USGA® GREEN SECTION

Record

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Making Contact

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

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Cover Photo:
Do not overlook uniform seed-to-soil contact during establishment or you may struggle with thin spots on a newly established green.

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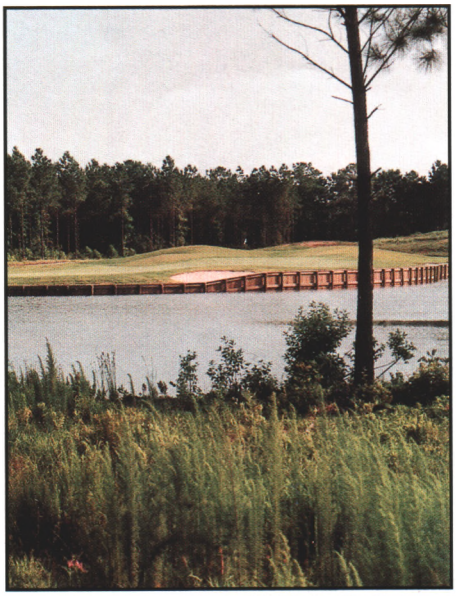
One of the keys to making golf affordable to the many young players taking up the game is to design courses that can be easily walked. See page 10.



Carolina National Golf Club (Bolivia, North Carolina) has initiated a significant naturalization program on the property, creating vast habitat areas. See page 19.

Build a new green on a shaded site that has poor air circulation and you can anticipate a slow, agonizing grow-in.

Bentgrass Putting Green Establishment

Avoid the perilous pitfalls frequently encountered during grow-in.

by BOB VAVREK

YOU HAVE decided to build a new golf course or perhaps rebuild a green or two on an existing course. From the minute the putting surface is seeded there usually will be a considerable amount of pressure from owners and members, and the pressure you put on yourself, to open the green for play.

Mistakes made during the grow-in of a sand-based bentgrass green can delay the opening date significantly. The worst-case scenario? The turf fails and the new green again must be taken out of play to be reestablished. Follow these tips and avoid the pitfalls, and you will have the golfers complaining about difficult hole locations faster than you can say, "I'm glad I followed USGA Guidelines."

Tips For Success — Do Your Homework

Have potential root zone materials tested by an accredited lab regardless of construction method. Do not rely on old test results from the supplier or the test results obtained by friends across town when they rebuilt their greens. The physical soil testing lab should also perform quality control testing during the blending operation *before* the root zone mixture is delivered to the green site. A list of accredited physical soil testing labs can be found at: *www.usga.org/green/coned*. A sample of the root zone mixture should also be submitted to a chemical soil -testing lab to determine nutrient levels. Porosity values, percolation rates, and nutrient analysis provide valuable information you can use to fine-tune the fertility program and irrigation practices during grow-in.

The adage "you can't make a silk purse out of a sow's ear" rings true when an attempt is made to build a green using questionable materials.

Following USGA Guidelines is a huge step in the right direction toward experiencing a smooth grow-in. A wealth of experience and know-how from other superintendents who have successfully established USGA greens and from the Green Section staff already exists. Review the USGA Guidelines and watch the USGA Putting Green Construction video. Tips for establishing a green are also available from the USGA website (*www.usga.org*) or contact your Green Section agronomist.

Don't Make The Same Mistake Twice

Why was it necessary to rebuild an old green in the first place? Dense shade, poor internal or surface drainage, restricted air movement, severe contours, a lack of putting surface to accommodate the amount of play at a particular course, and a variety of other factors can lead to the demise of a green. To help remedy the situation, cut down trees, use a construction mix that drains well and resists compaction, and provide ample putting surface for the anticipated amount of play. The formula for failure is to take a small, heavily shaded, severely contoured green out of play and build a similar small, heavily shaded, severely contoured USGA green in its place. A good tool to evaluate the overall growing conditions of the green site is the article "Helping Your Greens Make the Grade," found in the March/April 1998 issue of the *Green Section Record*.

Shade

Experience from the field strongly suggests that bentgrass greens need at least eight hours of direct sunlight each day for a consistent rate of growth and development. Expect a long, agonizing grow-in if you build on a shaded site. Greens in full sun will be ready to open weeks before shaded greens. Eliminate as many trees as possible from the south and east sides of new greens to ensure morning sunlight. Need a challenge? Try to establish turf on a green where morning sun has been limited by mature evergreens.

Timing Is Everything

Many green construction projects that are attempted across the northern tier of states suffer because the green is seeded too late in the season to provide enough time for bentgrass to grow, develop, and harden-off before winter. For example, a green that is seeded during the second week of August in Wisconsin will usually be ready to open the following spring, sometime during early June. Seed the same green during late September and the green may require the entire next season for grow-in.

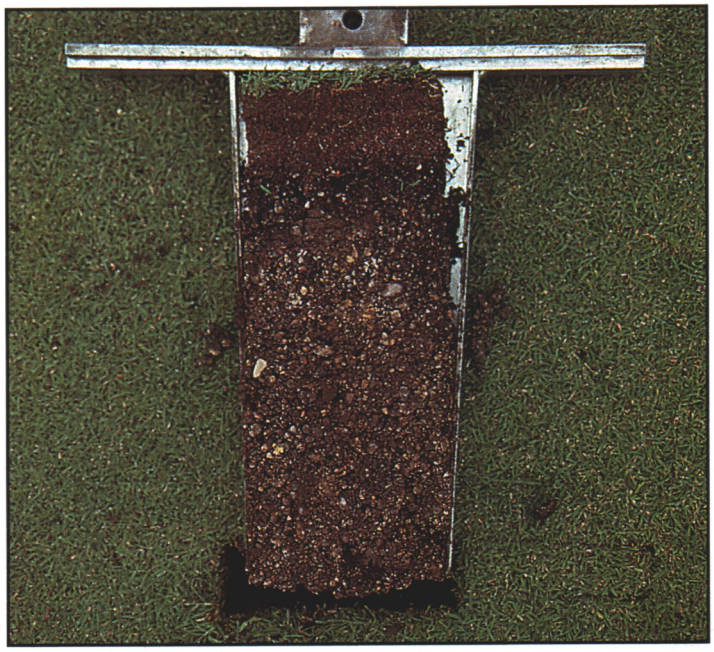
Late summer or early fall generally is considered to be the best time to establish a new bentgrass green, but the specific optimal seeding dates vary with location and climate. Across the northern tier of states a new green needs to be seeded by mid-August if a June opening date is anticipated. The recommended seeding date can be pushed more into early to mid-September in some parts of the transition zone.

Soil temperatures generally are high during late summer, and bentgrass will germinate quickly, usually within five to seven days. Heat and drought stress become less of a concern as the days become shorter. Seedling diseases, such as damping off, that accompany extended periods of heat and high humidity are less likely to occur in late summer as daytime and especially nighttime temperature/humidity moderates. In addition, weed encroachment is much less of a problem during fall compared to spring.

A spring seeding results in the most challenging grow-in because the immature seedlings must survive heat stress, weed pressure, and erosion from washouts that accompany afternoon thunderstorms. A relatively dense stand of crowded immature bentgrass seedlings is especially susceptible to turf diseases. Also, mechanical stress from mowing and topdressing applications is more of an issue during summer compared to fall.

Seedbed Preparation

Use soil test results as a guide to determine how much starter fertilizer to incorporate into the seedbed during the final grading operations. A rule of thumb used with success by many superintendents is to incorporate a 1-2-1 ratio starter-type fertilizer at a



Don't step up to the plate with two strikes against you. Always have the physical properties of a potential construction mix tested by an accredited lab and use sound construction techniques such as the USGA Recommended Guidelines for Putting Green Construction.

rate of approximately 1 lb. nitrogen per 1,000 sq. ft. of turf into the upper root zone just prior to seeding. Incorporating Milorganite or another source of natural organic nitrogen into the seedbed is also a common practice. Use a rate of approximately 5 lbs. of Milorganite per 1,000 sq. ft. of putting surface and lightly till the fertilizer into the top few inches of root zone during final grading.

Seeding Rate

Seed most modern varieties of bentgrass at a rate of 1 to 1.5 lb. per 1,000 sq. ft. of putting surface. Use a 1 lb. rate when using the ultra-dense varieties of bentgrass such as G-2 or A-4. Seed in at least two directions to ensure uniform coverage across the entire green. Mix bentgrass seed with a lightweight carrier such as a natural organic fertilizer to facilitate a more uniform distribution of seed through a drop spreader.

Maximize Seed-to-Soil Contact

A common practice is to use the knobby tires of a motorized sand rake to press the seed into the soil. Invariably, the first seedlings to germinate are those at the bottom of the tire depressions. Various types of light rollers also have been used to press the seed into the construction mix. The importance of adequate seed-to-soil contact cannot be overemphasized.

Mulch

Applying a clean straw mulch or hydromulch to a green after seeding is a technique that is rarely considered anymore. Mulching to prevent washouts and to maintain more consistent moisture levels in the upper root zone after irrigation was once a common practice. Perhaps the presence of more sophisticated irrigation systems that can be programmed to deliver frequent, light irrigation to turf in a uniform pattern has eliminated the need to mulch, and maybe not. Even a light straw mulch would be worth its weight in gold if it prevented just one washout of a recently seeded green.

Extremely lightweight geotextile fabric, such as Seed Guard, can be used in place of straw or wood fiber mulch. These polyspun fabrics allow free movement of air and water through the cover and do not trap an excessive amount of heat during a sunny day. They are inexpensive and disposable. Covers have been used with varying degrees of success to extend the growing season later into the fall and initiate turf growth earlier in spring.

Disease Control

Use seed treated with Apron to prevent damping off disease if the green is seeded during a period of hot, humid weather. Treating a new green for diseases is a challenge since most common golf course sprayers are too heavy and would cause wheel rutting across a putting surface during grow-in. Use granular fungicides on new greens and be sure that the materials chosen for disease suppression are safe to use on immature bentgrass. Be sure the person using the spreader is comfortable with the equipment and that the spreaders have been carefully calibrated. Another option is to have a walk-behind boom-type sprayer available for use during grow-in. This type of sprayer could also be used to apply light rates of soluble fertilizer to spoon feed the new greens. In fact, some superintendents prefer the walk-behind boom sprayer to the more common motorized sprayer for putting green management.

Walk-behind mowers equipped with solid front rollers are recommended to minimize stress to the immature stand of bentgrass during grow-in, especially along the perimeter of the green where the constant turning of grooved rollers usually injures turf.

Irrigation

Opinions vary greatly regarding the proper method of irrigating a new green. Too much irrigation is the tendency prior to seed germination. Frequent, light irrigation is believed to be much more important after seed germinates. A seed probably will not die if the surrounding soil dries out, but a seedling will.

The importance of dependable, uniform irrigation coverage is often underestimated during establishment because most superintendents believe the automatic irrigation system can always be supplemented with hand watering or roller-based sprinklers. Unfortunately, a sprinkler head that does not function properly may not be discovered soon enough to prevent seedling dieback, and wind may disrupt the uniformity of irrigation coverage even when the system is functioning properly. Moisture levels across the entire surface of a new green need to be checked several times a day during hot, dry weather.

How one interprets light and frequent irrigation can have a significant influence on the rate of turf growth and development. The weather dictates irrigation needs, since more frequent irrigation cycles are needed during a dry, windy day and less irrigation is needed during a humid, cloudy day. Consequently, the irrigation clocks may need to be adjusted to accommodate changes in the weather patterns. Irrigation frequency can be reduced as the stand of turf matures. Check the depth of the root system and adjust irrigation cycles accordingly.

