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Cover Photo:
Kentucky bluegrass fairways are still in the picture at the Chicago Golf Club and hundreds of other courses.

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Cosmetic striping by lightweight mowers has been a strong point for bentgrass, but it also does wonders for improved bluegrasses. This fairway was mowed at a bench setting of 5/8 inch. Briar Ridge C. C., Shererville, Indiana.

A Case for Bluegrass Fairways

by JAMES M. LATHAM
Director, Great Lakes Region, USGA Green Section

THE LAST U.S. Open Championship played on Kentucky bluegrass fairways was in 1955 at Green Gables Country Club in Denver, Colorado. While many golfers aspire to greatness, few reach the degree of skill required for that or any other championships played at scratch. Many golfers couldn't care less, preferring a more leisurely, recreational game involving minimal practice. This doesn't mean they don't care how they strike the ball, only that they have neither the will nor the skill to perfect their game. Why, then, must such a high population of northern golfers be subjected to the trials and tribulations of closely mown bentgrass fairways when we now have the means to produce beautiful, dense turf capable of being mown at a more comfortable playing height?

Kentucky bluegrass was, in the not too distant past, the principal turfgrass species used for golf course fairways in the northern United States and Canada. In recent years, however, it has been replaced at many locations by bentgrass or perennial ryegrass in an effort to produce more closely mown championship conditions desired by low-handicap golfers. Some folks, though, just can't cope with firm half-inch playing surfaces any better than they can cope with firm, fast championship greens. But no one, it seems, wants a *non*-championship course.

Bluegrasses have gotten a bum rap during this Age of Champions due to the poor performance of the common types used in years gone by, the survivors of an era without irrigation when the turf could become dormant during hot, dry summers and resume active growth in the fall, then repeat the dormancy routine in the winter. They were, like common bermuda, pasture types cut down for golf and lawn use. They were the workhorses, though, receiving little more care than mowing, a little fertilizer and perhaps some type of rudimentary irrigation to

This Poa annua *infestation of a bluegrass-perennial ryegrass fairway in Minnesota illustrates the need for control measures to suppress colonization.*

stave off summer dormancy, and with no pest control other than weed killer. It is no wonder that those fairways cannot compete with the dense swards of close-cut, coddled bentgrass and ryegrass seen today.

As a species, *Poa pratensis* is a winter-hardy, sod-forming perennial. It has a wide range of color from deep blue-green to apple green, the former being preferred by Americans. The shade of green is less a factor in large-scale plantings than in side-by-side plot comparisons, however. Its principal drawback for golf turf is its inability to sustain sod density under close mowing.

The demise of bluegrass fairways began when golfers began to complain about "cuppy lies." These were thin spots or small depressions (not divots) in otherwise uniform turf mowed at an inch or higher. Rather than work at improving the sod density, it was more expeditious to simply lower the height of cut to that in the depressions. This resulted in a loss of sod density and, with irrigation, opened the door for weed invasion, especially *Poa annua* and crabgrass. The irrigation pattern is still visible on some fairways — fairly good turf on the edges but *Poa annua* down the middle.

Today, the options available for northern fairway species are fairly well limited by the desired height of cut. Bentgrass for ⅝-inch cut or below, perennial ryegrass for ⅝- to ¾-inch cut, and bluegrass above that — if the new cultivars can take it. Perhaps a combination of bluegrass and ryegrass is appropriate. Bentgrass is, of course, the preference of champions and would-be champions — the strikers of the ball. Non-champions and never-will-be-champions — the sweepers of the ball — prefer a higher cut where they find more margin for error. These are the folks who get no joy at all from playing croquet over a closely mown fairway.

P. J. Boatwright, former director of USGA championships, once said that championship golf requires firm, tight fairways from which to hit well-controlled shots to firm, fast greens. Bentgrass fulfills those requirements and presents a delightfully cosmetic appearance. It is winter hardy and can be grown in a wide climatic range, extending into the old crabgrass belt if grown under a high level of maintenance. That includes a well-distributed water supply, adequate drainage, reasonable disease prevention, lightweight mowing (clipping collection preferred), minimum vehicular traffic, and aggressive thatch management.

