USGA® Green Section RECORD

January/February 1992

A Publication on
Turfgrass Management by the
United States Golf Association®

USGA®

Vol. 30, No. 1
JANUARY/FEBRUARY 1992

Green Section RECORD

Cover Photo:
The opportunity to select grasses for a new site often brings to mind meticulously manicured, virgin golf holes.

GREEN SECTION RECORD (ISSN 0041-5502) is published six times a year in January, March, May, July, September and November by the UNITED STATES GOLF ASSOCIATION®, Golf House, Far Hills, N.J. 07931. Subscriptions and address changes should be sent to the above address. Articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, Golf House, Far Hills, N.J. 07931. Second class postage paid at Far Hills, N.J., and other locations. Office of Publication, Golf House, Far Hills, N.J. 07931. **Subscriptions $12 a year. Foreign subscriptions $15 a year (surface mail) or $24 a year (air mail).**

Paspalum vaginatum, *'Excalibur,' has excellent tolerance of saline water supplies and provides a very good playing surface.*

The Best Choice May Not Always Be Your Favorite

by PAUL H. VERMEULEN
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WHILE PLAYING a round of golf, the topic of regrassing a tee with creeping bentgrass came up for discussion between two friends. Although bentgrass has an excellent reputation in certain areas of the country, its performance on tees in Southern California has been less than ideal on courses with heavy play.

"Why creeping bentgrass?" asked the first.

"Because it's my favorite," was the reply.

"Then why do you drive a station wagon?"

After a brief moment of silence, "Because I need room for the family. What's your point?" was the answer.

"The point is, you didn't buy a car based on an impulse, so why would you choose creeping bentgrass based on one?" replied the second.

During the renovation of an existing course or the construction of a new facility, the decision must be made as to which turfgrasses will be established. For the individual entrusted with this responsibility, mental pictures of beautiful, virgin golf holes immediately come to mind. This perfection, more often than not, includes favorite turfgrasses, meticulously manicured and offering the best possible playing conditions.

For the average person, the criteria used to select the favorite turfgrasses for greens, tees, fairways, and roughs include:

- thick turf density
- dark green color
- uniform appearance
- excellent playability

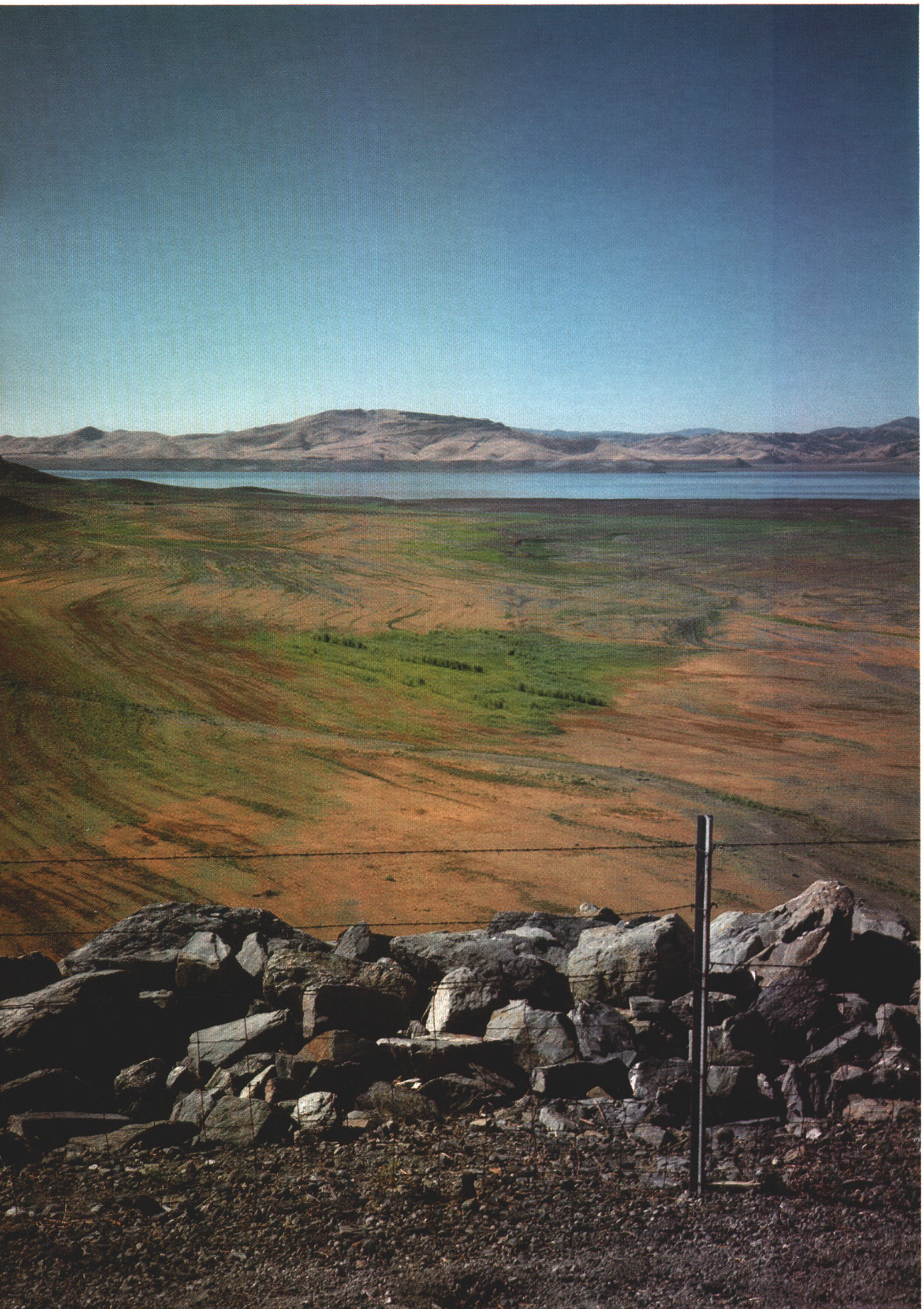
Using this short list of criteria, it is likely that the details of each person's mental image will be slightly different.

For example, the fairways in Mr. Smith's image would be established with hybrid bermudagrass, while in Mr. Jones's they would be perennial ryegrass.

Because it is intuitively apparent that not every turfgrass species or cultivar can be maintained successfully in all geographic locations, one man's dream can easily turn into another's nightmare. This nightmare would be that of the golf course superintendent, who is normally held responsible for the condition of the course.

Since it is not always possible to select favorite turfgrasses for establishment, then how does one make the best selection? The answer involves considering other criteria that account for variations at each course. These criteria could include climatic adaptation, irrigation supply and water quality, soil conditions, availability of pesticides and fertilizers, and the golfers' desires and demographic profile. While these factors may not be the only ones required to make the "best" selection, they are among the most important considerations.

Future water availability should not be taken for granted when selecting turfgrass species for establishment, as witnessed by the low water level in this reservoir.



Climatic Adaptation

Perhaps the best understood dimension of climatic adaptation is the varying tolerance of turfgrass species or cultivars to heat and cold extremes. An example of this is the poor adaptation of creeping bentgrass to summer extremes on putting greens in South Florida. There is only a modest period during the year when conditions are favorable for creeping bentgrass growth. Outside of this period, temperatures and humidity extremes can cause severe thinning.

Judging climatic adaptation of turfgrasses, however, is not always as easy as just considering heat or cold tolerance. Another point to consider is whether the turfgrass is capable of quickly recovering from damage when exposed to heavy play. If not, it might require complete or partial reestablishment each year.

As an example, consider the establishment of zoysiagrass fairways at a location well north of what is commonly considered the transition zone. In this location, zoysiagrass would survive summer and winter extremes, but because its dormancy period would overlap heavy play during the spring and fall, the fairways would be severely damaged by traffic and divoting.

If you are unfamiliar with the normal and extreme climatic conditions of a new location, the National Climatic Data Center in Asheville, North Carolina, provides public information about all major U.S. cities.

Irrigation Water Concerns

No matter where a golf course is located, the topic of irrigation cannot be taken lightly. There is no better time to address this topic than when selecting a turfgrass species or cultivar for establishment. To make the best selection, though, the topic of irrigation must be considered from two viewpoints.

First, there is the obvious concern of water availability, which may be controlled either by economics or by governmental regulation. In California, for example, the cost of irrigation water can run as high as $340 per acre-foot. Considering that an average 18-hole course can consume as much as 700 acre-feet in one season, the annual water bill can easily exceed a quarter of a million dollars! On the other hand, in Arizona, each course is permitted to use a specified quantity of water that often is less than what is needed to maintain ideal playing conditions.

Realizing that water availability would become a turfgrass industry concern in the '90s and beyond, the USGA, in cooperation with the GCSAA, organized a committee in the early '80s of leading turfgrass experts to begin funding water-related research projects at several universities across the country. Initially, this research effort focused on (1) identifying the genetic drought resistance mechanisms of turfgrasses with minimal irrigation requirements, and (2) developing a better understanding of drought resistance itself.

During these initial studies it was discovered that the variation in irrigation requirements can be as great between the cultivars of individual species as it is between the different species themselves. Knowing this information, the best decision can be made with respect to selecting the best adapted turfgrass species and cultivar.

Furthermore, selecting the best turfgrass in relation to irrigation requirements may require considering different ranking criteria in semi-arid and arid climates versus humid climates. In semi-arid and arid climates, it may be best to select a turfgrass with a low evapotranspiration rate; in a humid climate it would be more appropriate to select a turfgrass with good drought tolerance. The difference between these areas of the country is that soil moisture recharge is solely dependent on irrigation in semi-arid and arid climates, whereas periodic rainfall normally can be expected in humid climates.