Neglect the topdressing program and uneven areas on a new green will often be severely scalped as the height of cut is lowered throughout the establishment period.

Sand-based greens typically are overwatered during the grow-in because porous root zones accept water readily without puddling. Heavy irrigation cycles will do little more than move soluble plant nutrients beyond the root zone and encourage disease activity. Granted, immature bentgrass seedlings cannot tolerate much drought stress, but soaking greens several times a day is counterproductive.

Should an extended dry period occur during grow-in, it may prove necessary to periodically water more deeply. The combination of frequent applications of fertilizers and frequent, light watering can result in a buildup of salts in the upper root zone. These can usually be flushed by a 0.25- to 0.5-inch rain or irrigation application.

Fertility

Use the initial soil test results for the root zone mix as a guide for how much fertilizer to add to the upper inch or two of the green just prior to seeding. Once the turf begins to grow, a good rule of thumb is to apply about ½ lb. of nitrogen every 7 to 10 days for the entire first season of establishment. Use turf color as a guide to fine-tune the fertilizer rates. When the bentgrass needs to be mowed on a consistent schedule, the amount of clippings per mowing also can be used as a guide for fertilizer applications. If soil temperatures are above 60 degrees, try to supplement the more readily available forms of nitrogen with Milorganite or some other form of slow-release nitrogen. A monthly 1 lb. rate of slow-release nitrogen can serve as the foundation of the fertility program during grow-in, and the weekly light applications of soluble fertilizers sustain vigorous bentgrass growth and development.

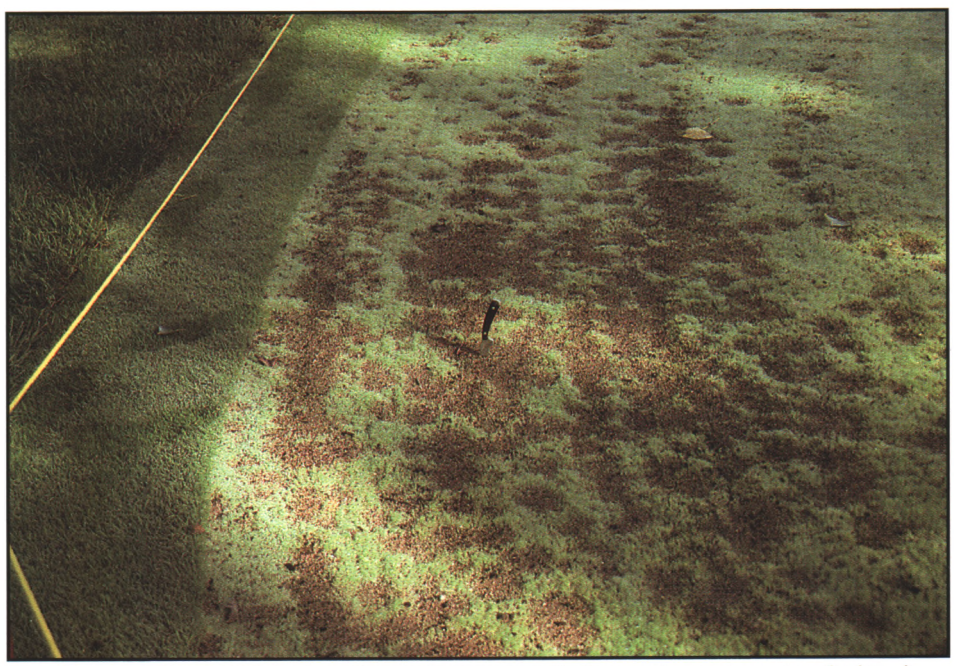
Furthermore, there is practically no chance of burning the turf or causing a flush of growth using natural organic sources of nitrogen. Skips or overlaps are rarely a concern because low nitrogen analysis fertilizers can easily be divided and spread across a green in two or three directions. Most natural organic fertilizers also provide slow-release micronutrients to the root zone.

Phosphorus levels also must be monitored. Typically, 1 lb. of phosphorus per month for the first couple of months during grow-in is sufficient. Micronutrients are easily applied through one or two applications of a micronutrient package such as O. M. Scotts' STEP product.

Poor fertility management of sand-based greens is probably the number one mistake made by superintendents during establishment. Oftentimes, heavy applications of soluble fertilizers are made at infrequent intervals. Then the rate of nutrient release is expected to last as long as the same fertilizer application to a mature green. The implications of frequent irrigation or heavy rainfall over an immature turf growing on a sandy root zone are not considered or understood. The unfortunate result is thin, wide-bladed, off-color turf that is starving for nutrients.

Topdressing

Some superintendents are successful using high-quality straight sand for topdressing throughout the grow-in. Washed mason sand that has a majority of its sand particles between 0.25mm and 0.5mm in diameter (medium sand) is a safe bet for topdressing greens. Medium sand has a desirable balance between moisture-holding capacity and



Frequent irrigation and high rates of nitrogen applied to an immature stand of turf will invite damping-off disease during extended periods of hot, humid weather.

A poor grow-in effort . . . can you find the putting green in this picture?

drainage. Other superintendents are equally successful using the original root zone mix during the first year of establishment and then switching to a compatible straight sand once the stand of turf matures and begins to recycle organic matter into the upper root zone.

The straight sand option is strongly recommended if the sand component of the root zone possesses a relatively high percentage of coarse and very coarse sand particles. A coarse root zone mix that meets USGA Guidelines may or may not be suitable as a topdressing material. When in doubt, seek advice from a USGA agronomist.

Topdressing applications during the grow-in serve several purposes. Light applications of sand level out uneven spots across the slope of a green that could become scalped by mowers when the cutting height is decreased throughout the grow-in. A common practice is to apply a relatively heavy application of sand to greens just prior to lowering the height of cut. The sand supports the mower a little higher and slightly raises the effective height of cut for a few days until the sand settles into the turf. As a result, frequent topdressing reduces the potential for scalping seedlings as the height of cut is slowly lowered.

Topdressing helps prevent excessive thatch from accumulating in the upper root zone during establishment. A little thatch or cushion is desirable and is one of the signs that a green can be opened to play. However, a distinct layer of dense thatch should not be allowed to develop. Too much thatch, a common occurrence during grow-ins, can slow the movement of water through the green and cause other concerns when the putting surface matures.

Use a spinner-type fertilizer spreader when topdressing to keep the unstable root zones from rutting during the first few weeks of grow-in. Once the surface firms up, try to use more conventional topdressing equipment, but only fill the hopper full enough to topdress one green. Keep brushing and other abrasive operations to a minimum. Try to water-in the topdressing or use a very light cocoa mat or a piece of upside-down artificial turf to work sand into the green.

Inadequate topdressing or no topdressing at all probably is the second most common mistake made during establishment. Try to match topdressing applications to the growth of the turf. Another common mistake is placing a full load of sand into the topdresser and then trying to sand four or five greens at a time. The heavy unit usually causes severe rutting that may take weeks, months, or years to smooth out. For every green where too much sand is applied to the putting surface during establishment, there are over a hundred greens that receive inadequate topdressing applications.

The Initial Mowing Operation

Hand mowing is necessary during grow-in. Keep the cutting units sharp. Use solid rollers to reduce physical damage to the seedlings, especially along the inside perimeters of the green. Roll the green to firm up the playing surface before the initial mowing. Walk-behind units can be run across the green with the reels off to roll the

putting surface prior to the initial mowing.

The most common height of cut for the first mowing is approximately ¼" for the ultra-dense varieties of bentgrass and about ⅜" for other bentgrass varieties. Mow the greens during the afternoon when the turf is dry. Start mowing when a small amount of clippings will be removed from most of the green at the initial height of cut. Collect the clippings during the initial mowing and then return clippings in subsequent mowings to recycle a little organic matter to the surface of the green, which serves as low analysis fertilizer and lightweight mulch. Maintain the green at a height of cut not lower than 5/32" for the entire first season. The exception would be a lower initial season mowing height of ⅛" when establishing the ultra-dense varieties of bentgrass.

Superintendents generally err on the side of waiting too long to initiate mowing. Rarely is a green mowed too soon. The initial mowing often removes too much leaf tissue and the growth of the turf is set back for several weeks. If the mowing height is adjusted, for example, to ½" to account for excessive growth, it may take the entire season to safely lower the height of cut to a playable 3/16".

The other mistake is trying to maintain the turf during establishment using a triplex mower equipped with grooved front rollers. The symptoms of the injury this practice causes to a weak stand of bentgrass seedlings are unmistakable. The perimeters of the greens are thin or bare, along with turf across humps and along severe slopes. Triplex mowers also can cause rutting of the new green before a dense stand of turf develops.

When is the Green Ready to Open?

This is the question that you will be asked throughout the grow-in, and there is no clear-cut answer. A very general rule of thumb for bentgrass greens is to allow at least three months of good growing conditions before opening to play. Most greens are seeded during fall and opened the following season. How many of the marginal growing days during late fall, winter, and early spring account for the "three months of growth" is impossible to determine. My personal, unscientific criteria for opening a green are as follows: If a wedge is cut from the green and is difficult to tear apart due to (1) the knitting of bentgrass stolons and (2) the development of a thin layer of thatch in the upper root zone, then the green is ready to open.

Unfortunately, pressure from golfers or financial considerations usually result in the green or greens being opened for play too soon. Very few superintendents have had the luxury of seeding a green during fall and having the entire next season to grow-in and groom the turf before opening to play the following spring.

Finally, avoid setting a specific date for the opening of a new green, because that date will likely be chiseled in stone by the golfers. The weather during establishment will have a considerable influence on how quickly the stand of bentgrass develops. Make sure the golfers understand the influence of weather conditions and the risks of playing a green too soon. It always will be very difficult to close a green after it is finally opened to play. Avoid the need to even consider such an unpopular decision by following the advice in this article to stack the odds in your favor for achieving a rapid grow-in.

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Supplement automatic irrigation with careful hand watering to maintain consistent levels of moisture in the root zone. Avoid one of the more common pitfalls during the grow-in: overwatering the putting surface.

Bermudagrass Sprig Heat Tolerance

High temperatures may be an unrecognized problem for many bermudagrass sprig shipments, and especially for putting greens.

by DR. EARL ELSNER and DOUG McWHORTER

Variable bermudagrass sprig establishment 40 days after planting.

THE NEW ultradwarf bermudagrass varieties are raising player and superintendent expectations for bermudagrass putting greens. Under ideal conditions it is possible to play the first round of golf within six weeks after sprigs are planted. Sprig planting rate and quality determine if that goal can be reached. Unfortunately, sprig quality will be severely compromised if they generate extreme heat in transit from the sprig farm to the golf course. Control of sprig temperature after harvest is vital for maintaining high quality sprigs for rapid and uniform grow-in.

This article will discuss temperature studies that we conducted in 1998 and 1999 in association with Ralph Hinz, golf course superintendent, as he renovated the Plantation Course at The Landings in Savannah, Georgia. It also will describe the characteristics of greens planted with heat-damaged sprigs and review some of the research conducted to assess the severity of the problem. Finally, suggestions for superintendents who are purchasing bermudagrass sprigs will be provided to assist in making the grow-in as rapid and problem-free as possible.

