to build."

Watching the New Course Come into Being

One thing that impressed the entire membership was how fast the grass grew. "Many of us had no idea how quickly the seed germinates," says Club Professional Jay McDaniel. "We seeded our third green in early September and we could have been putting on it a month later. Once our members saw that type of progress, the excitement meter shot upward in a hurry." Of course, the tees and greens were closed to regular play for approximately seven months following the construction phase (ten months in all). When the club reopened to full play this June, members were happily strolling down the fairways of a championship track with U.S. Open quality greens.

"For many of us," says Paul Leiber, Lake Merced's current President for 1997-98, "this has been like the birth of a child. We're watching the course come to life right before our eyes."

Getting the Right People to Do the Job

Although some may question the time and money that go into a remodeling project ("Why didn't they get it right in the first place?!"), there is a simple answer to the criticism. Quality golf course design and construction take time, require effort, cost money, and after enough years pass, may need upgrading. Most important, when Mother Nature points out a specific problem, as she did at Lake Merced, a club refuses to respond at its peril.

When tackling a remodeling job, a club would do well to seek out an architect and construction team who are in business for the craft, and for the love of doing things right. Because if the proper sequence of elements is in place, if the work is done correctly and with a touch of artistry, it has a good chance of creating something magical that has the quality of great music. Indeed, as every true golfer understands, when a hole is done right, it has a pulse, a beat, a tempo — an overall rhythm that makes a player's heart dance.

At Lake Merced, we not only hear and feel the music — we can see it, too. Our 18 holes will be making hearts dance for generations to come.

Living in San Francisco, California, BO LINKS *is a trial lawyer, photographer, and published author. He has served on the USGA Green Section Committee since 1991.*

THE TEN COMMANDMENTS

I. *Thou Shalt Seek Out Objective Analysis*

If you really want to know where you stand regarding the condition of your golf course, bring in an objective, outside evaluator, such as the USGA Turfgrass Advisory Service (TAS) for a full day's visit. Consultation with knowledgeable, objective experts will save months of research and avoid guesswork. Arm yourself with the facts before proceeding further. The key issue is: Do you need to do anything, and if so, what?

II. *Thou Shalt Educate Committees*

Make sure the Green Committee participates in all meetings with outside professionals, including all TAS visits. They can't do their job without knowing the status of the golf course and how to address diagnosed problems.

III. *Thou Shalt Educate the Golfers*

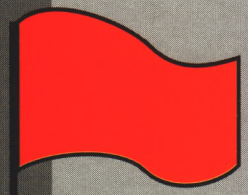
Course remodeling can be an emotional issue, and it may take time to make the golfers fully aware of problems that have been diagnosed. Go slowly, pay attention to everyone's varied concerns, and be sensitive to the fact that many golfers may not at first appreciate the seriousness of the problem. Give them time. Proceed golfer by golfer, talking to people on an individual or small group basis.

IV. *Thou Shalt Develop a Plan and Stick To It*

If the data support some form of remodeling or renovation, don't ignore the problem and, equally important, don't rush to cry out, "Let's remodel!" Decide what is needed, develop a realistic plan to accomplish specific goals, and make every attempt to finance the work without having the price become the main issue. Before submitting a plan, know the scope of the work, the true cost, and a realistic schedule.

V. *Thou Shalt Understand the Economies of Scale*

Keep in mind that it may be most efficient to do all the needed work at one time, rather than spreading it out over several years. A course can achieve substantial savings by having one crew and a single deployment of equipment. There also can be sizeable savings through *bulk buying* when it comes to purchasing the various supplies needed to do the job. If there are related tasks the golf course is contemplating (improvements to the sprinkler system, new irrigation pipes, etc.), consider doing the work at the same time as the remodeling job so as to minimize the inconvenience to the golfers. The only thing worse than having your golf course torn up is having it torn up more than once.



VI. *Thou Shalt Select a Cohesive Project Team to Do the Work and a Small Committee to Oversee It*

Make every effort to have a cohesive team in place. If the architect you select has a preferred contractor, give that recommendation serious consideration. Price may be a factor here, but consider that having a team working together — rather than one beset with internal friction — will likely save money in the long run and, more important, produce a superior end product. In addition, have a small committee oversee the project. No orchestra ever played a symphony with multiple conductors twirling the baton at the same time, and no remodeling job ever succeeded with an army of armchair architects "supervising" the real architect. Use the committee as the interface between the

OF COURSE REMODELING

architect, contractor, and the golfers. While opinions from knowledgeable golfers about playing conditions and potential changes in course design can be helpful, they should be filtered through the committee, rather than having the architect and contractor besieged by *golfers' input* during the job.

VII. *Thou Shalt Respect Mother Nature*

Realize that seasons change and so does the weather. Winter is not a good time for heavy construction work (rain is a four-letter word to golf course contractors). Anyone reseeding needs to give the grass enough time to *grow in* before the rainy season arrives. While no one can predict the weather, careful planning can allow the work to be done during the spring, summer, or fall — during a dry period and a good growing season — when earth moving can be done easily and efficiently, and the grass can be in place before trouble (in the form of rain) arrives. While this may entail cutting into the course's *busy season* and the remodeling work may result in some loss of revenue, in the long run it will be an advantage to have new fairways, bunkers, and greens in place with the grass *rooted* before the rains come.

VIII. *Thou Shalt Be Reasonable With Respect to the Difficulties of the Job*

Understand that there will be unforeseeable events. The contractor may encounter bad weather, unmarked utility lines, and so forth. Make every effort to anticipate these items and arrange for underground services to be marked ahead of time, but keep in mind that the unexpected can and will occur. No job is perfect, but the more reasonable people are about seeing the task through to completion, the better off everyone will be.

IX. *Thou Shalt Keep Thy Golfers Informed*

At most courses, even the *naysayers* eventually come to support the project. The key to producing a turnaround is informing everyone, including the doubters, and keeping them informed as the job moves forward. Take golfers on tours of the course and show them the work in progress, explaining how the greens are being built and how the new drainage system beneath the greens and bunkers is being installed. They can see for themselves how substantial the improvements are and how efficiently the contractor is proceeding to complete the job. One tip worthy of note: If possible, have the contractor complete the areas visible from the dining room first, so visitors can see the progress, rather than be constantly exposed to plowed dirt. And note: Make sure your golfers know what to expect once the job is done; perhaps the greens will be slow at first, and maybe there will be some plugged lies in bunkers. For an excellent reference, see "Avoiding the Hazards of Golf Course Renovation," *Green Section Record*, July/August 1995.