By establishing Kentucky bluegrass fairways in adapted areas, only the greens need to be treated for snow mold activity.

As a follow-up to identifying genetic drought resistance mechanisms, the USGA/GCSAA Turfgrass Research Committee has also funded several breeding programs that are producing new turfgrasses with greater genetic water conservation capabilities. To date, these programs have produced Sahara bermudagrass and several soon-to-be-available cultivars of buffalograss and zoysiagrass.

Water quality is another factor to consider when selecting turfgrasses, especially as it relates to salinity. The focus of water quality concerns generally has been restricted to the arid West. Salinity problems, however, are also becoming prevalent in other regions due to saltwater intrusion along coastal areas and the increasing use of effluent water sources.

Taking into account salinity in the process of turfgrass selection involves interpreting chemical analysis tests. Of greatest concern are (1) the total concentration of soluble salts, expressed in units of electrical conductivity (mhos/cm), and (2) the amount of sodium and bicarbonate in relation to calcium and magnesium, expressed as the Sodium Absorption Ratio (SAR).

In cases where the total concentration of soluble salts exceeds 0.75 mhos/cm, and the expressed ratio of sodium in

Turfgrass durability is a growing concern for the golf course superintendent as a result of the increasing popularity of golf.

relation to calcium and magnesium exceeds 10, selecting turfgrasses with high salinity tolerance would be prudent. For example, Fairbanks Ranch Country Club in Rancho Santa Fe, California, uses an irrigation supply containing a high concentration of soluble salts, and has established its fairways and rough with Excalibur, a cultivar of *Paspalum vaginatum*. This particular turfgrass has a very high tolerance of saline conditions, provides an excellent playing surface, and is adapted to many of the warmer climatic zones of the country.

Soil Factors

Due to the wealth of knowledge about the discipline of soil science, usually it is possible to overcome crippling problems relating to physical compaction or soil nutrient composition in most locations. These adjustments typically involve special cultivation equipment, topdressing with sand or other appropriate amendments, and/or the application of specially blended fertilizers.

In some cases, there are circumstances in which potential problems can be minimized by selecting turfgrasses with a low irrigation requirement or a slow vertical leaf extension rate. Fine-textured soils that restrict water percolation or turf areas associated with severely sloped banks or mounds serve as good examples.

In regions with a Mediterranean climate, such as Southern California, the list of climatically adapted turfgrasses includes all of the major cool- and warm-season species. Golf courses in this area that exhibit poor drainage characteristics can select one of several warm-season grasses with a low evaporative loss rate, thereby lowering irrigation needs for fairways and rough.

In the other example, many golf courses have been constructed with severely contoured banks and mounds to accentuate their design and are difficult to irrigate and mow. To minimize future maintenance, establishing these areas with turfgrass species or cultivars exhibiting slow vertical extension rate and a low irrigation requirement would be recommended.

Availability of Pesticides and Fertilizers

After the major agronomic circumstances have been accounted for in the selection process, the next step is to consider current and future limitations in the availability of agricultural products, including pesticides and fertilizers. To do so, a complete list of known pests, including insects, weeds, and diseases for each turfgrass candidate should be assembled.

Since it is essential that each list be as complete as possible, consultation should be sought with local and regional turfgrass authorities. These authorities could include neighboring golf course superintendents, university extension personnel, USGA Green Section staff, and other knowledgeable industry professionals.

With lists for each turfgrass candidate having been completed, a list of the pesticides required to control each pest can then be made. With this information in hand, it may quickly become evident that certain turfgrasses should not be selected because of a governmental restriction on the use of a particular product. For example, in some areas of the country, the application of certain fungicides for snow mold control is limited to their use on greens and tees. Under these circumstances, creeping bentgrass established on the fairways could be particularly susceptible to severe damage during the winter months.

This particular selection criterion can also be viewed from a different angle. Given the public's growing environmental awareness, it will become increasingly important for the turfgrass industry to respond, where possible, by establishing turfgrasses that require fewer pesticide and fertilizer applications.

Fertilization is another environmental factor worthy of consideration. When estimating total fertilizer requirements for each turfgrass candidate, remember that healthy turfgrass is more resistant to weed invasion and disease attack. With this in mind, do not underestimate fertilizer requirements. Reducing applications in the field could inadvertently increase the demand for herbicide and fungicide applications, nullifying the original intent of the turfgrass species or cultivar selection.

Golf Activity

Having considered agronomic limitations and the well-being of the environment, it is also necessary to take into account the amount of play anticipated on the course. This can be accomplished by estimating the maximum number of rounds expected and the anticipated maintenance budget. These estimates will provide a basis for determining (1) the possible need to select turfgrasses with maximum durability, and/or (2) limitations caused by the inability to complete the cultural requirements of a specific turfgrass due to heavy play or a low maintenance budget.

The *Los Angeles Times* recently reported that, at 135,000 rounds per year, Rancho Park Golf Course is the city's most heavily played course. This figure translates into 370 rounds per day, 365 days per year. Taking into account the short daylight period during the winter, daily play during the summer can exceed 450 rounds. To maintain dense turfgrass under such extraordinary circumstances requires working with only the most durable turfgrasses.

Interestingly, public facilities like Rancho Park Golf Course are large revenue producers; hence, you would think that the maintenance staff should have plenty of resources to maintain the course. To accommodate 450 rounds per day, though, requires scheduling foursomes off the first tee every seven to eight minutes from dawn until dusk. This heavy volume of play, unfortunately, makes it impossible to follow through with the cultural demands of some turfgrasses.

Alternatively, the maintenance of a golf course also can be limited by low play. While affluent memberships at private golf courses can raise membership dues to compensate for low play, golf courses that depend on income from green fees often must slash the maintenance budget to stay afloat.

Conclusion

In too many instances, the selection of turfgrasses for a site is based on an impulse rather than pertinent selection criteria. In reviewing criteria for selecting grasses for your site, be sure to include consideration of agronomic circumstances, environmental quality issues, and anticipated play. And don't be too disappointed if your favorite grass does not turn out to be the "best" selection.

A USGA/GCSAA-SPONSORED RESEARCH PROJECT

CULTIVATION HAS CHANGED

by DR. ROBERT N. CARROW
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FOR MANY YEARS golf course superintendents had relatively few choices for cultivation techniques: hollow-tine core aeration, slicing units, and pin spiking. Several versions of each cultivation technique were available, but all were confined to the surface 2 to 3 inches of soil. Though attempts at deeper cultivation were made, these units were too slow or heavy for commercial acceptance. Thus, cultivation programs could only deal with surface-related soil physical problems, including surface compaction, surface-located layers, and heavy (fine-textured) surface soil texture which limited infiltration of water. A second effect of limited equipment choices was that cultivation programs essentially were standardized. For example, on cool-season turf, core aeration was performed in spring and fall, slicing any time of the year, and pin spiking in the summer months.

Tremendous advances in turfgrass cultivation equipment have occurred during the past ten years. The most significant change has been the development of deep soil cultivation for turfgrass sites. Deep cultivation allows for alleviation of adverse soil physical problems that occur deeper in the profile, including soils with high silt or clay contents throughout the rootzone, compacted zones buried during construction, layers within the rootzone that impede water movement or rooting, and problems related to sodic soils.

Currently, several units can penetrate to a depth of 6 to 16 inches, including the Aerway slicer, Deep-Drill aerofier, Turf Conditioner, HydroJect, contain

The Verti-Drain uses solid or hollow tines to penetrate the soil 2 to 16 inches for deep soil cultivation of turfgrass sites.

straight-line slicer units, and the Verti-Drain. While previous equipment helped alleviate soil physical problems in the surface 3 inches, the newer devices can aid in correction of problems observed in the 6- to 16-inch zone. Of these new techniques, the Verti-Drain has become the most frequently used deep cultivation unit to date.

Though these new pieces of equipment are welcomed, they have made the formulation of a good cultivation program more complex. Each site must be evaluated for surface and subsurface soil physical problems. Then, appropriate choices must be made for equipment to be used, cultivation timing, procedure frequency, and correct soil moisture conditions at the time of treatment. This requires a good working knowledge of each technique and the underlying soil physical problems. The purpose of this article is to detail the characteristics of Verti-Drain cultivation and its role in cultivation programs.

The Verti-Drain

Introduced in the mid-1980s from the Netherlands, the Verti-Drain is a power-driven unit using solid or hollow tines to penetrate into soil to a depth of 2 to 16 inches, with tine spacings of 2 to 8 inches forward, and with 2½ to 7 inches between tines on the tine holders. Solid tines are available in diameters of ½, ¾, and 1 inch and lengths of 12 to 16 inches. Hollow tines have ¾- to 1-inch diameters and are 12 inches long.

A unique tine action allows for loosening of the soil to improve structure. The tine penetrates straight into the soil, rapidly rotates to the rear by 10 to 15 degrees with the fulcrum point at the soil surface, and is withdrawn at the angled position. This allows for greater loosening action deeper in the profile with very little turf or soil surface disruption. The latter aspect has resulted in the Verti-Drain being used even on closely cut golf greens.

Uses

The Verti-Drain can be effectively used to improve any subsurface (i.e., 6 to 16 inches deep) problems listed in Table 1 for fine-textured soils, except for poor contouring or a naturally occurring high water table. The channels created by the Verti-Drain tines and fracturing of soil between tines would be expected to improve water movement, air exchange, and rooting within the treated zone. In coarse-textured soils, disruption of layers impeding root, water, and air movement would be beneficial.

