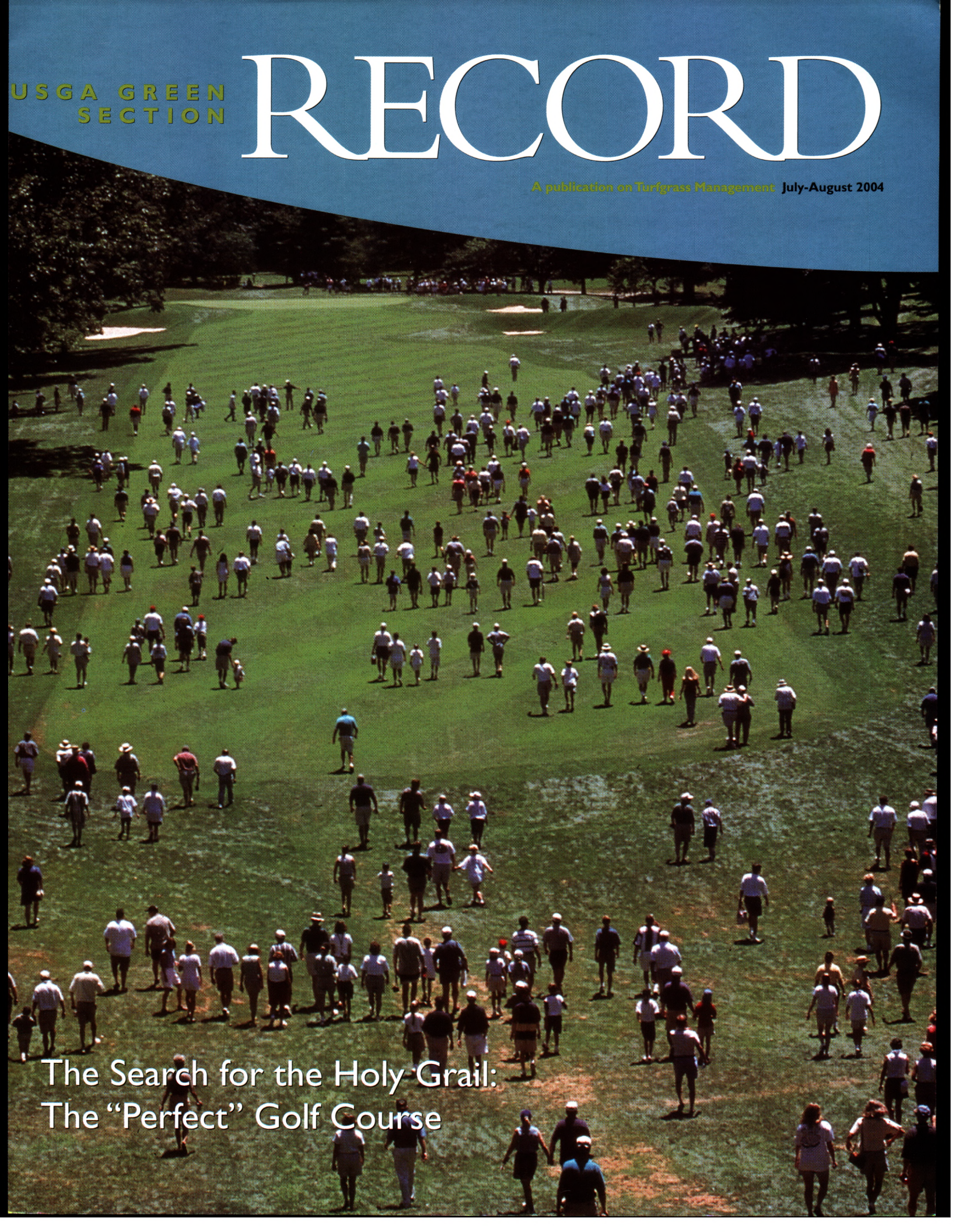


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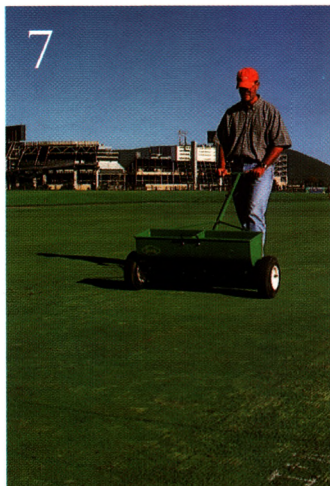
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A high-angle, wide shot of a golf course green. The green is a vibrant, well-maintained grass. A large, diverse crowd of people, mostly men in casual golf attire like polo shirts and shorts, are walking across the green in various directions. Some are in small groups, while others are alone. The background shows a line of trees and a clear blue sky. The overall scene suggests a major golf tournament or a large-scale maintenance exercise.

The Search for the Holy Grail:
The "Perfect" Golf Course

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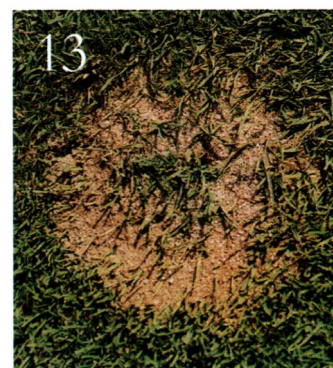
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Good communication can make all the difference in how golfers view their course and what conditions they expect on a regular basis.

“MAKING FRIENDS AND INFLUENCING GOLFERS”

Golfers' expectations are shaped by someone; why shouldn't it be you?

BY CHRIS HARTWIGER

Surveys conducted by the USGA Green Section staff over the years consistently show that communication is the number-one problem facing golf course superintendents. Nowhere is this “problem” more prevalent than in the area of expectations for the playing condition and appearance of the golf course. A wide gap often exists between what the golfer expects and what the turf management staff is able to achieve, given the existing resources and site conditions.

Expectations are not inherently a bad thing. Golfers do not dream expectations, but they are influenced by inputs such as television, friends, reviews of other courses, their own experiences, and so forth. Unfortunately, turf managers and course officials sometimes are put in a defensive or reactionary role when trying to meet or manage golfer expectations.

The goal of this article is to help course officials become a stronger influence on golfer expectations and, in doing so, bridge the gap between what golfers expect and what is being produced. Before players can be influenced, course officials must understand both the product they have and the product they want. To accomplish this goal, key areas of the golf course will be identified for staff and course officials to evaluate. A hypothetical example will show how to evaluate current course conditions and the resources that are available to help with this evaluation. Finally, several methods will be offered to share this information with the golfers and influence their expectations.

STEP 1: DETERMINING WHAT TO EVALUATE

If course officials and staff are on a mission to influence golfers and make friends, a plan is needed. What areas or aspects of the golf course should be most closely scrutinized and what areas



Proper course marking is essential to playing according to The Rules of Golf. Stakes are used to identify a hazard to the golfer while painted lines define the margin of a hazard.

are less important? This author proposes that emphasis should be placed on evaluating how the course plays, not so much how it looks. Too much focus on course presentation can send costs through the roof, and it does not buy long-lasting golfer satisfaction. If satisfaction increased with beauty, the clubs with the largest budgets would have the fewest complaints. This is not happening in the real world today.

Below is a list of areas that can be evaluated. This is not an exhaustive list and every golf course should focus on what it considers to be most important.

- Ability to play by the Rules of Golf.
- Architectural integrity of the golf course.
- Course setup.
- Tees.
- Fairways and rough.
- Putting greens.
- Bunkers.

STEP 2: CONDUCTING THE EVALUATION

The hypothetical example that follows shows how the course officials and staff of our imaginary course, Rolling Green Country Club in Birmingham, Alabama, evaluated the golf course and developed reasonable expectations for these areas. The resources they used to conduct their evaluation are included, too. At the end of each example are “payoffs” or benefits the club will receive from doing this work.

PLAY BY THE RULES

Rolling Green Evaluation: The membership at Rolling Green C.C. believes the Rules of Golf are part of the spirit of the game and help form the basis for years of enjoyment. We hope the golfers at our course expect the course to be prepared in such a way that they can play according to the Rules of Golf. We discovered that most of the year, the lateral hazards and water hazards on our course were not completely marked. A defined boundary or margin is necessary when taking relief from a lateral or water hazard under the Rules of Golf.

We contacted our state golf association to assist us in getting the course accurately marked. We decided to use a combination of stakes and paint when marking water hazards and lateral hazards. The stakes identify the presence of a hazard to the golfer, while the painted line defines the

margin of the hazard. Red paint and red stakes are used to mark lateral hazards, and yellow stakes and yellow paint to mark water hazards. Once the course was marked correctly and completely, the job of keeping the course marked all the time was assigned to one of our employees.

Resources Used: State golf association.

Payoff: The golf facility that takes the effort to keep the course marked at all times will reap several rewards. First, golfers will see that those in charge of marking the course have a thorough understanding of the game and a respect for playing the game according to the Rules of Golf. Additionally, preparation for outings and tournament play will be much easier.

ARCHITECTURAL INTEGRITY

Rolling Green Evaluation: Mr. I. M. Grate, the architect who designed Rolling Green C.C. in the 1950s is no longer with us, unfortunately. Nonetheless, we acknowledge he had certain intentions in mind when designing each of the holes. As course officials and staff, we have an interest in maintaining the integrity of our architect's design. We are mindful of the fact that the integrity of many holes has changed due to tree plantings, tree growth, and bunker additions over the years. We believe Mr. Grate created a challenging, unique course and that our members have every right to expect the opportunity to play the course as the architect intended.

Although some of the officials on our Green Committee have an affinity for golf course design, no one at the club was qualified to make recommendations necessary to restore the original intent of the architect. As a result, we hired Mr. James Green, an architect familiar with the designs of Mr. I. M. Grate, to guide us as we look to keep our course true to the intentions of the founding architect and relevant to today's game. Mr. Green toured our golf course and his expertise is benefitting us already. We posted Mr. Green's report on our Web site and golfers are able to learn more about the golf course. For example, we learned that the eighth hole was designed as a cape hole. This type of golf hole was meant to offer players the chance to try a risky shot over the lake in the corner of the dogleg with the reward of being much closer to the putting green. The two trees planted in the corner of the dogleg back in 1978 actually eliminate this option and steer all players away from the water.

Resources Used: A qualified golf course architect.

Payoff: By reporting this information to those who play the course, the officials and staff at Rolling Green are reinforcing how the golf course was intended to be played. Sharing this knowledge will inspire confidence among golfers that future changes or a lack of changes are based upon knowledge of the designer and not based upon personal agendas.

COURSE SETUP

Rolling Green Evaluation: Our course was rated four years ago by our state golf association. We understand that course setup determines the way each hole plays on a given day. The tee marker position and the hole location influence the length and relative difficulty of a hole. Our course setup crew understands the importance of maintaining the integrity of our course rating. In other words, we try to keep the course playing approximately the same length every day and provide a good balance of easy, moderate, and difficult hole locations.

Resources Available: State golf association.

Payoff: A good course setup policy demonstrates that course officials and the superintendent are serious about the way the game is played on the course. Further, criticism that the person setting up the holes on a given day had a long night or that certain hole locations are unfair can be dismissed with a minimum of effort. Finally, the use of available tee and green space will be maximized.

TEES

Rolling Green Evaluation: At Rolling Green, the teeing ground on each hole is used at least once by every golfer in a round. The quality of the tees is impacted by many factors, including the growing environment, soil type, turfgrass type, uniformity of the base, sunlight levels, tree limb interference, and size in relation to the number of rounds played. This helped our officials understand how the quality of tees can vary widely within our course.

We evaluated all our tees on the golf course for adequate size, surface uniformity, and shade. We used a formula introduced in a *Green Section Record* article called "Tailor Made" to determine if our tees and practice tee were large enough based upon our level of play (Vermeulen, 2002). The formula took into account rounds played, divot recovery time, and turfgrass type. Of the 62 tees on the golf course, we discovered serious shade

problems on two tees, inadequate size on three others, and an uneven surface on two more. All the other tees met our expectation of excellent surface uniformity and healthy turf.

Resources Used: *Green Section Record* article called "Tailor Made" and a USGA Green Section Turf Advisory Service visit.



Payoff: The evaluation of the tees confirmed that the vast majority of tees are meeting expectations. The weakest tees are caused by lack of size and shade, which the superintendent has been reporting for years. It wasn't until all the committee members conducted the evaluation that they understood the facts of the shade problems.

