USGA® GREEN SECTION
Record

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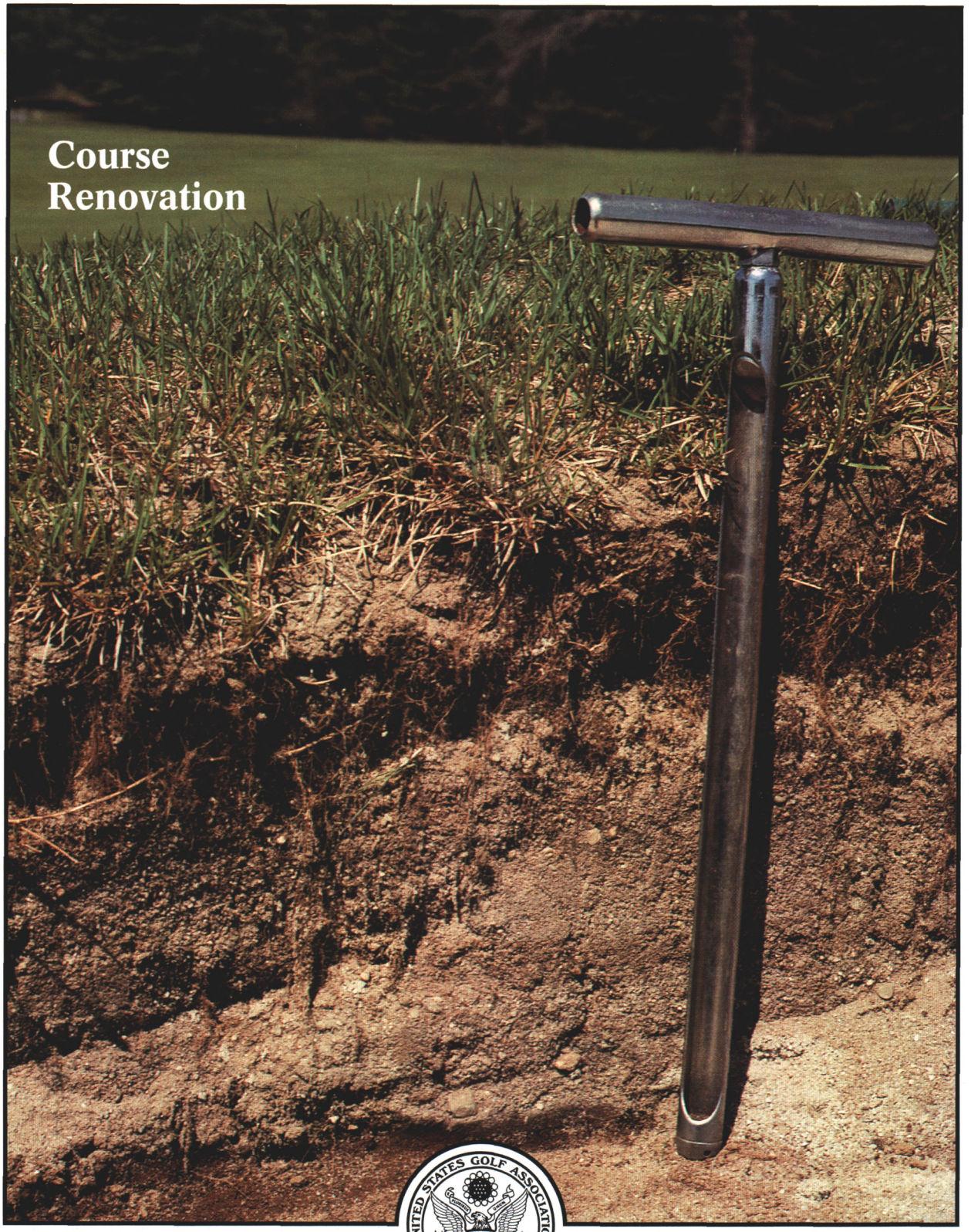

A PUBLICATION ON TURFGRASS MANAGEMENT

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Cover Photo:
Sand buildup after years of golfers blasting out of bunkers can be severe.

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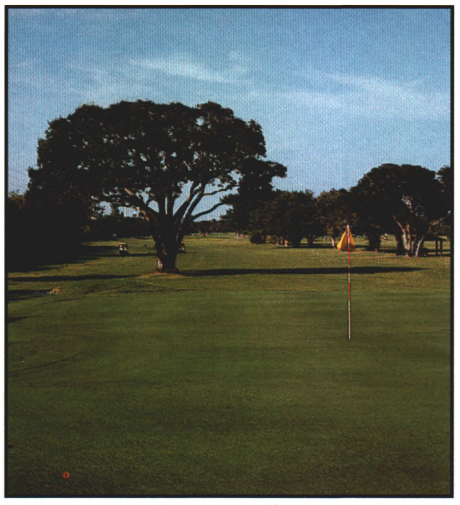
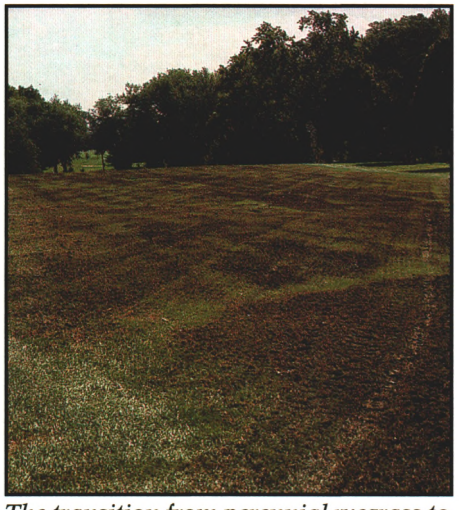


Key trees can have an effect on USGA Course and Slope Ratings. See page 6.



The transition from perennial ryegrass to creeping bentgrass can be a challenge to golf course superintendents. See page 12.

So, You Want To Renovate Your Golf Course?

There are hundreds of ways for course renovation programs to go awry. Here are a few tips to make your project a success.

by DAVID A. OATIS

A small tee with poor traffic flow is good reason to renovate!

MOST golf course superintendents eventually face course improvement projects of one type or another at some point in their careers. The proposal might be to rebuild a green or a tee or a bunker, or perhaps to add or expand a water feature. Regardless of the project, it is important to first examine the course in its entirety and to identify its strengths and weaknesses before proceeding. Course improvement projects tend to have a domino effect, and a project that improves one area of the course can easily cause problems in other areas. Projects often require considerable expense to complete and they can have a major impact on how the course looks and plays, and on the maintenance budget as well. Course improvement projects should be undertaken only after careful thought and much planning. Unfortunately, many renovation projects turn out poorly due to insufficient planning and preparation, poor design, or poor execution. The purpose of this article is to identify some of the common mistakes associated with course improvement projects and to provide concrete suggestions for avoiding them.

DEVELOPING THE PLAN

Defining the Objective

The first step is to define what you wish to accomplish through a renovation or course improvement project. *Monuments* to individuals or committees should be avoided like the plague. Frequently, projects that have been observed at other courses are suggested, but this amounts to little more than *keeping up with the Joneses*. Proposals should have a specific goal in order to avoid making change for the sake of making change. The goals may be to improve aesthetics or definition. You may want the course to play harder or easier, or perhaps more fairly or more safely. *There may be some confusion as to what the course needs, and it is quite possible that your ideas are inappropriate for your golf course or financially not feasible.*

Research Your Course

It is vital to research your own course as thoroughly as possible so that you are in possession of all of the facts when it comes time to decide on plans and projects. In the case of old, classic golf courses, it must be determined whether renovation or restoration is most appropriate. Too often, fine old designs have been ruined through well-intentioned but thoughtless renovation. A distinction must be made between good old architecture and bad, and time and research are required to make an informed decision. Much information can be obtained from golf course architects, but it is also wise to do your own independent research. You might just discover exciting new information regarding the origin of your course!

The attic is a great place to start looking for old records, pictures, plans, and documents that could provide clues to the history of the course. It may take weeks to thoroughly examine all of the old files, and you never know what you might find. Aerial photos from the early days of the golf course can provide invaluable evidence. Aerial photos dating back to the '20s and '30s exist for many areas of the United States, so check with county and local municipalities, planning/engineering departments, libraries, etc., to see if they can be located. Also, be sure to check with the National Archives, Records Administration, Cartographic Branch, 8601 Adelphi Road, College Park, MD 20720-6001. Many old photographs exist in the USGA Golf House Museum, so be sure to give that a try, too. Other methods of researching your course include interviewing longtime members and former staff regarding the history of the golf course.

A soil probe and perhaps even a shovel are some of the most important investigative tools available. Probing and digging in and around greens and bunkers can provide insight as to what has occurred over time. Through edging, mechanical raking, and wind and water erosion, bunkers generally tend to get larger. Sand blown and blasted out of bunkers over many years can completely change bunker mounding and even putting green contours. In some cases the changes can be so dramatic that traffic or surface drainage problems are created and usable cupping area is lost, leading to severe turf problems.

Special care should be taken to disregard the current mowing patterns, since these can change dramatically over time. In general, putting greens usually shrink in size and become more rounded. If the greens at your course are oval or circular in shape, there is a better than average chance that the mowing patterns have been altered over the years. Examining topography and comparing putting green soil profiles to those from the green surrounds can help determine the original putting green shapes.

The amount of usable teeing area often decreases as a result of trees and vegetation encroaching along the line of play, and often this can be corrected more easily through tree and brush removal than reconstruction. Mowing patterns on tees also can change over time, and expansion sometimes can be accomplished easily through adjustments in mowing patterns.

In the last 10 to 15 years, fairway acreage has intentionally been reduced at many courses to facilitate lightweight mowing programs. Years ago, fairway acreage commonly ranged from 40 to 50 acres, while today they more typically range from 23 to 28 acres. If the reduction is not done properly, prime landing areas may be lost, and alignment and playability may suffer. Since many older courses were designed without fairway irrigation, the increased roll prompted architects to place bunkers further from the center point of the fairways. With the addition of irrigation and improved turfgrass quality, some of these bunkers may need to be repositioned, and/or fairways may require recontouring and alignment. Indeed, most old courses can be improved by adjusting mowing contours.

Selection of Architects and Contractors

Choosing the right golf course architect and contractor for your course and project is extremely important, and time and research are required to do it properly. The most important advice is to thoroughly check the references of all potential candidates. Be sure to speak with the golf course superintendent, green chairman, and other course officials at courses where the prospective architects and contractors have worked. Obtain a variety of perspectives and ask tough, direct questions such as: "Would you hire them again? Were the promises made delivered on? Was the work completed on time and on budget; if not, who was to blame?" Delays are common and not necessarily the fault of the architect or contractor, but this is something to check.