There are situations where other methods may be preferred or where the Verti-Drain could actually be detrimental. For example: (a) On a properly constructed USGA golf green, the coarse sand layer and pea gravel interface forms a desirable perched water table. Verti-Drain tines do not judge between good and bad layers; they disrupt both equally as well. (b) In areas with shallow irrigation lines. (c) If the soil physical problem is confined to the surface 3 inches, other techniques may be as effective or more effective. For instance, a high-sand-based site without any subsurface layers that impede drainage may receive no benefit from deep cultivation. (d) As with most techniques, Verti-Drain cultivation when the turf has very shallow roots may cause severe turf disruption.

Soil Responses

As part of the USGA/GCSAA Turfgrass Research Program, the Research

Committee is funding a series of projects to evaluate different cultivation techniques at the University of Georgia. The studies are being conducted on an Appling sandy clay loam soil (55% sand, 22% silt, 23% clay, 1.74% organic matter) using common bermudagrass. The soil was subject to periodic compaction with a smooth power roller. Verti-Drain treatments were applied in mid-spring and late July of each year using 12-inch, ½-inch-diameter solid tines.

The Verti-Drain consistently loosened the soil to a depth of 4 inches and at times to a 10-inch depth as evidenced by reduced penetration resistance readings. Penetration resistance decreased by about 25% at all depths relative to the compacted control. Most measurements were made 20 to 27 days after treatment, but in one instance, significantly lower penetration resistance was apparent to a depth of 10 inches 7 months after the late-July cultivation.

At Michigan State University, Drs. James Murphy and Paul Rieke reported decreased penetration resistance to below 8 inches on an intramural field 2 weeks after Verti-Drain treatment. They used both hollow and solid tines and obtained better results with the hollow tines.

Saturated hydraulic conductivity measurements were conducted to determine effects on water infiltration plus percolation under saturated soil conditions. In saturated water flow, impedance to drainage anywhere within the soil profile will reduce water flow. On two out of three measurement dates, Verti-Drain-treated plots exhibited greater saturated water flow. At 30 days after cultivation, saturated hydraulic conductivity of the Verti-Drain plots was increased 7.7 fold over the control, and in the second instance at 21 days after cultivation, improvement was 1.6 fold.

Verti-Drain effects on the physical properties of the surface 2 inches of soil were determined on two dates at 41 and 107 days after the most recent cultivation in the second year of the study. No influence on bulk density, total pore space or aeration porosity (pore space after initial drainage) was observed. However, as noted, penetration resistance was lower than the compacted control in the surface 2 inches, and the saturated hydraulic conductivity data implies that infiltration was at least as good as the control (and probably significantly better since the most likely impedance to saturated water flow would be soil surface compaction).

Plant Responses

Injury to the turf that would detract from visual quality, especially immediately after cultivation, was not observed. Visual quality and shoot density were as good or better than the control. Improved quality was most apparent at the mid-fall and mid- to late-spring periods.

A 79% increase in roots within the 12- to 24-inch zone was observed in Verti-Drain-treated turf in late summer of the first year relative to the control. In the second year, rooting in July and September within this zone was numerically better by 25% to 38%, but not significantly different based on normal statistical procedures.

Timing

Verti-Drain cultivation can be done at any time of the year that the turf has sufficient roots to prevent sod tearing. Sometimes the question arises as to whether the vigorous action of the tines would injure roots. This is a possibility within the treated zone. In our study, rooting was less (not significantly) in the 0- to 12-inch zone in late summer after the late-July cultivation compared to the control, but greater within the 12- to 24-inch zone as noted previously. The magnitude was 15% to 25% less. However, soil compaction via low soil oxygen often enhances surface root development by stimulating adventitious rooting in the surface 1-2 inches of

The unique tine action of the Verti-Drain allows for greater loosening deeper in the soil profile with very little surface disruption.

TABLE 1
Primary Soil Physical Problems on Golf Courses

PROBLEM	Frequency of the problem by soil depth[1] 0-3 in.	4-16 in.	Will cultivation help alleviate this problem?
Fine-Textured Soils (high clay/silt content)	1 = most /	5 = least	
1. Excessive silt/clay content. Some soils contain high clay and/or silt that impedes infiltration, percolation, air exchange, and rooting. These problems are enhanced with traffic.	1	1	Yes
2. High water table or waterlogged soil either naturally or from a perched water table formed by a layer of fine-textured soil with limited percolation.	5[2]	3	Sometimes
3. Improper surface contouring that channels water to low areas that become excessively moist. This is more serious on fine-textured soils with limited internal drainage.	—	—	No
4. Presence of layers that impede water, air, or root movement. Layers may be a distinct textural change or buried organic layer.	2	3	Yes
5. Salt-affected soils, especially sodic soils. The high sodium causes soil structure to deteriorate.	2	2	Yes
6. Soil compaction, whether within the surface as a thin zone of 1 to 2 inches depth, a surface zone several inches deep, or a compacted layer below the surface.	1	3	Yes
Coarse-Textured Soils (high sand content)			
1. Excessive sand content, which leads to low water retention and droughty conditions.	1	1	No
2. Hydrophobic condition due to water-repellent organic coatings on sands.	2	5	Not alone[3]
3. High water table or waterlogged soil, either naturally or from a subsurface drainage barrier such as a clay lens or a fine-textured zone.	5[2]	3	Sometimes
4. Improper contouring that leads to excessive water accumulation in low areas.	—	—	No
5. Presence of layers that inhibit roots, water movement, or gas exchange. Layers may be from sod, topdressing, wind deposited, etc.	1	3	Yes
6. Salt-affected sands that interfere with water uptake but generally do not affect structure in a sand unless it disperses silt/clay and plug pores.	2	3	Sometimes
7. "Hard" sands with little resiliency due to wide particle size range, too many fines, or angular-shaped sand particles.	4	4	Sometimes
8. "Soft" sands with poor traction due to a very narrow particle size and rounded particle shape.	4	4	No

[1]Frequency of soil physical problems within the soil zones of 0 to 3 and 4 to 16 inches: 1 = very common problem, 5 = very rare problem within the zone.

[2]Excessive water may appear at the surface but the cause is normally deeper in the profile.

[3]Cultivation plus a wetting agent, but the wetting agent is more important than cultivation.

soil. If this occurred in our study, then Verti-Drain may have simply decreased the adventitious rooting by improving oxygen relations in the very surface 1-2 inches, which would not be detrimental since these roots are not important in drought. Thus, the questions remain unanswered.

Precautions can be taken to avoid potential injury to existing roots. For cool-season grasses, vigorous cultivation would be best in early spring and mid-fall just prior to the times of maximum root growth. The most intensive cultivation for warm-season grasses to promote rooting should be in mid- to late spring. If a mid-summer cultivation is intensive enough to cause some injury to warm-season grasses, they can still continue root development, whereas cool-season grasses cannot resume root growth until mid-fall.

All Verti-Drain operations are not of the same vigor. Obviously, more intensive operations are likely to cause some root damage. Therefore, if Verti-Drain cultivation is needed for better water and oxygen relations but the turf manager is concerned about effects on existing roots, cultivation intensity can be reduced by using smaller-diameter tines, 12-inch versus 16-inch tines, and greater distance between holes.