X. *Thou Shalt Make Arrangements for Golfer Play During Construction*

One of the biggest problems is making sure golfers can play golf while the remodeling work is ongoing. This can be done by making arrangements with neighboring courses or by constructing first-class temporary tees and greens within the existing golf course. Note: The issue of providing access to golfing facilities is especially important for older golfers, who may feel their course is being taken from them during their *last years* of being physically able to play. Aside from helping them understand that their present-day sacrifice will provide for their grandchildren, it helps to accommodate their needs so they not only can watch the future being built, but play their way into it at the same time.

— Bo Links

THE CHOKER LAYER

An examination of the water content of a USGA rootzone mixture in the presence and absence of a coarse intermediate layer.

by RAYMOND H. SNYDER and JOHN L. CISAR, Ph.D.

THE United States Golf Association has long been regarded as an innovator in putting green construction. Since the 1960s the USGA has suggested recommendations for putting green construction based on research conducted by a number of scientists at various institutions. These recommendations have been "the most widely used method for green construction throughout the United States and in other parts of the world" (Hummel, 1993).

The objectives of the USGA's recommendations for green construction are clear: Create a green that drains rapidly, resists compaction, and provides a suitable medium for plant growth. Additionally, a high level of uniformity exists within a golf course when all of its greens are of similar USGA specifications, a valuable characteristic when developing a turf management program because a turf manager is able to apply similar management practices to all of the greens, reducing confusion and headaches (in today's world, wasted time equals wasted money).

The components of a USGA green as initially described (USGA Green Section Staff, 1960) are: 1) the subgrade, 2) drainage pipes, 3) gravel layer, 4) intermediate layer, 5) rootzone mix. Each component is required to meet strict USGA recommended specifications to ensure a properly functioning green. (As of 1993, the need for the intermediate layer is determined by the properties of the gravel and rootzone mix.)

The trademark of the USGA green is an enhancement of the water-holding capacity of the rootzone mix relative to what would occur in the surface horizon if the same-textured rootzone mix extended to the subgrade of the green. This enhancement is created by placing the rootzone mix over a coarser-textured layer of sand, the intermediate layer or, as it is often called, the *choker* layer. Water held in the fine-textured rootzone layer does not pass into the coarse-textured layer "until the pressure head at the interface builds up sufficiently for water to penetrate into the coarse material" (Hillel, 1982). This essentially means that the pores in the rootzone mix must become nearly filled near the interface with the coarser sand before

The research study investigated the moisture-holding capacity of a green constructed with and without the intermediate layer, using a rootzone mix with physical properties recommended by the USGA.

water will move into the underlying coarse-textured layer. The enhanced water-holding capacity is often called a "perched water table." However, since the pores in the rootzone never remain saturated for an extended period of time, a true water table does not exist and the term "perched water table" will not be used herein. The enhanced water-holding capacity is important, because without it, the rootzone mix would be less able to hold sufficient water to maintain the turfgrass between reasonably scheduled irrigations during periods of heavy play and tournaments, or when regulatory agency irrigation restrictions are mandated.

The intermediate layer component (choker layer) of the USGA green has been the source of much debate. The intermediate layer is comprised of sand particles between 1mm and 4mm in diameter. Its original purpose was to prevent migration of sand particles from the rootzone mix into the gravel layer (Hummel, 1993). However, many golf course architects and superintendents have considered the intermediate layer to be the reason for the enhanced water-holding capacity of the rootzone. In fact, enhanced water-holding capacity will occur with or without the 1mm to 4mm particle-sized intermediate layer, as long as the rootzone mix is placed over a coarser-textured layer, such as the gravel layer.

The high cost of the intermediate layer has also made it the subject of controversy. The cost of the intermediate layer is high because guidelines call for a narrow particle range, requiring careful sieving by suppliers. Furthermore, the additional time and labor required to add this layer in green construction increases its cost. To reduce costs, many construction companies eliminate this layer during the construction of new greens; some such greens function correctly, but many fail.

The USGA recognized that it could better serve the industry by providing specifications for construction when the intermediate layer is omitted, and published revised specifications in 1993. When the intermediate layer is omitted, very strict gravel specifications must be met (Hummel, 1993).

Many in the golf course construction industry have discontinued the practice of installing the intermediate layer following the release of the new specifications; therefore, the effects of this practice should be examined. Miller and Bunger (1963) showed that the moisture content of the rootzone mix overlying a coarse sand material is less than that of a rootzone mix overlying a gravel material. The soil material used in their experiment was a sandy loam (54% sand, 36% coarse silt, 3% fine silt, and 7% clay), which is not a rootzone mix that meets USGA specifications.

Table 1
Particle Size Distribution of USGA Rootzone Mix Used in This Experiment

Name	Particle Diameter	Specification	Used %
Fine Gravel	2.0-3.4mm	Not more than 10% of the total particles in this range, including a maximum of 3% fine gravel (preferably none)	.3
Very coarse sand	1.0-2.0mm		9.6
Coarse sand	0.5-1.0mm	At least 60% of the particles must fall in the coarse and medium sand classes	48.0
Medium sand	0.25-0.50mm		34.1
Fine sand	0.15-0.25mm	Not more than 20% of the particles may fall within this range	7.9
Very fine sand	0.05-0.15mm	Not more than 5%	0.0
Silt	0.002-0.05mm	Not more than 5%	0.0
Clay	Less than 0.002mm	Not more than 3%	0.0
	VFS + S + C should not exceed 10% of total		

An experiment was conducted to determine the moisture-holding capacity of a green constructed with and without the intermediate layer, using a rootzone mix with physical properties recommended by the USGA.

Methods and Materials

The experiment was conducted using clear plastic columns having a diameter of 4.5cm and a length of 45cm. The columns were placed upright in a wooden rack. A rubber stopper having two holes was pushed into the bottom of each column and covered with a piece of wire screen. Gravel that met USGA guidelines was placed in the bottom of each column to a depth of 10cm (if no choker layer was to be used), or to a depth of 5cm (if choker sand was to be added). The choker sand was sieved to ensure that it would all be less than 4mm and greater than 1mm. In five columns, a layer of choker sand 5cm deep was added. The sand was packed gently with a wooden rod. The bulk density of each 10cm depth was determined (soil weight/soil volume) to verify the uniformity of packing. Then rootzone mix sand that met USGA guidelines (Table 1) was added to each column to a depth of 30cm. It was gently packed in place with a wooden rod after adding each layer of 5cm. When finished, there was 5cm of unfilled column remaining above the surface of the soil. The two treatments were replicated five times and the columns were arranged in a completely random fashion in the rack.