Be sure to ask how much the architect was on site during the project and whether he/she was accessible when not on site. It is imperative to visit the courses where the candidates have worked so their results can be observed firsthand. In the case of renovation, decide whether the work blends in well with the rest of the course, basing your judgements on the stated desires of the respective course committees. Determine whether the renovated areas require additional labor for maintenance. In the case of restoration, compare the work to old photographs and maps.

IMPLEMENTATION

The planning process can be very exciting and it is easy to become enamored with grandiose proposals, but this is something to be especially wary of. The infrastructure of the entire facility must be carefully considered before deciding how quickly to implement the program. Too often the money needed for a new maintenance facility, equipment replacement, or irrigation or drainage systems is used to finance the renovation program, and this can have disastrous and long-term effects on the financial state of the course.

In the case of multi-year programs, it is usually advisable to begin the implementation phase slowly to aid in golfer acceptance. "Don't bite off more than you can chew" is sound advice. Similarly, choose the easiest and least controversial projects for the initial phase in order to get the clientele excited about the program and to garner their support. Success breeds success, and a failure in the initial phase can compromise future projects.

In cases where the plan is not controversial and the need for the work is well understood, the best course of action often is to implement the plan more quickly. *Biting the bullet* and performing the work in one or two phases causes more disruption in the short term, but far less in the long term. It is best to perform all putting green construction and/or regrassing work in the same season so that all of the new turf is at the same stage. Building or regrassing greens piecemeal complicates the maintenance program because different sets of greens are at different stages of development and require different maintenance programs. This also causes greater inconsistencies in playability.

Sloppy construction — even the best contractor can have a bad day!

Furthermore, putting green construction work tends to be more controversial in nature and few courses ever complete a putting green reconstruction project on a piecemeal basis. Generally, it is far more economical to do all putting green construction work at the same time.

CLASSIC MISTAKES

Certain mistakes seem to be repeated consistently and deserve special mention. The following are some of the most common:

Not Knowing What You Have to Start With

This problem can be prevented by doing extensive research and getting opinions from a variety of sources. Much can be learned through interviewing golf course architects, but it is also worthwhile to discuss the various issues with your Green Section agronomist. Seek out and visit other courses designed by the original architect of your own course. Also, be sure to consult with other superintendents and course officials who have undertaken projects similar to the one you are considering.

Trying to Be Something You Are Not

Every spring, Green Section agronomists meet course officials who want to plant azaleas and rhododendrons so they can be *just like Augusta.* Similarly, I have visited several courses whose natural features happened to be natural rock outcroppings, yet the course officials wanted to remove or cover them up. Conversely, some courses in the southwest have actually constructed rocks and waterfalls from fiberglass and concrete! The point is, each course must be allowed to develop its own character. Trying to imitate other courses rarely works well. More often than not, imitators come off looking like cheap imitations. No two courses are alike, nor should they be.

Mixing in Too Many Materials and Design Themes

Tree plantings on links golf courses are simply not appropriate. There are countless bunker designs and styles, but including many varying styles on the same course, and especially on the same hole, would be considered inappropriate by most knowledgeable golfers. Similarly, the features for each hole and course must be appropriate for that geographic region. Exposed, high-sand faces on a windy site can lead to more sand being blown out of the bunkers, with the ultimate results being playability problems and increased maintenance costs.

Some consistency in design is also suggested. For instance, rectilinear tee shapes should not be mixed with free-form amoeba-like shapes. When renovating a portion of the golf course, the work should blend in with the remaining features and not look out of character. Taking the concept one step further, be sure not to include too many different hardscape materials in the landscape. It is best to choose a few materials and use them throughout the course for the sake of consistency. For instance, choose one type of signage, curbing, cart path material, steps, etc., and try to carry it through the entire course. At all costs, avoid including too many different types, colors, and textures of materials because they distract the golfers and draw unwanted attention.

Failure to Plan (Ahead)

Just as the title implies, poor or inadequate planning is the root cause of

many renovation snafus, and rushing into a construction project is a recipe for disaster. Educating the golfers regarding the need for the project and the rationale behind the decisions being made is essential. They deserve to be kept informed, and open forums with question-and-answer periods are good means of accomplishing this.

Research is required to identify the most appropriate grasses and materials for tee or green construction, but this is sometimes overlooked due to time constraints. Superintendents sometimes are forced to rely on old test data from another project at a different course. Also, consider individual motives when evaluating agronomic advice. If the materials and grasses chosen don't work well, it could mean your job!

The scope of the work must be clearly stated, and areas of responsibility for the staff and outside contractors must be established and communicated in no uncertain terms. Rushing into a construction project without doing your homework can result in disastrous consequences.

Lack of Continuity in Leadership

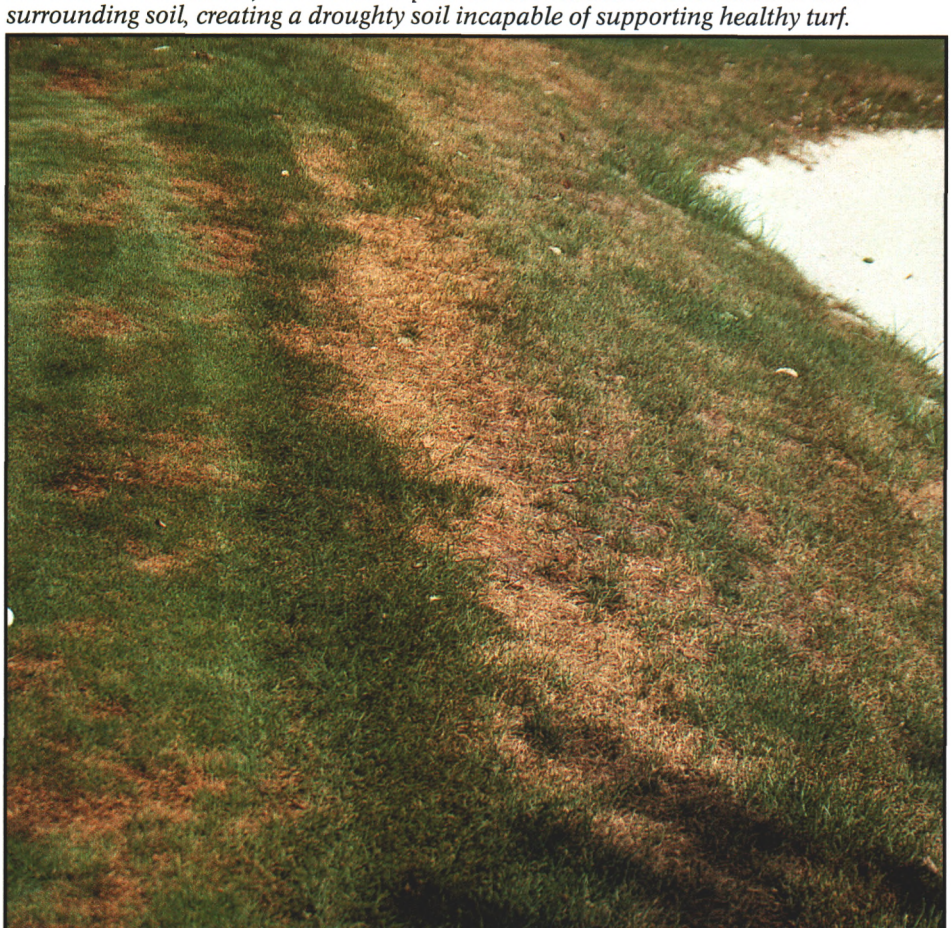
Renovation projects and maintenance programs often suffer due to rapid turnover of committee members. Alister Mackenzie put it accurately in his book *The Spirit of St. Andrews* when he wrote: "The history of most golf clubs is that a committee is appointed, they make mistakes, and just as they are beginning to learn by these mistakes they resign office and are replaced by others who make still greater mistakes, and so it goes on."

Reconstruction of Tees and Greens for the Wrong Reasons

More than one course has rebuilt the same green or tee multiple times, only to experience equally poor performance with each new version. The problem often is more related to the grass-growing environment the green or tee occupies than to the method of construction that was actually used. A favorite adage is that "even good construction cannot compensate for a poor grass-growing environment." Thus, if you are considering reconstruction of a green or tee because of poor turf performance, be certain to carefully identify the correct reasons for the problems before embarking on a reconstruction project. Above all, consider the grass-growing environment, and make improvements there before getting out the heavy equipment. Trees and underbrush that block sunlight and air circulation should be removed before considering reconstruction. In especially difficult environments, installing electric fans for the existing turf may produce adequate improvement.

In some cases, greens are rebuilt because they won't hold a shot. This goes back to knowing what you have to start with. Some holes, particularly those on older courses, were never designed for the aerial style of play that is now in vogue. If you have a green that won't hold a shot, consider the architecture of the hole. A downhill shot played to an elevated green, or one that falls away, is better suited for a bump-and-run type of shot.

The sand not removed from a bunker prior to reconstruction was mixed in with surrounding soil, creating a droughty soil incapable of supporting healthy turf.



Poor Performance of New Greens

There are many reasons for poor performance of new greens, but perhaps the most common is unrealistic golfer expectations. New greens require several years to mature and stabilize, and they generally cannot withstand the same amount of traffic and stress as older, established greens. Rushing them into play too quickly and/or expecting too much too soon can result in years of poor performance. New greens almost always play differently from older, mature greens, and they usually require a very different maintenance program. For these reasons, reconstruction of a few greens on an old course generally is best left as a last resort.

New green designs should be checked carefully to insure that adequate cupping area exists along with adequate surface drainage and traffic flow. Again, areas of surface drainage should not be located in high-traffic areas. The impact of the grass-growing environment on the performance of the putting greens cannot be overstated! Any proposed new green or tee should be located so that it receives adequate sunlight penetration and air circulation. Orienting greens towards the south as opposed to the north makes a tremendous difference climatically, and generally produces healthier, more vigorous turf.

Insufficient Tee Space

The following rule of thumb provides a simple and effective means of just how large tees should be: "One hundred square feet of *usable* teeing area is necessary for every 1,000 rounds of golf played annually for par 4s and par 5s. Double this figure for par 3s, the first and 10th tees, and any other holes from which irons are regularly struck." It should be noted that the

back two club-lengths, approximately one club length in the front and on the sides of the tee should not be considered usable for the sake of the formula. Areas blocked by vegetation also fall into the *unusable* category.