A constructive review of the tee conditions and subsequent communication to the golfers sent several messages. First, the overwhelming majority of tees meet the expectations of a level surface and strong turf every day. By acknowledging the weak areas and their causes proactively, complaints about the tees should decrease and the club is in a much stronger position to respond to complaints that do occur. This will be enhanced if they outline a program to improve the tees over some period of time.

FAIRWAYS

Rolling Green Evaluation: Fairway conditions have been a contentious issue at Rolling Green for years. One of the biggest areas of controversy is the fairway mowing height. Some players prefer taller fairways, but others favor shorter turf in the fairways. Still others seem concerned about color and perceive a lush, green surface as an ideal fairway condition.

We learned about the "Report Card for Fairways" developed by Patrick Gross of the USGA

Course officials and golf course staff who make the effort to evaluate their course and develop expectations are well on their way to solving golf maintenance's number-one problem, communication.



Putting greens receive the most scrutiny from golfers. Determining sustainable daily green speed involves taking into account the health of the turf, available resources, environmental conditions, and golf course design.

and described in an issue of the *Green Section Record* (Gross, 2000). The article explained that fairway conditioning involves several factors, including density, firmness, resiliency, turf selection, mowing and grooming practices, drainage, water management, and pest management. At the end of our evaluation, we realized that the fairways at Rolling Green did not have any serious deficiencies and that we needed to reach a consensus on mowing height and watering practices.

The first step in resolving these issues was deciding upon the definition of a good fairway. We agreed that a good fairway is one where the ball can be played down during the season, weeds are kept to a minimum, and the golfer is afforded the chance to play as many types of shots as possible (i.e., lowing running shots, high shots, etc.). Our golf professional and superintendent advised that a mowing height of $\frac{1}{2}$ inch was a fair compromise for players of all abilities and that the irrigation schedule should be based on keeping the turf healthy and not used as a means to produce optimum color.

Resources Used: "How Fair Are Your Fairways?" *Green Section Record* article.

Payoff: The Green Committee's evaluation is going to influence the golfers. First, they reached a consensus and articulated what they expect for fairway conditions. In doing so, they advised the

golfers that the major emphasis is placed on how the fairways play, not how they look.

PUTTING GREENS

The putting greens are the most important part of our course since they involve, on average, two out of every three shots in a round of golf and they generate most of the comments made by golfers. Although green speeds have increased dramatically since the mid-1970s when our superintendent arrived, there is pressure to make them faster each year. Could higher speeds be attained without sacrificing the health of the turf? Would our greens need to be rebuilt? Should our greens be rebuilt? All are excellent questions, but the Committee had no answers.

Our superintendent and regional USGA Green Section agronomist shared several resources with us to assist in our evaluation. The first was an article called "S.P.E.E.D. — Consider What's Right for Your Course" that appeared in the *Green Section Record* (Vermeulen, 1995). The article showed us how to determine a daily expected green speed that took into account the health of the turf, resources available, environmental conditions, the expertise level of our golfers, and course design.

Once we had a handle on an attainable green speed for daily play, we turned to the article "Helping Your Greens Make the Grade" (Moore, 1998). This article used a report card format to grade many of the factors that influence putting green performance. The evaluation was simple to do with the help of our superintendent, and everyone enjoyed participating. At the completion of our report-card analysis, we learned that our rootzone and turfgrass were still performing well. Problem areas were due mainly to restricted growing environments with poor air movement and shade. Improving the grades on those greens is possible without the expense and disruption of reconstruction.

We concluded that it is reasonable for our golfers to expect putting greens that feature a level of smoothness and speed that provide a good challenge, do not slow play unduly, are not disrupted by weed or other pest problems, and can be attained under our existing budget and staff levels.

Resources Used: "S.P.E.E.D. — Consider What's Right for Your Course" article, "Helping Your Greens Make the Grade" article, and a USGA Green Section agronomist.



It is never too early to begin communicating about expectations of golf course conditions. Beginning golfers should be instructed about bunkers being hazards and that putting green smoothness is more important than speed. Will they believe it? There is only one way to find out.

Payoff: The Green Committee at Rolling Hills has taken the time to create a sustainable program with green speeds that provide a good balance between the agronomic needs of the turf and the expectations of the golfers. This places the Green Committee and staff in a position of strength to answer questions about green speed. It now will be possible to provide a thoughtful answer to the golfer who has just putted miserably one Saturday morning and has cornered a Green Committee member or staff member with some variation of the question/demand/comment, "Why are the greens so slow?"

BRINGING IT ALL TOGETHER

The desire to become a greater influence on golfers has required a considerable effort on the part of the Green Committee and the staff at Rolling Hills. However, to be a unified and strong influence on the golfers, those in leadership positions at the club must understand the product the club desires to produce and what is being produced. This does take some effort, but doing so will contribute to the ultimate goal of influencing golfers. There are no shortcuts when it comes to evaluating your own course and determining reasonable expectations.

The information generated by our Rolling Green example is powerful. There are at least six conclusions that will influence golfers.

- The Rules of Golf govern play and the course is maintained and marked accordingly at all times.

- The membership cherishes the work of the original architect, and the club is committed to maintaining the integrity of his work.
- The course is set up daily to provide a challenge that is consistent with the course/slope rating.
- A level surface and strong turf are expected on the tees.
- The expectation for the fairways is to provide a firm, dry surface when weather permits and to keep the mowing height at a level satisfactory for the skills of most of the golfers.
- The expectation for the putting greens is to maintain a level of smoothness and speed that provides a good challenge, does not slow play unduly, is not compromised by weed or other pest problems, and can be attained under our existing budget and staff levels.

The true rewards at Rolling Green will come over time when this information is disseminated, relayed, promoted, discussed, and reviewed over and over with the golfers. This is a job that will never end because there will always be other factors shaping golfer expectations.

Although there are countless ways to share information with golfers, several of the more popular methods will be mentioned here. The first is a monthly e-mail update from the golf course superintendent. Although many will object that e-mail newsletters take too much time in an already overburdened schedule, the fact remains that once a superintendent spends a couple of hours creating a newsletter, it can be

e-mailed to one or 100 people with one click of the mouse and at the same cost. The e-mail update can be as simple or as elaborate as time allows. The superintendent at Rolling Hills could use one of the conclusions mentioned above for a lead story for each of the next six months.

The Web site for the golf course is another great way to inexpensively share information with the golfers. A page for course expectations could be created. In our Rolling Hills example, the details of the course evaluation could be written up and the expectations stated. This can be done for minimal cost, but the golfer will be exposed to this information over and over on the Web site. Ask yourself these questions: Would prospective members rather know what the expectations for course conditions are, or would they rather not know? Would existing members rather know that the Green Committee has developed course expectations and evaluated course conditions, or not?

Another simple, inexpensive, and effective way to influence golfers is to make sure the staff and Green Committee are armed with the same evaluation and expectation information so that questions will be answered consistently. It is such a simple concept, but it cannot be implemented until the club knows what it wants to produce.

Shade is one factor that should be considered when evaluating tees, as it has a major effect on turf quality.

CONCLUSION

Perhaps this article has sparked a few ideas and will serve as a starting point for golf courses interested in bridging the gap between golf expectations and current conditions. Despite economic challenges over the past few years, turf-grass conditions across the board are at an all-time high. For courses that take the time to understand what they have and agree upon what they want, they can make friends and influence golfers. For those who do not make the effort, communication will continue to be the number-one problem.

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Moss Control — New Products and Strategies

Promising moss control strategies for
Mid-Atlantic Region putting greens.

BY PETER LANDSCHOOT, PH.D., JOSHUA COOK, AND BRADLEY PARK

Moss in putting greens is a curse that can frustrate golfers and even the most diligent and experienced superintendents. Moss can creep into a green almost unnoticed, until suddenly it appears as though it is taking over the entire playing surface. Chemical control measures are often harsh on turf and slow in killing the moss. However, some new products and strategies for moss control are providing relief for golf course superintendents.

Recent research at Oregon State University, Cornell University, and other research institutions revealed that two relatively new products — Junction® and TerraCyte™ provide good control of silvery thread moss (*Bryum argenteum*) when used at proper rates and application timings.^{1,2} The objective of our research at Penn State University was to confirm if results of moss control research in other regions apply to the Mid-Atlantic region. We also wanted to determine the effects of dishwashing detergents and iron sulfate on moss control in putting greens. The following is a summary of what has been found to date.

PRODUCT DESCRIPTIONS

Junction is a turf and ornamentals fungicide (sold by Griffin L.L.C., Valdosta, Georgia) formulated as a dry flowable containing 15% mancozeb and 46% copper hydroxide as the active ingredients. Junction currently has a FIFRA Section 2(ee) recommendation for moss control in greens, tees, and



Moss can encroach into a putting green virtually unnoticed until one day it appears to be taking over the surface.

fairways, but no information on moss control appears on the 2003 product label. The 2(ee) recommendation for curative control of moss is 4 oz. Junction/1,000 sq. ft., applied in 2 gal. of water during cool weather at 7- to 14-day intervals. The recommendation states that sequential applications are required and that seven or more applications may be necessary for good control.

TerraCyte is sold by BioSafe Systems (Glastonbury, Connecticut) and contains 34% sodium carbonate peroxyhydrate as the active ingredient. This product is available only as a very

fine granular formulation. The carrier is finely ground dolomitic limestone. Because it is so fine, it should be applied to turf with a drop-type spreader. TerraCyte is labeled for moss control in greens, tees, and fairways, and recommendations call for 8 lb. product/1,000 sq. ft. during spring or fall when temperatures are 50°F or above. Only spot treatments are recommended in summer months. The label states that subsequent applications of 2-4 lb. TerraCyte/1,000 sq. ft. can be made on consecutive days. The product should be watered into the turf immediately following application.

MOSS CONTROL TRIALS AT PENN STATE

Moss control experiments were conducted at Penn State in 2002 and 2003 on a 20-year-old mixed stand of creeping bentgrass (*Agrostis stolonifera*) Penn-cross and annual bluegrass (*Poa annua*) maintained as a golf course putting green. The soil was a sandy loam with a pH of 6.8 and contained adequate levels of phosphorus and potassium. Nitrogen-containing fertilizer was applied in several applications during the growing season to provide a total of approximately 3 lb. nitrogen/1,000 sq. ft. The green was mowed six times per week at a height of 0.125 inch. This green had a uniform and heavy natural infestation of silvery thread moss (average of 40% surface area infested with moss). Thus, it was an ideal site for conducting moss control studies.

SUMMER TRIALS

Summer moss control trials were conducted during 2002 and 2003. These trials began in mid-July with the intent of evaluating the performance of several products in the heat of the summer. Although we don't recommend trying to control moss during July and August, some superintendents spot treat for moss in summer, and we wanted to look at how different products perform during stressful summer conditions.

The summer trials included three iron sulfate treatments (0.2, 0.4, and 0.6 lb. iron/1,000 sq. ft.); two treatments of Dawn Ultra dishwashing detergent (4.0 and 8.0 oz./1,000 sq. ft.); a combination of Ivory dishwashing detergent (8.0 oz./1,000 sq. ft.) and hydrogen peroxide (8.0 oz./1,000 sq. ft.); three TerraCyte

treatments (8 lb./1,000 sq. ft. and consecutive day applications of 8+4 lb./1,000 sq. ft. and 4+4 lb./1,000 sq. ft.); and two Junction treatments (2.5 and 5.0 oz./1,000 sq. ft.). All products except TerraCyte were applied in 2 gal. of water/1,000 sq. ft. (pH 6.5) and were not watered in. The TerraCyte treatments were applied in granular form on



Junction (plot on left) was ineffective in controlling moss during summer trials, but TerraCyte (plot on right) provided good control. TerraCyte should only be used for spot treatment of moss (applied directly to moss patches and not to turf) during summer when temperatures and humidity levels are high. Broadcast applications can be made during periods of cool temperatures and low humidity.

the day after liquid treatments were applied and watered in with about 0.1 in. water (according to label directions). In 2002, treatments were first applied on July 11 and every two weeks until September 4 to provide a total of five applications. In 2003, treatments commenced on July 13 and every two weeks until August 25 to provide a total of four applications.