On the afternoon of the first day, water was added to the top of each column until it dripped out of the holes in the stoppers in the bottom of the columns. Water was repeatedly added throughout the evening and the next morning until 10:00 AM to ensure that the soil was saturated with water. The columns were then covered with aluminum foil to prevent evaporation and allowed to drain for 24 hours.

After draining, the columns were removed from the wooden rack. Using a hacksaw, the top, middle, and lower 10cm portions of the 30cm rootzone mix sand were excised. The length of the cut portion of the column was measured, since sometimes the top or bottom portion was a little more or less than 10cm, and the sand, still inside of the plastic column piece, was placed in an aluminum tray and weighed to the nearest 0.1gm on a top-loading balance. After recording the wet weight, the tray containing the column piece and column was placed in an oven set at approximately 70 degrees centigrade. A higher temperature was not used to prevent melting of the plastic column. Over the next two days, the samples were weighed several times to obtain a constant dry weight. After the first day, the sand was shaken out of the plastic column to speed up drying, but the empty column was placed back into the

Table 2
Bulk Density, Moisture Content, Pore Space, and Air-Filled Pore Space for Different Soil Depths With or Without the Intermediate Layer

Factor	Bulk Density	Soil Moisture By Weight	Soil Moisture By Volume	Total Pore Space	Air-Filled Pore Space
	g/cc	---------- % ----------		%	%
INTERMEDIATE LAYER					
None	1.53	16.52	22.95	42.2	45.1
With	1.55	15.03	21.11	41.5	49.5
Significance	NS	**	*	NS	*
DEPTH (cm)					
0-10	1.56	8.74	12.10	41.2	71.1
10-20	1.53	16.17	22.55	42.3	46.1
20-30	1.54	22.42	31.46	42.0	24.7
Significance	NS	**	**	NS	**
CHOKER DEPTH					
– 0-10	1.55	9.07	12.53	41.3	70.0
10-20	1.51	17.38	23.98	43.0	42.6
20-30	1.53	23.11	32.35	42.2	22.6
+ 0-10	1.56	8.41	11.67	41.0	72.1
10-20	1.55	14.96	21.11	41.5	49.5
20-30	1.54	21.73	30.57	41.8	26.9
Significance of the Choker × Depth interaction	NS	NS	NS	NS	NS

NS means there is no statistically significant difference for the treatment
* and ** refer to statistical significance at the 0.05 and 0.01 probability levels, respectively

tray with the sand. Finally, the sand itself was weighed separately from the column.

The moisture in each column piece was calculated by subtracting the weight of the dry sand, including the column piece and tray, from the weight of the wet sand, including the column piece and tray. The moisture content based on weight was calculated by dividing the moisture by the dry weight of the sand. The bulk density of each column segment was calculated by dividing the dry weight of the soil by the column segment volume. The moisture content of the soil on a volume basis was directly calculated by dividing the moisture weight in grams (which also is the moisture volume in cubic centimeters) by the volume of the column piece. The pore space was calculated *as 100 – (bulk density/particle density)*, assuming a particle density of 2.65g/cc. Finally, the percent of air-filled pore space was calculated as 100 – {(volumetric moisture/pore space)100}, where a mean value of 41.8 was used for the pore space term.

The data were analyzed as a factorial experiment with one factor being the presence or absence of the choker layer, and the other factor being the depth of the rootzone mix.

Results and Discussion

The presence or absence of the choker layer and the depth (rootzone mix section) significantly affected the moisture content (by weight or by volume) and the air-filled pore space of the rootzone mix, but did not affect the total pore space or bulk density (Table 2). The factors of choker and depth should not have affected the bulk density or the pore space (which is calculated from the bulk density) since the rootzone mix was packed above the choker layer and an effort was made to pack it uniformly throughout the soil profile. There were no significant interactions among the choker and depth factors.

It was expected that the lower portions of the soil profile would contain more water than the upper portions, and that is what was found. When the choker layer was absent, the rootzone mix contained more water at all three rootzone mix sections (Figure 1) and correspondingly less air-filled pore space (Figure 2), than when the choker layer was present. This occurred because the matrix suction at which pores fill with water decreases as the pore size increases. Thus, the larger pore-sized gravel layer draws less water from the overlying rootzone mix than does the smaller pore-sized choker sand. The results of this study are consistent with the results found by Miller and Bunger (1963). However, their data could not be used to calculate the magnitude of the difference in water content in a USGA green with and without the choker layer. The water-holding capacity of a soil can be related to rainfall, irrigation, or evapotranspiration by considering a column of soil with unit surface area. As shown in Table 2, the 0-10cm soil column with the choker held 11.67% moisture by volume (11.67cm^3 moisture/100 cm^3 soil). Therefore, a 0-10cm column of soil with a 1cm^2 surface area would hold 1.17cm of moisture (1cm × 1cm × 10cm × 11.67g water/100cm^3 soil = 1.67cm of precipitation, irrigation, or evapotranspiration per cm^2 soil surface). Using this reasoning and the data in Table 2, it appears that with a choker layer, the 30cm of rootzone mix held a total of 6.34cm of water per 1cm^2 of surface area (1.17 + 2.11 + 3.06), and without a choker layer the total was 6.89cm (1.25 + 2.40 + 3.24), for a difference of 0.55cm. So what is the importance of 0.55cm of water? During cool weather in Florida, predicted evapotranspiration (pET) for turf may be only 0.127cm per day (McCloud, 1971). By having an extra 0.55cm of water in the soil profile, a turf manager may be able to delay irrigations by approximately four days, if it is assumed that the turf can extract water from the entire 30cm of the soil profile. Probably the actual delay time will be less, since most of the turf roots will be in the upper part of the profile. On warm, sunny, windy days in Florida, the turf may have a pET of over 0.864cm per day. Under these conditions, the extra water held in the absence of the choker layer probably would not permit the turf manager to delay irrigating even one day. Thus, although the presence or absence of the intermediate layer (choker) was found to have a statistically significant effect on the moisture-holding capacity of the overlying rootzone mix, the effect is probably not of major agronomic importance.