What the rule of thumb does not indicate is how the teeing area should be divided between forward, regular, and championship tees. This must be determined for each individual course, based on golfer tendencies. However, the forward tees generally should be the smallest since they usually receive the least amount of wear. Championship tees at some courses receive little play, and it is generally the regular tees that should have the greatest amount of teeing area.

The multiple tee concept is quite popular and can add interest and flexibility to course setup. However, each additional tee increases the percentage of unusable teeing area, and this can elevate the cost of maintenance dramatically. It is not uncommon to see four to five or more different tees for a given hole, but if they are small, the percentage of usable area actually may be quite low.

Poor Performance of New Bunkers

Bunker sand selection is of critical importance, and too often the choice is made based more on color than actual performance. There are no clearly defined specifications for bunker sand because choice is extremely subjective. Bunker sand performance is largely dependent on the shape of the particles and the size range of the particles included in the sand. The best method of selecting bunker sand is to install several sands side-by-side in a bunker a year or more before the project begins. This type of comparative study gives the golfers the opportunity to make the choice.

Shortcuts during reconstruction often result in major problems, and this is especially true with bunkers. A favorite trick is to not remove the existing sand but simply to blend it with the surrounding soil and use the mixture to reshape the mounding. This practice generally produces a droughty, inconsistent soil with poor structure that is incapable of supporting healthy turfgrass. Another common problem is failure to provide supplemental irrigation for the bunkers' banks. The turfgrass surrounding the greens typically is longer and has a higher water requirement than the putting surfaces, yet with conventional irrigation systems, the banks often receive less. Supplemental irrigation systems designed to water the banks independently of the greens will cure the problem.

Sand buildup from golfers blasting out of bunkers can change topography and even cause surface drainage problems.

Failure to Make Adequate Allowances for Traffic

At most courses, traffic is one of the most difficult problems superintendents deal with, and traffic problems are often created by poor design. Traffic problems are especially common on older courses since most were never designed for the level of play they currently receive.

There are many different ways to deal effectively with traffic, and the following involve a few design considerations:

1. Avoid placing immovable obstructions in high-traffic areas. Trees, shrubs, mounding, bunkers, etc., funnel traffic when located in high-traffic areas, and this can result in impossible-to-manage wear problems. It is best to keep the walk-on/walk-off areas around greens and tees as wide and as free of obstructions as possible.

2. The same comments can be made for the entrances and exits of cart paths. Creating as many points as possible for carts to enter and exit paths is critical for spreading wear.

3. Make sure that adequate surface drainage exists in all new green designs, and that the main areas of surface drainage are not also the highest traffic areas.

Remember, it doesn't matter how innovative or unique a design feature is; it won't play well if the turfgrass can't be maintained successfully.

CONCLUSION

In this age of heightened environmental awareness, we must be especially careful not to build environmental liabilities into our courses. For instance, drain lines must be routed carefully so that pesticides and nutrient leachate and runoff is not emptied directly into a body of water. Buffer strips are effective filters of surface water runoff and should be planted around water bodies wherever possible to help stabilize banks and preserve water quality.

More often than not, taking a critical, common-sense approach to golf course renovation will help you achieve satisfactory results. The process can be as simple as evaluating the strengths and weaknesses of the existing course and assessing whether or not the proposed changes solve the existing problems or create different ones. Granted, it requires some imagination to envision what the proposed changes will actually look like, but taking the plan out into the field and installing a few stakes and painting a few lines to outline the proposed work can help provide a clearer image of the proposal. Finally, taking care of obvious traffic and grass growing-environment problems will go a long way towards making your project a success.

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

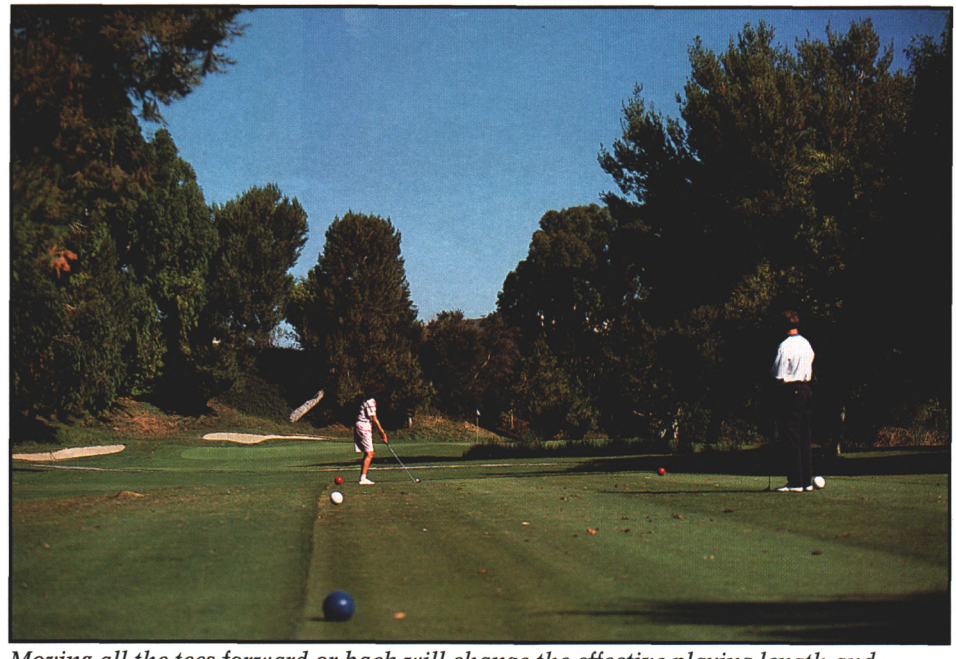
SET IT UP RIGHT!

Routine turf management and course setup influence USGA Course and Slope Ratings.

by VIC CARDACE and CHRIS HARTWIGER

THE PRIMARY FOCUS of a golf course superintendent is maintaining a golf course that offers golfers the best possible playing conditions under the existing budget and location. Typically, keeping the turf healthy and growing receives most of the attention at a golf course. An aspect of course management often forgotten is how daily course setup and maintenance affect the USGA Course and Slope Ratings. Sure, it's easy to agree that higher rough and faster greens make a golf course more difficult, but what are the effects of a new tree planting or a different irrigation schedule?

Before discussing how maintenance practices influence USGA Course and Slope Ratings, it is important to understand a few of the hows and whys of rating a golf course. With this information, the golf course superintendent will understand not only how the golf course maintenance program is influencing scores, but also how to manage these factors throughout the year in order to keep the Course and Slope Ratings from fluctuating widely.



Moving all the tees forward or back will change the effective playing length and USGA Course and Slope Ratings.

What Are Course and Slope Ratings, Anyway?

The USGA Handicap System was developed to make the game of golf more enjoyable by enabling golfers of differing abilities to compete on an equitable basis. A player's USGA Handicap Index compares his or her scoring ability to the scoring ability of an expert amateur on a course of standard difficulty. Because no two golf courses are alike, a means to quantitatively measure the relative difficulty of a course is needed to calculate a fair assessment of a player's ability. The USGA Course Rating is a USGA mark that indicates the evaluation of the course's playing difficulty for scratch golfers under normal course and weather conditions. It is expressed as strokes taken to one decimal place and is based on yardage and other obstacles to the extent they affect the scoring ability of a scratch golfer.

The USGA Slope Rating reflects the difficulty of the course for the players who are not scratch golfers. The greater the difference between the scores of the scratch golfer and bogey golfer on a certain course, the higher the USGA Slope Rating will be and the more strokes the golfer will receive.

Because the USGA Handicap Index is calculated based on an assessment of the difficulty of each course, the maintenance practices at a golf course influence both the Course and Slope Ratings. Therefore, it is important to understand how maintenance practices can change the way a golf course plays and how it affects these ratings. For most of the year, it is important to balance these factors to avoid large changes in difficulty or Course Rating. Maintaining a golf course in a manner different from when it was rated distorts a player's handicap and may necessitate the rerating of the course. Granted, special events may dictate a short-term change in course difficulty, but the long-term approach should be to maintain the course similarly to when it was rated. By understanding what management factors influence Course Rating and Slope Rating, steps can be taken to ensure that Course and Slope Ratings do not change much over time as a result of maintenance practices.

The Effect of Length on Course Rating

A golf course is rated based on the effective playing length and playing difficulty under normal conditions. The effective playing length is the measured length of the golf course, adjusted by factors such as roll, elevation, forced lay-ups and doglegs, prevailing wind, and altitude above sea level that make the course play longer or shorter than its measured length. Increasing the effective playing length of a course by 22 yards adds one tenth of a stroke to the USGA Course Rating; reducing the length lowers the Rating by the same amount. Increasing effective playing length also raises the Slope Rating; adding 93 yards increases the Slope Rating by 1. Shortening the course reduces the Slope Rating similarly.

The most obvious way to increase effective playing length is to move all the tee markers behind or ahead of the permanent yardage markers. Placing tee markers 10 yards per hole behind the permanent yardage markers adds 180 yards to the effective playing length,

which in turn increases the USGA Course Rating by 0.8 of a stroke and the Slope Rating by 2.

Adding obstacles that force a scratch player to lay up short of a normal tee shot increases the USGA Course Rating. Similarly, removing obstacles so the scratch player can hit a full tee shot lowers the Rating. Building bunkers across the fairway 230 yards from the middle or back tees, or 190 yards from the front tees forces the scratch player to lay up and adds 0.2 strokes to the USGA Course Rating. The male bogey golfer hits an average tee shot 200 yards and a female bogey golfer hits an average tee shot 150 yards. Since the male or female bogey golfer would not need to lay up to a cross bunker 230 or 190 yards from their respective tees, effectively not causing the bunker to come into play, the Slope Rating decreases by 1. Building bunkers or transplanting trees at the corner of a dogleg that previously was routinely cut by the scratch player adds effective playing length to the course equal to the added yardage of the approach shot.

Softening fairways increases effective playing length; hardening them decreases effective playing length. If overnight watering is increased so fairway conditions change from average to soft, the USGA Course Rating is increased by about 0.2 of a stroke. If the increased watering changes fairways from firm to average, the USGA Course Rating goes up almost 0.5 of a stroke, and the Slope Rating increases by 1.

Changes in Obstacles

Generally, changes in obstacles on the course do not affect Course and Slope Rating as much as changes in effective playing length. However, there are a few examples of changes in obstacles that produce an increase in USGA Course Rating. The examples listed below all change USGA Course Rating by 0.1 of a stroke unless otherwise noted.