Results: Dawn Ultra, Ivory/hydrogen peroxide, and Junction treatments were ineffective for controlling moss. On the positive side, we did not observe significant injury from these treatments during the summer months. Some superintendents in Pennsylvania have had success controlling moss with multiple applications of Dawn Ultra at rates between 4.0 and 8.0 oz./1,000 sq. ft. The reason(s) for the lack of moss control with Dawn Ultra in our trials is unknown, but may involve the moss species or biotype, application procedure (drenches of Dawn may be more effective), and/or

differences in environmental conditions between golf courses where Dawn Ultra has been successful and our test site.

Treatments that *were* effective in controlling moss included iron sulfate and TerraCyte. The two highest rates of iron sulfate (0.4 and 0.6 lb. iron/1,000 sq. ft.) provided 90-95% moss control but caused unacceptable injury to the turf. The lowest rate of iron sulfate (0.2 lb. iron/1,000 sq. ft.) provided 75% control of moss and caused only slight blackening, but no turf thinning. The black turf color diminished within two to three mowings. The TerraCyte treatment that was most effective in controlling moss with the least amount of injury was 8 lb./1,000 sq. ft. every two weeks (78% control in 2002 and 52%

control in 2003). All TerraCyte treatments produced some foliar injury following applications during high-humidity conditions.

FALL TRIAL

The fall trial was conducted during 2002 beginning in mid-October and continuing into December. Treatments were applied every two weeks for a total of five applications. Treatments included iron sulfate (0.2 lb. iron/1,000 sq. ft.), TerraCyte (8 lb./1,000 sq. ft. and consecutive day applications of 8+4 lb./1,000 sq. ft. and 4+4 lb./1,000 sq. ft.), and Junction (5.0 oz./1,000 sq. ft.). All liquid products were applied in two gallons of water/1,000 sq. ft. and were not watered in. The TerraCyte treatments were applied in granular form on the day after liquid treatments were applied and watered in with about 0.1 inch water.

With Junction, we followed the approach used by Tom Cook and

associates at Oregon State University in which 4.5–6.6 oz. Junction/1,000 sq. ft. (0.1 to 0.15 lb. copper/1,000 sq. ft.) was applied beginning in October and repeated every two weeks to provide five to seven applications.¹ Because snow cover sometimes prohibits spray treatments in late December in central Pennsylvania, we made only five applications.

Results: The iron sulfate treatment (0.2 lb. iron/1,000 sq. ft.) provided about 45% moss control, with no serious injury. The 8 lb./1,000 sq. ft. TerraCyte treatment provided the best control (about 80%) and the least injury of all the TerraCyte treatments. As in the summer trials, some foliar injury was noticed

following TerraCyte applications during high-humidity conditions. The most effective treatment in the fall trial was Junction at 5.0 oz./1,000 sq. ft., providing 100% control of moss. Although some yellowing was observed in early spring on turf treated with Junction in fall, the turf fully recovered following two to three mowings. Yellowing of turf has been reported in other studies using fall applications of Junction, and this effect has been implicated as copper-induced iron chlorosis.¹

SUMMARY

Results of our studies are similar to those obtained at Oregon State University and Cornell University.^{1,2} Junction was ineffective in controlling moss during the summer months, but provided excellent control at 5 oz./1,000 sq. ft. when applied in mid-October and every two weeks for a total of five applications. It is interesting to note that

no moss control was observed with Junction during the period of treatment applications in fall. Control (dead moss) was not observed until the following spring. In our trial, the turf quickly filled in areas containing dead moss once vigorous growth commenced in spring. We are not sure if the yellowing associated with fall applications of



Junction (plot on right) provided 100% control of moss following five applications in fall at 5 oz./1,000 sq. ft. The pitted appearance of the Junction plot is due to patches of dead moss. The plot on the left is an untreated control plot. No injury to moss was observed during the fall, and dead moss was not evident until the following spring.

Junction was due to copper-induced phytotoxicity or a copper-induced iron deficiency. Regardless of the cause, the effect was temporary and did not cause thinning of the turf. Another factor that can potentially affect Junction efficacy is the pH of spray tank water. If the pH of spray tank water is basic, efficacy may be compromised.² In our trials, the pH of the spray tank water was 6.5 and did not appear to negatively influence moss control.

TerraCyte at 8 lb./1,000 sq. ft. (four to five applications, two weeks apart) provided good, but not complete control of moss in summer and fall. Although some foliar injury occurred following treatment applications during humid conditions (both summer and fall), the turf recovered following several mowings. Injury resulting from the 8+4 lb./1,000 sq. ft. consecutive day treatment was more severe, and caution should be exercised if using this approach.

Although the purpose of this article is to provide a brief update on chemical control practices, we would be remiss if we did not mention that chemical control strategies must be accompanied by changes in the cultural conditions that allowed moss to encroach into the greens. The most obvious culprits, low nitrogen levels, aggressive mowing practices, and liberal irrigation, can usually be adjusted to allow turf to compete with the moss — at least to some reasonable degree. Other causes of moss encroachment, poor drainage, persistent disease problems, shade, excessive traffic, and poor air circulation, represent a greater challenge. If the major causes of moss encroachment are not dealt with, even the best chemical control

program will not prevent the moss from coming back.

ACKNOWLEDGEMENTS

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To ensure timely opening of a new course or a renovated area, consideration should be given to the turf's proper planting window. Using normal seeding rates for turf establishment will hasten stand development by minimizing seedling competition for space, water, and nutrients.

TURF ESTABLISHMENT: PEEPHOLE OR PANORAMA?

Establishing new turf during the proper planting window is essential for success.

BY CHARLES B. (BUD) WHITE

The final phase of every new construction or major renovation project is establishing the bare ground with a new stand of turf. At this point, the only remaining question is, can it be done successfully despite the time of year, or is the time of year critical to the success of the project?

In the turf industry, we refer to the optimal time frame for planting seed and sprigs as the proper planting window. By failing to appreciate

the importance of seeding or sprigging during the proper planting window, many newly constructed courses have experienced severe setbacks in terms of poor grow-in and delayed opening. In essence, they chose to ignore well-established protocol and fell victim to the ravages of unfavorable growing conditions.

Generally, the accepted planting window for warm-season grasses, such as bermudagrass and zoysiagrass, is late spring through midsummer,

whether established from seed or sprigs, and for cool-season grasses, such as bluegrass, bentgrass, and fescue, late summer through early fall.

Although there can be slight variations to these general time frames, planting well beyond these dates should definitely be avoided. This article will examine the importance of scheduling turf establishment during the proper planting window and some of the more serious ramifications of going astray.

Temperature and day length play key roles in the proper timing of warm-season grass establishment. For example, bermudagrass will not grow vigorously unless the daytime high plus nighttime low temperatures total more than 150°F. At combined temperatures below this value, bermudagrass may look green, but for all practical purposes, it is in a semi-dormant state characterized by minimal leaf, stem, and root growth. For this reason, it is physically impossible to push the opening date for new courses ahead of schedule by establishing bermudagrass before the beginning of its proper planting window in late spring.

At the other end of the bermudagrass planting window, its initial survival rate during winter is greatly diminished if it is established after mid-summer. This is due primarily to the fact that the maturation rate of bermudagrass is held in check by the shorter day lengths during late August and September. Moreover, it is not possible to make up for late bermudagrass planting by overseeding

in the fall with perennial ryegrass. In fact, the strong competition for space, water, and nutrients resulting from fall overseeding is so detrimental to young bermudagrass that the cost of complete reestablishment the following summer should automatically be factored into the budget.

By contrast, the planting window for cool-season grasses is better defined by the temperature of the soil just beneath the surface. More specifically, the optimal soil temperature for the germination of most cool-season grasses falls somewhere in the range of 60°F to 80°F. In keeping with this range, the seeding of creeping bentgrass in northern climates, for example, should be scheduled in late August and completed no later than late September. If delayed until October or, worse yet, November, soil temperatures in the 50s will likely prevent the creeping bentgrass seedlings from maturing before the onset of winter, thus reducing their odds of survival.

By increasing the soil temperature with either fabric or plastic covers, there are special situations in which the planting window for cool-season grasses can be expanded into late fall. However, to prevent rampant disease infection under the covers, the buildup of excessive heat on sunny afternoons must be continuously monitored. Additionally, the covers must be periodically removed to keep the turf mowed on a regular schedule. Because of the expense associated with handling covers on a frequent basis, their use is typically limited to greens and tees.



Fabric covers can extend the planting window for cool-season grasses. Special care is required to prevent rampant disease outbreaks that can occur under the covers.

Another popular, but largely unsuccessful, means of extending the planting window is to significantly increase the seeding rate. The downside of using increased seeding rates is that seedlings are forced to compete for limited space, water, and nutrients. In turn, this competition produces weak plants that have a spindly structure and are more apt to become terminally infected by destructive fungal pathogens.



Planting bermudagrass sprigs during late spring through midsummer is essential to their successful establishment and grow-in.

Using seeding rates lower than recommended also can lead to problems. By establishing a sub-optimal number of seedlings per unit area, the turf stand will require more time to develop a dense canopy and can become severely eroded. An excellent source of information for correct seeding rates by climatic zone and species is the book *Turf Management for Golf Courses*, Second Edition by Dr. James B. Beard and the USGA Green Section.

There are also drawbacks to establishing bermudagrass with abnormal sprigging rates. Higher than recommended rates are simply a waste of money because properly managed sprigs will develop into a dense stand of turf in a short length of time. Lower than recommended rates will require too much time to develop into a dense stand and, again, become subject to severe erosion. The only possible exception might be to use a higher, but not excessive, sprigging rate when establishing warm-season grasses near the end of their proper planting window.

While on the subject of sprigging warm-season grasses, it is important to shed light on bushel measurement. As regulated by the National Institute of Standards and Technology, a bushel has a volume equal to 1.244 cubic feet and is referred to as a U.S. bushel. Because the U.S. bushel is not used as the standard measurement in all parts of the country, however, there is confusion from time to time regarding the wording of some sprigging recommendations. For example, a Georgia bushel is approximately five times and a Texas bushel is approximately two times the volume of a U.S. bushel. Furthermore, for some fine-textured varieties, such as Tifdwarf and Tifeagle, the small stolon size can also increase the number of sprigs in a bushel by as much as 25%.

To avoid problems during establishment, it goes without saying that the measurement of a bushel should be clearly defined in all construction contracts. Maybe the best way to avoid confusion is to simply state the sprigging rate in terms of live sprigs per square foot, e.g., a minimum of seven to ten live sprigs per square foot.

To complement this discussion about planting windows, it is also wise to consider the grow-in period. It is common in the turf industry to think of the grow-in period as a time frame of approximately four to six months, depending on location and grass type. However, the specific months that are included in this time frame must be considered. Four to six months is usually adequate, assuming the weather is favorable for vigorous growth. If December, January, and February are included in the six-month time frame, then the grow-in period should be closer to seven to nine months. This is further magnified when planting windows are pushed closer to winter dormancy or summer heat stress.

In the planning phase of every new construction or major renovation project, it is always critical to account for the proper planting window. When golfers, developers, and/or owners view the proper planting window as a peephole of opportunity instead of a broad panorama of endless possibilities, a more rapid and successful grow-in will result. This, of course, equates to better turf, an earlier opening date, and greater profits.

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Research You Can Use

Nuisance Ants on Golf Courses

Understanding ant biology and behavior may help control mound building on putting greens and tees.

BY REID M. MAIER AND DANIEL A. POTTER, PH.D.

Mound-building nuisance ants have become one of the more troublesome pests in golf course maintenance. The problem occurs when the ants construct nests on putting greens and tees. Ant nests, which are located underground, often have multiple entrances, each surrounded by a small, volcano-shaped mound of soil. Mounds are formed from soil particles that the worker ants bring to the surface while excavating burrows and enlarging the nest chambers.

Ant mounds can be very abundant in high-sand rootzone putting greens and tees. Besides being unsightly, they dull mower blades, clog machinery, and smother closely mowed grass. On putting greens, ant mounds disrupt smoothness and uniformity and can directly impact the game. This article provides an update on our current USGA-funded research project concerning biology and proactive management of turf ants on golf courses.

BASIC ANT BIOLOGY

Most of the nuisance ant problems on golf courses in the cool-season and transitional zones seem to be caused by *Lasius neoniger*, the so-called turfgrass ant.⁴ Worker ants, the form most often seen, are light to medium brown and about 2-2.5mm ($\frac{1}{10}$ inch) long. *Lasius neoniger* is a cosmopolitan species that typically nests in sunny open areas. The subterranean nest consists of shallow interconnected chambers and is seldom more than 25-38mm (10-15") deep. Besides workers, the nest contains a single reproductive queen as well as



Mound-building ants have become one of the more troublesome pests on golf courses. Underground nests often have multiple entrances, each surrounded by a volcano-shaped mound of soil that disrupts the playing surface of putting greens and tees.

immature stages (eggs, larvae, and pupae) that collectively are called the brood.