The Situation

TifEagle sprigs were harvested for the Plantation Course from the Seed Commission's foundation field in mid-afternoon on Friday in early July. They were delivered early Saturday morning, the next day. Typical Southeast procedures for harvesting, packaging, and transporting the sprigs were used. The grass foliage was dry, ambient temperature was in the mid-90s, and the soil was approximately at field capacity. Most of the greens were planted on Saturday (ca. 18-28 hours after harvest), and the remainder were planted Sunday morning (ca. 40-45 hours after harvest). Ralph indicated that when they opened the boxes the sprigs were "really hot and had a bad odor."

Twelve days after planting Ralph described the putting greens as follows:

- Regrowth had started, it was not uniform, there were large areas with only a few living plants, and some areas had more dead plant material than live plants.
- Of the living sprigs, many had only one or two growing points with a single green leaf.
- The first-planted greens had more and better growth than the last planted.
- There was no pattern except the first greens planted were better than the last planted.
- Dead sprigs planted at the proper depth were in the same row and adjacent to living sprigs that were planted at the proper depth or were on the surface.

A new shipment of sprigs was arranged. When the boxes were opened (18 hours after harvest), they also were hot and had a pungent odor. The temperature in the center of the sprig mass was 145°F. Near the top and edges of the 48" × 45" × 50" cardboard box, the temperature was about 100°F.

Cardboard boxes fitted with 4-mil plastic bags have been used effectively to limit the oxygen in the enclosed sprig mass.

During the next few days, we contacted several growers and were told that no one ever has a problem with sprig survival on putting greens if the superintendent does his job and keeps the sprigs watered. They indicated that the only time that high temperatures are a problem is when wet grass is harvested. I also checked with two courses that were planted about the same time as the Plantation Course. Neither thought they had a problem and described grow-in as normal. However, under close questioning, the appearance and growth of the sprigs were described as being very similar to the sprigs at the Plantation Course. Thus, it seems likely the sprig quality and resultant grow-in experience at the Plantation Course may reflect an unrecognized problem with many sprig shipments and newly planted putting greens.

Researching The Problem

We conducted several experiments during the next few months to:

- Reproduce the high temperatures,
- Determine the temperature response of different varieties,
- Quantify the effect of high temperatures on sprig viability, and
- Develop an economical way to maintain acceptable temperatures in harvested springs.

The results of these tests revealed some interesting conclusions:

- The temperatures inside a 48" × 45" × 48" cardboard box filled with either Tifdwarf or TifEagle sprigs rose as much as 2.5°F per hour.
- The highest temperature measured in a box of sprigs was 160°F, 40 hours after harvest.
- There was no difference in the rate of temperature rise in Tifdwarf or TifEagle sprig boxes.
- Tifway and TifSport averaged about 1°F temperature rise per hour in aluminum trailers.
- Temperatures increased more rapidly when sprigs were harvested during periods of active plant growth than in late fall and early spring.
- Removal of all soil and thatch appeared to limit the temperature buildup,
- Neither the harvest time of day nor moisture on the leaves affected the rate of temperature rise.
- The center of a 48" × 45" × 48" box was significantly hotter than the edges. When the sprigs in the center of the box reached 145°F, approximately 50% of the entire box of sprigs had a temperature greater than 120°F.
- Sprigs can tolerate 110°F for an extended period and 120°F for 8-10 hours. However, after six hours at 120°F, regrowth is delayed and after 10 hours the percent of surviving sprigs is significantly reduced.
- After four hours exposure to 130°F, only 30% and 60% of the sprigs developed new shoots in 8 and 14 days, respectively. The surviving sprigs had fewer growing points and leaves.
- Exposure to 140°F caused almost 100% sprig death within one hour.
- Tifdwarf and TifEagle had similar patterns of regrowth after exposure to high temperatures.

What Really Happened at the Plantation Course?

The sprigs simply got too hot before they were planted. Sprigs that were subjected to high, but not lethal temperatures were slower to initiate new growth and had fewer growing points.

When the greens at the Plantation Course were planted, baskets were filled directly from the sprig boxes and spread on the green's surface such that sprigs from the center of a box were planted in the same general area and sprigs from the top were planted in another area. The part of the green that was planted with baskets filled from near the center of the box (130°-140°F) had a lot of dead material and poor regrowth. Some of these sprigs did not develop a new leaf until day 13. In contrast, areas planted with sprigs from the edges of a box (100°F) grew normally. These healthy sprigs on day 13 had several active growing points, each with 2-3 new leaves. Thus, growth on the green was uneven and overall coverage was significantly delayed. This was due not only from slow sprig regrowth, but also because the areas with a high percentage of dead sprigs had larger voids that required more time to fill in.

If the sprigs from each box had been thoroughly mixed before planting, the growth response would have appeared quite different. Rather than having areas with good, fair, or poor growth, it would have appeared that the average sprig survival was about 50%, but uniform across the entire green. The greens planted on Sunday would still have had less survival than the greens planted on Saturday because more sprigs in each box would have been subjected to lethal high temperatures during the extra day.

Fixing the Bug

We have concluded that the temperature rise in the sprig mass was due to heat generated by plant and microbial respiration. Additional studies

determined that the temperature rise can be reduced by sealing the sprig mass from oxygen because much less heat is generated in an anaerobic environment.

Most important, bermudagrass sprigs grow quite well after being in an anaerobic environment for several days. We have demonstrated that sprig regrowth is excellent after five days without oxygen.

Avoiding High Temperatures During Shipment

Growers who harvest and plant the same day or who use refrigerated trucks to transport sprigs avoid overheating problems. Excessively high temperatures do not appear to be a problem in late fall or early spring shipments or with growers who harvest sprigs with very little soil or thatch.

When sprigs are at risk from potential high temperatures, they can be placed in an anaerobic environment (sealed from oxygen), and maintain high quality for at least five days.

The most effective method we have found for limiting the oxygen in the sprig mass is to place the sprigs inside large 4-mil plastic bags inside the normal cardboard boxes. The bags should be large enough so that the top can be folded and sealed.

The following example illustrates the effectiveness of creating an anaerobic environment for bermudagrass sprigs while in transit to a planting site. Seven 48" × 45" × 51" cardboard boxes of TifEagle sprigs were shipped from Adel, Georgia, to Phoenix, Arizona, during May 1999. In six of the boxes, the sprigs were enclosed in plastic bags to exclude oxygen. The sprigs in the seventh box were not in plastic bags and thus obtained oxygen for normal respiration through the sides and top of the cardboard box. The temperature in the center of the seventh box was 160°F, 40 hours after the harvest. The temperature in the center of the boxes with plastic bags was only 98°F, 64 hours after harvest. Most of the sprigs in the seventh box were dead or of very poor quality. The sprigs in the six anaerobic boxes were healthy and produced excellent, uniform regrowth even when planted 3½ days after harvest.

Evaluating a Shipment of Sprigs

Superintendents are understandably concerned about the potential for diminished sprig vigor and regrowth. The best way to determine if high temperature is a problem is to check the sprig temperature. It should be measured immediately upon opening a container, and the probe should be placed several inches below the surface.

Since an entire box does not reach the same high temperature and since the time of exposure is critical to assess the potential loss of vigor, it would be almost impossible to describe every situation that a superintendent might face and provide the appropriate guidance. A better alternative is for the superintendent to be aware of potential high temperatures and discuss the matter with the sprig supplier before harvest and shipment.

The question remains, however, at what temperatures should a superintendent reject bermudagrass sprigs?

- Short-term exposure (< 5 hours) at 120°F usually does not cause significant deterioration in sprig quality.
- If the temperature is measured in the 130°F range, there will be a reduction in the number of sprigs that are capable of regrowing, and the ones that regrow will be slower to produce new leaves and will have fewer growing points.
- Almost all sprigs that are exposed to temperatures exceeding 140°F will be dead. These also usually have a pungent odor.

Are There Other Concerns About High Temperatures?

Planting bermudagrass sprigs in hot, dry soil will give the same results as high temperature storage. Dry soil temperatures in direct sunlight can exceed 130°F when ambient temperatures are near 100°F. The soil temperature under the same conditions but with moist soil will be below 100°F. Thus, only one hour in excessively hot soil between planting and the first irrigation may result in near failure of otherwise high quality sprigs. It is best to plant in moist soil.

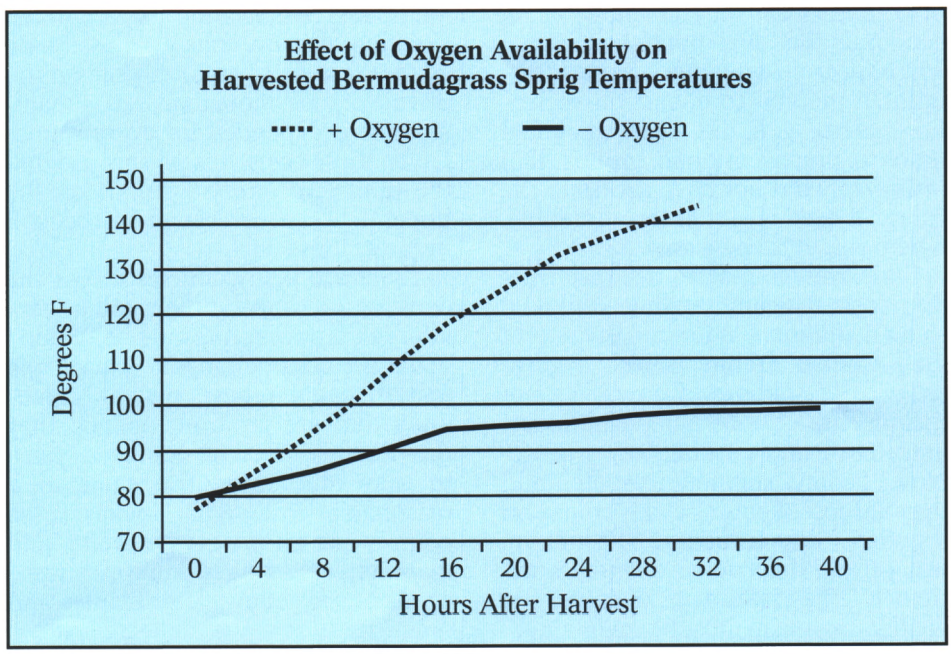
Conclusions

Although the best people and plans can be in place, the first requirement for a successful bermudagrass putting green is healthy sprigs. These studies have shown bermudagrass sprigs to lose vigor when exposed to 120°F for six hours. Furthermore, a high percentage of bermudagrass sprigs are incapable of producing new growth after one hour of exposure to 130°F. While it is possible to grow an excellent putting green with high temperature damaged sprigs, the grow-in time is significantly increased and the initial uniformity may be poor.

Tifdwarf and TifEagle have similar temperature responses and rates of temperature increase in sprig containers.

Reducing the oxygen supply to the sprig mass by enclosing sprigs in polyethylene bags will allow sprigs to be shipped at ambient temperatures and retain excellent quality.

DR. EARL ELSNER *and* DOUG McWHORTER *are with the Georgia Seed Development Commission at Athens, Georgia. They are responsible for genetic purity of Tifway, Tifdwarf, TifEagle, and TifSport, plus more than 65 varieties of other crops developed by the University of Georgia and USDA plant breeding programs.*



Building And Maintaining The Truly Affordable Golf Course

The do's and don'ts of affordable golf.

by JIM MOORE

With good planning and common sense, "affordable golf" can be more than a catchy phrase.

LIKE THE ECONOMY, and at least partially because of it, golf has enjoyed tremendous growth in recent years. More people than ever are taking up the game and are shelling out more money than ever before to play it. Golfers all over the country are paying $50, $60, $70, and more to play a round of golf. At least they are now, in an economy that has flourished. What will happen if/when we have less disposable income to spend on recreation? Also, golf has been marketed hard to socioeconomic groups that historically did not have access to the game. If golf is not truly affordable, where will these new golfers play?