Fairway — Change the mowing pattern to decrease fairway width by 10 yards on four holes. Decreasing fairway width from 30 yards to 20 yards on *all* par-4 and par-5 holes adds more than 0.3 stroke to the USGA Course Rating and increases the Slope Rating by approximately 1.5 points.

Recoverability and Rough — Raise mower blades to increase rough height of cut by one inch on three holes. Increasing the rough height on *all* holes from 2½ to 3½ inches for a cool-season rough such as ryegrass adds nearly 0.7 stroke to the USGA Course Rating and increases the Slope Rating by approximately 5.

Out of Bounds — Move the white stakes 10 yards closer to five fairway landing areas or greens.

Bunkers — Add 13 average bunkers, each in a strategic location, such as near the scratch player's tee shot landing zone (where none existed before) or closely bordering a green. These bunkers will add just over 1 to the Slope Rating. A smaller number of bunkers will produce the same result if they are deeper than three feet, have high lips, or must be carried to reach the target.

Green Target — Decrease watering the greens on 10 holes to change them from *soft* to *medium* or from *medium* to *hard*. Changing the holding properties of the greens on all 18 holes adds about 0.2 stroke to the USGA Course Rating and increases the Slope Rating by 1.

Green Surface — Lower the greens mower cutting height to increase the Stimpmeter measurement by 12 to 18 inches in eight greens. Speeding up all 18 greens by 1 to 1½ feet adds just over 0.2 of a stroke to the USGA Course Rating and almost 1 to the Slope Rating.

Finding a Balance

Maintaining an accurate USGA Handicap Index allows players of different abilities to compete against each other. As we have demonstrated in this article, there is more to maintaining an accurate USGA Handicap Index than making sure golfers submit all their scores. The way the course is set up and maintained can change Course Rating by as much as plus or minus five or six strokes and Slope Rating by as much as plus or minus 20 strokes. A course that is set up and maintained to be easier or more difficult than the original Course Rating and Slope Rating will distort the player's USGA Handicap Index. This can cause difficulty when players from one course compete against players from another course.

Due to changes in climate throughout the year, it is not practical to think the golf course can play to a consistent level of difficulty throughout the year. Wet periods, dry periods, and other extremes can influence playability. With these inherent fluctuations, the turf manager needs to make sure course setup and maintenance remain consistent with the difficulty when the course was rated. It may be advisable to move tee markers up during wet periods or explain to the members how their new tree planting program will influence Course and Slope Rating. Understanding how course setup and management practices affect Course and Slope Rating is another way for the golf course superintendent to improve the overall golfing experience at his/her course.

VICTOR CARDACE *joined the USGA in 1994 working for the USGA Handicap Department. In 1996, he assumed his new role as Manager, Handicap Education.*

CHRIS HARTWIGER *shares his time as agronomist for the USGA Green Section between the Southeastern and Florida Regions.*

Moving out-of-bounds stakes 10 yards closer to fairway landing areas on only five holes will increase USGA Course Rating by .10 of a stroke.

A commercial sod was used successfully to restore the back corner of this green at Whippoorwill Club in Armonk, N.Y.

Restoring The Past

A look at green restoration techniques.

by JAMES E. SKORULSKI

GREENS CAN SHRINK. It's a fact. Many of us have observed this phenomenon at one time or another. The problem is usually most evident on older golf courses, but it can be seen on newer courses as well. The once uniquely shaped greens evolve into bland spheres. It was common for the dimensions of older greens to be modified drastically when labor and budgets were cut during the Depression and war years, and again when triplex mowing became popular in the 1970s. Repeated turf loss may be another reason for green shrinkage. Small-scale changes can also occur when a staff is overly conservative in mowing the perimeter pass. Southern managers, battling bermudagrass encroachment, can face similar green shrinkage problems.

In recent years, there has been a renewed interest in restoring greens back to their original dimensions. There are several benefits that can be derived from such a program. Successful restoration provides challenging new hole locations that can bring surrounding hazards more into play and create interesting shots around the green. The additional hole locations can also be helpful for dispersing traffic more widely, a factor that is becoming increasingly important as play and green speed increase on older golf courses.

With all this said, you might think that restoration work is a good idea that should be implemented immediately, right? Well, maybe not. This is not a minor project, and in too many cases the efforts to restore lost green areas are implemented hastily and with little planning. This can result in severe turf thinning or complete turf loss. Initial failures can scare even the most strong-willed restorationists to abandon what was thought to be a good idea. This scenario does not have to be the case, though. Green expansion, although time consuming and sometimes difficult, can be completed successfully if the program is well planned and the golfers are fully aware of what to expect during the restoration work.

Site Review

The first phase of the project is to determine the green's original perimeters. This can be achieved with help from a golf course architect, the original design plans, or old aerial photographs. The expansion areas often are recognizable as pads with a grade similar to the green itself. The underlying soils should also be similar in nature to the subsoils found beneath the green. Use a soil probe to help make this determination. The grass species in the areas to be expanded are sometimes similar as well, and may offer another clue as to the green's original dimensions. Finally,

take a step back and reevaluate those areas that you believe were once part of the putting surface. Determine if the benefits derived from restoring that particular area are actually worthwhile, and what long-term implications the restoration work may have on your greens maintenance programs.

Determining the greens' original dimensions is probably the easiest part of the restoration process. Developing an actual plan to convert the area back into putting green turf is more difficult. There are several conversion strategies that can be used successfully. The goal is to discover which strategy will be most effective for your specific conditions. The only way to determine this is to closely evaluate the areas you wish to restore.

It is critical to examine the growing environments in which the areas are located. Problems with excessive shade and poor air movement may be the reason why a particular area is no longer a part of the putting green. Do not pursue restoring such areas until the shade and air-movement problems have been addressed. Closely examine the soil profile and especially the thatch accumulation in areas you wish to restore. Poor-quality soils, the presence of soil layers, excessive thatch, or the type of grass are the biggest factors in deciding which restoration strategy is selected.

Other factors that influence restoration strategies are the traffic patterns on the greens and the location of sand bunkers. Areas of heavy traffic always will be more difficult to restore and may dictate complete renovation with sod. It may also be necessary to complete bunker bank renovation work before green restoration is pursued, or as part of the project. Irrigation sprinkler heads, piping, and wiring may also interfere with the restoration. Relocate the irrigation components before continuing the project further.

Nursery sod is carefully installed after underlying soils have been graded and rolled.

Developing A Strategy

The conversion strategies involve either gradual adjustments in mowing practices or complete regrassing with sod. Areas with minimal thatch and suitable grass varieties can be converted back to putting green turf through a gradual reduction in mowing height, with the work initiated in cooler periods of mid to late fall. The sod option often is used to convert areas that contain excessive thatch, are composed of inappropriate grasses, or suffer from soil problems. Both methods have advantages and disadvantages that we shall explore.

A mowing conversion program is probably the most common method to restore collar areas back into putting green turf. Restoring turf cut at a higher height with this approach is more difficult and can result in failure if the mowing height is lowered too abruptly for the existing conditions. The quantity of thatch, in part, will dictate how the mowing conversion is pursued. Excessive thatch creates a spongy surface and elevated crowns, leaving the turf more susceptible to scalping injury. In this case, initiate an aggressive aerification, vertical mowing, and topdressing campaign to reduce thatch levels and firm the surface prior to lowering mowing heights. Such areas can be double-aerified in both spring and fall for this purpose. Remove the soil cores and thatch, and topdress to fill the aerification holes. Smaller-diameter (¼ inch) hollow tines can also be used throughout the season, as necessary. The intensive aerification is helpful for modifying the soils and for overseeding purposes as well. This process may require a full season or more to prepare the areas for a lower height of cut. It may be possible to lower the rough areas to collar height as the thatch reduction program is in progress.

Proceed with the mowing program after the thatch is reduced, the surfaces firmed, and the plant crowns are protected. Late fall is an optimal time to begin slowly lowering mowing heights in increments of 1/64 inch, on a 7- to 10-day schedule, until putting green height is obtained. A single, well-adjusted walk-behind machine should be used for this operation. Equip the machine with solid rollers to minimize wear stress during the conversion process. Expect some thinning to occur where thatch levels remain great, especially during stressful summer weather periods. Mowing heights can be raised slightly during periods of heavy rain or heat stress to prevent or minimize the injury. Turf thinning will be less of a problem if the proper steps are taken initially to prepare the grass for the lower cutting heights.

A good quality nursery or commercial sod may be a better and quicker alternative for the restoration work in some situations. This is true if the areas are composed of inappropriate grasses, contain large quantities of thatch, require extensive soil modification, or where traffic is heavy. Utilizing your own nursery sod is the most desirable

option, assuming the nursery soils are identical to soils in the greens. This will help minimize potential soil layering problems and improve establishment success. Consider dedicating a portion of the nursery specifically for the restoration work. The turf in this portion of the nursery can be established using a blend of aerification cores and bentgrass seed. The resulting sod will blend more effectively with the turf in the greens.

Commercial sod can be used successfully as well. Take the time to procure a sod that is grown on a good quality soil that most closely matches the soil at your site. This may not completely eliminate concerns about soil layering, but it will make the establishment easier. Excessive thatch also is a concern when selecting a sod, for obvious reasons. Washed sod is another option that can minimize concerns about soil layering. However, establishing the washed sod in higher-traffic or perimeter areas may be more of a problem.

The sod installation should not vary widely from other sod work. The existing sod, including thatch and adverse soil layers, should be removed. Use your topdressing material to establish a finished grade that blends with the original grade of the green. Irrigate and roll the surface to firm the soil and assure that the final grade meshes with the green. Install the sod, topdress the seams, and complete a final rolling. A water injection machine is well suited for this work.

Establishment practices are similar to those for any sod and will depend upon the quality of the sod itself. A nursery sod or very good quality commercial sod may require little preparatory work for the lower mowing heights. Sod grown on soils inconsistent with the greens or containing heavy thatch will require more preparation, including vertical mowing, aggressive aerification, and frequent topdressing before the mowing heights can be lowered. Small-diameter hollow-tine aerification is well suited to reducing the thatch or eliminating soil layers during the establishment period. Use the small tines soon after the sod is knitted, and continue with the practice, if necessary, on a four-week schedule as weather permits. Utilize solid tines or water injection for cultivation when weather conditions become more stressful. Aerification with larger-diameter hollow tines should be done in spring and fall, as necessary. Topdress the new sod lightly on a three- to four-week schedule. Use a soft-bristled brush to incorporate the topdressing material carefully into the turf. Utilize mowers equipped with solid rollers to minimize wear injury during the turf's establishment. Mowing heights can be lowered slowly, in small increments, as the sod establishes and the surface firms. Do not rush the process!