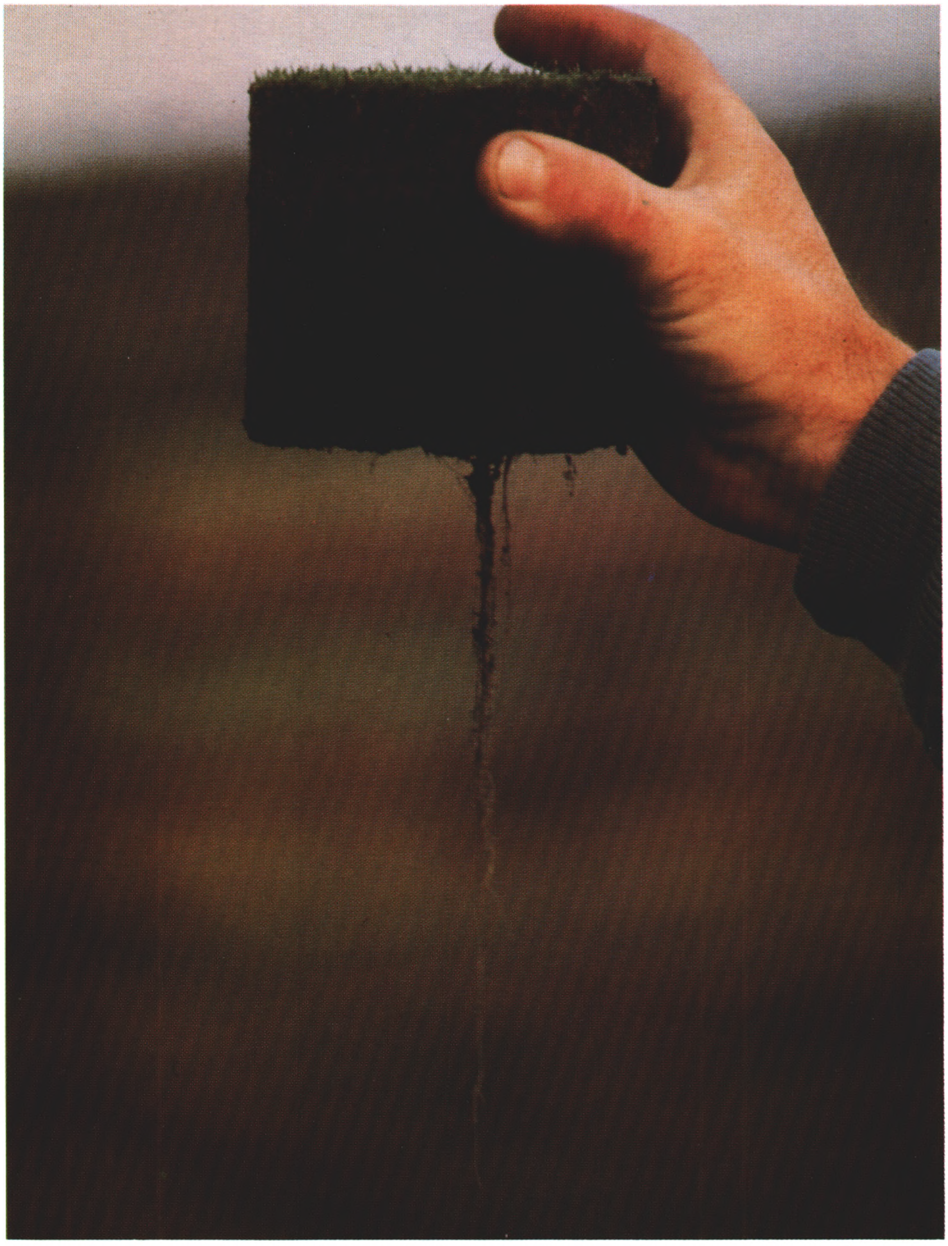
Frequency of Verti-Drain Cultivation

Frequency of an operation depends upon the severity of the problem and whether it recurs. An excessively fine-textured soil with poor physical properties throughout the profile will exhibit improvement after Verti-Drain cultivation. However, the structure formed by tine action will eventually deteriorate and require another cultivation.

Initially the surface portion of the core hole may collapse from foot and vehicle traffic. A good cultivation program with devices that penetrate to 3 inches will help delay this action. Once the surface core hole becomes closed, then certain benefits are lost; namely, better water infiltration and percolation (since water movement rate is controlled by the rate of water entry — i.e., infiltration rate) and gas exchange to some extent. However, the lower portion of the tine channel can still allow for better root growth, and gases can move within these channels.

Ultimately, the lower portion of the Verti-Drain tine channel and any soil fractures created between tines may close. How rapidly this occurs depends upon (a) initial size of the channel. Larger-diameter tines or hollow tines will create holes that will last longer. Another factor is (b) type of clay. Expanding clays (montmorillonite, vermiculite) when moistened can easily expand and seal the channels, especially since water entry is primarily in these channels. In contrast, one would expect greater longevity within a kaolinite or non-expanding clay, (c) reduced degree of traffic pressure, and (d) when sand is backfilled into the holes to keep them open. Sand-filled holes may not remain open to the surface unless sufficient topdressing is periodically added. Some turf managers have back-filled Verti-Drain holes with sand, usually by washing it into holes with water or tediously brushing it into the holes, but there is not any easy way to accomplish this task.

In the previous paragraph, the emphasis was on excessively fine-textured soil profiles. If the subsurface problem is a distinct layer, then one or two Verti-Drain treatments may be sufficient for a permanent solution. However, layers that are relatively thick (2 to 4 inches) or contain expanding clays can reseal. Soil profiles that require deep cultivation as part of a sodium removal program, especially sodic soils, may require frequent Verti-Drain treatment initially to maintain adequate water infiltration and percolation. In a sodic soil, the sodium ion would promote deterioration of the core hole until the sodium is leached out.



The channels created by the Verti-Drain tine action improve water movement and air exchange. The turf plant responds to the cultivation with increased rooting.

Soil Moisture for Application

Verti-Drain, as with all the methods that have a loosening action between tines, should be applied when soil moisture is somewhat drier than field capacity. Field capacity would be the natural soil moisture content after a rainfall or irrigation event, normally 8 to 24 hours afterwards. A somewhat drier soil will be prone to more fracturing action.

It is not unusual for the initial cultivations to be made at field capacity in order to obtain deep-tine penetration. After one or two operations, the soil may loosen sufficiently to allow a somewhat drier moisture level. Drier would mean allowing the soil to dry 1 to 3 days after reaching field capacity.

In conclusion, effective use of the Verti-Drain depends upon correct identification of the soil physical problems and their location in the soil, selecting the Verti-Drain procedure if it is the best for the observed problems, determining the time of year to cultivate, using the right frequency of Verti-Drain treatment plus any other cultivation being done, and treating at the correct soil moisture. Disregarding any potential adverse responses, effectiveness can be enhanced by: longer tines, larger-diameter tines, hollow tines, repeated treatment over a site, closer spacing of tines, adding sand to keep holes open, treating at the correct soil moisture, and more frequent treatment.

An impossible turfgrass growing environment openly invites problems for the golf course superintendent and golfers alike!

Looking at a Bad Year in a Good Light

by DAVID A. OATIS
Director, Northeastern Region, USGA Green Section

IT NEVER FAILS! Sometime during a long and difficult golf season, Green Section agronomists find themselves prefacing Turf Advisory Service reports to clubs that lost turf with phrases such as "If there is anything good to be said about a bad year . . ." or "It should be no surprise the grass died . . . ." These sentiments reflect that there are literally hundreds of golf courses that are openly inviting turf-related problems. That is, they have certain problems or conditions that predispose them to turf loss.

The problems may be as simple as inadequate or improperly timed aerification or renovation work (sometimes referred to as deferred maintenance). Or, the problems may be so severe that the solutions would require large expenditures, such as those involving large irrigation or drainage projects or putting green construction. In any given year some golf courses fare poorly, and often it's the weather that triggers the turf-related problem. To complete an earlier phrase, "If there is anything good about experiencing a bad year, it is that both the strengths and weaknesses of the golf course and its management programs are clearly exposed. They are often exposed in such a way that it is difficult to ignore them!"

It is easy to ignore fundamental problems with a turf management program in mild years, since those are years when most turf areas perform reasonably well despite the inherent deficiencies. Golfers are happy and even complimentary towards the superintendent's handiwork. Those are years when Green Committee members don't attend the scheduled Turf Advisory Service visit.

We all know what happens in the tough year, though. Golfers are sure that theirs is the only course in the area that is experiencing problems, and a group of five to ten concerned, anxious, and sometimes hostile members arrives at the superintendent's office a full half hour before the scheduled Turf Advisory Service visit! All demand immediate answers and immediate solutions.

Unfortunately, it is easy for superintendents to become too defensive when this type of scenario occurs. Course officials tend to go head-hunting, and superintendents respond with a sharp "I told you so!" Neither approach to the problem is very productive, and bad feelings, or employment ads, will probably occur at the expense of improvements in the golf course. A positive approach should be taken instead, preventing the member/superintendent relationship from degenerating into an adversarial one. Hard work and good communication is required on both sides to avoid slipping into this self-defeating cycle.

It is important to remember that golf course superintendents dislike seeing their turf fail even more than the golfers do. Seriously, have you heard of a superintendent cheering when a green died? Most would do almost anything to keep that from happening. All should cooperate to achieve their common goals.

THOUGH golf course superintendents are not infallible, turf-related problems often are not a result of the superintendent suddenly "getting stupid." In many instances, courses enjoy several successful years, and the golfers become complacent about the maintenance program or greedy with the golf schedule. The result is the same in both cases: The agronomic health of the course declines and the turf becomes more susceptible to failure.

Often, the disastrous consequences, so visible on the golf course, were actually predicted by the superintendent or Green Section agronomist, but the warnings were ignored or dismissed as "complaining" or "crying wolf." Most golfers probably were never aware of them. On the other hand, it is tough to ignore those same warnings when various portions of the golf course are dead, dying, or unplayable. The superintendent and the green committee will have all the golfers' attention when the condition of the course is at its worst. This is the time to make the best of a bad situation and take a difficult year and turn it to your advantage.

Consider the following case studies:

Hunkeydory Country Club

Hunkeydory Country Club received a Turf Advisory visit in August 1990 and the report essentially stated that even though the course was in fine condition, problems eventually would occur due to several factors. The club had an antiquated irrigation system that functioned poorly and was undependable. It also had a tremendous population of large trees which lined the fairways and surrounded the greens and tees. To cap things off, a large percentage of the turf on the course was *Poa annua*, increasing the likelihood of suffering turf loss. In short, this golf course was a time bomb waiting for the right meteorological events to trigger the explosion.

Unfortunately, the majority of members had no idea these problems existed. Many were surprised when the explosion came in 1991 after an extended period of heat and drought put intense pressure on the irrigation system and the *Poa annua*. As predicted, extensive turf loss occurred. The solution involved an extensive tree pruning and removal program, a new irrigation system, and a regrassing program for affected areas of the course. The solutions had been suggested the previous year but were considered too radical and had not even been presented to the membership.

Poor irrigation coverage guarantees turfgrass loss when the right meteorological conditions occur.

Wecanneverdothat Country Club

The greens at Wecanneverdothat (We-can-never-do-that) Country Club were built from dense, poorly drained native soils, yet the golfers were unwilling to consider any turf recommendations that entailed disruption to their course. Consequently, neither vigorous cultivation nor regular topdressing was permitted. The course was never closed for essential maintenance, and green speeds were expected to be kept above 9 feet at all times. Vital renovation work was pushed back later into the fall months each year. Unfortunately, Wecanneverdothat Country Club slipped into a vicious cycle of turf loss as it suffered severe damage for several consecutive years. The golfers were beside themselves with frustration and anger.