Perennial ryegrass was assumed to be an alternative species that would provide acceptable playing conditions for most golfers, since it can form beautiful, firm turf that can withstand a height of cut from about ⅝- to ¾-inch or above. When it is good, it is very good, but it has major problems in some areas. It is a bunch grass (non-spreading) and is subject to winterkill in areas where snowfalls may alternate with thaw-and-freeze cycles, which can kill or severely damage the crowns of the individual plants. Since the crown of a bunch grass is the area from which all above- and below-ground growth originates, turf loss is inevitable. Winterkill usually occurs in low areas or surface depressions where free water collects around the crown. When the water freezes, ice crystals formed within the crown tissue rupture cell walls to kill that part of the plant. Two Milwaukee area clubs lost almost all of their ryegrass fairway turf a few winters ago. (*Poa annua* has the same problem, so turf loss can be expected somewhere in the Great Lakes Region every winter.)

These episodes of winterkill are not due to lower temperature alone, because perennial ryegrass performs well in South Dakota, where winter precipitation is low. But in Minnesota, Iowa, Wisconsin, northern Illinois and Indiana, perennial ryegrasses are not very dependable on a long-term basis. That leaves golf operations with only two options — bentgrass or Kentucky bluegrass — as permanent fairway turf.

If new cultivars of bluegrass can withstand a ¾-inch height of cut, there is no reason for not using them on new or existing fairways. They have many positive attributes, including excellent sod density that supports the ball quite well. Their rhizomes, or spreading underground stems, provide good divot recovery. They respond to a high level of maintenance quite well (and may require it) — much better than old common types.

According to some authorities in the field, for a cultivar to withstand ¾-inch mowing it must be aggressive. This trait was evaluated in the 1985 National Turfgrass Evaluation Program in which the cultivars of major turf species were compared side by side. Those which rated an 8 or 9 can be considered most likely to tolerate a ¾-inch cut. In this evaluation, the 8s and 9s (9 is best) were A-34, Mystic, Princeton 104,

Sydsport, and Touchdown. Some which rated 7 cannot be ignored, however, because of other outstanding characteristics. There may be additional aggressive types that were not entered by the producers.

Selection should not be based on aggressiveness alone, because all cultivars have some weaknesses that may override this characteristic in some localities. The national program lists 42 test sites, so specific information on disease incidence, percentage of turf cover through the year, etc., is best obtained from data gathered where growing conditions are similar to those of a specific course. National averages are much less important than regional performance.

Seed blends, rather than monostands, have the best performance records in most turf plantings because they reduce the likelihood of a single disease, insect, or environmental stress wiping out the entire population. To go one step further, many seed people think that perennial ryegrass blends should be added to bluegrasses, partly as a nurse crop and partly as a companion grass in mature turf. The percentage of ryegrass should be fairly low to give the slower-growing bluegrasses an opportunity to develop. Ratios of bluegrass to ryegrass range from 70:30 to 80:20 to 85:15, although an extremely low ryegrass population may lead to a patchy or clumpy condition later on. The recommended seeding rate in new plantings generally is about 175 pounds per acre. Mixtures for interseeding existing fairways may have a higher percentage of perennial ryegrass, perhaps 50%. August is the preferred planting time, allowing adequate grow-in before winter.

The genetic color of each cultivar is important in seed mixtures, the goal being a uniform appearance. These data are presented in the National Test reports. It is also advisable to stay with aggressive types, because they can over-grow the more passive grasses under mowing stress. Unfortunately, all but two of the tests (at Lincoln, Nebraska, and Winnipeg, Manitoba) were maintained under a homeowner maintenance regime in which the height of cut was 1½ inches or more. This makes the extrapolation of some data to the level of golf course maintenance a bit risky.