With average golf course construction costs typically ranging from $1.6 to $4.5 million (American Society of Golf Course Architects web page at *www.golfdesign.org*. Figures do not include the cost of land, clubhouse, entry road and parking lots, maintenance facility, architect fees, etc.) and the total cost of putting a new course on line frequently exceeding $10 million, just getting the course opened is extremely expensive. After opening, the facility obviously must be maintained. Annual maintenance budgets have increased steadily for many years, reflecting golfers' desires for high quality course conditioning. The 1998 18-hole average maintenance budget for private courses is $635,930, it is $576,423 for resort courses, and it is $383,819 for municipal courses (Golf Course Superintendents Association of America). Looking at it another way, assuming 30,000 rounds of golf per year on the private course, more than $20 in maintenance is expended for every round. Given these costs, it is no surprise that the phrase *affordable golf* is on the hopeful lips of everyone in the golf industry these days.

There are many courses across the country that already offer golf at very affordable prices. Although they don't make the cover of anyone's magazine and they often have playing conditions that are far from perfect, they do offer millions of golfers a place to play and enjoy the game at a reasonable cost. What makes these courses so affordable to build and maintain? They have employed some or all of the following principles and practices.

When Preparing to Build the Course, Select a Site that Requires as Little Earth-Moving as Possible

Site selection has the greatest single impact on the eventual cost of building a new golf course since heavy earth-moving tasks are the most labor and equipment intensive. These tasks include general clearing, stockpiling and purchase of topsoil, excavation of the subgrade, rock removal, rough shaping, and fine grading. Although there are a few notable exceptions, the majority of sites selected for the construction of new golf courses are less than ideal in terms of contouring. As a result, it is now common to move tremendous amounts of soil in the form of cuts and fills. At one time, moving more than 200,000 cubic yards of earth was considered unusual if not excessive. Today, it is not uncommon to move over 1,000,000 cubic yards to build and shape the new course. As a result, the cost of the heavy earth-moving tasks alone can easily exceed $1,000,000. Obviously, hole routings that result in large cuts and fills add greatly to the cost of construction, as do design fea-

tures such as excessive bunkers, hollows, and mounds.

Selecting an appropriate site and developing a good design that requires as little earth-moving as possible will go a long way toward making the course truly affordable. Agricultural lands usually are excellent choices for such courses. They typically have plentiful topsoil, good surface drainage, and a minimum of trees and brush. When combined with a design that requires only limited earth-moving, such courses may be unremarkable in their overall appearance. They also are far less expensive to build and maintain, and therefore less expensive to play.

During Construction, Keep Steep Slopes to a Minimum

Steep slopes created during construction are not just costly to build — they are also expensive to maintain. Slopes in excess of 3:1 (for every 3 linear feet the elevation changes by 1 foot) almost always require specialized mowing equipment or must be mowed by hand using line trimmers or hover-type mowers. They also are more difficult to water and fertilize, adding further to the cost of maintenance. While softer slopes offer less dramatic visual accents to the course, they can be mowed with large riding equipment. Since labor is the most expensive aspect of golf course maintenance, layouts that can be maintained properly with smaller crews result in long-term savings that can be passed on to the golfer.

Select a Design that Requires Less Trim Work

Trim work is the most labor-intensive aspect of golf course maintenance. This is particularly true in the southern portions of the country, where bermudagrass is the predominant turfgrass used on courses. Perimeters of lakes, creeks, bunker edges, sidewalks, and cart paths, and around the bases of trees, signs, and ballwashers, all require near-constant trimming. On highly maintained courses it is not unusual to find 6 to 8 crew members devoted solely to trim work throughout the entire growing season. Bunkers and water features are particularly labor intensive, so the more they can be kept to a minimum during the original design of the course, the greater the labor savings will be each year thereafter.

Heavy earth moving is expensive. This operator is making a cut of at least five feet.

Build Fewer Sand Bunkers — and More Grassy Hollows

Although sand bunkers are not overly expensive to build, they are second only to greens in terms of the labor required to maintain them to the standards today's golfers have come to expect. Unfortunately, the trend in golf course design over the past couple of decades has been to increase the number of sand bunkers placed on the course. Today, it is not uncommon to find 50 or more bunkers on a course, where in the past 20 to 30 would have been considered sufficient. Each of these bunkers requires labor-intensive tasks such as edge trimming, periodic addition and replacement of sand, frequent raking (both mechanical and by hand), and the shoveling of sand back onto the bunker faces following heavy rains. The affordable course should keep sand bunkers to a minimum. Twenty well-placed sand bunkers can provide plenty of challenge without overwhelming the maintenance staff.

The style of the sand bunkers also affects the amount of maintenance required to keep them in good shape. Steep, flashed faces are attractive but invariably result in the washing of sand from the faces during heavy rains. Grass-faced bunkers with relatively flat sand surfaces are far less intensive to maintain, and the sand will last longer because there is much less chance for soil to mix with the sand.

Softly contoured grassy hollows can provide plenty of challenge to the player. In fact, the flop shot required from a closely mown grassy hollow to an adjacent elevated green can be even more difficult than a shot from a sand bunker. Unlike bunkers, grassy hollows require virtually the same maintenance as the other turf areas around the greens or fairways and therefore require no additional cost to maintain properly. The combination of challenge, beauty, and low maintenance requirements make grassy hollows an ideal choice for the facility striving to provide affordable golf.

Build Agronomically Sound, Sensible Greens

Like irrigation systems and drainage, the construction of greens is not an area in which corners should be cut in the effort to save money. Well-built greens are much less expensive to maintain throughout the remainder of their lives than those that are built poorly. Recently, there has been something of a trend to reduce the cost of building greens by leaving out such critical components as drainage tile, the gravel drainage blanket, and organic matter from the root zone itself. Yes, greens can be built for less money without these components, but at what cost ultimately? For nearly 40 years greens have been constructed to the admittedly stringent USGA guidelines. Since greens are expected to last a minimum of 20 years and in most cases

much longer, and since greens are easily the most critical physical component of every golf course, the extra effort and expense to stay with these time-tested and scientifically sound construction techniques is well justified. The fact is, well-built greens are not expensive in the long run. A good analogy can be made to building a house. There are houses that look great when they are new, but they are constructed using substandard plumbing, wiring, and foundation materials. Such houses soon become maintenance nightmares for the owners. Then there are houses that are solid as rock from the bottom up and are simple yet functional in their design. These houses provide years of trouble-free living and are unquestionably the better long-term investment. Likewise, greens that are constructed utilizing proven agronomic principles are better investments.

This is not to say that money cannot be saved during the construction of USGA greens. Most communities have multiple sources for sand and gravel. In many cases, it is possible to identify (through laboratory testing) lower-cost materials that meet USGA guidelines. In 1993 the USGA modified the guidelines to provide the option for leaving out the intermediate layer. By selecting properly sized gravel and sand, the intermediate layer can be omitted, resulting in significant savings.

A new and potentially promising aspect of green construction is the utilization of inorganic amendments in the root zone mixture as a substitute or complement to traditional sand/peat mixtures. However, these amendments are extraordinarily expensive. For example, a typical 19-green construction project requires approximately 7,000 cubic yards of root zone mixture. Assuming the 12-inch-deep root zone mixture will be composed of 85% sand and 15% either peat moss or one of the inorganic amendments, the cost of that mixture varies dramatically. The cost of the peat would be approximately $32,000, whereas the cost of either of two of the most popular inorganic amendments easily exceeds $200,000 (both figures include the cost of shipping to Dallas, Texas). Incorporating the amendments in the upper few inches of the root zone instead of through the entire profile can reduce their cost. However, this results in root zone layering that is inconsistent with the USGA's guidelines. In addition, there is little research available on the long-term stability of the inorganic amendments and their impact on the root zone. For these reasons, the USGA does not currently recommend the use of inorganic amendments in the construction of new greens.

Avoiding extreme contouring of the green site itself also can significantly reduce the cost of building greens. In addition to the large quantities of fill material and topsoil necessary to con-

Although obviously beautiful, the natural areas require minimal trimwork.

struct such sites, the steep contours often preclude the use of riding equipment for greens mowing. This permanently increases the labor requirements for green maintenance. And, although such green sites are dramatic, they contribute nothing to the development of a top quality putting surface.

Reducing the total square footage of the putting surface also reduces the cost of construction and maintenance. There has been a trend toward very large greens over the past 15 to 20 years. At one time, a 5,000-square-foot green was considered large. Today, greens are frequently in excess of 7,000 square feet. Obviously, greens must be large enough to endure the traffic they receive. However, a small green that is located in an area with good growing conditions (particularly adequate light and air movement), has plenty of entrance and exit points, and has contours that allow a wide selection of hole locations, will outperform a large green that does not have such attributes.

Without question, bunkers such as these are beautiful assets to any golf course. However, they are far more expensive to build and maintain than a grassy hollow.

Plant the Right Grasses Throughout the Course

Perhaps no aspect of the potential for affordable golf has been more overlooked than the choice of grasses for the course. Thanks to the efforts of turfgrass breeders and scientists, and the support of many of these programs by the USGA, the industry has a greater selection of grasses for golf course use than ever before. Many of these grasses have very low maintenance requirements. However, since they seldom provide the level of perfection today's golfer has come to expect, they are underutilized. For example, improvements in buffalograss have yielded varieties that are perfectly suited to golf course roughs, typically the largest acreage of the course. Once established, buffalograss requires miniscule amounts of water, fertilizer, and pesticides. It seldom needs mowing and provides a turf canopy that fairly penalizes the errant shot without making it difficult to locate the ball. If there was ever a grass that personified the concept of affordable golf, it is buffalograss. So why is it not extensively used on today's new courses? First, it is slow to establish (two to three years from seed) — a trait not well received in today's instant-everything society. Second, when properly maintained, buffalograss does not provide the lush green color desired by so many golfers. Buffalograss turns brown when under drought stress and, depending on the variety, develops seedheads that some find unattractive. In other words, in spite of the fact that the grass provides excellent playing quality for the rough at a very low price, many golfers find it too unattractive for widespread use.

An even more glaring example of how choosing the wrong grass can impact affordable golf is the trend all across the southern portion of the country to establish bentgrass instead of bermudagrass greens. Maintenance costs (particularly for pesticide, water, and labor) increase dramatically when bentgrass (a cool-season plant) is planted in a climate that is far better suited to bermudagrass (a warm-season plant). At one time, it was difficult for

Mounds such as these are dramatic in appearance and appeal to some. However, they are expensive due to the large degree of hand work necessary to build and maintain them.

the bermudagrass golf course superintendent to provide a putting surface comparable to his bentgrass brethren. However, thanks to the development of better equipment, improved bermudagrass varieties, and the expertise of today's highly trained superintendents, bermudagrass greens can and do offer outstanding putting quality.

Establish Reasonable Maintenance Standards Throughout the Course

To put it bluntly, today's golfer is spoiled when it comes to course conditioning. Expectations of the daily player have risen with each televised tournament displaying hand-mown greens, tees, and even fairways. Perfectly manicured flowerbeds are timed for the ultimate tournament-week display. Fairway and tee divots are filled by hand with sand dyed to match the undamaged adjacent turf. Every lake, creek, bunker, and path is perfectly trimmed. There are no weeds anywhere and few plants of any type grow with anything less than perfect symmetry. Even bunkers are expected to provide a level of consistency that suggests we should reevaluate their classification has hazards according to the Rules of Golf.