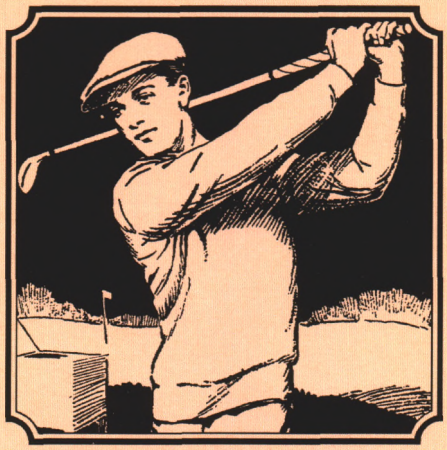
Summary

Green restoration can be an intimidating project, especially if you have little experience with the procedure. It is a good idea first to complete a smaller, less difficult restoration project to become familiar and confident with conversion strategies and to show the golfers what to expect. Planning and initiating a large-scale restoration program will be simplified as a result. Green restoration is a worthwhile program that can bring new interest and challenge to a green complex. Thorough planning, patience, and maintaining an open line of communication with the golfers will make that program a success.

JIM SKORULSKI *is an agronomist for the USGA Green Section in the Northeastern Region, based in Palmer, Massachusetts.*

Expanding a bent green into a Poa annua *collar produced this result.*

A restoration attempt fails as mowing heights were lowered too rapidly. Excessive thatch left the surface prone to mowing injury.



AS WE FIND THEM

This article was written 69 years ago.
It could have been written today.

Stepping from the 18th green with the Green Committee Chairman and the Greenkeeper, it was suggested that we "stick around and hear the angels sing. You will hear their daily chant to the Green Committee and Greenkeeper." So there we waited and watched.

One Mr. Average Golfer soon waddled up to attempt what looked like a "dead sure one." In that terrifying silence, which precedes great storms, he went through all the most approved and prolonged preliminaries of sighting and preparing for that momentous tap. Horror of horrors, he missed! We guessed it; the green was all to blame. The storm broke!

"Bill, why in the name of galloping golf balls can't we have some greens on this course? These things would be a disgrace to any cow pasture. There isn't a golfer in the world who could putt on them." Ad infinitum.

All this in spite of the fact that the other members of his foursome sank good, long shots and were last seen headed for the locker room with beaming faces not ordinarily associated with "rotten" greens and high scores.

The next group furnished this helpful suggestion: "If you fellows are interested in improving greens, why don't you first find out what the players want? After all, greens are for the golfers and everything should be done to give them exactly what they want."

We beat him to that idea by many years. We had long ago been told, "When a baby cries, give him what he wants." But we had also learned that to obtain results it makes some difference whether baby is "crying for something" or "just crying."

The greenkeeper suggested that we question a few of the club's best players as to how fast they preferred to have greens. "One of my men is ill and that has interrupted our schedule. Number 16 has not been cut and is very slow today, but this 18th is the real 'lightning type.' " The first reply was:

"This green is perfect! Anyone can putt on it. If you could only get all our greens as fast as this one, every player in the city would be clamoring to join this club. Number 16? Is that supposed to be a green? We thought you were planning to let that grow up for hay."

"Fore!" The next foursome is having a terrible time rolling them back and forth across the green. "Bill, what on earth is the matter with this green? If you simply touch the ball, it goes clear across. No use trying to putt on it. Why can't we have all the greens like 16 is today? You can really hit a ball on that one without making it roll a mile."

Now that's settled! All that the green committees, greenkeepers, and "those scientific guys" have to do to give the players just what they want (in speed of greens, at least) is to develop some kind of gear-shift. Then if a player "likes 'em fast" he can shift into high, and if he "likes 'em slow" he can shift to low. Bet some of them will want it fixed so they can shift after the ball is struck. Then they'll want a "reverse" so that the one which is "too strong" will roll back at just the right speed — all counting a single stroke.

— From *USGA Green Section Bulletin*, Vol. 8, No. 2, February 1928

The Transition From Perennial Ryegrass to Creeping Bentgrass Fairways for the Mid-Atlantic Region

A history of the conversion process.

by PETER H. DERNOEDEN, Ph.D.

THE INTRODUCTION of new grass species is a normal aspect in the evolution of enhancing the game of golf. Although seldom noticed by the casual golfer, superintendents almost annually overseed fairways, tees, and greens with improved cultivars. When the time comes, however, to change the species and not just introduce new cultivars, the transition often is costly in terms of time that areas are out of play, not to mention the cost of seed, chemicals, fertilizers, and labor. When greens are fumigated in late summer, the golf course normally closes until the following spring or else temporary greens are used. In either case, club revenues fall precipitously. The transition process for a fairway conversion program, however, is not as difficult as it is for greens.

In the Mid-Atlantic region, many golf courses grow perennial ryegrass as the primary species for fairways. Furthermore, most rough areas, tees, collars, and green surrounds also are composed primarily of perennial ryegrass. The emergence of perennial ryegrass as an important golf course species began in the mid to late 1970s. Basically, perennial ryegrass replaced annual bluegrass and Kentucky bluegrass on fairways. Kentucky bluegrass cultivars had improved dramatically in the 1970s, but as fairways were reduced to a height lower than 0.75 inches, even improved Kentucky bluegrass cultivars could no longer compete with weeds and diseases. Summer patch disease and annual bluegrass invasion were major factors in the demise of Kentucky bluegrass fairways and tees.

Summer patch, formerly known as *Fusarium* blight, was first observed on golf courses near Washington, D.C., in the mid-1950s, not long after Merion Kentucky bluegrass was released. When common-type bluegrasses were grown on fairways mowed at 1.5 inches, they would persist even without a good fungicide program, but density was poor and weeds were abundant. Improved Kentucky bluegrasses, which have better density and color than common types, were still susceptible to summer patch. As mowing height continued to be lowered, even the so-called *resistant* bluegrasses lost their resistance to summer patch.

By 1980, summer patch was the most important disease of bluegrass fairway turf, and no fungicides were available to effectively control the

A very effective but disruptive renovation method involves complete turf removal, followed by seeding or sodding.

malady. The advent of Bayleton® and Banner® in the early 1980s enabled us to control summer patch in annual bluegrass on greens, but high rates and multiple applications were required and this was prohibitively expensive for 25 or more acres of fairway turf.

By the early 1980s, improved perennial ryegrasses such as Manhattan and Citation became available. These new cultivars could be mown cleanly, without ripping vascular bundles, a characteristic that had given the older ryegrass cultivars a grayish appearance. Perennial ryegrass has several important characteristics that led to its widespread acceptance: 1. it is resistant, if not immune, to summer patch; 2. it is compatible with Kentucky bluegrass from the standpoint of appearance and growth habit, so it could easily be overseeded into fairways without having to use a non-selective herbicide such as Roundup; 3. ryegrass germinates and establishes quickly; 4. it does not produce thatch; 5. it can be mowed very low, and a golf ball sits up nicely; 6. it has fewer insect pest problems than Kentucky bluegrass; and 7. it has excellent tolerance to most herbicides, including Prograss,® which effectively controls annual bluegrass.

At the time perennial ryegrass was widely introduced, several of its weaknesses were unknown. Rust disease was an early disease problem of the older ryegrasses, but this problem was overcome by breeding resistant cultivars. The breeders, however, have been unable to overcome other significant diseases of perennial ryegrass, including brown patch and *Pythium* blight. The discovery of the ryegrass endophyte, however, led to an intensive breeding effort to produce high endophyte-containing cultivars. The endophyte, which is the fungus *Neotyphodium lolii* (formerly *Acremonium loliae*), is seed-borne and grows systemically through sheath and leaf tissue. This beneficial fungus produces a substance that deters the activity of surface-feeding insect pests.

Hence, most new-generation perennial ryegrass cultivars were resistant to rust, contained a beneficial endophyte, and were easier to mow. By 1983, the final and perhaps most appealing aspect of having perennial ryegrass fairways was that the herbicide Prograss became available. This herbicide effectively controls the *annual* type of annual bluegrass. Although high herbicide rates and multiple applications are required in most years, perennial ryegrass is remarkably tolerant of the herbicide. Furthermore, ryegrass seed and seedlings also are tolerant of Prograss. Hence, in fairways with high annual bluegrass populations, perennial ryegrass could be disk-seeded either just prior to or just after Prograss was applied.

A less disruptive technique includes severe verticutting and interseeding.

Prograss only works consistently well when fall applied, and although it may take all winter, more than 90% *Poa* control can be achieved. As the *Poa* dies, the overseeded ryegrass tillers and fills in rapidly so that by early May, perennial ryegrass fairways could be presented at 100% density with little or no *Poa*. Over time, however, resistant perennial-type annual bluegrass biotypes begin to appear on golf course fairways with an eight- or ten-year history of Prograss usage.

Hence, perennial ryegrass became the preferred species for fairways in most of the Mid-Atlantic region. Perennial ryegrass is even used as a lawn and fairway turf in many northern regions of the U.S. and is extensively used to overseed winter dormant bermudagrass in the southeastern and southwestern U.S. During the 1980s, more revolutionary products and equipment were developed to enhance golf turf quality. Among these advances were lightweight triplex fairway mowers, improved cultivation equipment, and very sophisticated irrigation systems. With these and other innovations and improved products, the standards for playing surfaces became higher and higher. Superintendents found they needed ever-increasing budgets to buy expensive fertilizers, pesticides, and the latest equipment to maintain the high standards that were established. As long as budgets were able to grow, the standards of quality increased.

Two natural events in 1994 and 1995 brought to the forefront a weakness of perennial ryegrass which became prohibitively expensive to overcome. During the 1993-94 winter, a series of storms coated golf courses in the Mid-Atlantic region with thick ice layers. The ice persisted for many weeks, and when it was finally removed mechanically from greens or by the spring melt, superintendents were presented with acres of dead turf. Wherever ice had lain for an extended period, virtually all of the annual bluegrass, bermudagrass, and perennial ryegrass was dead. Superintendents were forced to purchase large quantities of bentgrass to reseed greens and perennial ryegrass to reseed fairways, tees, green surrounds, and roughs. Because of the great vigor of perennial ryegrass, fairways were made playable in four to six weeks, but at considerable expense.