The same cultivar selection process should be used for perennial ryegrasses. One important characteristic with this species is appearance after mowing. Some cultivars have extremely tough fibers in their leaves that leave a ragged, stringy surface even when mowed by sharp reels and bedknives.

Some authorities believe that the new bluegrass blends can be planted without a nurse crop of perennial ryegrass when adequately mulched and irrigated. Germination time is about two weeks, but the development of spreading growth is not too different from that of bentgrass — about five weeks or so after planting. Irrigation procedures are similar for all seedings, aimed at keeping the soil surface moist until root development is well underway. The Dr. Pepper watering schedule fits well. It calls for a daytime drink at 10:00 a.m., 2:00 p.m., and 4:00 p.m. If the soil profile is moist initially, there is no real need for night watering, except in areas where the wind blows all the time.

Mowing operations on bluegrass-ryegrass mixtures should begin early on at a fairly low cut, as reported by Drs. Brede and Duich (*Agron. J.* 1984. 76(5): 711-714). This apparently enables more direct sunlight to penetrate the canopy of the fast-growing ryegrass to help the bluegrass along. They found no advantage to this practice in monostands of either species.

The key to producing high-quality playing surfaces is the level of maintenance they receive. John Price, a former golf course superintendent at Southern Hills Country Club in Tulsa, Oklahoma, once said, after being asked how he kept such excellent common bermudagrass fairways, that he *voluntarily* gave them the same degree of intense maintenance as that *required* by the hybrids. Few superintendents have been able to follow this philosophy with the bluegrasses. Some have, and their golfing clientele enjoys the results.

When bentgrass became the "in" species at private clubs and some public courses, the first recommendation was to reduce fairway acres to cut operational cost. Lightweight mowers require more manpower than 7-, 9-, or 11-gang setups; large-scale fungicide applications were anticipated, and most centerline irrigation systems could not adequately cover the existing fairway widths uniformly. It helped. Acreages are now well below 30 at many courses, but that has created a demand for better quality intermediate and primary roughs. The individual mowing units are narrow, so they fit the vertical contours in the terrain quite well. The results are attractive, striped

A half-inch bentgrass fairway does not eliminate bad lies. This imbedded ball (new) was found in an otherwise excellent fairway — apparently given up for lost.

bentgrass surfaces fit for a champion — but not necessarily enjoyable by a sweeper.

The same quality is being produced with perennial ryegrass *and* with Kentucky bluegrass if you look in the right places: Eagle Ridge in the Galena, Illinois, area and Wedgewood Valley near the Twin Cities, to name a couple. These courses, and many farther west where disease pressure is low, have good sod density year after year while keeping mowing heights under an inch.

The height of cut, incidentally, is a relative number, since it is set using the absolute, measured distance between the bottom of the rollers or skids and the cutting edge of the bedknife. The actual mowing height depends on the consistency of the turf surface and the amount of support it gives, relative to the weight of the cutting units. The lightweight triplexes and five-plexes "float" over the surfaces, but the heavy old gangs really dig in. The "float" of the lightweights over dense bluegrass should help sustain leafiness on the surface by not gouging into the stemmy area below.

Soils on which high-quality bluegrass is to be grown should be near neutral, pH 6.5 - 7.5, and well supplied with phosphorus and potash. Recommendations for achieving these levels can be made by state or commercial soil testing laboratories experienced in the fertility needs of turfgrasses.

Bluegrass does not perform well in saline or alkaline conditions, so electrical conductivity and sodium absorption ratios should be checked in areas where these conditions may exist. Attempts to correct saline/alkali problems are seldom feasible unless the soil has adequate internal drainage. In some areas iron deficiency can cause chlorosis in bluegrass turf due to high pH and perhaps high phosphorus levels. This can be overcome with spray applications of ferrous sulfate or chelate or with an application of conventional fertilizer to which an iron source has been added.