Such perfection on the golf course is perhaps justified for those with large maintenance budgets. For those who seek to keep golf affordable, there are many options to reduce the cost of maintenance. For example, instead of hand-raking bunkers four to five times per week, labor hours can be greatly reduced by machine raking twice per week. Of course, this assumes that golfers will actually smooth the bunker after their shots and that they will once again recognize the fact that bunkers are indeed hazards. Another labor-saver is to reduce the mowing frequency of roughs that seldom come into play. On most courses, there are many acres of such areas. Granted, although there probably are few places on any course that sooner or later will not be hit by someone, the saving in fuel, labor, and equipment justifies the effort. As stressed earlier, keeping trimming to a minimum can also significantly reduce labor hours. Although frequent trimming of bunker edges is important to define the boundaries of this hazard, lakes and creeks need not be so manicured. By staking and painting the water hazard boundary well away from the edge of the lake or creek, the player is able to quickly determine whether or not the ball is in the hazard. To speed up the search for lost balls and still reduce labor hours, trim only the portion of the hazard that frequently comes into play.

Trim work can further be reduced by utilizing herbicides instead of labor-intensive line trimmers around trees and alongside boundary fences. By using a combination of non-selective and pre-emergence herbicides, the interval between sprayings can be greatly extended. Since line trimmers do provide a more manicured look, consider their use only around the highly visible areas of the course such as near the clubhouse.

Regardless of the choice of grass for the greens, placing less emphasis on speed can save money. In many parts of the country, those interested in affordable golf must recognize that the quest for lightning-fast greens is

counter-productive. Quite simply, it is much more expensive to maintain extremely fast greens than those of a more moderate pace. Greens rolling 7 to 8 feet on the Stimpmeter can provide very enjoyable playing conditions to golfers of all levels. Such speeds can be produced at higher cutting heights, which invariably result in an overall healthier turfgrass plant. Healthier greens require less intensive care and are far less prone to failure of all types.

Irrigation System Design

Like the greens, the irrigation system should not be compromised in terms of quality. Irrigation systems are critical to the success of most courses in this country. Like almost every aspect of golf course construction, the cost of purchasing and installing an irrigation system has risen dramatically in recent years. With today's heavily computerized systems and the trend to wall-to-wall coverage (where virtually every area of the course is irrigated), it is not uncommon for the cost of the irrigation system to exceed $1 million.

Again, as when building greens, the key to saving money on the irrigation system is to reduce quantity, not quality. Component quality (including the heads, controllers, pipe, and pump station) should be nothing less than first-rate. However, great savings can be realized by reducing the total acreage irrigated. In some areas, very low-cost manual heads can be employed in roughs that require a minimum of supplemental watering to survive dry periods. This is particularly true when the roughs are planted to water-efficient turfgrasses. Most courses have many acres that seldom come into play and therefore need little if any supplemental irrigation. If future expansion of the system is anticipated, the pipe sizing and pump station can be designed accordingly.

The degree of control of individual irrigation heads also affects the cost of the system. Hilly courses with a variety of turfgrass species being employed require a greater degree of individual head control and result in higher installation costs. In contrast, courses that can utilize block designs (multiple heads controlled by a single valve) in large turf areas such as fairways and key roughs can realize significant savings. In areas of the country where the cost of water is high, computerized control systems often result in tremendous savings. However, in parts of the country where water is more plentiful, the control package can be less sophisticated and significantly less costly.

Design and Build Courses That Can Be Easily Walked

Another means of making golf more affordable is to design courses that can be easily walked. Unfortunately, many of today's courses are designed under the assumption that virtually all the players will utilize riding carts. Vast distances often separate the green and the following tee, taking the enjoyment out of walking the course. Some courses even prohibit walkers altogether in order to generate greater cart revenue. Obviously, revenue is important and it is a fact that many players prefer riding to walking. However, on courses that are conducive to walking, players can save $10, $15, or even $20 per round simply by hoofing it. Assuming the goal is affordable golf, this simple step has a tremendous impact on the player's pocketbook.

Conclusion

All of these suggestions will result in significant savings in the construction and maintenance of the golf course. If these savings are passed on to the golfer in the form of reduced green fees, more people will be able to enjoy the game — even during less favorable economic climates. However, it is very important to stress that many of the suggestions will result in a reduction in the overall appearance of the facility. While a high level of playing quality can be maintained, the course that is designed, constructed, and maintained in an economical manner will seldom compare favorably in terms of appearance to those facilities with deeper pockets. As a result, one of the most important aspects of achieving the goal of affordable golf is the willingness of the golfer to accept significantly less than perfection in terms of course conditioning. Fortunately, this does not mean the game itself must be any less fun or challenging — just less expensive.

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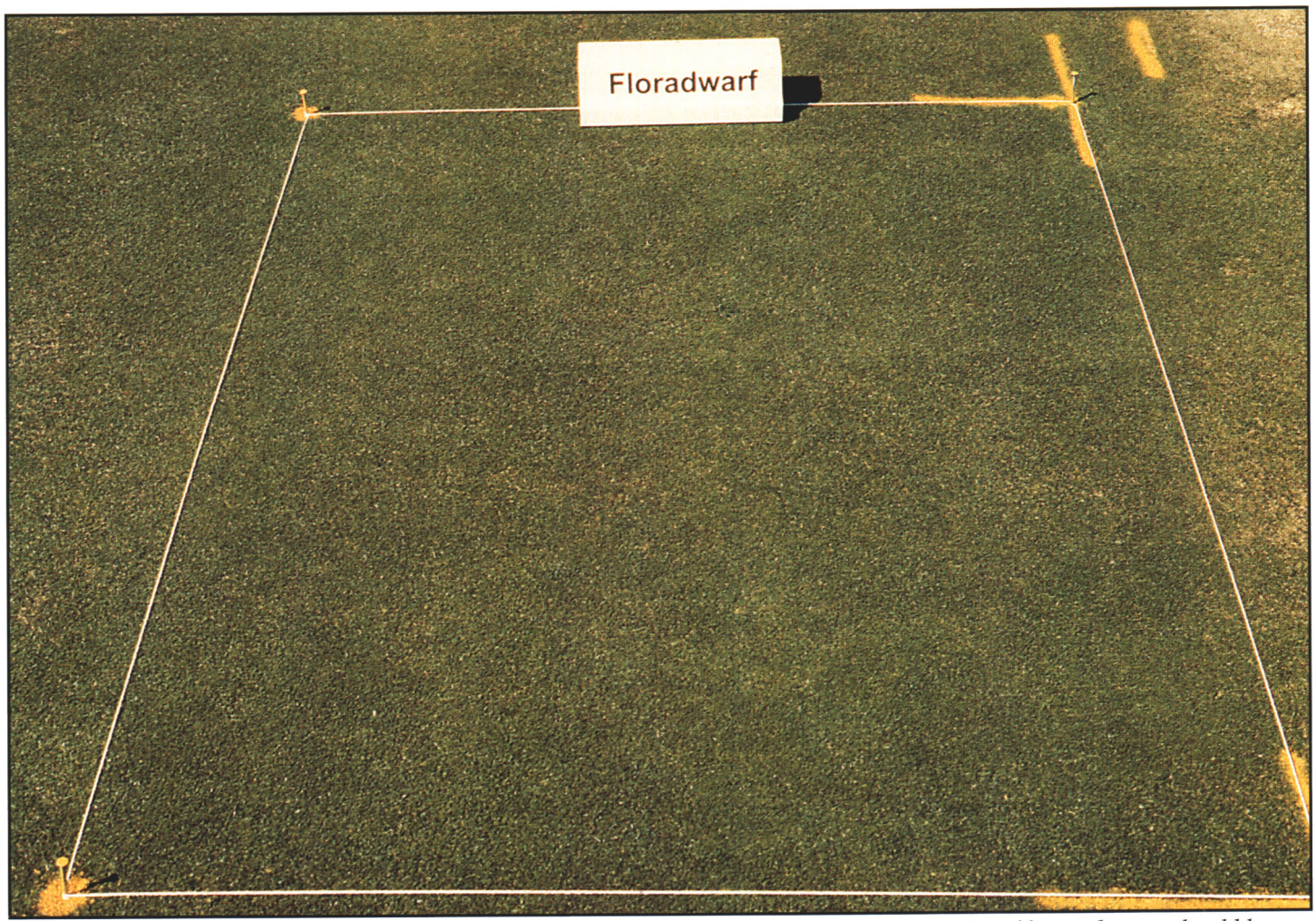
Without question, it is more expensive initially to build a green properly, but well-built greens are good investments that will provide years of reliable service. This benefit more than justifies their initial expense.

Unleash the Full Potential of New Bermudagrass Cultivars

Research is helping superintendents produce superior putting surfaces with the new dwarf bermudagrasses.

by RICHARD WHITE, Ph.D.



To produce optimum putting conditions during the winter months, greens established with Floradwarf bermudagrass should be lightly vertical mown on a frequent schedule prior to overseeding. This practice improves seed-to-soil contact, thus helping to ensure good germination and establishment.

BERMUDAGRASS is the most highly adapted grass for use on golf greens in hot, humid regions due to its superior heat tolerance and low water consumption. Tifgreen and Tifdwarf bermudagrasses have been the two most popular cultivars planted on putting greens in the southern United States during the past 40 years. Of these two, Tifdwarf has been the dominant choice during the 1980s and early 1990s due to its adaptability to lower cutting heights.

In recent years, golf courses have begun replacing Tifgreen and Tifdwarf with one of several new so-called *vertical or horizontal* dwarf bermudagrass cultivars. This trend is being fueled by three distinct factors. First, many older greens are badly contaminated with off-type bermudagrasses that disrupt uniform putting conditions because of their coarse texture and the likelihood of scalping. Second, golfers desire putting green speeds in the range of 9 to 10 feet, requiring cultivars that tolerate continual mowing at a very low height of cut. Third, turfgrass breeders and sod producers have made cultivars available that are significantly better than the old standbys.

The objectives of ongoing research at Texas A&M University are to determine the performance, mowing tolerance, and pest resistance of experimental and commercially available bermudagrasses on a golf green. We also want to determine the effects of vertical mowing, topdressing, and

nitrogen fertility on performance, thatch development, fall and spring overseeding transitions, and turf quality of five dwarf bermudagrasses.

The studies are located on a 25,000 sq. ft. experimental green at the Turfgrass Field Laboratory on the Texas A&M University Campus in College Station, Texas. The Texas Turfgrass Association provided funding for construction of the USGA specification green. Several Texas-based businesses donated materials used in construction or assisted in construction. The USGA and the Houston Golf Association have provided funding to support this research.

Variety Performance Evaluation

To evaluate the initial establishment rate of the dwarf cultivars, the percentage of plot coverage was rated during June and July 1997. Using Tifgreen and Tifdwarf as standards for the comparisons, the cultivars broke out into two groups. Baby, Champion, Floradwarf, MiniVerde, Mobile, TXDB67, Tif94-18, and TifEagle had coverage similar to Tifdwarf, which rated poorest in the study. Lakewood, MS Supreme, Tif94-21, Tif94-29, and Tifgreen had coverage superior to Tifdwarf. Although establishment from plugs as used in this study may be different from sprigs, the coverage values may be relevant to recovery from stress or pest injury.