For most of the growing season, the queen lays eggs that develop into infertile female workers that cooperate in various tasks of the colony, including cleaning and enlarging the nest, gathering food, defending the nest from natural enemies, and tending to the queen and her brood. In mid- to late summer, the queen begins laying eggs that develop into reproductive individuals (i.e., males and new queens). These winged reproductive ants emerge from the nest in late summer and mate, and the newly fertilized young queens then fly or crawl to new sites to overwinter where they will start a new colony the following year.

Egg-laying begins in early spring. Queens initiating a new nest first lay a small batch of 10-20 eggs. This first brood will develop into tiny workers called nanitics. Nanitics, although small and weak, begin foraging for food for the queen, ensuring that she will have

enough nutrients to lay additional eggs. The queen then remains in the nest and lays eggs that develop into normal workers. The colony grows rapidly during late spring and early summer as the ants enlarge their foraging area, and increasingly more brood and workers are reared. Winged reproductive forms are produced in late summer to complete the cycle. It is believed that once a nest is established, the resident (old) queen may survive and lay eggs for more than one year.

We determined the seasonal pattern of mound-building by counting active *L. neoniger* mounds on ten sand-based bentgrass tees on each of two Kentucky golf courses monthly from February until November. Mounding started in February or March, increased rapidly in April and May, and declined by late summer.

Workers of *L. neoniger* forage on the surface for food, including insect eggs, small insects, or insect fragments. A successful foraging trip results in the worker depositing a pheromone trail from its hindgut while returning to the nest. Additional workers use this trail to find the resource discovered by the scout. Subsequent workers reinforce this pheromone trail so long as the food resource is present. Workers also may obtain carbohydrates by feeding at extrafloral nectaries, or by collecting nectar from flowers of nearby plants. For example, we have observed *L. neoniger* feeding at extrafloral nectaries of peonies in flower beds near turf.

In general, ants are beneficial to turfgrass. They are important predators,

Lasius neoniger
ant queen on
closely mowed
bentgrass.



contributing to natural control of pest insects.^{2,3} Ants are the main predators of white grub eggs in the soil, as well as eggs and small larvae of cutworms, sod webworms, and other turf insects. Ants' burrowing and nesting activities promote air and water infiltration, and help incorporate organic matter into the soil, where the nutrients are available to the grass roots.

ANT-APHID MUTUALISM

Many ants obtain carbohydrates by feeding on honeydew that they obtain from aphids or other tiny insects that suck plant sap. The honeydew, essentially sugary aphid excrement, is a complex mixture of nutrients, including free amino acids and amides, minerals, and B-vitamins. Often the ants "tend" the aphids like dairy cattle and defend them from predators. When an ant strokes an aphid with its antennae, the aphid relinquishes a sugary droplet from its anus. The ant swallows the droplet and carries it back to the nest, where it is shared with the colony.

L. neoniger ants have a specific relationship with root-feeding aphids, *Geotica* spp., which they maintain in their nests. The ants store and care for the aphid eggs over the winter, mixing them in with their own. The root aphids

hatch by early spring and are carried by the ants to nearby grass roots to feed. As the aphids multiply, the ants care for and protect them. Turfgrass that receives supplemental nitrogen and other nutrients often supports large numbers of root aphids that provide ample honeydew for ants. The ants also may eat some aphids to supplement their diet. The aphids themselves don't seem to measurably harm the grass.

WHY ARE ANT MOUNDS MAINLY AROUND EDGES OF SAND-BASED GREENS?

Superintendents often report that ant mounds are most abundant around edges of sand-based putting greens. We speculated that the abrasiveness of the green's rootzone mix might be unsuitable for the ant nest and the soft-bodied root aphids from which the ants get food. If that is true, then the main nest chambers with the queen may be restricted to just outside the collar in native soil. Perhaps ant control efforts should be directed there rather than spraying the green itself. Mounds encroaching onto greens may represent secondary nest chambers connected by tunnels to the main nest.

We tested that hypothesis by sampling the distribution of ant mounds and root

aphids on sand-based greens, collars, and in adjacent roughs, and examining their abundance in relation to soil sand content. Locations of several hundred mounds were mapped on ten different greens on each of three golf courses by measuring the distance of each mound from the outside edge of the collar. Aphids were sampled by pulling soil cores along transects centered on the collar and extending into the green or rough. The cores were placed in a Tullgren funnel apparatus that slowly dries the samples under heat and light, driving soil invertebrates downward into collection jars. Root aphids were then counted and the sand content of each core was analyzed.

Our samples confirmed that *Lasius* ant mounds are concentrated around the edges of sand-based greens. More than 90% of mounds on greens were located within 2 meters (6.5 feet) of the perimeter, and only 3% were more than 3 meters (10 feet) into the green. Root aphids were abundant in native soil, but absent from the high-sand rootzone of collars and greens. It was not practical for us to dig up the greens on cooperating golf courses to look for ant nests, but in 2004 we hope to sample the University of Kentucky research greens to determine if the main ant nests are

located in the green, collar, or close rough.

While our results are correlative and do not *prove* that maintaining access to root aphids is why ants encroach from the perimeter, the ant-aphid mutualism may be a weak link that could be exploited for ant management. We plan an experiment for 2004 to determine if eliminating root aphids with a systemic soil insecticide will discourage ants from nesting in that area.

season, as soon as mounds appear. At that time, new colonies are just getting started, and established ones are weakened from overwintering, with depleted food reserves, older workers, and few new brood. Even so, spraying ant-infested turf is not likely to eliminate the ants.

Fipronil, the active ingredient in Chipco Choice and Chipco TopChoice granular insecticides, is labeled for control of mole crickets, fire ants, and

take it into the nest and feed it to the queen and her brood. The nest dies out in a few days. Ants do not take wet bait, so if trying this approach, apply the bait after dew dries and withhold irrigation for at least 12 hours.

In 2004 we plan to determine if targeting newly emerged queens in late summer will prevent new ant nests from becoming established in high-profile areas of golf courses. Of the several trap designs we have tested, the most



Many ants obtain carbohydrates by feeding on honeydew that they obtain from aphids (such as the root aphids shown here) or other tiny insects that suck plant sap.

PROACTIVE ANT MANAGEMENT

Superintendents often find that spraying putting greens gives only temporary suppression of mound-building nuisance ants. Residues of fast-acting insecticides do kill workers foraging on the turf surface, but often they fail to eliminate the queen in her underground nest chamber. Several pyrethroids, including bifenthrin (TalstarOne), cyfluthrin (Tempo), deltamethrin (DeltaGard), and lambda-cyhalothrin (Scimitar) are labeled for ant control on golf courses. The best timing is early in the growing

nuisance ants on southern golf courses. It is very effective against *L. neoniger*, providing season-long suppression of mound activity. Fipronil is only labeled in the 13 southern states where fire ants are established, so presently it is not an option for use on temperate zone golf courses.

Our earlier USGA-funded research³ showed that spot-treating with Max-Force Fine Granule Insect Bait (Clorox Co.) often will eliminate ant mounds on putting greens. When the bait, which contains a slow-acting insecticide, is sprinkled around mounds, the ants

effective for queen monitoring was a sand-filled, 12-ounce plastic drink cup set flush with a golf cup cutter. Crawling queens burrowed into the sand, which was periodically checked. Superintendents might set a few such traps in green surrounds or simply watch for the first queens crawling on greens or tees. Recent work¹ indicates that pyrethroids such as deltamethrin or lambda-cyhalothrin provide up to four weeks' residual control of cutworms. Queen ant emergence seems to be synchronized, so spraying a narrow buffer zone just outside the collar once



University of Kentucky researchers measured the distance from the edge of putting greens where ant mounds were found to understand the behavior of the turfgrass ant.

in late summer might intercept new queens, prevent nest establishment, and greatly reduce ant problems the following year.

There is much still to be learned about the biology of nuisance mound-building ants on golf courses. Our USGA-funded research project hopefully will point to more efficient ways to manage this pest while reducing overall insecticide use.

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Grasses for Overseeding Bermudagrass Fairways

Results of a national trial demonstrate the consistent improvement of perennial ryegrass cultivars.

BY KEVIN N. MORRIS

It's true that Americans love green grass — especially when playing golf. Uniform green grass to a golf course superintendent, manager, or owner is akin to a perfectly round, red, luscious summer tomato to a farmer — the product sells itself. However, producing that perfect grass surface or summer tomato is far from easy and not always attainable.

For much of the southern half of the United States, overseeding bermudagrass fairways is a common practice used by golf courses to produce that beautiful green product that so many golfers desire, especially those escaping the winter blues of northern climates. It's not surprising, then, that green grass on greens, tees, and fairways adds to a course's bottom line by increasing rounds in winter. And overseeding does

more for a golf course than add beauty, as actively growing turf in winter is more tolerant of cart traffic, divots, and weed invasion than brown, dormant bermudagrass.

For these reasons, millions of pounds of seed are bought and sown each fall on golf courses in this region. Golf course owners, managers, and superintendents seek grasses that establish quickly, exhibit exceptional playability, are aesthetically pleasing, and require less input. Consequently, a research project was developed and jointly sponsored by the United States Golf Association (USGA), the Golf Course Superintendents Association of America (GCSAA), and the National Turfgrass Evaluation Program (NTEP) to evaluate cultivars, blends, and mixtures for use in overseeding bermudagrass fairways.

HOW THE TRIALS WERE CARRIED OUT

Ten golf courses were chosen to host the on-site overseeding trials (Table 1). Because overseeding grasses provide a temporary playing surface for fall, winter, and spring, and are reseeded each year, cultivars were seeded in two consecutive years (fall 1999 and fall 2000). Since speed, ease, and uniformity of transition from bermudagrass to the overseeded grass in fall and back to bermudagrass in spring is one of the biggest concerns when overseeding, entries were seeded in exactly the same location on each course for each of the two years. This allowed researchers to identify entries that persisted over time.

NTEP solicited entries for the trial from sponsoring companies. Trials were conducted with named cultivars and

Table 1
Trial Locations — On-Site Overseeding of Bermudagrass Fairways
Sponsored by USGA, GCSAA, and NTEP

Location	Golf Course	Superintendent	Research Cooperator	University
Tucson, Arizona (1999-2000)	Tucson Country Club	Marty Wells	Dr. David Kopec	Arizona
Green Valley, Arizona (2000-2001)	C.C. of Green Valley		Dr. David Kopec	Arizona
Palm Desert, California	Mountain Vista	Nancy Dickens	Dr. Robert Green	California-Riverside
Orlando, Florida	Grand Cypress	Tom Alex	Dr. Al Dudeck	Florida
Duluth (Atlanta), Georgia	Atlanta Athletic Club	Ken Mangum	Dr. Gil Landry	Georgia
Starkville, Mississippi	Mississippi State University	Pat Sneed	Dr. Jeff Krans	Mississippi State
Crescent (St. Louis), Missouri	Players Club at St. Louis	Todd Marquette	Dr. Erik Ervin	Missouri
Myrtle Beach, South Carolina	Blackmoor	Bob Zuercher	Dr. Bruce Martin	Clemson
Garland (Dallas), Texas	Fire Wheel Golf Park	Gary Chambers	Dr. Milt Engelke	Texas A&M-Dallas
The Woodlands, Texas (Houston)	The Woodlands	Scott Hamilton, Gant Austin	Dr. Richard White	Texas A&M-College Station
Charlottesville, Virginia	Glenmore C.C.	Tim Thomas	Dr. David Chalmers	Virginia Tech

Table 2
On-Site Fairway Overseeding Trial Location Seeding Rates
Seeding Rate in lbs. per acre

Grass Type	Starkville, Mississippi	Duluth, Georgia	Charlottesville, Virginia	Orlando, Florida	Tucson, Arizona	Myrtle Beach, South Carolina	Palm Desert, California	St. Louis, Missouri	Dallas, Texas	The Woodlands, Texas
Perennial ryegrass — single cultivars or blends	300	450	300	450	600	300	600	300	300	450
<i>Poa trivialis</i> single cultivars	100	100	100	100	100	200	200	100	100	200
Mixtures of perennial rye or intermediate rye and <i>Poa trivialis</i>	250	400	250	400	400	250	400	250	250	400

commercially available blends or mixtures. In addition, experimental entries that were to be commercialized in the immediate future (i.e., before the end of the testing cycle) also were permitted. Various species used in overseeding, such as perennial ryegrass and *Poa trivialis* were allowed. This led to the submission of many perennial ryegrass entries as single cultivars or blends, and also single cultivars of *Poa trivialis* as well as mixtures of perennial ryegrass and *Poa trivialis*. In addition, two cultivars of intermediate ryegrass and one annual ryegrass cultivar were included in the trial.