It also is interesting to note that the 30cm profile averaged approximately 6.6cm of water per square centimeter of surface area across the two choker

At the start of the study, each soil column was saturated with water before calculating the moisture content.

conditions. A native deep sand soil probably would hold only 2cm to 3cm of water in the upper 30cm of profile (Smajstrla, 1996). Thus, the value of having a coarse-textured layer below a finer-textured layer for holding additional water was illustrated.

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RAYMOND H. SNYDER *is the 1997 Granville C. Horn Graduate Student Scholarship Award recipient, and* JOHN L. CISAR, Ph.D., *is Associate Professor, Turf Water Management, at the University of Florida. This report is based on a class project.*

Figure 1
Effect of USGA Profile Construction on Water Content by Volume

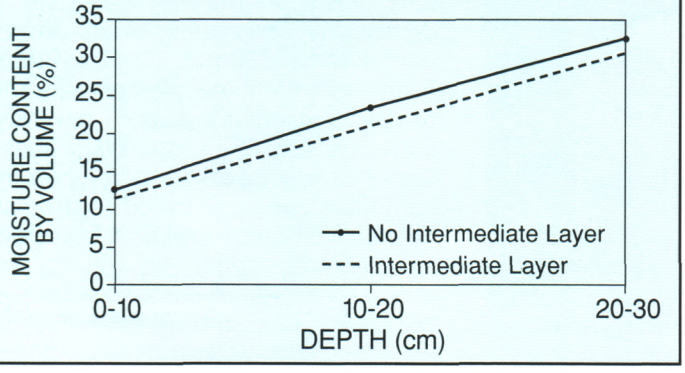
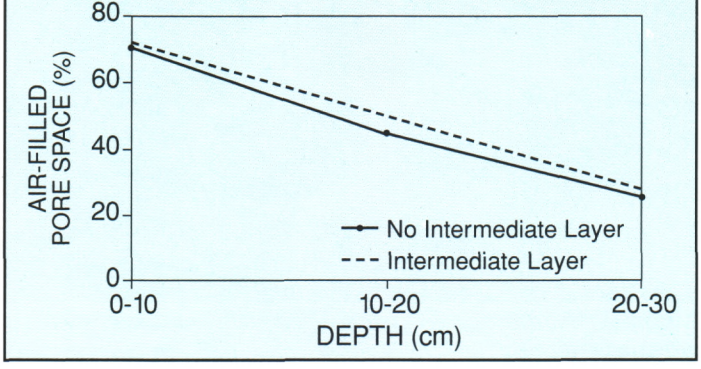


Figure 2
Effect of USGA Profile Construction on Air-Filled Pore Space (based on % of total pore space)



Pop-Up Sprinklers For Mound Irrigation

Mounds can be meaningful additions to a golf course, but sometimes they require special treatment.

by PATRICK J. GROSS

MOUNDS are popular features of modern golf architecture. They add visual interest to the golf course and often increase the difficulty and challenge of a golf hole. Although mounds often look nice, they can be difficult to irrigate and maintain. Even if irrigation coverage is relatively good, the tops of the mounds tend to dry out more rapidly, causing turf decline and an undesirable appearance.

Several factors are responsible for substandard turf growth on mounds. Poor quality soil is often used for construction, creating different water management needs and maintenance requirements. Because of the elevation difference and slope of mounds, localized dry spots often occur on the top, and wet areas develop around the base due to irrigation runoff. Even if the irrigation system is properly designed and installed, perfect coverage is difficult to achieve on hilly areas. Eventually, this can become an unmanageable situation for the superintendent unless plenty of labor is available for hand watering.

Mounds can add visual interest to the golf course, but they are difficult to irrigate. The different management needs of the mounds often result in dry spots and turf decline.

A supplemental irrigation system, specifically for the mounds, can be installed to provide better irrigation control.

As an alternative to costly hand labor, a supplemental irrigation system for mounds can be installed using pop-up sprinklers. There are several models available that typically are used for home lawns and landscapes. The pop-up heads usually cover a radius of 8 ft. to 15 ft. and are ideal for use on mounds. It is recommended to select a sprinkler head with a low precipitation rate since the slow, steady application of water reduces runoff and provides better water penetration. A supplemental system can be easily installed by connecting to a nearby main line and installing either a manual or remote-control valve to operate the system. Most courses that have installed such systems prefer the manual valve, which can be used by the irrigation technician or sectionmen for spot watering only. After connecting the valve, PVC pipe can be pulled or trenched to the desired location, followed by the installation of the pop-up heads.

Before installing a supplemental irrigation system for mounds, it is important to evaluate the existing system to ensure that everything is in proper operating condition. Unlevel sprinkler heads and worn nozzles may be the primary reasons for uneven coverage and localized dry spots. Once these issues have been resolved, the pop-up sprinklers can be installed to provide better irrigation control with fewer wet spots and dry spots.

PATRICK J. GROSS *is an agronomist in the Green Section's Western Region.*

A copy of the Audubon print "Blue Heron" is presented to each fully certified member.

IT'S PARTY TIME!

The Audubon Cooperative Sanctuary Program reaches a milestone.

by RON DODSON

BELIEVE IT OR NOT, it has been five years since the launching of the Audubon Cooperative Sanctuary Program for Golf Courses. In 1991, the Audubon Society of New York State had the idea that a properly sited, designed, and maintained golf course could be an environmental benefit to a community. We believed that it was time for an environmental organization to take a proactive approach to environmental improvement, rather than the typical reactive, negative, anti-everything approach that seemed to be the norm in the environmental movement. As we just complete our fifth year, it is time to reflect . . . and party!

It all started with a couple of courses in upstate New York and a chance meeting between Audubon and the USGA. As we discussed environmental and wildlife issues surrounding the proposed redevelopment of a closed golf course, a light went off. Just possibly, we could gain more if we worked together rather than against each other, particularly since we seemed to really believe in the same things relative to environmental protection. The idea of the Cooperative Sanctuary Program was already in place for homeowners and business properties, so why not take it to golf courses across the country?