The summer of 1995 also brought a record extreme in high-temperature stress and long periods without rain. In the midst of the 1995 heat wave, a disease ravaged perennial ryegrass fairways from southern New Jersey to Kentucky. The disease was gray leaf spot and it ultimately killed more perennial ryegrass than the ice storms in early 1994. Once diagnosed, the

disease was checked by applying high rates of Daconil® or Dyrene® on five- to seven-day intervals during the heat wave. Some superintendents chose not to spray fungicides, but instead purchased more perennial ryegrass seed. Unfortunately, gray leaf spot attacked the seedlings and remained active up to the first week of November. Hence, fungicides had to be applied to keep seedlings alive. The cost of seed and fungicides in 1995 was enormous.

The two catastrophes in back-to-back years initiated the debate of whether perennial ryegrass fairways should be converted to another species. The three alternative species for the Mid-Atlantic region are zoysiagrass, bermudagrass, and creeping bentgrass. From an overall cost/benefit perspective, zoysiagrass may be the best species for the region. There are, however, some formidable negatives associated with zoysiagrass. In reality, it must be sodded, and sod is very expensive (cost is about $475,000 to $500,000 for 23 to 25 acres). Zoysiagrass also becomes dormant and turns brown between mid-October and late April, during which time cart traffic must be restricted from the fairways. Zoysiagrass also can be damaged or killed by ice; hence, good surface drainage across zoysiagrass fairways is essential. Despite these drawbacks, the installation costs for zoysiagrass are recoverable in a seven- to eight-year period by virtue of the savings from its lower requirements for water, fertilizer, and pesticides. Furthermore, zoysiagrass provides an outstanding surface because golf balls invariably are nicely elevated (i.e., sit up) on both green and dormant zoysiagrass.

Bermudagrass makes an excellent, low-maintenance fairway turf for golf courses south of Baltimore, Maryland. Bermudagrass is less expensive to establish and can be sprigged into existing perennial ryegrass fairways. Conversely, zoysiagrass sprigs or plugs cannot compete in an existing cool-season turf. By restricting fungicide use and water after sprigs have rooted, properly managed bermudagrass can dominate the stand within two years. Use of a selective herbicide such as LESCO TFC® in spring of the second or third year after sprigging eliminates the remaining ryegrass. Bermudagrass has excellent drought tolerance, few pest problems, and requires only a modest supply of fertilizer between spring green-up and mid-August. Like zoysiagrass, however, bermudagrass enters a similar brown winter dormant period. During winter the ball does not sit up as well on dormant bermudagrass. Bermudagrass is more prone to winter injury than zoysiagrass, and it is likely to winter-kill every seven to ten years. Regardless, the potential savings in management inputs over a seven- to ten-year period make bermudagrass a cost-effective fairway turf for transition zone areas.

It takes time for the desirable grass to fill in and mature.

For several of the reasons outlined above, most Mid-Atlantic courses are considering conversion to creeping bentgrass. Because it can be seeded, creeping bentgrass is less expensive to establish compared to bermudagrass or zoysiagrass. Creeping bentgrass has superior winter hardiness compared to all other alternatives. Hence, creeping bentgrass is considered to be a more reliable fairway turf. Creeping bentgrass is susceptible to a myriad of diseases; however, they generally are not as chronically severe as ryegrass diseases. The major bentgrass diseases in the Mid-Atlantic region include: take-all patch (primarily on new golf courses), dollar spot, *Fusarium* patch or pink snow mold, anthracnose, brown patch, and *Pythium* blight. Brown patch and *Pythium* blight tend to be chronically severe only in low-lying and shaded bentgrass. A good scouting program and spot spraying can effectively address most of these potential disease problems. Hence, creeping bentgrass fairways can be managed with fewer fungicide inputs compared to perennial ryegrass grown in a humid transition zone or northern regions.

There are, however, other management considerations regarding creeping bentgrass grown on fairways. Fairways must be mowed with lightweight triplex mowers and the clippings must be removed. Creeping bentgrass is more sensitive to herbicides and, as such, weed management is a greater challenge in bentgrass fairways. Unlike ryegrass, creeping bentgrass develops thatch. Thatch control is essential in retaining high-quality bentgrass, particularly during summer months. Bentgrass fairways generally require two core cultivations annually. The fall cultivation should be performed by late August to avoid the first flush of annual bluegrass seed germination, which begins in mid-September. Core cultivation after mid-September encourages annual bluegrass, which is not as easily removed from bentgrass as perennial ryegrass, zoysiagrass, or bermudagrass.

Creeping bentgrass fairways develop dry spots, which can be alleviated only by wetting agents, careful irrigation, or water injection cultivation during summer months. Syringing can be effectively performed only by hand. Hence, a double-row irrigation system with conveniently spaced snap couplers is required before creeping bentgrass conversion can be considered.

Large divots also will be a significant problem. Even the most dedicated golfers are not able to keep up with proper divot management. Divot repair crews, therefore, are needed weekly during high-play periods to minimize their impact. Furthermore, during hot or excessively wet periods, carts need to be restricted to roughs and paths.

There are two approaches to converting from perennial ryegrass to creeping bentgrass fairways. One involves using a plant growth regulator and the second the non-selective herbicide Roundup Pro®. The latter approach is the most likely to succeed in the shortest period of time. Roundup should be applied in early August and the site vigorously core cultivated after the ryegrass shows signs of dying. Careful overlapping of the herbicide is required to avoid ribbons or islands of surviving perennial ryegrass. These skips or misses should be sprayed as soon as they are discerned. During humid or overcast periods, Roundup can take up to 48 hours to dry totally or be inactivated. Walking or driving carts across Roundup-treated areas may result in tracking the herbicide onto greens or other non-treated areas. It therefore is important to wait two or more days before allowing golfers to re-enter Roundup-treated areas. The new Roundup Pro formulation dries more rapidly and is considered rain safe within a few hours of application on sunny days. While the fairways may be dying, they can remain in play after the two-day post-Roundup application waiting period.

Once it is determined that all of the ryegrass is dying or dead, fairways are core cultivated and the bentgrass is disk-seeded in two or more directions and seed broadcast into aerifier holes. The fairways are dragged with a heavy steel mat to break up soil cores, and dead organic matter is blown off. Because it is difficult to get uniform fertilizer distribution during the dragging process, the starter fertilizer normally is applied after dragging. For best results, the seeding should be completed on or before September 1.

With light and frequent syringing and warm temperatures, the bentgrass should germinate in five to seven days. Assuming there are no serious washes or other problems, the bentgrass fairways can be put fully into play within a six- to eight-week period after seedling emergence. Cart traffic, however, will have to be restricted until the following spring. Once the fairways have been mowed two to three times in the spring, and assuming it is not excessively wet, carts can be allowed on fairways.

Using plant growth regulators (PGR) is a slower approach to bentgrass conversion; however, fairways can remain open for play. There is little research, unfortunately, to allow us to predict the level of success to expect from a PGR program. The most commonly used PGRs for fairway conversion are Embark® and Primo®. These are the preferred materials because they have no soil activity and, as such, germinating bentgrass seedlings would be unaffected by these PGRs.

The final product — great fairway turf!

About one week prior to seeding, the highest label rate of the PGR is applied. Embark causes much more discoloration and injury and its use may slow perennial ryegrass recovery, thereby giving bentgrass seedlings an additional competitive edge. Primo does not discolor perennial ryegrass as severely, and this may be a preferred feature for some golfers. It takes five to ten days for PGRs to show growth suppression. Regardless, a few days after a PGR is applied, the mowing height is lowered and the ryegrass is severely scalped. Fairways are core cultivated and dragged, and bentgrass seed is disk-seeded and broadcast. Like the Roundup program, the bentgrass should be seeded by September 1. Given warm and moist conditions, the bentgrass seedlings will begin to appear in five to seven days. By the following spring a successful overseeding will result in 30 to 50 percent bentgrass cover. Lower mowing heights and spoon feeding in summer should enable bentgrass to compete with the ryegrass. By the fall of the second growing season, or when more than 90% bentgrass cover is achieved, an application of the herbicide LESCO TFC will eliminate the remaining perennial ryegrass.

Regardless of which program is chosen, there are a few key factors to success. It is imperative that no preemergence herbicides be applied in the spring prior to an August overseeding. The herbicide Acclaim® can be used to control annual grassy weeds at very low rates without producing a soil residual problem. Secondly, a higher-than-normal seeding rate of two to four pounds of bentgrass seed per 1,000 square feet is suggested. The earlier a dense bentgrass stand is achieved, the better the competitive edge it will have against annual bluegrass or perennial ryegrass. Because of the first flush of annual bluegrass seed germination during the second or third week of September, it is very important to have bentgrass seedlings emerging on or before September 1.

Acknowledgments

I am grateful to Stanley Zontek, USGA Green Section Mid-Atlantic Region Director, and Stephen Potter, CGCS, Woodholme Country Club, for their helpful suggestions in the preparation of this article.

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KNOW WHEN TO OVER-IRRIGATE

An easy way to monitor soil salinity.

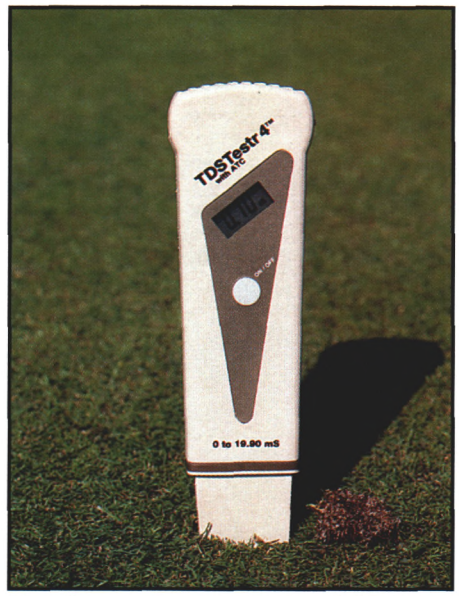
by PAUL H. VERMEULEN

AS POPULATION CENTERS continue to expand in all areas of the country, the demand for fresh water supplies is becoming greater and greater. To help ease this growing demand, many golf courses are electing to use alternative irrigation supplies. The two principal alternatives are: 1) poor-quality groundwater and 2) reclaimed water from a nearby sewage treatment facility.

Because alternative irrigation supplies generally contain high concentrations of soluble salts, periodic over-irrigation or leaching is required to prevent excess salts from accumulating in the root zone. Without over-irrigation, the accumulation of salt will increase the osmotic potential of the soil solution, and, in turn, decrease water and nutrient availability to the roots.[1] Typical symptoms of salt accumulation reported by golf course superintendents include premature wilting, reduced clipping harvest, and poor fertilizer response.