Annual ryegrass offers the advantage of less heat tolerance than perennial ryegrass and thus a quicker transition in spring back to bermudagrass. However, annual ryegrass does not have the darker green color and finer leaf texture of perennial ryegrass. Intermediate ryegrasses are developed by crossing annual and perennial ryegrass, then selecting plants that have the best traits of both species. Companies have worked to develop intermediate ryegrasses that provide a smooth spring transition back to bermudagrass, but also with a finer leaf texture and darker green color.

Trials were established on active play sites where golfers hit fairway golf shots and/or drove golf carts. Plots were carefully seeded by hand or by using a drop spreader. Since seeding rates vary widely from one region to another,

each location was consulted concerning typical overseeding rates in their area. Consequently, three seeding rates for the ryegrasses (300, 450, and 600 lbs. per acre), two rates for *Poa trivialis* (100 and 200 lbs. per acre), and two rates for mixtures (250 and 400 lbs. per acre) were developed. The most appropriate rate for each grass type was then assigned to the locations (Table 2).

- The experimental plot size was large (5 ft. × 20 ft.), replicated three times. A large plot size allowed for a greater distribution of traffic and divoting. Host courses provided the daily maintenance of the fairway site. An advisory committee consisting of representatives from GCSAA, USGA, NTEP, universities, and the turfgrass seed industry recommended establishment and maintenance procedures.

The researcher at the cooperating university was responsible for data collection. The following data were collected from each trial site:

- Percent establishment rate (4–6 weeks after seeding).
- Turfgrass quality (monthly during winter and 2–4 times per month during the spring and fall transition period).
- Plot color, genetic color (twice — late fall/early winter and spring).
- Rate or speed of transition from bermudagrass to overseeded grass in fall (2–4 times per month during fall).
- Rate or speed of transition from overseeded grass to bermudagrass in

spring (2–4 times per month during spring).

- Environmental stress, traffic, and divot damage, disease and insect damage, and other data deemed appropriate and feasible by the research cooperator.

RESULTS OF THE TRIAL

FALL 1999 - SPRING 2000 DATA COLLECTION

The 42 entries in this trial (Table 3) were seeded in September or October at the ten golf course sites. Establishment was good; no problems were seen with any entries. Data collected from fall 1999 through spring 2000 were compiled, statistically analyzed, and reported. These data can be found in NTEP Report No. 00-13 and on the NTEP Web site (www.ntep.org/onsite/ost.htm).

Following are general observations concerning the trials in fall 1999 – spring 2000:

- The *Poa trivialis* varieties were generally slower to establish and develop into a dense stand than the perennial ryegrasses. They also exhibit a lighter green color than the perennial ryegrasses. The slow establishment may prohibit the use of straight *Poa trivialis* for overseeding of fairways.
- The Charlottesville, Virginia, site did little to thin the bermudagrass on the fairways before overseeding. Overall, this resulted in a poor stand of the trial. Overseeding procedures at the other

courses did not seem to affect trial establishment.

- Overall, placement of the tests (physical location on the course) was very good, with most being placed between the tee and the first landing area. Traffic distribution and divoting appeared uniform at the sites visited. The Orlando, Florida, test was planted at their golf academy (teaching facility) and received very little cart or foot traffic.

- Transition from overseeding grass to bermudagrass started early in most sites, as winter was mild and early spring was warm in many locations. However, a cool, wet April in the eastern portion of the U.S. slowed the transition by aiding the overseeding grasses.

- Generally, entries were consistent in their performance from one location to another. Several of the perennial ryegrasses were excellent in fall and winter through early spring. Transition back to

bermudagrass varied by location. We believe this was mainly due to differing weather patterns between locations.

- In general, the perennial ryegrasses provided the highest quality turf. The exception was the high performance of the *Poa trivialis* varieties and perennial ryegrass/*Poa trivialis* mixtures at the Florida and Virginia locations. The Florida site had a severe annual bluegrass (*Poa annua*) invasion, which may have been less noticeable in the *Poa*

Table 3
On-Site Testing of Grasses for Overseeding of Bermudagrass Fairways
Entries and Sponsors

Entry No.	Name	Species or Composition	Sponsoring Company
1	Allsport	perennial ryegrass	LESCO, Inc.
2	LS-DEI	perennial ryegrass	LESCO, Inc.
3	Proam	<i>Poa trivialis</i>	LESCO, Inc.
4	Barlennium	perennial ryegrass	Barenbrug USA
5	Pirouette	perennial ryegrass	Barenbrug USA
6	Bariviera	<i>Poa trivialis</i>	Barenbrug USA
7	Professional's Select	40% Windstar, 35% Sonata, 25% Jet perennial ryegrass blend	Pennington Seed, Inc.
8	Transist	intermediate ryegrass	Pickseed West, Inc.
9	Pick HR A-97	intermediate ryegrass	Pickseed West, Inc.
10	First Cut	85% Paragon perennial ryegrass, 15% Stardust <i>Poa trivialis</i>	Turf Merchants, Inc.
11	Brightstar II	perennial ryegrass	Turf-Seed, Inc.
12	Charger II	perennial ryegrass	Turf-Seed, Inc.
13	Citation III	perennial ryegrass	Turf-Seed, Inc.
14	Brightstar II + Winterplay	85% Brightstar II perennial ryegrass, 15% Winterplay <i>Poa trivialis</i>	Turf-Seed, Inc.
15	Charger	perennial ryegrass	Standard Entry
16	Citation III + Winterstar	85% Citation III perennial ryegrass, 15% Winterstar <i>Poa trivialis</i>	Turf-Seed, Inc.
17	Winterplay	<i>Poa trivialis</i>	Standard Entry
18	Axcella (ABT-99-3.268)	annual ryegrass	DLF International Seeds
19	Paragon	perennial ryegrass	Turf Merchants, Inc.
20	PST-3BK-99	perennial ryegrass	Pure-Seed Testing, Inc.
21	Fiesta 3	perennial ryegrass	Pickseed West, Inc.
22	Futura 2500	33% Cutter perennial ryegrass, 33% Sunshine perennial ryegrass, 33% Transist intermediate ryegrass	Pickseed West, Inc.
23	MED-007	25% JR-151, 25% JR-142, 25% JR-128, 25% JR-265 perennial ryegrass blend	Simplot Turf & Hort.
24	Capri	perennial ryegrass	DLF International Seeds
25	Leaderboard	34% Pennant II, 33% Panther, 33% Seville II perennial ryegrass	ProSeeds Marketing
26	Seville II	perennial ryegrass	ProSeeds Marketing
27	Snowbird	<i>Poa trivialis</i>	ProSeeds Marketing
28	MP58	perennial ryegrass	Jenks Seed Connection
29	Prime	33% Elfkin, 33% MP58, 33% MP88 perennial ryegrass blend	Jenks Seed Connection
30	Elfkin	perennial ryegrass	Jenks Seed Connection
31	MPII	perennial ryegrass	Cascade International Seed Co.
32	Mountain View Seed Blend 1	40% Pearl, 30% Pageant II, 30% EP57 perennial ryegrass blend	Mountain View Seed Co.
33	Mountain View Seed Blend 2	40% EP56, 30% Pearl, 30% Academy perennial ryegrass blend	Mountain View Seed Co.
34	Mountain View Seed Blend 3	40% EP57, 30% EP56, 30% Flash perennial ryegrass blend	Mountain View Seed Co.
35	Essence	perennial ryegrass	DLF International Seeds
36	Top Hat	perennial ryegrass	Standard Entry
37	Cebeco Blend I	33% Top Hat, 33% R2, 33% Gator II perennial ryegrass blend	DLF International Seeds
38	Sabre	<i>Poa trivialis</i>	Standard Entry
39	Tourstar	34% Imagine, 33% Ice, 33% Lynx perennial ryegrass blend	AgriBio Tech, Inc.
40	Marvelgreen + Laser	40% Palmer III, 20% Prelude III, 20% Phantom perennial ryegrass, 15% Laser <i>Poa trivialis</i>	AgriBio Tech, Inc.
41	Phantom	perennial ryegrass	ProSeeds Marketing
42	Marvelgreen Supreme	50% Palmer III, 25% Prelude III, 25% Phantom perennial ryegrass blend	AgriBio Tech, Inc.

trivialis plots. With the minimal pre-plant preparation at the Virginia site, the *Poa trivialis*, being smaller seeded, had an easier time falling through the bermudagrass canopy and thus germinated better.

- At most locations, there was no statistical difference in overall turfgrass quality between the top 25-30 entries (out of a total of 42 in the trial). We have seen this happen in past overseeding trials. This may reflect the unusual nature of overseeding. If an entry is very strong in the beginning and receives high quality ratings, it may receive low ratings during spring transition as it has competed too heavily with the bermudagrass, thus holding back the bermudagrass. Grasses that start slowly and receive low ratings initially often become stronger later and receive higher ratings during transition.

A major concern of overseeding is having a smooth transition from overseeding grass back to bermudagrass in spring. In the first-year data from most locations, the annual ryegrass and intermediate ryegrass entries transitioned more quickly (going from 75% to 25% plot coverage in 3-4 weeks) than the perennial ryegrasses. At the Arizona and Mississippi locations, *Poa trivialis* entries and perennial ryegrass/*Poa trivialis* mixtures transitioned faster than perennial ryegrass. However, at the California and Florida sites, the opposite was true. And in South Carolina and Texas sites, *Poa trivialis*, intermediate ryegrass, and perennial ryegrasses transitioned in a similar fashion. Again, we believe these differences are weather and environment-related.

FALL 2000 - SPRING 2001 DATA COLLECTION

The 42 entries seeded in fall 1999 were seeded again in September or October 2000 at the ten golf course sites. The same physical locations on the golf courses were used with the following two exceptions. Tucson Country Club decided to cease overseeding its fairways, so another test location was

needed. The cooperator decided on the Country Club of Green Valley, site of the on-site bentgrass and bermudagrass trials, for the second year's overseeding trial. Another fairway at the Atlanta Athletic Club was used in 2000 due to lack of uniformity at the previous site.

A progress report containing 2000-2001 data and management information on this project was compiled and distributed in November 2001. This report can also be found on the NTEP Web site at <http://www.ntep.org/onsite/ost.htm>. Following is a summary of the results from 2000 to 2001.

Data collected by cooperators on fall and spring transition, percent ground cover of each species, color and turfgrass quality varied considerably from location to location, as it did during fall 1999 to spring 2000. Following are some observations concerning the second year of this trial:

- At five locations, the perennial ryegrass entries or blends of perennial ryegrasses were the best performers. Often, there was little or no statistical difference among the perennial ryegrasses for overall quality, fall and spring transition. Following are the locations where a large number of perennial ryegrass entries finished in the top statistical grouping for overall turfgrass quality:

- Palm Desert, California (26 entries)
- Duluth, Georgia (28 entries)
- Starkville, Mississippi (19 entries)
- Crescent, Missouri (33 entries)
- Green Valley, Arizona (15 entries)

- At the Myrtle Beach, South Carolina, and Garland, Texas, locations, there was no statistical difference among any of the 42 entries for overall turfgrass quality.

- *Poa trivialis* entries as a group finished at the bottom of the trials listed above and at the top of the trials in Orlando, Florida; Houston, Texas; and Charlottesville, Virginia. Mixtures of perennial ryegrass and *Poa trivialis* performed close to the top in the above locations and close to the bottom at all other locations.

- At almost all locations, *Poa trivialis* entries established significantly more slowly than the perennial ryegrasses, taking until 30-40 days after seeding to establish the same percentage ground cover as the perennial ryegrasses. At some locations (i.e., Green Valley, Arizona; Duluth, Georgia; Starkville, Mississippi), *Poa trivialis* disappeared very quickly in spring, leaving a plot with only 30-40% green bermudagrass. Conversely, at the Houston, Texas, and Orlando, Florida, sites, *Poa trivialis* entries transitioned more slowly and smoothly than the perennial ryegrasses.