During 1998, turf quality ratings were tabulated to reflect performance during three periods: (1) when overseeded during the winter months, (2) during spring transition, and (3) during the summer months. This data demonstrated that nine of the new dwarf bermudagrasses rated superior overall when compared to Tifdwarf. During the winter months, overseeding with *Poa trivialis* rather than perennial ryegrass produced better ratings. One explanation for the better ratings was that the plots were not cultivated prior to overseeding, so the small seed size of *Poa trivialis* penetrated the dense bermudagrass canopies more effectively. Once in the canopy, the seed was able to germinate and establish in a favorable environment.

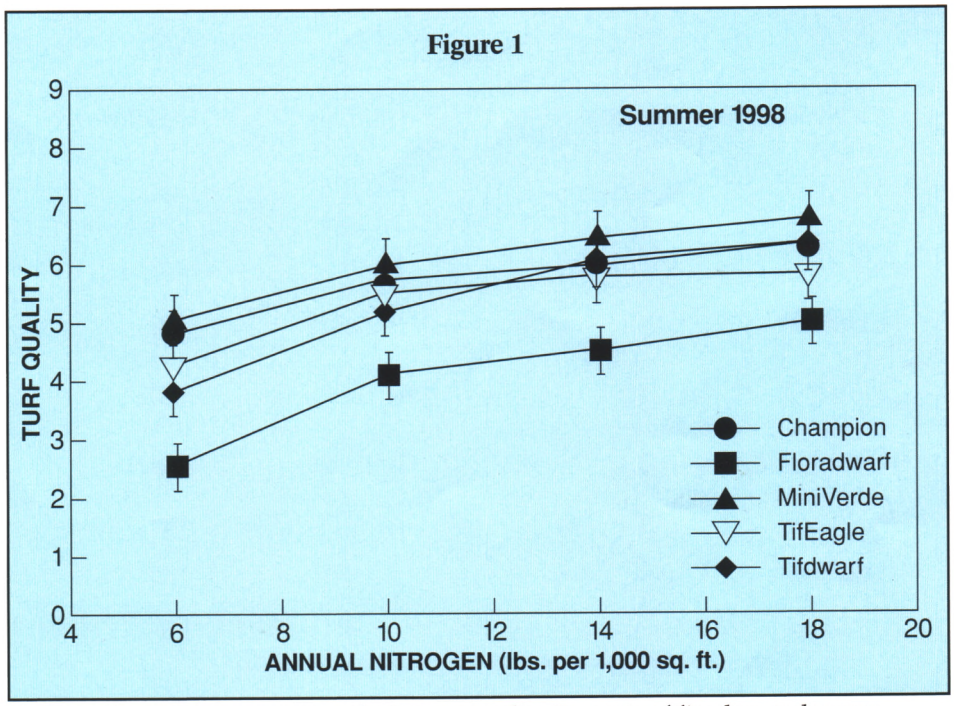
Culture of New Bermudagrasses for Golf Greens

Nitrogen requirements of new dwarf bermudagrasses were a major question that we sought to answer when undertaking this research. To determine nitrogen needs, a wide range of fertilizer applications was made. Initially, annual applications of 14 to 18 lbs. of nitrogen per 1,000 sq. ft. were applied. These rates produced superior turf quality ratings during cultivar establishment and grow-in. However, when the long-term effects of nitrogen are considered, increasing nitrogen above 10 pounds annually provided no additional improvement in turf quality except for the quality of Tifdwarf. Tifdwarf demonstrates increased turf quality ratings as annual nitrogen applications are increased from 6 to 14 lbs. per 1,000 sq. ft. When more than 14 lbs. of nitrogen per 1,000 sq. ft. is applied annually, Tifdwarf shows no additional improvement in turf quality.

Across all observations, Floradwarf turf quality received lower ratings than Champion, MiniVerde, TifEagle, and Tifdwarf. The lower performance of Floradwarf was probably due to the combination of high sodium and pH levels caused by irrigating the plot with water containing 250 to 350 ppm sodium. Compounding the poor quality of the irrigation source was the fact that the summer of 1998 was the hottest and driest on record in Texas, so the frequent irrigation required to keep the turf alive resulted in a soil pH reading of 9.4. Under the stress brought on by high sodium and pH levels, only MiniVerde and Tifdwarf appeared to respond to nitrogen application rates of more than 10 lbs. for 1,000 sq. ft.

According to data collected in Texas, judicious control of nitrogen nutrition is an important management strategy for the new dwarf bermudagrasses. In addition to the strong influence of nitrogen on turf quality ratings, it also affects the rate of thatch accumulation. Our work indicates that many of the new dwarfs accumulate thatch more aggressively than Tifdwarf. Between June and August 1998, that accumulation was on average five times greater for Champion, Floradwarf, MiniVerde, and TifEagle than for Tifdwarf at the lowest nitrogen application rate.

Figure 1



Turf quality mean versus annual nitrogen application rate of five bermudagrass cultivars at the Texas A&M University Turfgrass Field Laboratory in College Station, Texas. Vertical bars represent standard error about the mean.

Turf Quality

During this same period, Champion accumulated more than ten times the thatch of Tifdwarf when an annual rate of six pounds of nitrogen per 1,000 sq. ft. was applied. When an annual rate of 18 lbs. of nitrogen per 1,000 sq. ft. was applied, Champion, Floradwarf, MiniVerde, and TifEagle accumulated an average of 14 times more thatch than Tifdwarf. At the highest annual nitrogen application rate of 18 lbs. per 1,000 sq. ft., the new dwarf bermudagrasses produced between 0.25 and 0.33 inches of thatch during a period from

June through August 1998 across all vertical mowing and topdressing regimes.

In general, acceptable summer turf quality was produced with all of the new dwarf bermudagrasses except Floradwarf at an annual nitrogen application rate of 10 lbs. per 1,000 sq. ft. Exceeding the 10 lb. rate dramatically increases thatch accumulation, decreases Stimpmeter readings, and does not substantially increase shoot density. By summer's end, high nitrogen application rates produce mower scalping and poor turf quality that would be visible to superintendents and golfers alike.

Vertical mowing and topdressing regimes used to combat thatch accumulation in the study appear to provide similar control. It should be noted, however, that the results of severe, infrequent vertical mowing, as practiced on some golf courses with Tifdwarf, negatively affected the turf quality of the new dwarf cultivars during 1998. The damage caused by severe vertical mowing when comparing the new dwarf bermudagrasses to Tifdwarf may be due to the unique growth habit of the new dwarf bermudagrasses. These new grasses have a concentration of stolons near the soil that predisposes growing points to mechanical, abiotic, and biotic stresses.

The influence of severe vertical mowing also was evident in the overseeded cultivar quality ratings during the winter of 1997-98. Generally speaking, the ratings were higher for the plots that were lightly vertical mown on a frequent schedule during late summer than for those that were severely vertical mown just prior to overseeding. On the severely vertical mown plots the ratings were low because the emergence of *Poa trivialis* was primarily confined to the deep grooves in the putting surface.

Table 1

Cultivar	Quality	Cultivar	Quality
MiniVerde	6.3	TXDB67	5.1
TifEagle	5.9	Tif 94-18	4.9
Champion	5.8	Tifdwarf	4.5
Mobile	5.5	Tif 94-21	4.2
Floradwarf	5.4	Tif 94-29	4.2
MS Supreme	5.4	Tifgreen	4.2
Lakewood	5.1	Baby	3.9
$LSD_{0.05}$			0.4

$LSD_{0.05}$ — Least Significant Difference at the 0.05 level of probability for comparison of turf quality means

Turf quality means during 1998 of 15 bermudagrass cultivars maintained as a golf green at a ⅛ in. mowing height at the Texas A&M University Turfgrass Field Laboratory in College Station, Texas.

Important Considerations

Answering the question "Are the new dwarf bermudagrasses really superior?" based on work that has been performed to date may be premature. On the one hand, the performance of the new dwarfs has been superior. On the other hand, a few superintendents who are managing some of the new dwarf bermudagrasses in a real world situation have reported problems during the second or third growing seasons. Where poor performance has been observed, the cause of the problem appears to be most strongly associated with nitrogen nutrition.

The greatest attribute of the new dwarf bermudagrasses is clearly their high shoot density at a very low mowing height when compared to Tifdwarf. However, consider a few important points before planting a cultivar that can and should be maintained at ⅛ in. or less. First, low mowing heights require greens that are as smooth as a dining room tabletop and are only moderately to mildly surface contoured. Still, with these physical characteristics, the new dwarf bermudagrasses will have a tendency to scalp even when thatch is kept under control.

Second, the golf course *must* have a budget that reflects high intensity maintenance. Frequent vertical mowing, topdressing, and walk-behind mowing that are needed to properly groom a putting surface established with one of the new dwarf cultivars take plenty of money and manpower. If the budget will not support proper maintenance, then the golf course would be better suited for Tifgreen or Tifdwarf until circumstances change.

The new dwarf bermudagrasses provide golf course superintendents with alternatives to older cultivars such as Tifgreen and Tifdwarf. Several new dwarf bermudagrasses provide good to excellent turf quality at ⅛ in. mowing heights and have been superior to Tifdwarf in performance and evaluation trials. Research is continuing at Texas A&M University to provide golf course superintendents with additional information on which to base cultural recommendations to unleash the full potential of the new dwarf bermudagrasses.

DR. RICHARD WHITE *is an Associate Professor of Agronomy at Texas A&M University. His major duties on campus include turfgrass research and undergraduate and graduate student instruction.*

Naturalization at Carolina National Golf Club

One course's path to full certification in the Audubon Cooperative Sanctuary Program.

by MATTHEW MAYS
and DR. TERRY L. VASSEY

CAROLINA National Golf Club at Winding River Plantation in Bolivia, North Carolina, received full certification in the Audubon Cooperative Sanctuary Golf Course Program in the fall of 1998. As part of our participation in the program, we naturalized 30 acres to create wildlife habitat, decrease maintenance, and enhance the look of the golf course.

Built in 1997, the 1,100-acre residential community and public golf course is located in the scrub oak and pine forests of southeastern coastal North Carolina. The primary native vegetation includes wild blueberry, lovegrass, wiregrass, broomsedge, little bluestem, bracken and cinnamon ferns, wax myrtle, various oak and pine trees (including live oaks), and spartina. Because these plant species are so abundant, we chose to highlight and continue using these species as our primary landscape feature.

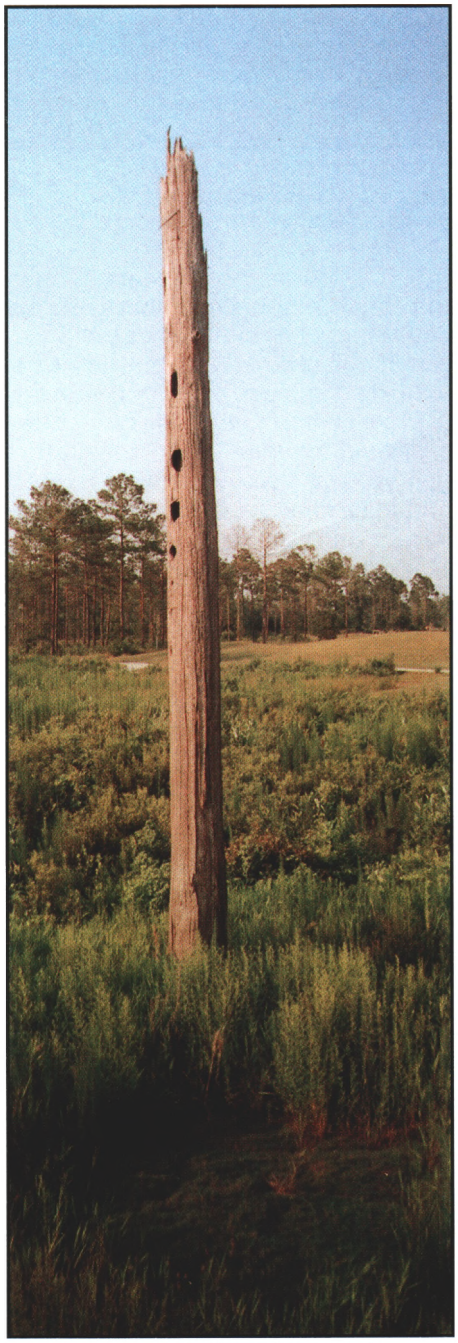
Even after building the golf course and residential areas to blend with the surrounding environment, we found additional areas that could be naturalized to showcase native vegetation. Before we began to naturalize, we established two important goals:

1. Continue to create and enhance the naturalized areas on our course.
2. Utilize native species, such as wiregrass, broomsedge, and big and little bluestem, in naturalized areas.