During 1991, I had the pleasure of traveling around the United States and meeting with a large number of golf course superintendents, owners, and course officials to introduce the idea of working cooperatively with Audubon. Most of these gatherings took place at regional USGA meetings. If we could get 100 golf courses to enroll as Cooperative Sanctuaries, we might just have a workable program. By the end of 1991, we found that 275 properties had enrolled. There was no question

in our minds that interest was high and the desire was great to merge golf course management and environmental management into a unified program.

During that first year we learned a lot. We learned that many courses were already practicing great conservation management, and many courses had a long way to go. We also learned that those of us who were trained in the wildlife and environmental sciences had a lot to learn about the policies and politics of golf course management.

As a central focus for the program, we created an opportunity for each golf course to become *Fully Certified* in the program. We began by creating certification categories in Environmental Planning, Wildlife and Habitat Management, Water Conservation, Water Quality Management, Integrated Pest Management, and Outreach and Education, to serve as check marks while striving toward Fully Certified status. Today, nearly 100 courses have been fully certified. We have created forms, booklets, fact sheets, and videos, and we have spent countless hours on the telephone explaining what our forms mean, where bluebird boxes are supposed to be placed, and how to discourage Canada geese. We've hired staff that spends 100 percent of their time working with those who manage golf courses. And recently we hired a golf course superintendent to be our golf program specialist.

We have seen the golf program grow from two members to more than 2,000 in the past five years. Although that number is impressive, what is even more impressive is the fact that those Cooperative Sanctuary members represent 359,197 acres of woods, wetlands, prairie, turf, estuary, desert, and other types of habitat that are homes for countless numbers of wildlife species. We have members who have treated secondary wastewater, reclaimed abused land, and who continue to expand their commitment to conservation. This year superintendents around the country have become mentors for school kids and sources of agronomic and land management information for government agencies and homeowners.

From the beginning of the program in 1991, the USGA has been the sponsor. In addition to the financial support that has allowed us to keep the annual membership fee of the program at $100 per course, while at the same time increasing the variety of materials that we are giving members, they have pushed for participation in the program during meetings, in printed materials, and everywhere else they can. Thanks to those of you who took up the challenge, we can now say that the first five years have been a resounding success.

Your involvement has resulted in millions of gallons of water savings, countless kilowatt hours of electricity not having to be produced, huge reductions in the use of non-renewable, chemical-based products for course management, and increases in the biological diversity on courses that have blended the game back with nature. Golf and the environment are both better off because of your involvement. So, from me to you, here is a collective PAT ON THE BACK for your membership, commitment, and support. We believe that you have hit a hole-in-one for the environment, and it is time to celebrate. We'd like to highlight those leaders and staunch supporters who became charter members of the Audubon Cooperative Sanctuary Program for Golf Courses that first year and have continued to support and participate in the program over the past five years.

Together, let's make the next five years even more impressive. Although 2,000 members is exciting, it is only a small percent of the total courses in the United States. Challenge your fellow course managers to follow your lead. See you on the links.

RON DODSON *and the staff of Audubon International are celebrating at the Selkirk, New York, headquarters.*

Scout troops have volunteered to build, install, and monitor nest boxes on the golf course while learning about wildlife habitat management.

Charter Members of the Audubon Cooperative Sanctuary Program for Golf Courses

Golf Course	State	Fully Certified
Chenal Country Club	AR	
Hindman Park Golf Course	AR	05/25/1994
Rebsamen Park Golf Course	AR	
Kierland Golf Club	AZ	
Aptos Seascape Golf Course	CA	
Fallbrook Golf Club	CA	
North Ridge Country Club	CA	
City of San Mateo G.C.	CA	
Bel Air Country Club	CA	
Resort at Squaw Creek	CA	11/21/1995
Olivas Park Golf Course	CA	
Pasatiempo Golf Club	CA	
Bear Creek Golf Club	CA	
Riverside Golf Course	CA	
Morro Bay Golf Course	CA	01/06/1995
Bartley W. Cavanaugh Course	CA	
Crystal Springs Golf Course	CA	
Old Brockway Golf Course	CA	
Stockdale Country Club	CA	
Castle Pines Golf Club	CA	12/16/1994
Fox Hollow at Lakewood	CO	
City Park Nine Golf Course	CO	
Grand Lake Country Club	CO	
Rolling Hills Country Club	CO	
Lakewood Country Club	CO	
Greenwich Country Club	CT	
Country Club of Farmington	CT	
Black Hall Club	CT	
Fairview Country Club	CT	
Woodway Country Club	CT	12/01/1994
Country Club of New Canaan	CT	
Lake Waramaug Country Club	CT	
Country Club of Florida	FL	
Orange Tree Golf Club	FL	
Pelicans Nest Golf Course	FL	
Old Marsh Golf Club, Inc.	FL	
Oak Tree Country Club	FL	
Piper's Landing Country Club	FL	
Grenelefe Golf & Tennis Resort	FL	
TPC at Sawgrass	FL	02/01/1996
Country Club at Jacaranda West	FL	
Feather Sound Country Club	FL	
Johns Island Club	FL	
Fiddlesticks Country Club	FL	
Tampa Palms Golf & Country Club	FL	03/31/1993
Panama Country Club	FL	04/30/1997
Wilderness Country Club	FL	
Farm Golf Club	GA	
Standard Club	GA	02/01/1995
Golf Club of Georgia	GA	
Waikoloa Golf Club — Beach Course	HI	
Kapalua Land Co. — Bay Course	HI	01/11/1993
Kapalua Land Co. — Village Course	HI	09/22/1994
Kapalua Land Co. — Plantation Course	HI	08/22/1994
Finkbine Golf Course	IA	
Danville Country Club	IL	
Pinecrest Golf & Country Club	IL	
Village Links of Glen Ellyn	IL	07/21/1993
St. Charles Country Club	IL	02/12/1993
Mt. Prospect Golf Course	IL	
Rail Golf Club, Inc.	IL	
Aldeen Golf Club	IL	
Forest Hills Country Club	IL	
Silver Lake Country Club	IL	05/06/1997
Wolf Run Golf Club	IN	
Lake Hills Golf Club	IN	
Indian Oaks Golf Club	IN	
Elcona Country Club	IN	
Harrison Lake Country Club	IN	
Meridian Hills Country Club	IN	
Salina Country Club	KS	
Willowbend Golf Club	KS	
Mission Hills Country Club	KS	
Lake Quivira Country Club	KS	
St. Andrews Golf Course	KS	
Bluffs on Thompson Creek	LA	
Eastward Ho! Country Club	MA	
Acoaxet Club	MA	
Farm Neck Golf Club	MA	
Nashawtuc Country Club	MA	
Stockbridge Golf Club	MA	
Kings Way Golf Club	MA	
Sagamore Spring Golf Club	MA	
Oyster Harbors Golf Club	MA	
Shaker Hills Golf Club	MA	
Congressional Country Club	MD	
Eagle's Landing Golf Course	MD	06/05/1995
Caves Valley Golf Club	MD	
Portland Country Club	ME	04/29/1997
Lochmoor Club	MI	
Gull Lake View Golf Club	MI	10/16/1995
Saginaw Country Club	MI	
Treetops Sylvan Resort	MI	04/13/1994
Grand Traverse Resort	MI	03/26/1997
Belvedere Golf Club	MI	
Bloomfield Hills Country Club	MI	
High Pointe Golf Club	MI	
TPC of Michigan	MI	01/28/1994
Spring Lake Country Club	MI	
Meadows Golf Club	MI	
Minikahda Club	MN	01/06/1995
Superior National at Lutsen	MN	
Golden Valley Country Club	MN	
Rochester Golf & Country Club	MN	
Princeton Golf Club	MN	
Rush Creek Golf Club	MN	
Sunset Country Club	MO	
Quail Creek Golf Club	MO	
Algonquin Golf Club	MO	
MSU Golf Course	MS	
Eagle Bend Golf Course, c/o Golf NW	MT	
Lake Hickory Country Club	NC	
Country Club of North Carolina	NC	
Woodlake Country Club	NC	
St. James Planta: Gauntlet Course	NC	
Landfall Club	NC	
Cedarwood Country Club	NC	
Apple Creek Country Club	ND	03/02/1994
Pioneer's Golf Course	NE	
Abenaqui Country Club, Inc.	NH	