The problems were easy to analyze. The late fall renovation work and compacted, poorly drained soils promoted *Poa annua* encroachment. The result was an incredibly good environment for disease and stress problems. Once the problems were thoroughly explained, the golfers at Wecanneverdothat Country Club found the prospect of an appropriate cultivation and soil modification program more palatable. They even agreed to abandon their deferred maintenance program and adjust their golf schedule to permit late August renovation work.

THE MORAL of these stories is that great progress can be the result of a disastrous year or years if a good plan of attack is devised and carried out. In these two cases, the loss of turf was so devastating and the solutions were so painfully obvious that the golfers were rather easily convinced to proceed. Other times, problems are more difficult to identify and solutions are less clear-cut.

What can be done to avert the gloomy fates just described? The first step is to take an offensive approach rather than a defensive one. Act — don't wait to react. Call in appropriate consultants and begin a fact-finding mission. The Green Section is an excellent place to start. Analyze the course's strong points as well as its weak ones. Look for potential problems in the water management systems, including irrigation and drainage, since failure here guarantees turf loss. Examine the growing environment around greens and tees. What is the air circulation like? Are trees becoming a problem? Is the majority of turf the best-suited species or variety? Does your turf have a reasonable chance for survival if the weather becomes unfavorable? All of these questions have to be answered before a plan of attack can be devised.

The golfers also must be kept well informed. New programs are more readily accepted by those who understand why failures occurred and what is being done to prevent them from recurring. They should be made to feel a part of the decision-making process. Do not be surprised if the problems are fairly complex and cannot be solved by a single solution. Usually, a variety of factors are involved. Do not fall into the trap of looking for a painless (low cost/non-disruptive) solution to your course's problems. It is very rare for a single piece of equipment, soil additive, growth enhancer, pesticide, etc. to turn a program around. Severe problems rarely develop overnight, and solutions require time, funding, and patience to work effectively.

In short, do not wait for disaster to strike; anticipate it. If disaster has already struck, use it to help institute the necessary corrective programs. Don't be afraid to *look at a bad year in a good light* and use it to the course's advantage.

A complacent maintenance program or an overloaded golf schedule has the same results: declining agronomic health of the turf.

Touching Up The Mona Lisa

by **ED MILLER**
Golf Course Superintendent, Pebble Beach Golf Links, Pebble Beach, California

PREPPING Pebble Beach for the 1992 U.S. Open has been a consuming focus for many months, and it will definitely remain the focus until this national championship event occurs in June. As an added consideration, our crew has spent the past year overcoming several years of drought on the Monterey Peninsula which had deteriorated the condition of Pebble Beach Golf Links in several ways. The predominant turfgrass, *Poa annua*, had expired to the point that fairway surfaces had become parched and unplayable. With the *Poa* continually under stress, it posed little competition to the extremely aggressive and invasive kikuyugrass (*Pennisetum clandestinum*). Kikuyugrass was running rampant, with stolons as thick as a pencil and virtually nothing to stand in its way. Its population had increased to the point that it was dominating the holes along the coast and becoming a significant force in the remaining areas. At the same time, the 4th, 5th, and 7th greens were in disrepair and needed a facelift.

With the 1992 U.S. Open only 22 months away, the situation was becoming critical and considerable work had to be done. In September 1990, with the support of the Pebble Beach Company ownership, the United States Golf Association, the Monterey Peninsula Water Management District, and the architectural assistance of Jack Nicklaus Golf Services, the Pebble Beach Company embarked on a three-phase program to restore Pebble Beach Golf Links and prepare for the 1992 U.S. Open Championship.

THE FIRST PHASE consisted of a large-scale kikuyugrass-control program and the establishment of a more desirable turfgrass species. The second phase was scheduled for the spring of 1991 and involved rebuilding greens 4, 5, and 7. The third and final phase was the "one hole at a time" kikuyugrass-control program around greens and tees, with bunker restoration, reclamation of putting surfaces, and the leveling and enlargement of tees being performed while the areas were renovated. Phase three was performed during the summer and early fall of 1991 with the intent of having all projects completed by the last week of October.

In a country club environment, when a decision to embark on a major project has been made, a majority of the

To halt the aggressive kikuyugrass encroachment, fumigation with methyl bromide was used.

membership has elected to undertake the project, and the entire membership has been informed of the process. At Pebble Beach Golf Links, course play is by resort guests and the public, most of whom have made reservations months, if not years, in advance. Because the decision to regrass the course was made somewhat spontaneously, and there was a lack of time remaining before the U.S. Open, it was not possible to inform incoming guests or to make plans to close the course during the project. As a result, restoration work and golf play had to co-exist harmlessly and, if possible, harmoniously.

KIKUYUGRASS control was initiated in September 1990. To accomplish the renovation goals, all kikuyugrass had to be killed and the golf course reseeded with desirable turfgrass species. The most heavily infested areas, including fairways 3, 6, 8, 9, 13, and 16, underwent fumigation with methyl bromide. Fumigation was performed by an independent contractor, using technology developed for strawberry fields in local agricultural operations. Methyl bromide, a gas at temperatures above 55° F, must be applied under a tarp to keep it from dissipating before it can do its work. The fairways were done in two halves, with the fumigated and tarped area roped off and posted with the appropriate signs. The roped areas were played as ground under repair, and a staff member was positioned at the site to retrieve balls landing on the tarp and to ensure that no one inadvertently entered the area. The tarps remained in place for 48 hours, and the area was allowed to air for 24 hours before the second half was fumigated. A total of nine acres were fumigated.

The remaining 90 acres of golf course, excluding the immediate area around the greens and tees, were sprayed with a tank mix of Roundup, ammonium sulfate, and Bivert. The green and tee banks were left unsprayed and acted as a buffer to avoid tracking Roundup onto the tee and putting surfaces. These areas were addressed in phase three.

Early in the development stage of the kikuyu-control program, a small silver lining became apparent in this ugly cloud. As the *Poa annua* was suffering from its worst case of "*Poa annua* decline," the perennial ryegrass, seeded into the fairways while filling divots, became very evident. With virtually no irrigation, ryegrass was co-existing with kikuyugrass. Research conducted at the University of California - Riverside has shown that during renovation, the use of perennial ryegrass or tall fescue, because of their rapid establishment, produced the greatest degree of success. The ability of perennial ryegrass to tolerate several herbicides found to be detrimental to kikuyugrass growth, and the knowledge of the fine playing surface it provides, made perennial ryegrass the only choice for establishment as far as we were concerned. With the Spalding Pebble Beach Pro-Am Invitational two months away and the AT&T Pebble Beach National Pro-Am four months away, rapid establishment was essential.

With the herbicide and fumigation applications complete, it was time to make the golf course green again. Regrassing was addressed just like a southern over-

Stay alive at 55°. A constant soil temperature will be maintained year round on the 5th green with the installation of the sub-surface heating systems.

Kikuyugrass control around the greens and bunker renovation were done in the same phase.

seeding. Seedbed preparation consisted of aggressive scalping, dethatching, and cleanup. The coarse stolons and thick mat of thatch made seedbed preparation particularly challenging. As seedbed preparation was completed, fairway areas were broadcast with 500 pounds of seed per acre and the roughs with 350 pounds per acre.

Tupersan, a preemergence herbicide identified by UC-Riverside to be effective in the control of kikuyugrass seedling emergence, had been taken off the market but not banned from use. Our renovation effort was boosted by discovering 500 pounds of Tupersan in the chemical storage building. Tupersan was applied at the labeled rate for annual weedgrass control five days after the area was seeded. The application gave the perennial ryegrass seedlings about a 45-day head start over kikuyugrass germination, and by that time, very little kikuyugrass emergence occurred.

The perennial ryegrass germinated after seven days and established quite rapidly, with total grass cover occurring one month after seeding. With solid ryegrass in the fairways and roughs, the only kikuyugrass still in play was surrounding the putting greens and tees. This problem would be addressed in the early summer when kikuyugrass growth became active.

With the first hurdle out of the way, it was time to look at our problem greens. The Pebble Beach greens have a reputation for being small, tricky targets. In fact, there is not a green on the golf course larger than 4,000 square feet. Three of the smallest greens, on holes 4, 5, and 7, are surrounded by bunkers, which created a definite traffic pattern over the years and contributed to a tremendous buildup of sand on the putting surface.

Through the use of a computer terrain modeling system, we were able to obtain a very accurate picture of why these greens were always in disrepair. The modeling program revealed that number four, a 2,420-square-foot green, had only 942 square feet of putting surface available for usable hole locations at the present day green speeds. The same situation was evident on two other greens as well. In addition to a small amount of usable area, all of these greens were constructed with native soil and had, over time, become very layered.

GREEN reconstruction to USGA Green Section Specifications commenced in March 1991. The fifth green, in addition to being very small and having definite soil profile problems, was also located in the coldest spot on the golf course. A large hill to the east obscures the sun during the winter months, and soil temperatures drop to 38° F through January. We enlisted the services of Biotherm Hydronics, which specializes in greenhouse bed heating systems in the nursery industry, to address this problem.

A sensor, located on the edge of the green, four inches below the surface, monitors soil temperatures. When soil temperatures drop below 55° F, a thermostat fires a boiler similar to a swimming pool boiler. As water is heated to 140° F, it is pumped by a circulating pump through a grid system installed in the root zone mix, 11 inches below the surface.

With the U.S. Open now only 15 months away and all of the other greens consisting of 100 percent *Poa annua*, obtaining 18 holes with consistent putting surfaces was our next concern. It just so happened that one of the other Pebble Beach Company golf courses also had three *Poa annua* greens in need of rebuilding. A deal was struck with the superintendent, and by rebuilding three Del Monte greens, enough *Poa annua* sod was salvaged to sod three new greens at Pebble Beach.