- The intermediate ryegrass entries generally had lower quality ratings than the perennial ryegrasses, and they transitioned more quickly. The two entries Transist and Pick HR A-97 differ in their appearance and performance. Transist appears to have more annual ryegrass characteristics, which gives it a lighter green color and causes it to transition more quickly. Pick HR A-97 is darker green and behaves more like a perennial than an annual. The one annual ryegrass entry, Axcella, finished in the bottom third of all entries at most locations.

SUMMARY

Since seeding rates and maintenance levels differed from one location to the next, data were not summarized and averaged across all locations. However, we can make the following general conclusions concerning this trial:

- Many perennial ryegrasses perform well in overseeding, and often there is no statistical difference among the entries. We have seen this same trend in other overseeding trials.

- *Poa trivialis* may be useful in overseeding fairways, though its performance may be inconsistent. It is slower to establish than perennial ryegrass, and it seems that when *Poa trivialis* is weakened due to heat or disease, it disappears quickly. This leaves insufficient green bermudagrass for acceptable quality. However, if the goal is little or no physical disturbance of the bermuda

grass prior to overseeding, the small seed size of *Poa trivialis* allows it to sift through the bermudagrass canopy to make soil contact. The result is a better stand of *Poa trivialis* compared to perennial ryegrass.

- Perennial ryegrass and *Poa trivialis* mixtures generally do not perform as well as perennial ryegrass or *Poa trivialis* cultivars. The addition of *Poa trivialis* generally results in lower quality ratings, except where the *Poa trivialis* entries perform exceptionally well. The mixture may hasten transition somewhat,

Green Valley, Arizona, and Palm Desert, California, intensively scalped and verticut their bermudagrass prior to overseeding. This is a standard practice in the Desert Southwest and is probably more beneficial to the perennial ryegrasses.

- Intermediate ryegrasses may be useful in fairway overseeding if the goal is an earlier transition. However, this will also depend on whether the grass is closer to being a perennial than an annual.

- Transition from the overseeding grass to bermudagrass in spring is rarely

The lower the quality of overseeding in fall, the less overseeding present in spring, often leading to a better spring transition. Use of a weaker cultivar or species may make for a better spring transition. However, if heat and humidity come early, these weaker grasses may leave sooner than expected.

Overseeding bermudagrass fairways has definite benefits but also associated risks. An overseeding grass that is too strong through the winter may lead to slower bermudagrass recovery in spring. Also, weather patterns can be quite



The National Turfgrass Evaluation Program (NTEP) jointly sponsored a project with the USGA and GCSAA to evaluate cultivars and mixtures used in overseeding bermudagrass fairways. To test their performance, the trials were placed on ten golf courses where the research plots received golfer traffic and play.

but overall quality will most likely suffer.

- Since the performance of individual entries varied so much from location to location, management practices must play a big role in establishment and transition. At the Orlando, Florida, site, the superintendent used chemical applications (simazine) at light rates to hasten transition. This seemed to affect the perennial ryegrass more than the *Poa trivialis*. At the Charlottesville, Virginia, site, the superintendent did not physically damage the bermudagrass before overseeding, resulting in better establishment and quality of the *Poa trivialis* entries. Other locations, like

smooth. Weather patterns are important in determining the ease of transition from one species to another. In the cooler, northern sites, grasses that are strong going into winter may not have as much bermudagrass returning in spring. When the overseeding grass dies, there may not be sufficient bermudagrass to provide adequate cover and quality.

- There seems to be a balance between quality and cover of each species in fall and spring. The higher the quality of the overseeding early in fall, the more overseeding present in spring, along with reduced bermudagrass cover. The result is a more difficult spring transition.

variable from one season to the next, so overseeding results can be dramatically different over time. Management practices, including pre-plant preparation, maintenance practices during the winter season, and management of spring transition, can significantly affect the quality of overseeding. Therefore, golf courses that overseed fairways need to have clear goals and objectives for the practice as well as realistic expectations of the outcome. Successful overseeding is still as much art as science.

KEVIN MORRIS is executive director of the National Turfgrass Evaluation Program, located in Beltsville, Maryland.

Future Directions for Golf Course Water Use Regulation: A Regulator's Perspective

The future of golf course water use and regulation in one of the nation's highest ET use areas.

BY CINDY SHIMOKUSU

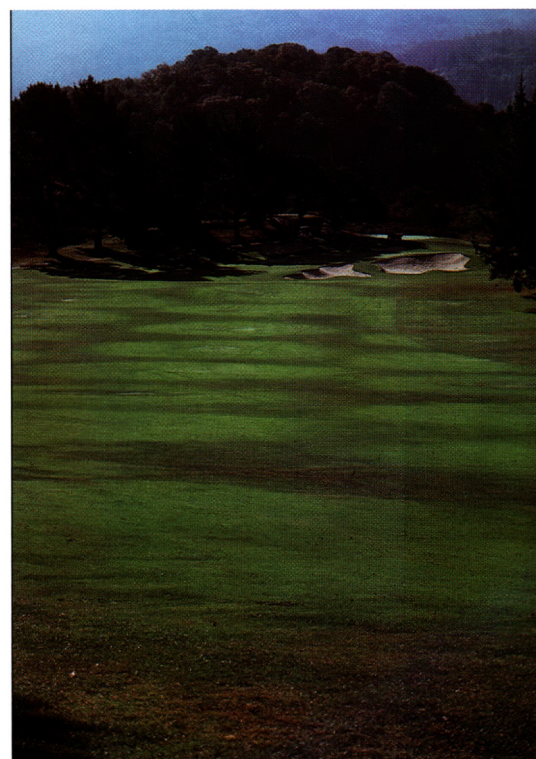
Tucson, Arizona, and the region surrounding it, is one of five Active Management Areas (AMA) administered by the Arizona Department of Water Resources (ADWR) set up to regulate water use in the state. Although the maximum annual water allotments assigned to each course have been in place for more than 20 years, it is clear that more research and dialogue are needed to determine if golf courses have in fact maximized their efficiency potential or if increased irrigation effectiveness is reasonable and achievable.

Golf course operators in the Tucson AMA are intimately familiar with ADWR's annual allotments, which are revised every ten years. Through the revision process, the science behind the application rates on which the allotments are based is scrutinized. Many studies, including some funded by ADWR, have been conducted on the needs of high-quality turfgrass in Arizona. Unfortunately, we still lack consensus regarding the exact amount of water a golf course needs to operate. ADWR believes that our regulations are close, but the complexity of this question impedes a precise answer. Existing studies have narrowed the answer, but we have yet to examine fully such issues as the effect of irrigation inefficiency, the economic impact of reductions in overseeding, and the transferability of plot-sized studies to full-sized courses. All of these factors

introduce uncertainty, and definitive answers are needed.

Golf courses in the Tucson AMA reported using approximately 21,000 acre-feet in 2002 (the most recent year of complete data), up from about 12,000 acre-feet in 1985. We also know that the total number of golf courses in the Tucson AMA has increased from 24 in 1985 to 38 in 2004, yet we do not know precisely where the irrigation water is being applied.

If a golf course meets its allotment, is it because that course applied the appropriate amount of water to its turf, or is it because they deficit-irrigated the low-water-use landscaping and applied extra water to the turf or lakes? Alternatively, the compliance might be attributed to inaccurate metering and reporting methods. A third possibility is that the course was constructed before 1985 and has retained its full original water allotment, even after turf or water body acres are removed. If a course exceeds its maximum annual allotment, is it because the course is inefficient and over-applied water to its turf, or does it have a leaky lake? Exceeding the maximum allotment could also be due to exceptionally hot, dry weather (i.e., higher ET demand). While ADWR closely tracks weather and each course's acreage and total water use, we still lack the necessary data to differentiate between these various factors. Moreover, we suspect that golf course managers similarly lack the data to determine



Golf course water use is conspicuous and in the public eye. In addition to developing a water management plan, golf course superintendents need to ensure that water is efficiently used. Poor irrigation system distribution results in inefficiency and over- or under-watering of the turfgrass.

which factors most influence their total water use because irrigation systems typically are not configured to offer this data.

We believe the following scenarios exist at different times and places:

- New courses in the Tucson AMA and possibly throughout the western United States are having more difficulty

meeting their allotments than older courses.

- Hot, dry weather in successive years contributes greatly to a course failing to meet its allotment.
- Lack of irrigation system distribution uniformity contributes to inefficiency and over-watering on some parts of most courses.
- Data are lacking to determine the individual impacts of each factor.
- We suspect golf course managers can only guess which factors most influence their total water use because most irrigation systems are not configured to offer such detailed data.

It is clear that the regulators, scientists, golf course designers, irrigation manufacturers, and golf course owners and operators need to build better relationships. We all will benefit from open dialog about the appropriate role for golf in helping to meet the Tucson AMA's water management goal, which is defined as safe-yield. Safe-yield is a long-term regional balance between groundwater withdrawals and natural and artificial recharge. It also is the Tucson AMA's statutorily mandated goal with which the AMA must comply by the year 2025. Although golf is not the largest water user in the AMA, it is certainly a significant user and must contribute, along with all other major water users, in reducing demand for limited water supplies in this arid region. On the other hand, ADWR must continue to recognize that water is an essential element for golf courses and that golf is an important contributor to the state and regional economy. A balance must be maintained in establishing water use requirements.

Generally speaking, the ADWR and the golf industry must explore options for additional enhancement of golf-related water efficiency while also ensuring that water restrictions do not compromise the industry's ability to profit. Technology continues to evolve and offer further opportunities for conservation. Development of conservation-oriented management practices such as

Figure 1 Tucson, Arizona, Active Management Area (AMA) Third Management Plan Turf Conservation Requirements	
For All Facilities: Conditions and restrictions apply depending on the year that the turf, water surface, and low-water-use landscaped areas were installed at the golf course. See TMP Tucson Section 6-301 through 6-305.	
Turf Acres	4.6
Water Surface Acres	5.8
Low-Water-Use Landscaped Area	1.5

irrigation best management practices that are accepted as industry standards may be one avenue for improving efficiency. New technologies and products that improve area measurement and water application precision, such as global positioning satellite (GPS) surveying computer applications, offer promising improvements in irrigation system performance, including increased distribution uniformity for existing systems. New water treatment options may prove useful for reducing leaching requirements and enhancing the ability of grass to use water. Lower-water-use turfgrass varieties also continue to be developed. Industry and regulatory demand for, and support of, more research and development of these types of products and services will improve water application precision. Explicit partnerships between ADWR, the golf industry, universities, and

manufacturers could further intensify the process. Furthermore, partnerships between courses and university researchers that allow golf-course-scale studies, as opposed to small-plot studies, could help answer fundamental questions about irrigation efficiency and limitations on conservation improvements.

Aside from the regulatory focus, the golf industry also must improve its ability to communicate with the public about its water resource stewardship. ADWR understands and appreciates that most golf courses in the AMAs have been making significant progress toward improving water use efficiency and transitioning to use of renewable water supplies. In spite of these achievements, we regularly hear from the public that "until golf courses are required to conserve, why should I do more — the water I save only allows more golf

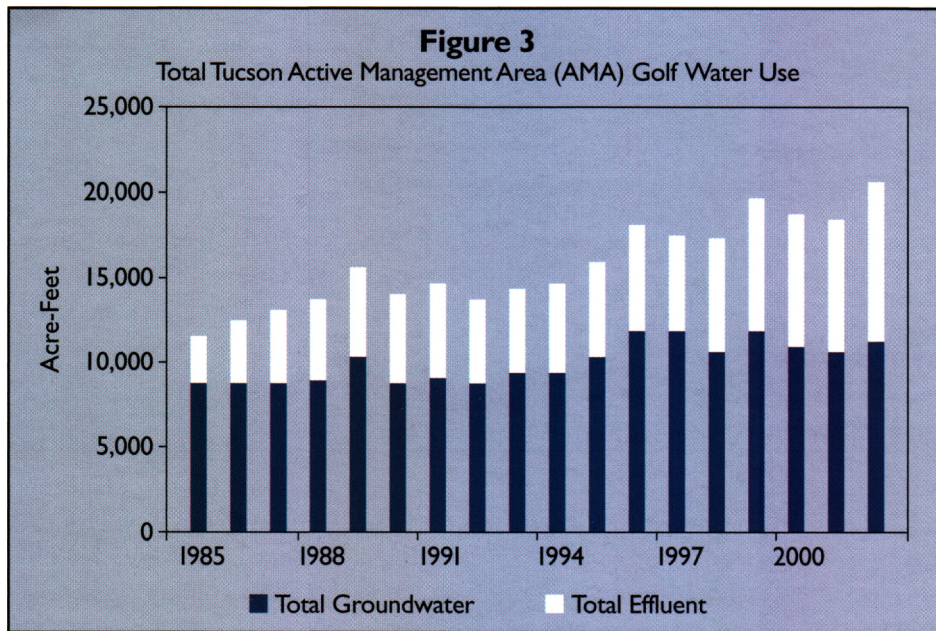
Figure 2 Current Water and Irrigated Acre Regulatory Limits by State for Golf Courses			
Regulatory Limit	Arizona¹	California²	Nevada³
Maximum acre feet* of water per acre, per golf course, per calendar year	4.6 to 4.9 acre feet	2.3 to 6.36 acre feet	5.7 to 7.4 acre feet
Maximum irrigated acres per golf course	90 acres	110 acres	90 to 110 acres

¹Arizona data from Tucson Active Management Area and Phoenix Active Management Area. Data shown are from the Third Management Plan Turf Conservation Requirements.