There is a wide tolerance range among the different turfgrass species to alternative saline irrigation supplies. While some species, such as Seashore paspalum and alkaligrass, are very tolerant, others, such as *Poa annua* and Kentucky bluegrass, are very sensitive.[2] The physical characteristics of the soil also can be important. Poorly drained soil is more apt to accumulate salts than well-drained soil. No matter what the turf/soil combination, though, the key to using a saline irrigation supply is to over-irrigate before the salt accumulation reaches the lethal limit.

Salt accumulation has to be monitored to determine when over-irrigation is necessary. The most common monitoring method used by superintendents is to submit soil samples for laboratory analysis. While this method is popular, the lag time in receiving the results and the inconvenience of sample collection are serious drawbacks. Instead, many superintendents tend to look for turfgrass symptoms rather than rely on accurate test data to determine the need for over-irrigation.



New, low-cost meters are available to help superintendents better manage their courses. The TDSTestr 4™ meter measures salt accumulation in the root zone from saline irrigation supplies and lets superintendents know when over-irrigation is required to prevent turf damage.

With the recent development of low-cost, portable meters that gauge salt accumulation by measuring electrical conductance (EC), soil salinity now can be easily monitored on a daily basis. These meters give superintendents the means to track salt accumulation more precisely and make informed irrigation decisions before turfgrass symptoms develop. A portable meter that has received good reviews in the Green Section's Western Region is the TDSTestr 4J sold by Cole-Palmer Instruments (1-800-323-4340, Cat. No. H-19800-30).

To convert the TDSTestr 4J readings from mS/cm into equivalent soil extract values in dS/m (1 dS/m = 1 mmhos/cm), Dr. Larry Stowell of the PACE Turfgrass Research Institute published the following correlation equation (R = 0.94, P < 0.0001):

Saturated soil extract EC (dS/m)= 0.8 + 2.7[TDSTestr 4J EC (mS/cm)][3]

This correlation equation was developed by comparing the results from soil extracts using a Horiba EC meter with direct immersion of the TDSTestr 4J in soil samples. Depending on meter calibration and protocol, the correlation equation may require a slight adjustment for each individual.

A simple protocol for monitoring salt accumulation in the root zone of a green using the TDSTestr 4J is:

1. Saturate, but do not over-irrigate the test area using the irrigation system or a watering can.

2. Remove a shallow plug of thatch from the surface of the green with a soil probe or similar implement.

3. Insert the TDSTestr 4J meter into the saturated soil so that the electrodes are completely immersed.

4. Record meter reading.

When used consistently, the results of monitoring the accumulation of salt will indicate when over-irrigation is necessary to maintain high-quality turf conditions.

[1]Beard, J. B. 1973. *Turfgrass: Science and Culture.* Prentice Hall, Inc., Englewood, NJ.

[2]Harivandi, M.A., J. D. Butler, and L. Wu. 1992. *Salinity and Turfgrass Culture.* Turfgrass Series No. 32, pp. 207-229. American Society of Agronomy, Madison, WI.

[3]Stowell, L. J. and S. Davis. 1993. *Direct Measurement of Electrical Conductivity in Golf Course High-Sand-Content Soils.* Phytopathology 83:6:693.

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LINKS-STYLE BIRDING

Results of the 1997 Ryder Cup Birdwatching Championship.

by RON DODSON

Birders gather at the 16th green of Falsterbo Golf Club, in Sweden, to observe the annual migration of many bird species. On a single day, more than a quarter of a million migrating birds can fly overhead.

THE QUESTION started out as "Where can you see the most species of birds during one day in the spring — on golf courses in Europe or golf courses in the United States?" It seemed like a simple question at the time and one that might generate some interesting information as well. That's how the first Ryder Cup Birdwatching Championship was created in 1997.

Since 1997 is a Ryder Cup year, David Stubbs, Director of the European Golf Association's Ecology Unit, and I thought it would be fun to develop an informal international wildlife competition to coincide with the Ryder Cup, highlighting the relationship between golf and wildlife. Besides proving that birds don't acknowledge political boundaries, we were interested in generating usable wildlife information from golf courses in both Europe and the U.S. With those simple goals, we established some equally simple rules and defined the *playing field*.

The playing field consisted of 12 United States golf courses and 12 European golf courses chosen by the two team captains (Stubbs for the European and Dodson for the U.S.). The final site selections were based on input from a wide variety of sources. In the U.S., USGA Green Section regional directors were sent a questionnaire announcing the event and given the opportunity to nominate courses for the competition. The courses that were finally selected were members of the Audubon Cooperative Sanctuary System and represented a variety of geographical areas and habitat.

Once final site selections were made, the birdwatcher teams had to be assembled. At first, the U.S. and Europe decided that there would be one birdwatcher per course. For the sake of companionship and a little bit of fun, it was agreed that the *official* birdwatcher could have up to three assistants in the field.

Birdwatchers could spend up to 24 hours on their assigned course recording all of the species that could be identified. They had to see the bird species using only binoculars or identify the species by their call. Telescopes weren't permitted, and the bird had to be identified while the birdwatcher was standing on land that was under the management of the superintendent of the golf course.

The official birdwatching day was May 21, 1997. The sites were chosen; the teams were ready; the rules were set. But one final decision had to be made for this international rivalry between Europe and America. Since the United States is home to approximately 800 species of birds and Europe has only 500 species, the European team captain wanted a handicap. I thought that the site selection process and the whims of weather would balance things out, but the Europeans held out until we reluctantly agreed to an 8-to-5 handicap.

May 22 proved to be a tense day as birders called, e-mailed, or faxed in their previous day's results. At day's end, it was the United States that saw the most species, but with the handicap, the Europeans won the event. The final count was 239 species for the United States and 217 species for the Europeans.

Aside from the enjoyment of everyone involved in this lighthearted competition, the event certainly showed that golf courses support a wide variety of species. For the European count, 70 species were found on four or more sites. A number of these species are listed as species of conservation concern, such as the white stork, green woodpecker, and woodlark. For the Americans, a significant percent of the species identified were neo-tropical migrants and birds of prey. More importantly, on just one day, on 12 golf courses, nearly 30 percent of the total number of birds found in the United States were seen on the golf course competition sites. That is an impressive accomplishment!

The first Ryder Cup Birdwatching Championship was a great success. In some cases, it provided golf courses an opportunity for community involvement, it provided additional information for each of the golf courses to educate their golfers about golf course habitat, and, at the same time, it contributed to a number of very interesting

questions and conclusions about the incidence of birds on golf courses. We hope competitions in the future will help to compile a stronger base of information about bird species here and in Europe.

On a personal level, given the positive responses from superintendents and birders alike, we hope it is the first of what will become a series of international competitions that will benefit both wildlife and golf. Many thanks to all the participants for their time and effort, and thanks to the golf course superintendents for facilitating the competition at their golf courses, and for their support and continued involvement in the Audubon Cooperative Sanctuary Program for Golf Courses.

And congratulations to the Europeans as well. Wait until next year!

RON DODSON *captains another team in Selkirk, New York, where he directs the environmental activities and programs of Audubon International.*

THE BIRDWATCHING RYDER CUP

EUROPEAN (Captain: David Stubbs)

Golf Course	Country	Birdwatcher	Total Species
Valderrama Golf Club	Spain	Martin Jacoby	48
Club de Golf Ulzama	Spain	Antonio Rodrigues Arbeloa	101
St. Andrews Links Trust	Scotland	Les Hatton	54
Golf Club Du Domaine Imperial	Switzerland	Wendy Strahm	61
Falsterbo Golfklubb	Sweden	Bjorn Malhagen	94
Golf Course Bled	Slovenia	Janez Gregori	44
Hensce National Golf Club	Hungary	Kallay Gyorgy	63
Birdland Golf Club	Hungary	Tibor Kelemen	63
San Lorenzo Golf Club	Portugal	Nuno Grade	67
Golf Des Fontenelles	France	Theophane You	39
Stuttgarter Golf Club	Germany	Michael Schmolz	58
Sarfvik Golfklubi	Finland	Jan Södersved	75
Europe's Score — Species Recorded: 217. With Handicap: 347.			

UNITED STATES (Captain: Ron Dodson)

Golf Course	State	Superintendent	Birdwatcher	Total Species
Granite Bay	California	Jim Ferrin, CGCS	Ed Whisler	61
Golf Links at Spanish Bay	California	Ted Horton, CGCS	Don Roberson (Roxayne Spruance)	50
Stevinson Ranch Golf Club	California	George Kelley	Jim Gain	67
Arrowhead Golf Course	Colorado	Ron Sherbert	Scott Gillihan	42
Amelia Island Plantation	Florida	Ron Hill, CGCS	Pat Rider (Christina Nelson, Mike Taylor, Carol Wyatt)	69
Prairie Dunes Country Club	Kansas	Stan George	Max Terman	47
The Ivanhoe Club	Illinois	Peter Leuzinger, CGCS	Steve Bailey	81
Eagles Landing Golf Course	Maryland	Joe Perry	Catherine Waterhouse (David Ciekot)	94
Egypt Valley Golf Club	Michigan	Jeff Holmes, CGCS	Gordon Van Woekrom	64
Schuyler Meadows Club	New York	Peter Salinetti, CGCS	Charlie Rouse	67
The Club at Seabrook Island	South Carolina	Alan Pulaski	Joseph E. Stevenot (Martha Stevenot, Tom Hilton)	73
Springhouse Golf Club	Tennessee	Shelia Finney	Nancy Richardson	64
United States' Score — Species Recorded: 239.				

A Waste of Time

Save money with this tip to reduce mowing!

by PATRICK M. O'BRIEN

GOLF COURSES are always searching for ideas to save money and reduce the maintenance budget. With every phase of the budget under close scrutiny, many golf courses feel their budget is efficient and productive. However, golf courses in the South with an intermediate rough cut may not be operating at peak efficiency.

Most golfers' expectations of bermudagrass fairways and roughs are based on management practices of cool-season turfgrasses. At these northern golf courses, mower striping and the establishment of an intermediate rough cut is popular. Both practices are appealing to the golfer, though primarily from an aesthetic point of view. Typically, one-half to one inch height differentials exist between these mowed areas on cool-season turfgrasses. The intermediate rough or "step cut" is usually six feet wide next to the fairways. Each of the three mowed areas is readily visible from the tee.