The third and final phase of the restoration effort really put the finishing touches on the golf course. With the fairways maturing and 18 greens in playable condition, each project brought us closer to the end. Starting in May 1991, 11 green complexes needed complete or partial kikuyugrass conversion. While these areas were being addressed, the bunkers were remodeled, the putting surfaces lost to kikuyu encroachment were reclaimed, and the eight tees were leveled and enlarged.

By researching the company archives, we were able to put together a set of early 1900 photographs that proved instrumental in the bunker renovation effort and added a finishing touch to the restoration goals. More details need to be addressed before the Open, but we are confident our touch-ups will be shining when the cameras roll in June.

The old 11th green was bulldozed into history, much to everyone's delight, as preparations were made for the green renovation.

Washed Sod: Viable Alternative in Greens Construction

by LES KENNEDY, JR.
Oak Lane Country Club, Woodbridge, Connecticut

THE 11TH HOLE at Oak Lane Country Club has been a subject of discussion for many years. At 190 yards from the back tee, this decidedly uphill par-3 plays to a small green with a greater than 7 percent pitch from back to front. The net result was a hole that was both unenjoyable and unfair, particularly in view of the frequency of four- and five-putts. The idea of rebuilding the green had been debated for many years.

In July 1990, a plan for the green's redesign was developed. The proposed green would be enlarged to 5,000 square feet, with a more gentle pitch from back to front and left to right, and it would be built to USGA Specifications. The plan was well received, and reconstruction was approved.

A bid package was developed, contractors were interviewed, and bids were received for the project. A contractor was selected, and September 4th, 1991, was set as the starting date for construction. This date allowed members to enjoy their entire summer and complete the Labor Day Tournament while allowing planting of the green and surrounds during early fall.

All appeared to be moving along according to schedule until the July Executive Committee meeting. The question arose as to when the newly seeded green would be ready for play. I suggested that if everything worked in our favor, the new green "MIGHT" be ready for Memorial Day weekend. This grow-in period didn't sit well with the board, and the possibility of sodding the green was suggested. A long discussion followed concerning the short- and long-term difficulties associated with layering problems that could result from sodding the green. I suggested these problems were of greater importance than a few extra weeks of grow-in inconvenience. The board did not agree and the decision was made to sod rather than seed, with the understanding that I was free to explore all available options to minimize agronomic problems that result when sod is grown on "topmix" that differs from that used in green construction.

My search for Penncross sod revealed a number of sources and soil types, ranging from native soil, to straight sand, to USGA Spec mixes, and everything in between. The problem was further compounded as I researched available USGA Spec mixes and found that the six mixes for which I had received samples fell within the specifications but still exhibited differences from sample to sample. Layering could be a long-term problem if I did not use sod grown on precisely the same mix as used in the construction of the green.

While searching for bentgrass sod, I contacted several sources, one of whom suggested that "washed" sod be considered. The advice made me recall an article I had read about washed Kentucky bluegrass sod being used on the new PAT field at Foxboro Stadium. The process was intriguing, though I hadn't heard of its use in green construction. I subsequently learned that Paul Miller at Nashawtuck Country Club was going to use washed bentgrass sod on a tee.

I HAD MY DOUBTS about the washed sod, but the trip to Nashawtuck was well worth my time. The sod edges were a bit ragged, but the turf handled very well. I was later able to obtain additional sod samples with a tighter edge cut. It almost seemed too good to be true; quicker, easier grow-in and no soil layer.

At the August 20th board meeting, I announced that washed sod represented our best chance for success, and this was the way I wanted to proceed. The discussion that followed was lengthy and, at times, heated. The greatest apprehension resulted when I didn't know of a green where washed sod had

After the green subgrade was finalized and the drain tile installed, the grade stakes were reset to ensure uniform depths of pea stone, coarse sand, and topmix.

been used, though I had seen excellent results on the Nashawtuck tee. We continued to discuss the advantages of washed sod compared to conventional sod, and I was given a vote of confidence to proceed.

The contractor was on site September 3rd, and construction started the next day. Materials had been ordered and were arriving on schedule. The decision had been made not to save the existing sod on the green and, at 7:00 a.m. on September 4th, the old 11th green was bulldozed into history, much to the delight of myself and the several members present. The weather could not have been more cooperative, and the construction crew worked from dawn to dusk to ready the green for the September 9th delivery of the washed sod.

With no soil or topmix on the root system, washed sod is very light and easy to transport.

THE NEW GREEN was built to USGA Specifications. As with any course construction project, though, it was necessary to modify our plans as we went about the work. Shale was found beneath the old 11th green, and the final shape and contour of the subgrade had to be modified a number of times. Once the subgrade was finalized and tile installed, grade stakes were re-set to ensure uniform depths of pea stone, coarse sand, and topmix. A closely cut bentgrass fairway approach was added to soften the blow for the less-skilled players on this "new" hole, which was going to be difficult enough even if it were more manageable.

By noon on Sunday the 8th, the green and surrounds were ready for turf. The afternoon was spent watering, hand raking, and rolling the mix. Two pounds of quick-release nitrogen per 1,000 square feet was worked into the top few inches of mix.

The sod was waiting on the truck at sunrise the next morning. With no soil or topmix, the sod was very light and comes 1,000 square feet per pallet. The mix was hand raked one final time before each section of green was sodded, the seams were tamped, and each section was hand rolled. A crew of six completed the sodding by noon.

The sod comes dripping wet from the washing process, but dries very quickly due to the lack of soil. It was necessary for one crew member to water completed turf sections before the green was half done. After completing the sodding, the washed sod required irrigation every hour for the next week to prevent desiccation.

The next day our efforts shifted to the fairway approach and green surrounds. Conventional bluegrass sod was used for the surrounds, and the difference was amazing. The unwashed sod was heavier and broke apart from its own weight; it was more difficult to place, and the seams were not as tight.

The entire project was completed and the construction crew was off site in only seven days. Our members were amazed, and I was relieved.

Three days after installation, root hairs began to emerge from the washed sod. On the fourth day, the green was rolled and mowed for the first time with a walking unit set at 0.4″. After 10 days, roots approached two inches in depth and the green was mowed daily. The height of cut was reduced to 0.3″, and the seam lines were almost gone.

At the time of the first topdressing after sodding, starter fertilizer at 0.5 pounds of nitrogen per 1,000 square feet was applied along with granular fungicide and insecticide. The cutting height was reduced to 0.225″, and rooting depth was greater than 3″. With seam lines gone and the cutting height continuing downward, members began asking if the green was ready to play. They were assured that the green would be ready for spring 1992, and all agreed that there was no need to rush this date.

A second topdressing at a lighter setting was applied one month after sodding, and the cutting height was lowered to 0.18″. By mid-October, the green had been topdressed a third time, the height of cut was 0.165″, and the root zone was a full 6″. A fourth topdressing is planned before winter, and a dormant natural organic fertilizer feeding at 2 pounds of nitrogen per 1,000 square feet will be made.

The project to date has been very successful, and I credit three main reasons: The project was well planned, it was well funded by the club, and it was well executed by the contractor. We are all looking forward to the opening of the new green next spring, when the washed sod will receive its true test as a viable alternative for turf establishment in green construction.

(Above) A crew of six completed the sodding by noon.

(Left) Ten days after installation, the seam lines were almost gone.

A USGA/GCSAA-SPONSORED RESEARCH PROJECT

Introducing an Improved Native: '609' Buffalograss

One method used to plant buffalograss nurseries is a sod plugger. Buffalograss sod is broken in 3- to 4-inch pieces and pressed into the sod with a roller.

by **BARBARA BAUER**
Crenshaw & Doguet Turfgrass,
Austin, Texas

BEN CRENSHAW, professional golfer and avid supporter of the USGA Green Section research program, and David Doguet, a 20-year veteran turfgrass producer and current member of the American Sod Producers Association board of directors, have joined forces to propagate and market a new grass from one of the USGA breeding projects — '609' buffalograss. While planning one of his golf course projects, Crenshaw discussed with Doguet the potential use of buffalograss (*Buchloe dactyloides*) to give the appearance of a Scottish links style golf course. These discussions led to the formation of Crenshaw & Doguet Turfgrass, Inc., in early 1990.

The buffalograss research program is one of several USGA breeding projects initially funded in the mid-1980s. The overall objective of these projects was a 50-percent reduction in water use and maintenance costs associated with golf course turf. As environmental consciousness has increased in the 1990s, these objectives have proven to be prophetic. The first product of Crenshaw & Doguet Turfgrass was 'Prairie' buffalograss, developed by Drs. Milton Engelke and Virginia Lehman of Texas A&M University. The newest product, '609' buffalograss, was developed by Dr. Terry Riordan and the Turfgrass Science Team at the University of Nebraska, and became available to the marketplace in September 1991.

'609' buffalograss is one of the first turf-type buffalograsses developed for golf and lawn use. Prior to the release of 'Prairie' and '609,' all buffalograsses in use were common types from the native prairie or types developed for forage to feed livestock. '609' buffalograss has a fine texture, excellent genetic color, a low growth habit, and the ability to stay green later into the fall than most other warm-season grasses. It is very drought tolerant and is resistant to most insects and diseases in its area of adaptation. '609' has met the objectives of the USGA project by reducing water and chemical inputs by at least 50 percent, and up to 75 percent compared to other turf species. Its low growth habit requires less mowing in the rough than the bermudagrasses or Kentucky bluegrass currently used. This new variety is a vegetative, female plant with no pollen production.