²California data from Long Beach (coastal), Riverside (inland), and Palm Springs (desert). Figures include both optimal turf and water conservation turf water use levels.

³Nevada data for drought watch and drought alert levels mandated for Las Vegas.

*1 acre foot of water is the amount of water needed to cover 1 acre area 1 foot deep. 1 acre foot of water equals 325,850 gallons.



courses to be built." This sentiment is especially pervasive in the Tucson AMA, where many people already have a strong conservation ethic. Because a golf course's water use is so conspicuous and in the public eye, it is the golf industry's responsibility, especially during a drought, to ensure that golf courses are as water-efficient as possible and to communicate with and demonstrate to the public that water conservation is a high priority within the industry. ADWR frequently distributes information to help the public understand golf's relatively minor part of overall water demands, but the golf industry must also educate the public about its conservation efforts.

Through my participation in the 2003 USGA Regional Conference at Phoenix Country Club, I heard the following concerns from the Arizona golf industry:

- Fears of possible future ADWR-imposed new water-use restrictions.
- Frustrations with current regulations that appear to place undue burden on some courses but ask very little of others.
- Belief that golf contributes more than its share toward water conservation in Arizona.

I do not dispute most of what I heard, and I agree that little evidence

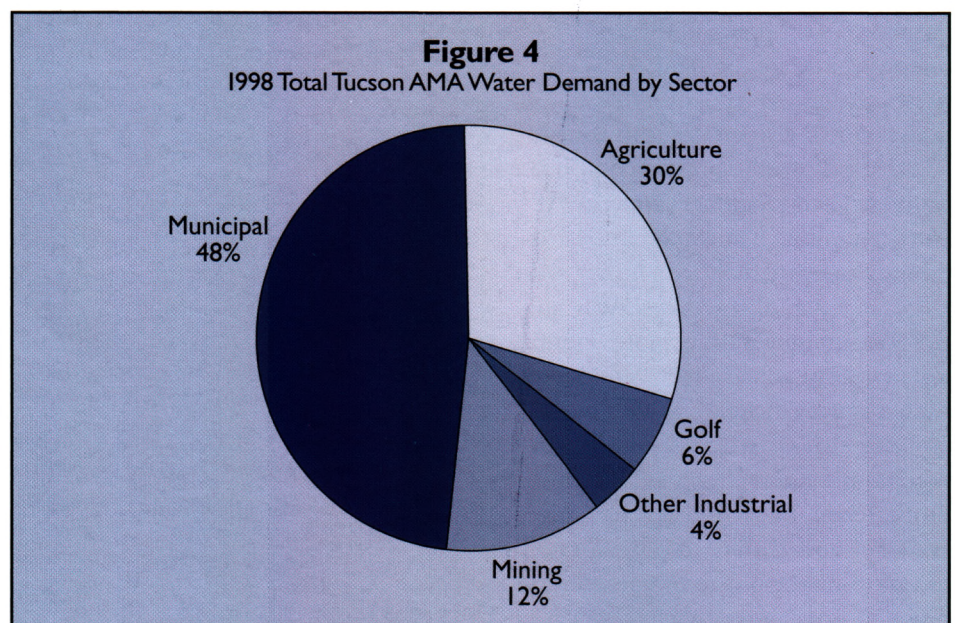
exists to support additional water-use reductions beyond those already in place for new courses. I agree that golf is more closely regulated than most other water users in Arizona and that the turf regulations favor older courses and more strictly limit newer ones. This is consistent with Arizona law, which grandfathered existing uses when the 1980 Groundwater Management Act was adopted.

Hopefully, the golf industry also heard the following perspectives voiced by the ADWR representatives at the USGA Conference:

- Most golf courses in Arizona are doing a good job of conserving water.
- ADWR would like to pursue program improvements for the Fourth Management Plan and does not anticipate any major new allotment reductions.
- Consideration may be given for greater flexibility and account adjustments if the existing program cannot sufficiently accommodate prolonged periods of hot, dry weather.
- ADWR and the golf industry must confront the issue of golf's role in reducing total water demand during drought and supply shortages.
- ADWR is eager to establish a dialog with researchers and industry representatives to identify concerns and define research questions.

We know that we don't have all the answers and that we will need help getting answers. There is great value in partnerships between regulatory agencies and regulated users, and we look forward to working with the golf industry to evaluate and improve Arizona's turf water conservation program.

CINDY SHIMOKUSU has been Tucson Active Management Area Director for the Arizona Department of Water Resources since 1995.



Sharing Your Course With Raptors

Eagles, hawks, owls, and other birds of prey can be a vital part of wildlife on a golf course.

BY JEAN MACKAY

On February 16, 2004, Landscape Superintendent Doug Fuller was making a routine early morning tour of LaPlaya Golf Club (Naples, Florida). At the 13th green, he noticed a bald eagle swooping close to the treetops of a nearby slash pine stand. Suddenly, a juvenile great horned owl, not yet able to fly, fell to the ground. The young raptor scurried to safety in a nearby landscape bed and was not attacked again. But would the owlet survive on the ground? Did it sustain any injuries? What was Fuller to do?

Fuller's experience is not uncommon. Among the most charismatic wildlife species that frequently inhabit golf courses are hawks and owls. In my work with the Audubon Cooperative Sanctuary Program for Golf Courses, I've heard many bird stories, but none so numerous as the spectacular tales of red-tailed hawks swooping down to catch unwitting squirrels, osprey diving into ponds to nab fish, or stories of injured raptors.

Golf course maintenance staff need to know what to do *and what not to do* in these circumstances to ensure that birds of prey have a chance of survival. All raptors are protected by federal law, which prohibits disturbance to the birds themselves, as well as their eggs, nests, and even molted feathers. Injured birds must be handled with care, not only to prevent further harm to the bird, but also to protect the would-be helper against being attacked by the bird's powerful beak and strong talons.

Dan Dinelli, CGCS, knows raptors firsthand. Not only does he oversee North Shore Country Club in Illinois, but Dinelli is also a licensed falconer with a raptor breeding permit who raises captive birds of prey for educational programs and works with injured hawks and owls. Dinelli's red-tailed hawks have gone on to live at the likes of Disney's Wild Animal Park in Florida, Six Flags in Texas, Wings of America at the American Eagle Foundation in Tennessee, and the Minnesota Zoo.

"I have been infatuated with birds of prey for as long as I can remember," shares Dinelli. "With their proud stature, keen eyesight, and ability to rise high above, raptors impress me as powerful creatures, always in control." Growing up with his father and uncle serving as golf course superintendents, Dinelli got his start watching American kestrels, red-tailed hawks, and Cooper's hawks on the golf course. As a child, Dinelli recalls one early spring when his uncle found a young great horned owl while



Amy Heller of the Conservancy of Southwest Florida prepares to return the young great horned owl to its nest on LaPlaya Golf Club (Naples, Florida).

conducting course setup. Not sure what to do, the elder Dinelli brought it into the shop and raised it until it could fly.

"My uncle did what most people have an urge to do," says Dinelli. "Though meaning well, he probably should have taken a different course of action." The maiden flight of fledgling hawks, eagles, and owls rarely ends up with a pinpoint landing on a tree branch. In many cases, when a young bird falls out of a nest or fails at its first attempts at flight, its parents are nearby, ready to offer assistance.

"Looking back, the best approach might have been to set the fledgling up high on a branch and observe its well-being for the next few days. Often, a parent shows up and nature takes its course," explains Dinelli.

That's just what happened at LaPlaya Golf Club. Fuller and Assistant Golf Course Superintendent Mark Shoemaker called local expert Joanna Fitzgerald at The Conservancy of Southwest Florida to get advice on the best course of

WHAT TO DO IF YOU FIND AN INJURED BIRD OF PREY:

- Don't move the bird unless it is in immediate danger.
- Contact a wildlife rehabilitator who works with raptors. In most states, the Department of Natural Resources maintains a list of licensed wildlife rehabilitators. A local nature center or Audubon Society may also be able to make a referral. Or use the Internet to find a rehabilitator near you. Conduct a search using the key words "wildlife rehabilitator." Many state and international references are available on the Web.
- Most wildlife rehabilitators volunteer their time to work with wildlife, *in addition* to a regular job. If they are not able to provide immediate assistance, they will tell you what to do until help arrives.

RED-TAILS: AT HOME ON THE GOLF COURSE

- The most common raptor on golf courses is the red-tailed hawk, whose habitat preferences overlap with its nightly counterpart, the great horned owl. Both hunt on the edges of fields and nest in woods.
- Red-tailed hawks and other raptors are at the top of the food chain, feeding on rodents, squirrels, rabbits, and, occasionally, snakes and birds. Manage tall grass areas or prairie cover with small brush piles or groupings of shrubs to offer habitat for their prey. Allow dead tree limbs to remain in areas posing no threat to people or buildings to serve as perching sites.
- Red-tailed hawks are common in their range throughout North and Central America. Standing 19" to 24", they are often seen perched on poles and dead tree limbs, which provide an open view of the surrounding terrain.
- Red-tailed hawks lay two to three eggs on average each year in a nest that is 15 to 70 feet high in the crotch of a large tree with a commanding view. The female incubates the eggs for 30 to 32 days and cares for the young for about 45 days before they are ready to fend for themselves.
- The first year of a raptor's life is so challenging that a mere 20 to 50 percent are estimated to make it to their second year. Adult birds have an average yearly mortality rate of 20%.

— F. Dan Dinelli, CGCS



Dan Dinelli, CGCS of Northshore Country Club in Illinois, holds his red-tailed hawk, Merly Girl. He has held his Master Class Falconer license since 1983 and a Captive Raptor Propagation Permit since 1988. Dinelli's adventures with raptors include helping the Chicago Peregrine Release Program to reestablish peregrine falcons in Chicago and finding active nests of the endangered Philippine eagle to assist the Philippine Eagle Foundation.

action for their fallen owl. Fitzgerald came to the course to inspect the young owl for injuries and, finding none, determined that the bird should be placed back in its nest. But the bird needed a lift. Steve Acquafresca, a Nations Rent representative, courteously donated the use of a 60-foot boom lift, and within 24 hours, the bird was home.

"During the course of that day we anxiously awaited the mother great horned owl to return, which did not happen," reported LaPlaya Superintendent Brian Beckner. "But the following day, we found the mother huddled next to the juvenile near the nest on an adjacent branch. Through our day-to-day routine, this was quite a rewarding experience."

WORKING WITH WILDLIFE REHABILITATORS

If a fledgling bird is really orphaned or injured, then intervention is needed. Superintendents should contact a licensed wildlife rehabilitator who is trained to properly care for raptors. Raptor rehabilitators understand the many laws that apply to captive birds of prey, have proper housing and equipment, and know how to handle and treat them.

When injured raptors have been rehabilitated, they can be released back onto the golf course. In fact, golf courses are often ideal release sites, since golfing activity discourages wild predators during the day and maintenance schedules allow for supervision of released animals. "A golf course doesn't have to wait until it has an injured bird to contact a wildlife rehabilitator," advises North Shore's Dinelli. "Why not offer the course as a release site for orphaned or rehabilitated wildlife that can't be returned where they came from? We have released American kestrels and eastern screech owls at North Shore Country Club and used the ponds to release orphaned mallards and wood ducks, which returned in subsequent years to nest and raise their young."