As part of the Outreach and Education certification category in the Audubon Cooperative Sanctuary Program, some golf course superintendents have hosted student field trips to the golf course to teach about conservation and stewardship projects.

Golf Course	State	Fully Certified
Hoodkroft Country Club	NH	
Kingswood Golf Club	NH	
Brooklake Country Club	NJ	
Trenton Country Club	NJ	
Ridgewood Country Club	NJ	08/01/1996
Mendham Golf & Tennis	NJ	
Oak Hill Golf Club	NJ	
Pine Valley Golf Club	NJ	
Alpine Country Club	NJ	
Cedar Creek Golf Course	NJ	
Eastlyn Golf Course	NJ	
Fiddler's Elbow Country Club	NJ	06/08/1995
Arcola Country Club	NJ	
Cape May National Golf Club	NJ	
Brooklake Country Club	NJ	
Metedeconk National Golf Club	NJ	
Santa Fe Country Club	NM	
Painted Desert Golf Course	NV	
Oak Hill Country Club	NY	
New Course at Albany	NY	
Stafford Country Club	NY	
Quogue Field Club	NY	
Blind Brook Club	NY	
Dyker Beach Golf Course	NY	
Niagara Falls Country Club	NY	
Twin Hills Golf Course I	NY	
Southward Ho Country Club	NY	
Schuyler Meadows Club	NY	06/28/1995
Westchester Country Club	NY	07/03/1996
Marriott's Golf Club at Windwatch	NY	
Pinehaven Country Club	NY	
Country Club of Troy	NY	
Centerpointe Country Club	NY	
Weatherwax Golf Course	OH	
Maketewah Country Club	OH	
Sycamore Creek Country Club	OH	
Yankee Run Golf Course	OH	
Hickley Hills Golf Course	OH	
Salishan Golf Links	OR	08/01/1994
Willamette Valley Country Club	OR	
Astoria Country Club	OR	
Resort at the Mountain	OR	
Lords Valley Country Club	PA	01/16/1996
Radnor Valley Country Club	PA	
St. Davids Golf Club	PA	
Cedarbrook Public Golf Club	PA	
Scotch Valley Country Club	PA	
Blue Ridge Country Club	PA	
Cherry Wood Golf Course	PA	
Chester Valley Golf Club	PA	02/16/1995
Sakonnet Golf Club	RI	
Rhode Island Country Club	RI	
Palmetto Hall Plantation	SC	03/13/1997
Country Club of Charleston	SC	
Pawley's Plantation Golf & CC	SC	
Whispering Pines	SC	
Minnehaha Country Club	SD	
Honors Course	TN	
South Shore Harbour C.C.	TX	
Lakeside Country Club	TX	08/18/1995
Barton Creek Conference Resort	TX	
Homestead Resort & Golf Club	UT	
Kingsmill Golf Club	VA	
Robert Trent Jones Golf Club	VA	11/20/1995
Chantilly National Golf & C.C.	VA	
Golden Horshoe Golf Course	VA	
Equinox: Gleneagles Golf Course	VT	
Glendale Country Club	WA	
Wing Point Golf & Country Club	WA	
Semiahmoo Golf & Country Club	WA	11/24/1993
Everett Golf & Country Club	WA	
Glendale Country Club	WA	
Royal Oaks Country Club	WA	05/05/1997
Blackwolf Run	WI	
Bristol Ridge Golf Course	WI	
Wausau Golf Club	WI	
Edgewood Country Club	WV	01/27/1997
Seymour Golf & Country Club Ontario, Canada		
Conestoga Country Club Ontario, Canada		05/07/1997
Hamilton Golf & Country Club Ontario, Canada		
Nobleton Lakes Golf Course Ontario, Canada		04/18/1997
West Haven Golf & Country Club Ontario, Canada		
Islesmere Golf and C.C. Quebec, Canada		
Royal Montreal Golf Club Quebec, Canada		
Valderrama Golf Club Cadiz, Spain		

NEWS NOTES

Tom Mascaro (right) and Eb Steineger, longtime superintendent at Pine Valley, were often together at turfgrass meetings and trade shows.

In Memoriam — Thomas C. Mascaro

The Green Section staff was saddened to learn of the passing of Tom Mascaro on May 6, 1997. Tom was a leader in the turfgrass industry for more than 60 years, and in 1971 was named the recipient of the Green Section Award for his significant service to golf through work with turfgrass. He also served for many years on the USGA's Green Section Committee and its Green Section Award Committee.