Buffalograss is native throughout the central portion of the United States, from Mexico into Canada. Improved cultivars are doing well across the central and southern United States, including some coastal regions. California, with its well-publicized drought, could be a prime target for '609.' The pleasant green color keeps up with Californians' expectations for grass, but without the high maintenance and water consumption required by other turfgrasses. Its usefulness in the more humid, higher rainfall areas of the country is unclear, and will require further study.

In test plots at Lincoln, Nebraska, '609' does not go dormant until mid-October, approximately one month after other warm-season grasses. At the Crenshaw & Doguet Turfgrass farm near Austin, Texas, '609' held its color late in the fall (mid-December) and was completely green by mid-February, well before bermudagrass. Certain parts of the country may find '609' will not go dormant at all. In the transition zone, the rapid spreading characteristics of '609' could make it a desirable alternative to slower growing zoysiagrass. Southern states with good soil conditions and adequate moisture should find that plugs of '609' planted on 12″ to 18″ centers establish completely within three to six months.

In the past, common buffalograsses were used on fairways and roughs of low-maintenance golf courses in the Great Plains. The new turf-type buffalograsses will be used on roughs, slopes, and bunker faces. The blue-green color provides an effective contrast to other grasses presently used on golf courses.

There is a definite penalty when hitting a golf ball from a buffalograss rough, but it is less than that experienced with a similar lie in common or '419' bermudagrass. In many parts of the country the primary use for '609' on golf courses will be in the rough. However, it is being evaluated at a ⅝″ mowing height for fairways, especially in areas where water availability is critical.

'609' will be commercially available throughout the South in the spring of 1992. In addition to approximately 100 acres in Texas, it is being produced in Arizona, California, Oklahoma, and Florida. As dictated by the license agreement, royalty payments will be returned to the USGA and the University of Nebraska to fund further research in buffalograss improvement.

'609' is a new and exciting option for golf course architects and superintendents. Lower water consumption, reduced chemical needs, and generally low maintenance requirements make '609' an alternative to the more traditional golf course grasses. A more detailed background of the USGA buffalograss project can be found in the January/February 1991 issue of the USGA Green Section Record.

ON COURSE WITH NATURE
GOLF COURSE WINTER PROJECTS

by NANCY P. SADLON
Environmental Specialist,
USGA Green Section

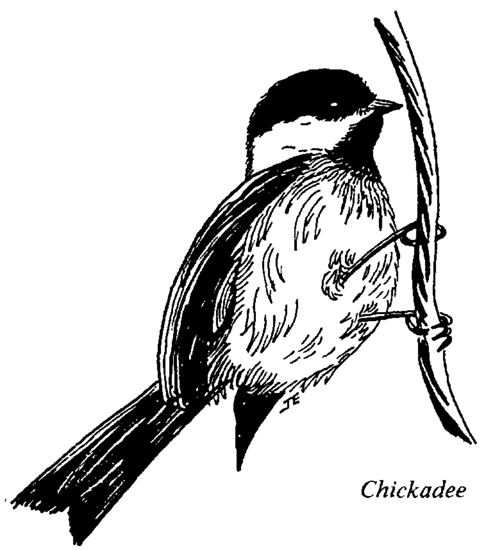
WINTER, with its cold temperatures, sharp winds, and lack of deciduous cover, is by far the most difficult season for many birds and mammals of the northern latitudes. Deep snow and ice often completely eliminate available food supplies, and supplemental feeding and brush shelters can be valuable aids for wildlife survival.

Brush Shelter Project

When it is time to do tree pruning or remove trees from the golf course, refrain from immediately reducing the timbers to woodchips. If there is room on the golf course, consider creating brush shelters or leaving fallen trees in out-of-play areas until early spring, to provide cover for wintering birds and animals.

Construction of a brush pile is easy, but it involves more than throwing an armful of brush or tree limbs into a pile.

Downy Woodpecker



Chickadee

Creating a base with open tunnels under the pile is a key to providing useful wildlife cover. Locate brush piles near feeding areas, or along golf course borders, or intersperse them 10 to 50 yards apart in fields. Avoid piles at a tree base as this creates a perfect opportunity for hawks or owls to ambush prey as it strays from the cover.

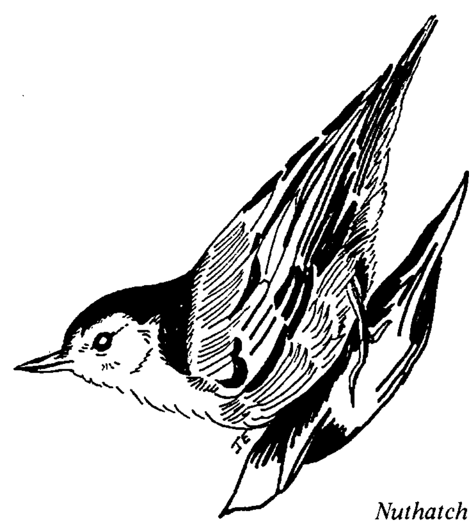
Living brush piles offer cover and important food sources. These foods are used by wildlife such as white-tailed deer, cottontail rabbits, ruffed grouse, and wild turkey. Many songbirds benefit from living brush piles by foraging for insects that harbor in the foliage.

Create a living brush pile by partially cutting through the lower conifer limbs, forming a "tepee." Deciduous saplings 5 to 12 feet high can also be used. Partially cut through the trunk 6 to 10 inches above ground and topple over toward one another. Select a tree already scheduled to be removed in the spring, because cutting the tree limbs greatly diminishes vigor and causes tree death. Cut limbs can be considered unsightly and should be removed after winter, prior to the start of the golf season.

Supplemental Feeding Project

Aside from assisting in winter survival, supplemental feeding stations provide educational opportunities. Feeding birds is a great way to introduce golfers and yourself to the joys of bird watching and to inventory bird species that utilize the golf course as a migratory stopover or permanent residence. Without feeding stations, many wild birds are not easily seen due to their highly mobile and elusive nature.

When choosing a feeding station location, consider where golfers and employees spend their time, and choose a location with good visibility. The clubhouse entrance, the ninth hole, or



Nuthatch

the patio area where course patrons can view the feeding stations may be possibilities. Another choice is the maintenance shop in an area that can be seen from the major work areas.

Feeding stations should include a variety of choices such as food variety, several feeder types at different heights above the ground, and feeders at different distances from human activity and varied distances from the nearest cover. According to Cornell University researchers, placement of feeding stations within 10 to 20 feet of nearby shrubs helps reduce bird mortality from predators.

Greater bird species diversity can be achieved, and competition reduced, by providing different foods (suet, grain, dried and fresh fruit) at different feeders. Another way to reduce congestion is to provide a perch for birds waiting in line to get to the feeder. This can simply mean placing a branch on the feeder or locating the feeder near a sapling.

The most useful winter food sources include suet and seed, which should be available at dawn and dusk. These two times represent the most important periods of bird foraging. Feeder activity is greatest in the early morning after long, cold nights when energy reserves must be replenished, and again at dusk. Beef kidney suet provides a rich source of fat and is readily eaten by at least 80 species of North American birds, including woodpeckers, chickadees, titmice, wrens, orioles, thrashers, and warblers. Winter is a good time to put out food for fruit-eating songbirds, such as the northern mockingbird and eastern bluebird. Raisins and dried or frozen grapes or cherries will attract robins, mockingbirds, waxwings, and other winter birds that would not normally visit the feeder.

Commercial seed mixes often contain useless fillers such as milo, flax, wheat, red millet, and oats, in addition to some useful seed. They look nice in the bag but are of modest value to the birds. Many birds with a preference for sunflower seeds will discard other seeds, which are lost in snow or ground surface debris. If possible, use separate feeders for different kinds of grain. Multiple feeders allow more selective feeding for preferred species.

Feeding continuity is encouraged, but there is little concern of birds becoming entirely dependent on a feeding station for survival. This concern is valid only in isolated areas where feeding stations are few and feeders provide large amounts of food from fall to winter. Most birds do not depend on single food supplies or feeder stations. Temporary discontinuation of a food source at feeding stations is unlikely to cause death. Loss of the flock to other feeders and difficulty in attracting the variety and numbers back to the feeder are probably the biggest concerns.

Supplemental feeding is valuable in all climates for the educational opportunity it provides. Feeding throughout the seasons is also important. *Spring feeding* helps build migratory energy and entices breeding populations to nest on the property. *Summer feeding* attracts insect-eating birds to help pest-control programs and to entice hummingbirds and nectar-feeding birds to the site. *Fall feeding* is important to build energy for migratory flights and to entice wintering birds to the property.