Across the southern U.S., maintaining an intermediate step cut between the fairway and rough is also a routine management practice today. The step cut is usually mowed three to four times weekly at a one-inch height of cut and a widthof 72 to 84 inches. This mowing height is selected since bermudagrass fairways are usually mowed between ⅜ and ⅝ inches and roughs at 1¼ to 1½ inches. With these one-half-inch mowing height differences between the bermudagrass playing areas, the intermediate cut isn't visible to the golfer from the tee. The golf course superintendent achieves nothing by mowing the step cut on bermudagrass playing areas.

Why have golfers requested golf course superintendents to spend time mowing the intermediate roughs? The practice could have originated from USGA championship preparation practices for major golf events, such as the U.S. Open and U.S. Amateur. For these championships, rough heights of cut sometimes are maintained at four to six inches, with Kentucky bluegrass the primary grass. The USGA feels a rough should inflict a half-shot penalty on an expert golfer. This means it should take a great recovery shot from the primary rough for the golfer to par the hole. A poor recovery shot from the rough will result in at least a bogey. It was felt that with the narrow fairway landing areas (26 to 32 yards) provided at these championships, some intermediate rough (two-yard width) around the entire border of the fairway would be more fair for golfers who stray just a few feet off the fairway turf.

In the South, bermudagrass is the most popular turfgrass for fairways and roughs. To see an intermediate rough, at least a one-inch height differential is needed between the adjacent mowed areas. Typically, bermudagrass roughs are mowed at 1¼ to 1½ inches in the summer. In order for the golfers to see the step cut from the tee, the rough would have to be mowed at 2½ to 3 inches. A bermudagrass rough at this height would be at least a full shot penalty for even an expert golfer, and maybe more for the bogey golfer!

With a normal bermudagrass rough, the intermediate rough is invisible. The step cut is invisible because no significant leaf color differences exist between any of the bermudagrass varieties when mowed at the usual heights. With the cool-season grasses, two turf species, creeping bentgrass and Kentucky bluegrass, usually are grown and have different leaf colors and textures in the various mowed areas. The step cut is easily seen with normal mowing heights with cool-season turfs. Nothing is achieved with this maintenance practice for the typical golf course across the South. To save money, personnel, gasoline, and equipment, forget the intermediate rough with bermudagrasses.

So if you are a golfer on a bermudagrass golf course, don't mandate the intermediate rough height. Errant tee shots that stray into the rough will be penalized more severely at these courses with routinely cut warm-season turfgrasses. An intermediate rough cut does nothing to enhance the golf course.

PATRICK O'BRIEN *is the director of the Green Section's Southeastern Region.*

The intermediate cut is more visible at this mowing height, but the bermudagrass rough is too tall for regular play.

NEWS NOTES

In Memoriam:
Arthur A. "Art" Snyder, CGCS
1898-1997

Art Snyder, for many years the oldest living member of the Golf Course Superintendents Association of America and recipient of the 1979 Green Section Award, died on March 12, 1997, at 98 years of age in Tucson, Arizona. He was born in Oakmont, Pennsylvania, on September 13, 1898. He shared with his good friend Ernest G. Jacob of Pittsburgh the longest total number of years of membership in GCSAA at the time of his passing. Both were accepted as members on the same day 68 years ago.

Art began his golf career 90 years ago as a caddie at the famous Oakmont Country Club, near Pittsburgh. He caddied for W. C. Fownes, Jr., before Fownes became National Amateur Champion in 1910. Mr. Fownes and his father, W. C. Fownes, designed and built Oakmont Country Club.

Art later worked on the course at Oakmont and at the old Westmoreland C.C., now Green Oaks C.C., before becoming superintendent at Alcoma C.C. in 1927. He became the club professional there, as well, for a period of ten years. During this time he also served as the golf coach at the University of Pittsburgh. In 1943 he moved to the Longue Vue Club in Penn Hills, near Pittsburgh. During World War II he also found time to work a night shift in a defense plant.

As a result of attending the GCSAA Conference and Show in Los Angeles in 1949, Art and his wife Retta decided to move to Arizona in 1953, accompanied by their sons Jim and Carl and their families. At that time they, along with Art's brother, Carl M. Snyder, began a commercial turfgrass nursery and developed one of the earliest fine-leafed bermudagrasses. Designated as A-53 (Arizona 1953), it later became known as Snyder bermuda.

In 1955 Art collaborated with Gary Madison and Milt Coggins, Sr., in the design and construction of the first nine holes at the White Mountain Country Club at Pinetop, Arizona. In 1956 he became the superintendent at Paradise Valley C.C., where he remained until his retirement in 1974. During these years he was instrumental in organizing the Cactus and Pine GCSA and the Arizona Turfgrass Council. The Art Snyder Award was a feature of the Cactus and Pine Association for a number of years, honoring an outstanding chapter member. Art was the first recipient.

Art was an excellent golfer and could have competed on the Tour. His main interest, though, was in golf course maintenance. He was honored with the GCSAA Distinguished Service Award in 1978, the USGA Green Section Award in 1979, and in 1975 he was inducted into the Arizona Golf Association Hall of Fame, the only superintendent so honored.

He was an active player of the game through his 96th year, and was capable of beating his age every time he played. Skyline C.C. in Tucson presented a plaque to him when he made a hole-in-one on the 191-yard ninth hole at age 85.

One of Arthur Armstrong Snyder's greatest contributions to the game of golf was the encouragement he gave to people to enter the field of golf course maintenance and become proficient at it. Among surviving family members are his sons Jack, Jim, and Carl, grandsons David and Larry, and nephew Arthur A. Snyder II and his son Michael, all of whom are or have been golf course superintendents, including four AA-Life Members and three CGCS Members of GCSAA.

A Note from Audubon International

Northern Flicker

We are delighted to report the high readership for the July-August *Green Section Record* regarding the five-year anniversary of the Audubon Cooperative Sanctuary Program for Golf Courses ("It's Party Time!"). Many of you scanned the list to find your golf course, and some were disappointed not to be listed. The Audubon Cooperative Sanctuary Program apologizes for the confusion!

We didn't make it clear that, although the article celebrated the first five years of the program, the list highlighted the charter members who joined in 1991 during the first year of the program, and who have been active members for the past five years.

We want to applaud all of our members who have supported the program, and who have made great strides as stewards of the environment. We hope you'll keep reading "On Course With Nature" for future articles highlighting members who have initiated special projects on their courses, and who have demonstrated special efforts as members of the Audubon Cooperative Sanctuary Program. If you have ideas for a project or topic that you would like to read about, please contact Lee Mangum at Audubon International at 518-767-9051.

Physical Soil Testing Laboratories*

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

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*Revised September 1997. Please contact the USGA Green Section (908-234-2300) for an updated list of accredited laboratories.

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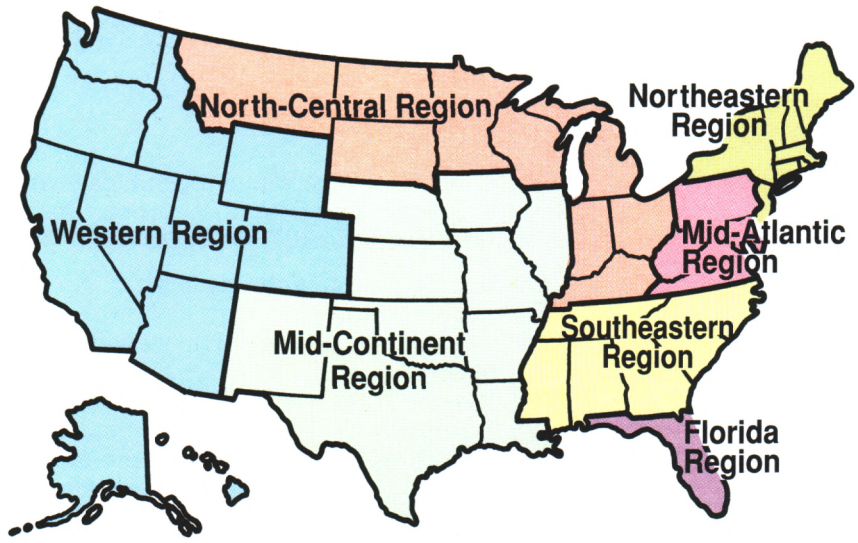

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TURF TWISTERS

SPECIFY MEASUREMENTS

Question: We are preparing to replant our bermudagrass greens. In the process of requesting bids for the sprigs, we have run into a lot of confusion regarding which type of bushel measurement to use. What is the difference between a *Texas bushel* and a *Georgia bushel*? (Texas)

Answer: Confusion is the right word. No one is exactly sure how, but at least two different bushel measurements have evolved. The *Texas bushel* is the same as the U.S. Customary System of measurement with a volume of 2150 cubic inches or 1.24 cubic feet. In contrast, the *Georgia bushel* provides a volume of sprigs of .4 cubic feet or ⅓ of that of the Texas bushel. The Georgia bushel is also occasionally referred to as the *ISB* or *Industry Standard Bushel.*

The Texas bushel is most often used in the western part of the U.S., while the Georgia bushel is most often specified in the eastern part of the country (oddly enough, the Georgia bushel is the standard in Texas). Planting rates and bid proposals obviously must be adjusted to which bushel is specified (be sure to specify one or the other). A typical planting rate for greens is 12 to 15 Texas bushels per thousand square feet, and these numbers would be tripled to 36 to 45 for Georgia bushels.

TO ESTABLISH

Question: Last year, we tried establishing native grasses in a few locations of our secondary rough. Instead of an attractive stand of grasses, we wound up with an unsightly weed patch that was not well received by the golfers. What went wrong? (New York)

Answer: More than likely, much of the problem can be traced to establishment. Seed bed preparation should involve minimal or no tillage, and drill seeding in early fall is preferred. This approach will reduce weed seed germination, and mowing these areas twice a year for the first two years will help control broadleaf weeds. Native grasses generally take two to three years to become fully established; thus, some patience is needed. Hard fescue can be used as a nurse crop during establishment, but keep seeding rates low (25 lb/acre) to avoid dominating the stand and choking out the native grasses.

PERMANENTLY SIZED TEES

Question: We are rebuilding tees and are looking for an easy way to establish a permanent marker for the corners of the tees so that the contour of the tees will not be lost. (Alabama)

Answer: Mark the corners of the tees with a piece of rebar driven into each corner. To prevent damage to mowing equipment, create a PVC sleeve to be driven over the rebar. Both the rebar and the PVC sleeve should be flush with the soil surface. Cap the PVC sleeve with a smooth, rounded cap. Each spring, these points can be located and the mowing patterns on the tee can be reestablished.