Naturalizing Designated Areas

Many of the areas we chose to naturalize were set aside during the construction phase of the golf course. The set-aside areas were not sprigged or sodded. These areas were seeded primarily with lovegrass, but the mix also included meadow foxtail; switchgrass; big and little bluestem; tall, hard, and sheep fescue; and wildflowers.

In order to establish this foundation mix as soon as possible, we followed directly behind the construction contractor with our seeding program. The entire golf course, including the natural areas, was limed with four tons of lime per acre to enhance our sandy, acidic soils, and all non-sod areas were pre-plant fertilized with an 18-18-18 (50% SCU, 1 lb. N/1,000 sq. ft.) fertilizer. The areas to be seeded were scratched with a Gill Pulverizer, seeded, and dragged with a metal drag mat.



This tree snag was found in another location on the golf course and then "planted" on number 14. Birds have used the numerous holes to establish homes.

Constrained by the progress of the contractor, we seeded when each area was ready. We generally like to seed warm-season grass species and wildflowers in late March through early April. Cool-season species, like the fescues, should be seeded in late August and early September.

Naturalizing Existing Turfgrass

In contrast to the set-aside areas, naturalization of former bermudagrass turf areas was all done by hand planting. These areas were marked and the sod was stripped and used elsewhere. The remaining root and vegetative material was then treated with glyphosate and allowed to sit for 24 to 48 hours. The plants were then installed on 8" to 12" centers and mulched. These plantings included such species as wiregrass, big and little bluestem, spartina, broomsedge, Mexican hairgrass, fountaingrass, and wild blue rye. Follow-up treatments of glyphosate were usually needed to eliminate weeds.

We also harvested native plants such as wiregrass and broomsedge from our property to use in our naturalized areas, and we purchased thousands of plants, including miscanthus, fountaingrass, and spartina to create large grass beds.

Committed for the Long Haul

One important consideration when undertaking a project like this is the time it takes to establish these species. A year or more may be necessary before the desired look is achieved. This point is especially true for seeded

Naturalization of former turf area was accomplished by hand planting. The sod was removed and the remaining vegetative material was sprayed with a non-selective herbicide. After a 48-hour waiting period the area was planted.

switchgrass and little and big bluestem. These species produce very little aboveground growth the first year in favor of root growth. The second season is much more productive. For some course officials this is a hard reality to accept. Failure to see quick results is a common reason most people decide to discontinue the project or refuse the initial effort altogether. Patience is key to a successful project.

Maintenance

Maintenance of these areas primarily includes periodic weeding and burning. Everyone on the crew participates in pulling weeds by hand. When the density of the native plantings gets great enough, most weeds will be shaded out.

Each March we burn all of the large prairie expanses to control weeds and encourage top growth and flower production. The difference between burned and unburned flower production is significant. At the same time, hand plantings are cut back to approximately 6 inches.

Results: Maintenance Savings

We have naturalized approximately 30 acres to date and will continue to increase that number with the construction of our third nine holes. We estimate that it cost $10,000 to implement our natural areas, and we calculate our savings to be about $15,000 annually.

The savings from naturalization are significant. If you reduce manicured turfgrass by 30 acres, you can save up to $1,800 (if your treatment costs are $60 per acre) by eliminating pre-emergent herbicides. Add to this the cost of fertilizer ($40 per acre) and mowing ($15 per acre), etc., and you can see that over time this can result in significant savings. This does not include the cost of added wear on equipment or time lost for other maintenance duties.

We have greatly decreased the amount of man-hours needed to maintain these areas and also decreased the amount of wear and tear on our equipment. Savings are significant when you consider that mowing, fertilization, chemical controls, and cultivation are eliminated and the costs associated with them are not included in the budget.

Enhanced Wildlife Populations

One of our main goals in establishing the natural areas was to attract more wildlife to our property. As a result of our efforts we believe we have added greatly to our animal population. We have observed many birds of prey, including a bald eagle, ospreys, and barred owls. We also see kingfishers and both little and great (white and blue) herons on the golf course property.

Many mammals also make Carolina National Golf Course their home. We have recorded sightings of beavers, fox, rabbits, fox squirrels, raccoons, bobcats, and deer. We have inventoried many different snakes as well, including black snakes, copperheads, rat snakes, garter snakes, and king snakes.

Golfer/Employee Response

We have received positive responses from golfers concerning our naturalization projects, both from an aesthetic viewpoint and from the increased

The number-one tee surround has been established with lovegrass to minimize maintenance.

Broomsedge, lovegrass, and sedges were used in a low-lying area on number eight of Carolina National Golf Club.

amount of wildlife in these areas. We communicate our actions with signage throughout the course and brochures available at the pro shop explaining our participation in the Audubon Cooperative Sanctuary Program.

Perspective and Recommendations

If we were to begin this project now, the only thing we would do differently would be to increase the amount of areas to be naturalized. We are continuing to increase and supplement the naturalized areas we currently have, but it would have been better to set aside more native areas during the construction phase.

With urban expansion and the ever-increasing destruction of plant and animal habitat, the need to preserve and expand native habitats becomes even more important. That is why we are so excited about the Audubon Cooperative Sanctuary Program at Carolina National. Not only does it enhance the plant and animal species at the golf course, but it also improves the golfing and living experience.

We recommend the following pointers to other golf courses that wish to implement this kind of project:

1. Try to allocate natural areas during construction, if possible.

2. When creating native areas, make sure all of the turfgrass is removed. This will decrease the amount of maintenance needed.

3. Try a small, out-of-the-way area first, making every effort to guarantee its success, before implementing large-scale projects. Show off all of the positives and let it become the golf course's or owner's idea to expand the program. On older, established golf courses, golfers may not initially like the changes and may perceive them as unnecessary new hazards. Use the look sparingly at first; bring it into play slowly, if at all.

4. Choose plants that are best suited for your particular location. These plants will thrive best once established and will help attract beneficial wildlife. We have gone through a tremendous learning curve here and have transplanted and replanted many times. In order to find the best place for each species, you may need to try different plants or techniques. Some initial sources of this information can be found at local nurseries, extension service publications, and books such as *The Landscape Restoration Handbook* by Donald Harker.

5. Clearly mark naturalized areas to minimize concern over lost balls.

6. Be responsive to golfers' needs. As we determine those areas that do not fit in well to the golfers' play, we either reduce or elminate them altogether. Fortunately, we have had minimal need to reduce natural areas at Carolina National.

For more information, contact:
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LET 'EM PLAY

Addressing environmentally sensitive areas on the golf course.

by JOHN MORRISSETT

THESE DAYS IT HAS become fashionable to keep players from playing golf. More and more courses are cultivating what they call *no-play* areas where they do not want the players to set foot.

Some programs are undertaken for laudable goals, e.g., to create a safe habitat for certain wildlife species on the golf course. Some are undertaken for cosmetic or maintenance purposes. The tall, native grasses can be aesthetically appealing and reduce the amount of area that requires regular maintenance. Some courses grow such areas just to keep up with the course down the road, as they are now perceived by some as status symbols — "You have only two no-play areas? We have six!"

While the reasons for having such areas may vary, the one issue that all golf courses should consider is how such a program will affect the players. This is where the Rules of Golf come into play. In 1996 a Local Rule for handling environmentally sensitive areas (ESAs) was introduced (it can be found in Appendix I of the Rules of Golf). Some courses look at this as a green light to initiate their own programs. Nothing could be further from the intent behind the Local Rule.

The Local Rule was created to help golf courses (such as Pumpkin Ridge near Portland, Oregon) operate under the Rules of Golf. Starting in the early part of this decade, some courses were forced, by law, to prohibit players from entering, let alone play from, areas that had been designated as environmentally sensitive, such as wetlands. Such actions immediately raised some eyebrows in Rules circles, as there was not a good way to treat such areas. Before 1996, a Committee could have prevented players from playing from an area by defining it as either out of bounds or as ground under repair from which play is prohibited. Such a procedure would work well with something like a fragile sand dune, but it would be either too severe or too lenient with a wetland area, something that would otherwise be a water hazard. There was simply nothing in the Rules at that time that would allow a Committee to prohibit a player from playing a ball from a water hazard.

The primary significance of the Local Rule is that it gave Committees the authority to prohibit play from water hazards that are also ESAs. Another important step included provisions for taking relief for a ball outside the ESA when the player's stance or area of intended swing would be interfered with by the ESA.

So when should a course employ this new, wonderful Local Rule? Only when forced at gunpoint.

Points to consider:

- The Local Rule for ESAs is authorized only when a governmental agency has declared the area(s) to be environmentally sensitive (e.g., Army Corps of Engineers, state department of environmental protection, etc.). A Committee may not, on its own, make such a determination. It has to be imposed on the golf course.
- Such a Local Rule is a pain in the neck. For water hazards it requires a different marking so as to differentiate it from *normal* water hazards (the USGA recommends yellow or red stakes, whichever is appropriate, with green tops); the course has to put the lengthy and somewhat complicated Local Rule from Appendix I in effect, with some question as to whether the players will learn it and properly play by it; and the players themselves can be forced to take a penalty stroke in some frustrating situations (e.g., a player's ball lies one inch inside an ESA water hazard with a good lie and nothing that would keep him from playing the necessary 5-iron to the green).
- The Local Rule cannot penalize a player for entering the ESA; it penalizes him only for playing from it. Although a player who enters the ESA may have broken the law or might be subject to disciplinary action from the course, it is still difficult to keep a player from walking five yards to retrieve his new, shiny golf ball, to some degree defeating the purpose of the Local Rule.
- A Committee may not define an area such as native grasses or trees as a lateral water hazard if that area does not meet the Definition of "Water Hazard" (Decision 33-8/35). Some golf courses will do so to discourage players from searching for their balls in such an area and to help the pace of play, but such a procedure is contrary to the Rules of Golf.

An old tenet when marking courses is to give the player as much room to play as possible. That goes hand in hand with the enjoyment of the game — in playing strokes, not dropping balls.

JOHN MORRISSETT *"rules" at the USGA as Manager of the Rules of Golf and Amateur Status.*

1998 Research Summary Available

IN 1998, the United States Golf Association embarked on a new five-year research effort as part of the ongoing Turfgrass and Environmental Research Program. This program employs science as the foundation to benefit golf in the areas of turfgrass and resource management, sustainable development, and environmental protection. The 1998 Turfgrass and Environmental Research Summary summarizes the results from the first year of this five-year research effort, as well as other ongoing research efforts.

There are two primary goals of the research program. The first is to develop turfgrasses and cultural systems with enhanced stress tolerance and reduced water requirements, pesticide use, and other costs. Fifty research projects initiated in golf course construction practices, integrated pest management, and turfgrass germplasm enhancement address the USGA's first research goal.