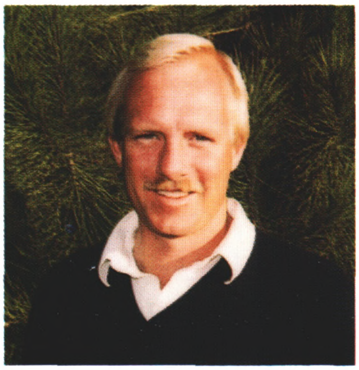
	Sunflowers											Feeding Location	
	Grey Stripe	Black Stripe	Black Oil Type	Hulled	White Proso Millet	Peanut Hearts & Shelled Peanuts	Fine Cracked Corn	Niger Thistle Seed	Safflower Seed	Suet	Berries & Fruit	Hanging	Ground
Bluejay	●	●	●	●	●	●					●	●	●
Cardinal	●	●	●	●	●	●			●		●		●
Chickadee	●	●	●	●	●	●				●		●	●
Cowbird: Brown-headed					●	●	●						●
Doves: Mourning, Ground		●	●	●	●		●		●				●
Finches: American Goldfinch	●	●	●	●				●				●	●
House	●	●	●	●								●	●
Purple	●	●	●		●			●			●	●	
Grackle: Common			●		●		●					●	●
Grosbeak: Evening	●	●	●				●				●		
Red-Breasted												●	
Junco: Dark-Eyed	●	●	●				●				●		
Nuthatches: White-Breasted	●	●	●	●		●							●
Pine Siskin								●				●	
Sparrows: Song Sparrow			●		●								●
Tree Sparrow		●			●		●						●
White Crowned		●	●		●	●							●
White Throated		●	●		●	●	●						●
Titmouse	●	●	●			●				●		●	
Woodpeckers: Downy		●								●		●	
Flicker		●								●		●	
Hairy		●								●		●	
Pileated		●								●		●	
Red-Bellied		●								●		●	

NEWS NOTES

Patrick J. Gross Joins Green Section Staff

Patrick J. Gross has been appointed to the Green Section staff to serve as agronomist in the Western Region. He joins Larry Gilhuly, Western Region Director, and Paul Vermeulen, Agronomist, serving Turf Advisory Service courses in Arizona, California, Nevada, Idaho, Utah, Oregon, and Washington.

Pat comes to his new position from the Industry Hills Golf Course in City of Industry, California, where he was golf course superintendent of the Eisenhower Course for more than three years. Prior to his work at Industry Hills, Pat was superintendent at Shandin Hills Golf Course in San Bernardino, California, and assistant superintendent at Hacienda Golf Club in La Habra Heights, California. Coincidentally, Pat began his post-college golf course experience as a sectionman at Industry Hills Golf Course, returning 3½ years later as the superintendent.



Patrick J. Gross

Pat received his Bachelor of Science degree from California State Polytechnic University, majoring in ornamental horticulture, with a specialization in turfgrass science. The Green Section is pleased to welcome Patrick Gross to its staff.

Correction

Once each year we sneak an "intentional" mistake into an issue of the GREEN SECTION RECORD to see how many of you are paying attention. We are pleased that so many of our readers caught our annual mistake, which appeared in the November/December 1991 issue. We were impressed, too, that so many of you are so expert in geography. Yes, the beautiful Skyland Resort golf course is located in Crested Butte, *Colorado*, not in Montana.

Let's see how many of you catch that single mistake among all our 1992 issues!

ALL THINGS CONSIDERED

Is the Grass Always Greener on the Other Side?

by JOHN H. FOY, Director, State of Florida Region, USGA Green Section

COMPARISONS between golf courses will always be made. I have lost count of the number of times I have been on a TAS visit and someone has commented about Speedy Greens Country Club being in better condition than their course. If golfers had a better understanding of the factors that affect course conditioning, they would realize that the grass is not always greener on the other side.

One of the most common comparisons made is to the professional tournament courses seen on television almost every weekend. Golfers want to know why their greens are not as fast, why their fairways are not as lush, or why their course lacks the fairway/rough definition that occurs with a six-inch rough mowing height. In the May/June 1991 issue of the GREEN SECTION RECORD, Tim Moraghan's opinion article presents an excellent statement of the unrealistic picture televised golf tournaments paint compared to the real world.

In Florida, a very common comparison made by golfers is with golf courses in the North. In the fall, southward migration begins and we are bombarded with comments about how much better things are up North. Granted, bentgrass greens provide the best championship playing surface, but for general play, non-overseeded Tifdwarf or bentgrass/*Poa trivialis* overseeded bermudagrass greens are more than adequate. Just because Florida courses are not exactly like northern golf courses does not make them inferior facilities. Having had the opportunity to visit golf courses from Maine to California, there is no doubt in my mind that there are as many superior conditioned courses in Florida as any other part of the country.

Another comparison often made is to a local golf course that recently has been played. It seems that the other course is in much better condition than their home course. When a golfer goes to a course he does not play regularly, his head is up and he sees only the "big picture." When he gets back to his home course, because he has already seen the "sights," his head drops down and the flaws, such as an occasional weed or an area of thin turf on a green, really stick out. Usually when I hear these comparisons, I am often familiar with the other course and know that all is not as perfect as it is made out to be.

Golfers need to understand that Florida is not an easy place to maintain top-quality course conditions. Sure, we get plenty of sunshine and lots of rain, but the long, hot and humid summer also results in the proliferation of every major pest problem known to man. Furthermore, the primary season of play occurs when the bermudagrass is in a greatly reduced, or even dormant, state of growth. Consider the problems associated with not being able to recover from traffic and damage for two to four months, or the complications of managing an overseeded, cool-season turfgrass part of the time and a warm-season bermudagrass base the majority of the year.

Golfers will continue to compare one course to another, but it needs to be continually stressed that circumstances at every golf course are unique, and it is difficult, if not impossible, to make an "apples to apples" comparison. All too often, golfers overlook such factors as local environmental conditions, turf composition, play load, age of the course, special preparation efforts, and most important of all, the available operating resources. The vast majority of golf course superintendents consider the condition of their course a very personal issue. When unfair comparisons are made, it hurts. Only through education of the golfing public will it be possible to break the "grass is greener on the other side" train of thought.

USGA Green Section Educational Conference

in conjunction with the 63rd

GCSAA International Conference and Show

New Orleans, Louisiana — Monday, February 17, 1992

PRACTICAL SOLUTIONS FOR TODAY'S PROBLEMS

8:00 a.m.	**Welcoming Remarks** Raymond B. Anderson, Chairman, Green Section Committee, and Member, USGA Executive Committee
8:15	**The Best Turf Tips from the Green Section Staff** Jim Latham, Director, Great Lakes Region Jim Connolly, Agronomist, Northeastern Region Chuck Gast, Agronomist, State of Florida Region
8:30	**USGA/GCSAA Research Results You Can Use** Dr. Michael Kenna, Director, Green Section Research
8:55	**Turf Tips — More of the Best** Larry Gilhuly, Director, Western Region Jim Skorulski, Agronomist, Northeastern Region Pat O'Brien, Director, Southeastern Region
9:10	**Course Maintenance with Wildlife in Mind** David Stone, Golf Course Superintendent, The Honors Course, Ooltewah, Tennessee
9:35	**Turf Tips — Even More of the Best** Dave Oatis, Director, Northeastern Region Bob Brame, Agronomist, Mid-Atlantic Region George Manuel, Agronomist, Mid-Continent Region
9:50	**Issues in Golf in the 1990s** Stuart F. Bloch, President, United States Golf Association
10:15	**Turf Tips — The Best Keep Coming** Nancy Sadlon, Environmental Specialist Jim Moore, Director, Mid-Continent Region Paul Vermeulen, Agronomist, Western Region
10:30	**News and Views on USGA Green Specifications** Dr. Norman Hummel, Associate Professor, Cornell University
10:55	**Standards and Practices for a Fragile Environment** Stephen J. Cadenelli, CGCS, President, Golf Course Superintendents Association of America
11:20	**Turf Tips — Last, But Not Least, of the Best** John Foy, Director, State of Florida Region Tim Moraghan, Agronomist for Championships Stan Zontek, Director, Mid-Atlantic Region Bob Vavrek, Agronomist, Great Lakes Region
11:40	**Closing Remarks** Mr. Anderson

TURF TWISTERS

DURING THE SPRING TRANSITION

Question: In late winter and early spring it is almost impossible to identify how much bermudagrass is alive beneath the ryegrass overseeding. Is there an easy way to eliminate the uncertainty of whether or not the bermudagrass has survived the winter prior to spring transition? (Louisiana)

Answer: The following tips should prove helpful. First, do not overseed the entire area of every green. A 4′ × 4′ sheet of plywood can be laid over a seldom used portion of the green during the overseeding process. This will create a "window" to view the status of the bermudagrass as the spring progresses.

Another approach is to remove plugs from your greens every three to four weeks throughout the winter. These plugs should be placed in either a greenhouse or a warm, sunny window to force the bermudagrass to break dormancy. This will help you monitor the viability of the dormant bermudagrass throughout the winter.

GEOTEXTILE COVERS

Question: Our club has begun using geotextile covers on two perennially weak greens. Currently, the greens are lush and free of disease. Is there anything we should do prior to removing the covers to assure continued success? (New Jersey)

Answer: As with any "good thing," too much can be a problem. Keep an eye on what is happening under the cover. Elevated heat and humidity levels under the cover create a good environment for disease activity which normally would not occur.

In addition, it is critical to avoid a severe frost on newly uncovered greens during late winter and early spring. Cold temperatures can set back the turf considerably, negating some of the positive effects of the covers. Therefore, once the covers are removed in early spring, keep them available should the threat of severe frost arise. The mowing height should be raised for the initial cuttings to avoid scalping, and a contact fungicide should be applied to extend protection against cool-season diseases.

NEED REGULAR MONITORING

Question: I'm having a difficult time maintaining an effective equipment replacement program. With a continually rotating board of directors, my equipment requests tend to be tabled regularly "until the next set of directors is elected." What can I do to convince the Board that these equipment needs will not go away? (Florida)

Answer: Develop and graph a five- or ten-year "high-use equipment" replacement program that can be referred to annually. Within this program include the date of purchase of existing equipment, original cost, life expectancy, estimated replacement cost, and the year to be replaced. Delays in annual equipment purchases can then be shifted to the following year and not be forgotten, thereby illustrating the cumulative effect of delaying annual capital improvements. As directors change, the equipment replacement program will be well defined.