Tom first became involved in the turfgrass industry in 1936. West Point Industries, the company he and his brother Tony founded, developed and produced the first practical fairway and putting green aerifier. Not long afterward, he introduced the first vertical mower for control of grain and thatch on golf greens. He held many patents for his innovative inventions.

In addition to his manufacturing activities, Tom assisted and supported many state university research programs, and designed, built, and donated several special machines for turf research. During the early days of turfgrass conferences, he recorded, mimeographed, and distributed the proceedings to interested parties throughout the United States, all for the benefit of the golf course superintendent and the turfgrass industry. He was co-founder, with the late H. B. Musser, of the Pennsylvania Turf Council and served as its secretary and president.

Through Mr. Mascaro's efforts, his company developed and published a book entitled *A Handbook for the New Green Chairman.* His informal editorial staff included Richard S. Tufts, former President of the USGA; Admiral John S. Phillips, of Army Navy Country Club; H. B. Musser, of Penn State; and others. In 1994 he published another book, *Diagnostic Turfgrass Management for Golf Greens,* which emphasized treating the *causes* of turfgrass problems rather than the symptoms.

He also developed a turfgrass school for salesmen, and this later evolved into the first correspondence course in turfgrass management for golf course superintendents. The course was offered at cost and had well over 1,000 alumni.

Tom was a prolific photographer/writer on turfgrass management topics. He accumulated over 100,000 slides, including one of the first golf cart and another of Superintendent Joe Valentine identifying the spot where he discoverd Merion Bluegrass. His photos were used in many magazines, and his "Photo-Quiz" column appeared in GCSAA's magazine for more than 20 years. He also wrote for numerous magazines, newspapers, and technical publications, and his writings were translated into Japanese, Italian, French, German, and Swiss.

It would be difficult to imagine where golf turf would be today without the mechanical wizardry of Tom Mascaro. He contributed much to the turfgrass world and will be missed by his many friends in golf.

A comprehensive article on Tom's life and career can be found in the January 1997 issue of *Golf Course Management* magazine. Memorial donations can be made to the GCSAA's Historical Preservation Committee.

In cooperation with the National Fish & Wildlife Foundation, the USGA co-hosted a one-day symposium at the National Geographic Society in Washington, D.C., on the topic "Golf Environments of the 21st Century: Integrating Wildlife Conservation Into Golf Courses." Presenters from the U.S. Environmental Protection Agency, Save the Bay, North Carolina State University, Audubon International, the GCSAA, and others discussed the importance of partnerships between the golf and environmental communities. Mr. Bill Leary, special counsel to Secretary Bruce Babbitt of the Department of the Interior, gave the lunchtime keynote address.

Dean Knuth Resigns

Dean Knuth, Senior Director of Handicapping, GHIN, and Green Section Administration has resigned his position with the USGA to become Managing Director of the Inter-National Research Institute in San Diego, California. INRI develops command and control software for the U.S. military services.

Since 1990, Dean has overseen the expansion of many USGA Green Section programs. He has been a longtime supporter of the Green Section's Turfgrass and Environmental Research Program, and he played an active role supporting expanded funding for turfgrass research. During his tenure as Senior Director, the Green Section has developed and implemented the Audubon Cooperative Sanctuary Program for Golf Courses, the Wildlife Links research program, and the Construction Education Program.

During his 16 years on staff, Dean also developed the USGA Slope Rating System (implemented nationwide and in many other parts of the world), Junior Par for Kids, the USGA Pace Rating System, and the USGA's Golf Handicap and Information Network (GHIN). In recent years, he developed the USGA's web page, increasing communication about USGA programs around the golfing world. His ideas have impacted nearly every USGA activity.

From all of the staff, thanks go to Dean for his invaluable support of the USGA Green Section, and best wishes in his exciting new endeavor.

CORRECTION

In the article "Green Speed Physics," which appeared in the March/April 1997 issue of the *Green Section Record*, a more precise calculation for the absolute value of the coefficient of friction resulting from a Stimpmeter measurement taken on a level green (Equation 6) will be obtained by fixing the roll of the golf ball down the 36-inch-long Stimpmeter at 30 inches long from its center of mass in the Stimpmeter notch from which it releases. The article mistakenly reports the length as 36 inches. This change also refines the initial velocity of the golf ball from the base of the Stimpmeter to be 91.1 instead of 95.5 inches per second. However, as a practical matter of application, the summary sets of curves developed in Figures 4, 5, and 6 remain unaffected, as they relate Stimpmeter measurements made on level and sloped greens to maintain corresponding putting speeds, being based upon the same absolute values of the coefficients of friction one to the other.

Say No To Memorial Trees!!!

When remembering the departed, don't forget the turfgrass!

by DAVID A. OATIS

FROM the pyramids in Egypt to the Tomb of the Unknown Soldier, man has for centuries created memorials to the people who have shaped our world. Leaving memorials to loved ones is a popular custom, and planting a memorial tree or flower bed is a means of incorporating their memory in nature, thus insuring that their memory will live on. Memorial tree planting programs on golf courses seem a harmless and thoughtful means of remembering a loved one, but no well-intentioned program has greater potential for causing the ruination of the course. This statement may shock some, but consider the following:

Trees are an integral part of many courses and can perform a variety of valuable functions. Trees can add definition and strategy, improve safety, and add a wonderful naturalizing quality to the landscape. However, trees can also wreak havoc on golf courses. Between the shade and reduced air circulation caused by their canopies, and the competition caused by their root systems, trees can make it physically impossible to grow healthy turfgrass. They can cause severe playability problems. USGA Green Section agronomists have for years agreed: **Trees are the leading cause of turfgrass failure and poor performance in North America.**

Planting trees can be enjoyable, and healthy trees can provide years and even generations of satisfaction. However, the negative effects that result from a poorly chosen or located tree are just as persistent. Donating money for planting trees is a noble gesture, but purchasing and planting the tree is usually the cheapest part of the enterprise. The years of additional expense that result are rarely understood or considered. Trees must be trimmed around and their debris must be picked up. Trees often require pruning and some require pest control programs. The eventual cost of removal must also be considered, and this can be substantial and disruptive. Trees can elevate the cost of turfgrass maintenance tremendously, but even with increased fertilizer, pesticides, and labor, the resulting turf still may not perform up to expectations. Living with poor turf is often the price of having too many trees or having the wrong trees in the wrong locations.