The second goal is to investigate environmental issues and sustainable resource management for golf courses. Fifteen research projects that investigate the environmental impact of golf courses and wildlife management issues are underway.

The USGA Turfgrass and Environmental Research Program actively coordinates and supports research, associated educational programs, and other partnerships to benefit golf, the environment, and people. For example, the USGA cooperates with the National Fish and Wildlife Foundation to conduct the Wildlife Links® program. Wildlife Links projects focus on the research concerning wildlife management and habitat issues. The USGA and the Golf Course Superintendents Association of America (GCSAA) co-fund five projects involving putting green construction. The USGA, GCSAA, and National Turfgrass Evaluation Program together have developed turfgrass variety testing programs conducted on golf courses throughout the United States.

The research summary is available free of charge by contacting Mary McConnell at the USGA Green Section at 908-234-2300, *mmcconnell @usga.org*, or by writing to the USGA Green Section, P.O. Box 708, Far Hills, NJ 07931-0708. Please include your postal mailing address if sending an e-mail. In the near future, the entire 1998 Research Summary will be available on the USGA Website (*http://www.usga.org/green*).

Audubon Cooperative Sanctuary Program Around the World

THE RESPONSE we receive from those involved in the Audubon Cooperative Sanctuary Program is important not only for the mission of Audubon International, but also for our own sense of achievement. We know through certification requests, pictures, phone calls, and other correspondence that through your efforts, our efforts are fruitful. Letters such as the one below lift our spirits and remind us why we are here.

Audubon International would like to take this opportunity to thank our members and supporters who are out there planting, building, and educating, taking the actions and spreading the word as we never could alone.

The man-made lakes within Southwoods provide food, water, and roosting and nesting sites for a variety of marsh birds. Vegetation also prevents soil erosion and aerates and filters the water.

Mr. Ronald G. Dodson
President, Audubon International

Dear Mr. Dodson,

I would like to take this opportunity to thank you and your Audubon staff for all the assistance and support you have given The Manila Southwoods Golf and Country Club and myself during our certification process with the ACSP for golf courses.

I have never been involved in a program that has inspired the management and the staff to be so proactive in improving the environment we live in. The accomplishments that our club has achieved in the past 18 months have far surpassed my expectations.

Special thanks is needed to Mrs. Joellen Zeh, who has always communicated to us in a helpful and timely manner and has always offered assistance and information to help us work through each certification category.

I look forward to continue the relationship with Audubon International, further improve our environment and increase environmental awareness of the school children, members, staff and the public in the Philippines.

You and your team are a credit to the golf industry and the world we live in.

Regards,

Darren Moore
Golf Course Superintendent
The Manila Southwoods
Golf and Country Club
Carmona, Cavite, The Philippines

You Don't Always Have to Raise the Bar!

When unrealistic expectations and environmental alternatives meet at a crossroads, choose the environmental approach.

by LARRY GILHULY

IN MARCH 1982 the USGA Turfgrass Research Committee was formed to guide the USGA's long-range multi-million-dollar turfgrass research plans for the coming decade. The purpose is to develop Minimal Maintenance Turfgrasses for Golf with particular emphasis on a 50% reduction in water use requirements and 50% lower maintenance costs overall" — 1985 USGA Annual Turfgrass Research Report.

"It is the intent of the United States Golf Association (USGA) Executive Committee, through the USGA Foundation, to collect and disseminate substantial amounts of money for support of research to: 1) "produce improved turfgrasses which substantially reduce water use, pesticide use, and maintenance costs . . ." — 1995 USGA Turfgrass and Environmental Research Summary.

"Furthermore, the cost of working with their aggressive growth habits (new bents and hybrid bermudagrasses) and inherent problems, such as excessive thatch buildup, can be substantial in terms of increased maintenance labor and equipment" — May 1999 *Golf Course Management* magazine, page 22.

Wait a minute! The turf industry has been funding meaningful research for nearly two decades to reduce overall costs and impacts on the environment, and what we get are vastly superior putting surfaces that cost substantially more! Is there something wrong with this picture? You bet there is, and it is called a lack of understanding and expectation levels that are out of control. Let's look at one example.

Several decades ago, seashore paspalum was introduced into Hawaii due to its ability to withstand poor water quality. The grass was spread from site to site over a 20- to 25-year period and became a highly adapted grass for oceanfront hotel complexes due to the combination of excellent color, the ability to withstand salts, less water inputs, a natural capacity to compete with weeds and a significantly reduced requirement for fertilizer, specifically nitrogen! Let's see — a grass that uses poor quality water or seawater, requires ⅓ to ½ the amount of nitrogen, naturally competes with weeds where seawater is used as a herbicide, apparently has no major disease or insect concerns and maintains a consistent green color. Doesn't this sound exactly like the original goals of the USGA Research and Environmental Program? Wouldn't you think that golfers and golf course superintendents would be all over this grass as the answer for the greens, tees, fairways, and roughs in areas where it is adapted, to counter the environmental claims being made against golf courses in Hawaii? The answer should be an obvious *yes*; however, the reality has been less than enthusiastic, with some notable exceptions.

Why would a grass that obviously can address all of the worthwhile goals stated earlier not become the dominant and most desired grass? In Hawaii, it is called the Mauna Lani experience. On the mainland, you can relate to it as the *Poa annua* experience. When seashore paspalum is introduced into hybrid bermudagrass putting surfaces, the grass grows at a different rate than the bermudagrass because it is being overfertilized. The resulting playing surface is extremely bumpy, inconsistent, and definitely not fun to play. This occurred at Mauna Lani through the late '80s to mid-'90s, just as *Poa annua* invasion occurs on so many creeping bentgrass golf courses. Those who played Mauna Lani during this time came away with nothing but negative thoughts, including yours truly. However, once the greens became 100% seashore paspalum, the visiting players have had no complaints concerning the greens.

Fast forward to 1999. A new golf course on Oahu (Coral Creek) has opened with 100% seashore paspalum. All of the positive attributes of greatly reduced fertilizer use (¼ lb. N/1,000 sq. ft. every 6-8 weeks on tees and fairways!), irrigation with brackish water, no disease or insect concerns, and no need for herbicides have been observed at this course. In addition, the greens are maintained at ⅛" at a normal speed of 9 feet. Reports from regular players are extremely positive, yet there are still those who nearly go into convulsions at the mere mention of seashore paspalum. After all of the extremely positive attributes of this grass and the new greens-type seashore paspalum developed by Dr. Ron Duncan, of the University of Georgia, how in the world can anyone be against this grass? The unfortunate answer is that the majority in the golf industry are still far more interested in creating fast greens with excessive amounts of money than truly addressing environmental concerns. How else can one look at the preceding example and not come to this conclusion?

Granted, the introduction of new bents and bermudas has "raised the bar" for golf courses with high-end budgets. Don't begrudge these facilities for making nearly perfect playing conditions. However, do resist this "raising the bar" mentality when perfectly acceptable and environmentally appropriate alternatives come your way that can save you money. In these cases, take the bar and hide it!

LARRY GILHULY *has provided Turf Advisory Visits to most of the western United States during the past 15 years. His current territory includes Washington, Oregon, Idaho, Wyoming, Alaska, and the southwest portion of the Northwest Region, Hawaii.*

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

Turfgrass Information File (TGIF):
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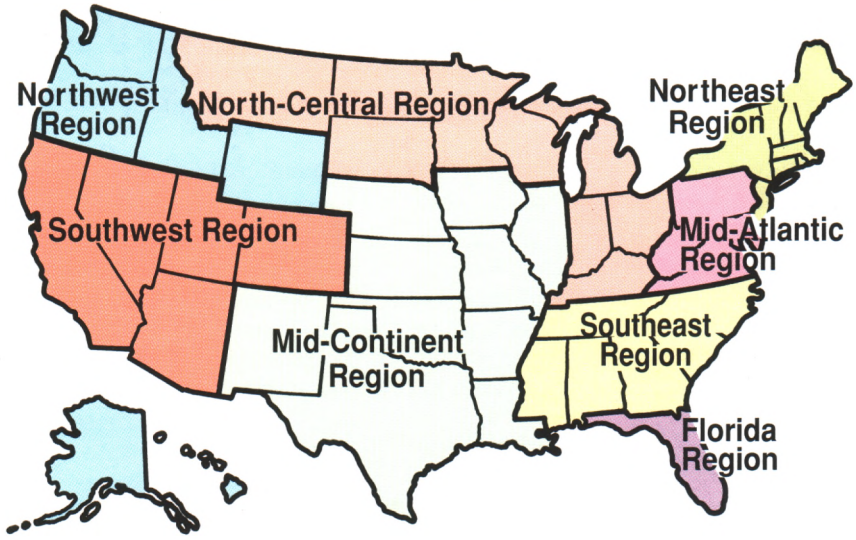

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TURF TWISTERS

LEASED YOU FORGET

Question: Our golf course needs new maintenance equipment. Should we purchase this equipment or lease it?

Answer: From a purely financial point of view, purchasing the equipment and committing to a regular equipment replacement program will be the most economical approach. Leasing offers some advantages, however. A leased fleet of equipment will be replaced on schedule every two to four years, which means the club will always have the most up-to-date equipment on the course. Also, the mechanics can spend more time focusing on quality-of-cut issues and reel maintenance. Finally, if the club needs a large amount of equipment and cannot afford to purchase all of it, leasing may provide an attractive alternative.

MOTHER NATURE

Question: What can we do to prevent frost on our greens and get golfers out on the course earlier? I've thought about using activated charcoal, synthetic turf covers, fans, or wetting agents. Do any of these things work? (Nevada)

Answer: Superintendents have tried a wide variety of products and practices to prevent frost or melt the frost earlier, all with limited results. Sometimes irrigation water is used to melt the frost during early fall and mid-spring when the irrigation system is charged. While the dark color of the charcoal should absorb heat and help melt the frost, the material is messy to use and actually does little to melt the frost. Fans and wetting agents are two other methods that sound good but are generally ineffective. Synthetic turf covers are effective to protect greens, but what about heavy frost on the fairways? Generally, you are better off being patient and letting Mother Nature melt the frost with good sunlight exposure to the turf surface. Be sure to address any situations that might be restricting morning sunlight and delaying the melting of frost, such as large trees on the east side of the green.

IS INTEGRAL TO THE GAME

Question: In South Florida, our bermudagrass fairway and rough areas never go fully dormant and off-color during the winter. Yet, because the growth rate of the bermuda is very slow for two to three months, cart traffic takes its toll and we inevitably get complaints from the golfers about very "tight" fairway lies and the loss of definition between the fairway and rough cuts. We have a continuous cart path system and our golfers, for the most part, are good about adhering to the 90-degree cart usage policy. Are there other suggestions for minimizing cart traffic wear? (Florida)

Answer: Golf carts have become an integral part of the American game and are an important revenue source at a lot of facilities. Yet, most golfers have a limited appreciation of their negative impact on course quality and conditioning. Cart traffic management must be viewed as a basic part of course management. This is especially true during Florida winters when the base bermuda turf is not actively growing. Along with directional control devices put into place prior to a pronounced deterioration in turf quality, it is recommended that all courses have multiple cart usage policies to distribute traffic over as much area as possible. At some golf courses with a continuous cart path system, restricting the carts to the path on one hole per nine for one week at a time has been very beneficial. This setup is rotated among the par-4 and par-5 holes, and it allows some additional time for turf recovery without drastically slowing the pace of play.