Establishing a relationship with a wildlife rehabilitator is an excellent way to show a course's commitment to conservation. In addition to offering a potential home to needy wildlife, involvement with a rehabilitator provides golf course staff with access to expert advice and may result in golfers getting a close-up view of a hawk or owl. "Golfers take pride in knowing the land used to play the game can offer a great opportunity for wildlife," concludes Dinelli. "All in all, it's a win-win relationship for everyone."

JEAN MACKAY is director of educational services for Audubon International (jmackay@audubonintl.org). For more information about the Audubon Cooperative Sanctuary Program for Golf Courses, visit www.audubonintl.org.

NEW GREEN SECTION PUBLICATIONS AVAILABLE

The *Turfgrass and Environmental Research* and *Executive Summaries* are now available free of charge through the USGA Order Department. The *2003 Turfgrass and Environmental Research Summary* provides a one-page summary of each research project. This publication is appropriate for researchers, university extension personnel, and golf course superintendents who are interested in a bit more in-depth information on the research projects. Request publication NS1640. The *2004 Turfgrass and Environmental Research Executive Summary* provides a brief synopsis of each project supported by the USGA's Turfgrass and Environmental Research Program. The general public and course officials will be more interested in this format. The publication number to request is NS1649. Both documents are available free of charge by contacting the USGA Order Department at 800-336-4446 or by contacting Mary McConnell, USGA Green Section, at mmcconnell@usga.org.

The newly released 2004 revision of the *USGA Recommendations for a Method of Putting Green Construction* also is available through the USGA Order Department. For more than 40 years the USGA recommendations for green construction have been the most widely used method of green construction throughout the United States and in other parts of the world. The steps of this method are explained in depth through a 10-page color packet. This document can be ordered by contacting the USGA Order Department at 800-336-4446 and requesting product code PG1110. The cost is \$1.50 each. This information also is available to print free of charge on the Green Section's Web site at http://www.usga.org/turf/course_construction/green_articles/putting_green_guidelines.asp.

GREEN SECTION INTERNSHIPS AWARDED FOR 2004

For the eighth year, the USGA Green Section has awarded internships to outstanding turfgrass management students. During 2004, the Green Section will provide the opportunity for 15 students to travel with the Green Section staff on Turf Advisory Service visits. Each intern will travel for one week with an agronomist in his region between the months of May and August. The goal of the internship program is to provide students with a broader view of the golf course industry and the opportunity to learn about golf course maintenance through the perspective of the Green Section agronomists. More information about each intern can be found on the USGA Green Section Web site at http://www.usga.org/aboutus/green_section/green_section.asp.

Intern Name	Year	University	Advisor
Zachary Anderson	Master's Program	University of Illinois	Thomas Fermanian
Jerry Bonner	Junior	University of Rhode Island	Michael Sullivan
Tina Duperron	Doctor of Plant Medicine Program	University of Florida	Grady Miller
Joe Gardemeyer	Junior	California Polytechnic State University	David Green
Christopher John	Senior	North Carolina State University	Richard Cooper
Patrick LaPerle	Junior	Arizona State University	Ken Marcum
Jason Ostlund	Senior	Utah State University	Paul Johnson
Hunter Perry	Junior	Mississippi State University	Michael Goatley
Nicholas Pool	Master's Program	University of Florida	Grady Miller
Robert Raley	Master's Program	Penn State University	George Hamilton
Jacob Schneider	Junior	University of Wisconsin	Wayne Kussow
Jesse Shulse	Senior	Texas A&M University	Richard White
Dylan Stafford	Senior	Western Kentucky University	Paul Woosley
Joel Vint	Senior	Iowa State University	Nick Christians
Matt Williams	Junior	Washington State University	William Johnston

PHYSICAL SOIL TESTING LABORATORIES

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

Brookside Laboratories, Inc.

308 Main Street, New Knoxville, OH 45871
Attn: Mark Flock
Voice phone: (419) 753-2448
FAX: (419) 753-2949
E-Mail: mflock@BLINC.COM

Dakota Analytical, Inc.

1503 11th Ave. NE, E. Grand Forks, MN 56721
Attn: Diane Rindt, Laboratory Manager
Voice phone: (701) 746-4300 or (800) 424-3443
FAX: (218) 773-3151
E-Mail: lab@dakotapeat.com

European Turfgrass Laboratories Ltd.

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

Hummel & Co.

35 King Street, P.O. Box 606
Trumansburg, NY 14886
Attn: Norm Hummel
Voice phone: (607) 387-5694
FAX: (607) 387-9499
E-Mail: soil@zoom-dsl.com

ISTRC New Mix Lab LLC

1530 Kansas City Road, Suite 110
Olathe, KS 66061
Voice phone: (800) 362-8873
FAX: (913) 829-8873
E-Mail: istrnewmixlab@worldnet.att.net

Sports Turf Research Institute

hyperlink to www.stri.co.uk
St. Ives Estate, Bingley
West Yorkshire BD16 1AU
England
Attn: Michael Baines
Voice phone: +44 (0) 1274-565131
FAX: +44 (0) 1274-561891
E-Mail: stephen.baker@stri.org.uk

Thomas Turf Services, Inc.

2151 Harvey Mitchell Parkway South, Suite 302
College Station, TX 77840-5247
Attn: Bob Yzaguirre, Lab Manager
Voice phone: (979) 764-2050
FAX: (979) 764-2152
E-Mail: soiltest@thomasturf.com

Tifton Physical Soil Testing Laboratory, Inc.

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“As The Turf Turns”

Break the vicious cycle in your quest for perfection. **BY JAMES H. BAIRD**

The dog days of summer are here again. For golf course superintendents it is a time for survival. Keeping turf alive can often mean the difference between employment and unemployment. All too often, when the turf conditions get challenging the knee-jerk reaction is to fire the superintendent. Although it can be argued that termination of employment is justifiable or that it is unfair to judge job performance based upon a whim of Mother Nature, this article has more to do with the quest for near-perfect playing conditions and how many clubs lose sight of the key ingredients while getting caught up in a vicious and costly cycle of “As The Turf Turns.”

MAKING THE CHANGE

First, consider the costs of separating from your former superintendent — severance pay, unemployment compensation, and possibly legal fees. Next come the costs of acquiring a new superintendent — advertising and headhunter fees, administrative costs and personal time associated with screening applications and conducting interviews, and, most of all, providing a competitive salary and benefits package required to entice and sign the best qualified candidate. Hiring a new superintendent may entail increasing the operational budget by increasing staffing levels and/or purchasing more, different, and new equipment. Add to this the additional costs of salaries and employee training. These are several examples of the tangible costs involved in the turnover process. But consider the intangible costs that can occur in between superintendents, such as increased workload, stress and tension among remaining employees, and

decreased quality and productivity on the golf course. A conservative estimate is that your new superintendent will cost at least one-and-a-half times the salary of your former superintendent.

THE HONEYMOON

Once you hire a new superintendent, now comes the time to correct a “few more” of the problems that contributed to turf loss in the first place. Notice that I did not say “all” of the problems. You allowed your former superintendents to correct some of these problems, and chances are that you will save the remainder for future superintendents. With dead turf fresh in their minds, golfers usually are more accepting of disruptive practices aimed at restoring and maintaining turf health such as aeration and tree removal. In addition to equipment, much needed improvements to infrastructure of the golf course will likely be made during your superintendent’s honeymoon period, such as a new irrigation or drainage system or a new turf care facility.

THE GOOD OLD DAYS

Are you tracking how much this is costing your club? Well, it really does not matter because your golf course has never looked or played better, everyone is happy, and your new superintendent can do nothing wrong. Right? Wait a minute. The golf course now is in such good condition that you want practices like aeration and tree removal to stop. Furthermore, the perception is that “problems are solved,” so you cut the maintenance budget.

THE GRADUAL DECLINE

So begins the subtle but persistent decline in turf health and playing con-

ditions. As course conditioning begins to fade, it does not take long for the superintendent’s status to change from the hero to the hunted, and thus communication channels quickly break down around the golf course. Take all of these ingredients, add some bad weather, and you end up with dead turf and the vicious cycle begins again.

BREAKING THE VICIOUS CYCLE

Your club has just spent or continues to spend a considerable sum of money and what are you ultimately left with? Dead turf. One step forward and two steps back. And how many jobs have been lost and lives adversely affected, not to mention the negative impact on the club’s economy?

No golf course or golf course superintendent is immune to the perils of Mother Nature. Nevertheless, the best defense against turf loss is to provide your superintendent with the resources that will produce the healthiest turf and best possible playing conditions. This means developing and adhering to a set of long-range plans and golf course maintenance standards to help ensure that successful practices are retained or improved upon over time in the event that changes in personnel or course officials may occur. Learn to put up with the occasional disruption to playing conditions for the long-term betterment of the golf course. All of this can happen along with savings to the club. Imagine that!

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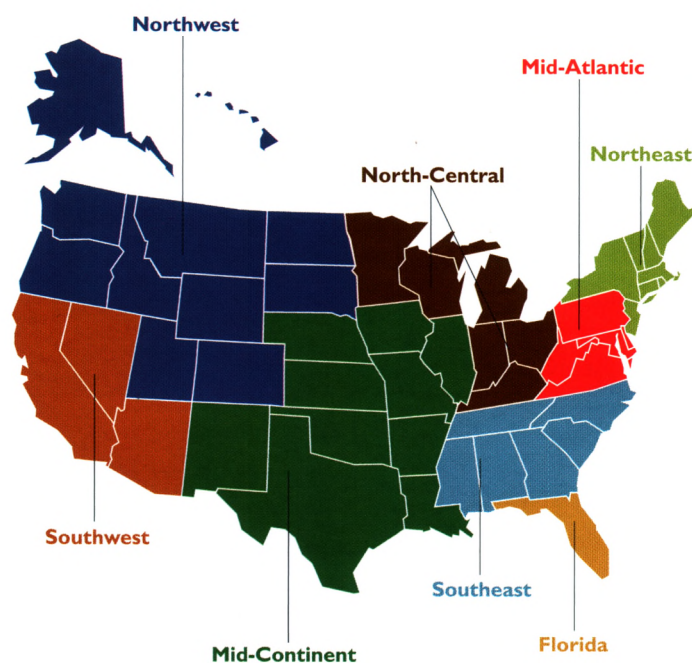


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Turf Twisters

Q: Last year we continuously experienced a severe yellowing of the turf during the growing season. Leaf blades elongated and appeared as if they were infected with some disease. The infected, chlorotic plants always grew above the canopy of the healthier-looking turf. Any thoughts? (Tennessee)

A: Enlist the aid of a diagnostic laboratory and request that a test for bacterial wilt be performed. Clogging of the plants' vascular systems from xanthomonas activity causes an unnatural elongated

growth pattern similar to turf trying to compete under extreme shade. Bacterial wilt could predispose the turf to complete collapse if harsh environmental conditions are experienced. If this condition

is in the fairways, then consider incorporating grasses that are not susceptible to this pathogen. Look at it as an opportunity to selectively remove *Poa annua*, which is susceptible to this organism.

Q: We installed a new double-row irrigation system on our golf course 20 years ago when I was the green chairman. It was a state-of-the-art system, but now the new green committee tells us that we need to replace it. Could that be possible? (New Jersey)

A: Unfortunately, the answer is yes. Although old irrigation systems can be kept running indefinitely with frequent repairs and a constant influx of parts and labor, at some point it becomes unwise to do so. Irrigation technology has advanced significantly since your system was installed, and even without the wear your current system undoubtedly has experienced,

dramatic improvements in coverage and distribution uniformity now are possible with the technology in topnotch new irrigation systems. This means that water, an increasingly precious natural resource, can now be managed and used with far greater efficiency.



New systems also can make a dramatic difference in turfgrass health and playability.

Q: We have just converted our greens to ultradwarf bermudagrass and are utilizing three aerifications per year with one-inch center spacings. It has worked wonderfully for us, but timing during the playing season is a concern. Do you recommend a late summer aerification as one of our timings? (Texas)

A: Absolutely! A late summer aerification on bermudagrass greens gives excellent agronomic benefits and healthier turf for the upcoming fall. Later summer/early fall is a time of increased heat, humidity, and rain

showers. These add to disease pressure as the bermudagrass is hardening off for winter. Late summer aerification greatly reduces the tendency for disease problems through a development of roots and rhizomes at summer's end.