Memorial plantings can cause the course to take on a cemetery-like appearance if consideration is not given to the long-term implications of the program.

Courses with memorial tree planting programs usually find themselves plagued with tree-related problems more quickly than other courses because they are forced to "look for places to plant trees!" Every open spot on the course becomes a potential tree planting site and little thought is given to long-term implications. With a memorial program, the goal becomes to plant trees rather than to accomplish some specific objective through tree planting. This puts the cart squarely in front of the horse. Even more significant, once a memorial tree is planted, it becomes a sacred cow that cannot be removed short of an act of God. Memorials are intended to be forever, and it can be extremely upsetting to the friends and family of the deceased if it becomes necessary to remove a memorial tree. Placing memorial plaques on individual trees also is costly, labor intensive, and in time can cause the course to take on a cemetery-like appearance. Memorial planting programs are easily started, but like runaway trains, they are not easily stopped.

If you remain unconvinced and still wish to have a memorial tree program, at least set it up so that it has a chance of achieving success. Make it a "Memorial Tree Fund" providing the funding for the life cost of the trees. This would include the cost of planting, maintenance, and removal. Instead of placing plaques on individual trees, place the names of those being memorialized on a plaque prominently located in the clubhouse. However, trees should only be planted when necessary. All plantings should have a specific purpose and be aproved by the green committee, golf course architect, and course superintendent.

Golf courses belong to the living, and in the final analysis we must remember their purpose. Golf courses are intended to be neither cemeteries nor memorial parks; they are the playing field on which the game is played and must be maintained as such. Trees should never be planted on a golf course without a specific goal in mind, and trees should never be planted by quota. Don't plant trees just for the sake of planting trees. Resist the temptation to initiate a memorial tree planting program; say no to memorials!

DAVID A. OATIS *is director of the Green Section's Northeastern Region.*

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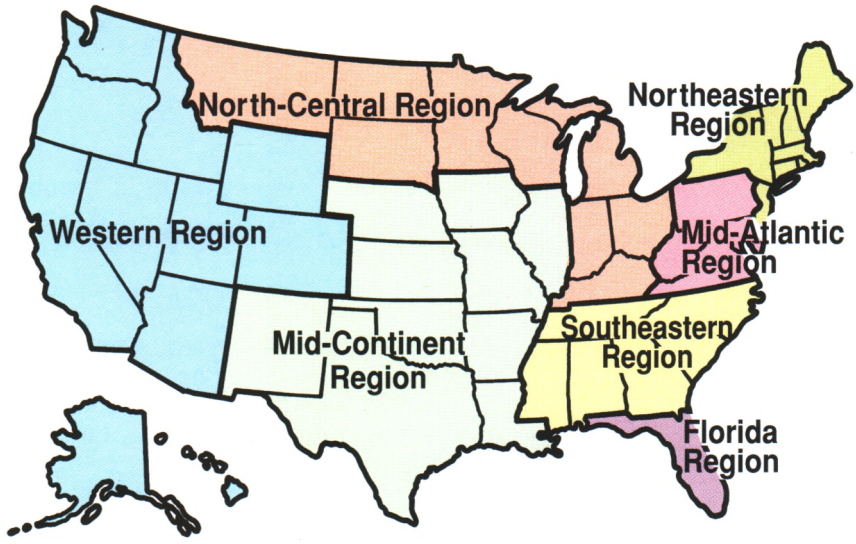

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TURF TWISTERS

CAREFULLY EVALUATE

Question: We are in the early planning stages of a sand bunker renovation project and wish to obtain a copy of the USGA specifications for bunker sands, but we are having difficulty finding these specifications. Where can we obtain a copy of your sand specifications? (Vermont)

Answer: The USGA has never had specifications for bunker sands. The article "Selecting and Handling Sand," *Green Section Record*, November/December 1983, provides general guidelines regarding the sand's particle size, shape, composition, color, and other factors that will be helpful for the initial selection process. Remember that a sand's playability is subjective. It is a good idea to develop a test bunker so that several of the potential sands can be installed and sampled by the golfers. This will help to form a general consensus that will be useful in the ultimate selection of the sand. Keep in mind that bunker sand becomes firmer over time, as it becomes contaminated with soil and organic particles.

VARIOUS RESOURCES

Question: Over the past several years, we have heard of problems in acquiring top-quality bermudagrass planting stock (sprigs and sod) for new construction and renovation projects. A nine-hole addition has been proposed at our course. Is there any way to guarantee that we get what we pay for? (Florida)

Answer: Purchasing and using certified *Blue Tag* bermudagrass planting stock offers the highest degree of assurance for genetic purity and quality stock. Unfortunately, at this time not all states have a bermudagrass certification program. There are also differences in the standards utilized by the organizations administering turfgrass certification. The Georgia Crop Improvement Association has conducted a thorough review of their certification program of bermudagrasses, and their standards are considered the most up-to-date.

If certified planting stock is not available in your location, request from your area producers a list of courses they have supplied during the past five years. Visit these courses and interview the golf course superintendent about the general performance and quality of the bermudagrass supplied. Also, arrange a visit to the production farms. While determining genetic purity in the production fields is difficult, it would be worthwhile to find out what measures are utilized to control off-type bermudas and other pests, as well as general management practices and quality-control standards. Given that the quality and purity of the bermudagrass planting stock is a major factor in the success of new construction and renovation projects, and that the cost of planting material is a small percentage of the total project cost, basing decisions only on the cost of the sprigs or sod is not advised.

TO EFFICIENTLY COMPLETE PROJECTS

Question: Our golf course operates on a relatively low budget. An article written in the *Green Section Record* (July/August 1995) described golf courses that are operated on a shoestring budget. We fit this category! My question is, do you have a tip for eliminating some hand labor, thus freeing-up resources to use on other areas of the course? (Pennsylvania)

Answer: You're right, hand labor is terribly expensive and inefficient. Begin by evaluating each and every teeing area. Near the ball washers or benches, eliminate all of the rotary mowing or weed-eating work. This can be done by using a non-selective herbicide and then mulching the area. Design the contours around these areas so that larger equipment can flow through the site without creating a great deal of turf stress (no tight turns). Look for the small things first — they can add up in a hurry to save labor resources for larger, more critical projects.