Bluegrass fairways mowed well over an inch with mid-weight mowers look good but lack adequate ball support.

Nitrogen requirements for high-class bluegrass are 3 or 4 pounds per 1,000 square feet, with one application being a temperature-dependent slow-release material in the late fall/early winter, when the grass is dormant or nearly so. Soluble sources are not recommended for dormant applications because of runoff risks and the possibility of stimulating excess growth during wintertime thaw periods. This late fall application provides for the needs of early spring growth without having to run heavy equipment over the soft soil. An easily remembered schedule is the Holiday Routine — Memorial Day, Labor Day, and Thanksgiving Day. Lighter, more frequent applications are, of course, preferable or at least equally desirable.

Mowing height and frequencies have been studied from coast to coast, but it is difficult to determine the appropriate procedure due to climatic, varietal, and cultural differences. The main consideration is to mow when no more than one-third of the leaf tissue is removed. This equates to from three to even five operations per week, depending on height of cut, fertility level, and other factors. Continual close, frequent mowing does reduce potential root development, especially in older cultivars and even Merion, which could tolerate some degree of close mowing.

Reduced root depth and vigor will affect irrigation requirements. Overwatering is undesirable since high moisture levels at the surface aid and abet the invasion of *Poa annua*, bent, and other weeds. It may be difficult to follow the old regime of heavy and infrequent watering today because of demands for day-to-day playing consistency, but it is still an admirable ideal.

Susceptibility of all fairway turf to disease or insect damage is a major consideration because of the area involved and the cost of plant protectants. This is a sizeable budget factor where *Poa annua*, perennial ryegrass, or bentgrass is predominant.

Bluegrasses are not pest free. Rusts, smut, *Fusarium* blight, as well as other common diseases may become problems, but they are treatable, just like those infecting other species.

The most persistent problem in bluegrass fairways is the invasion of bentgrass, even though *Poa annua* is a formidable competitor. Both can make headway when sod density is reduced, but there are more opportunities to suppress *Poa annua* than bent. The difficulty with bentgrass control is its general characterization as a desirable species, rather than as a weed, so its selective elimination from bluegrass turf has not been adequately researched. The most obvious control method is the use of an eradicant such as glyphosate as a spot treatment. Regrassing

existing fairways to bluegrass can follow the same procedures as used for bentgrass. *Poa annua* is the most likely invader here, but the use of ethofumesate is limited to specific cultivars. Among them, however, are several of the desirably aggressive cultivars listed earlier. Nevertheless, *Poa annua* control procedures should be approached with care to avoid injury to its cousin. Plant growth regulators may help the suppression of *Poa annua*, but we know little about their selectivity in *Poa pratensis* cultivars. Their use at this time should be approached with a great deal of caution.

Bent fairway turf without high-intensity aeration equipment is unthinkable in most cases, but circa-1950 rolling stock is still used on bluegrass. Here again, ryegrass gets a better deal because it should be interseeded every year, often broadcast over freshly aerated surfaces where a great deal of soil is brought to the surface to act as a sort of topdressing. Aggressive bluegrass growth will produce thatch, and most thatch management programs are based on intensive aeration. Microorganisms in the soil slowly decompose the accumulation of plant debris while the soil adds some degree of firmness to the surface. The holes in the soil offer an entryway for water and air penetration into the root zone and easy growing for new roots formed around the perimeter of the hole. The more deep holes the better, for growth above as well as below the soil line.

Worth mentioning here are earthworms, since their casts are visible and distressing at low mowing heights. They can be a major problem in closely mown perennial ryegrass, because it lacks the ability to grow over these little mounds like bentgrass. Worm casts are seldom a problem when the turf is mown at ¾-inch or higher. They may be down there someplace, but out of sight, out of mind. Earthworms are valuable creatures in thatch reduction and general soil health, and they deserve some degree of praise rather than condemnation.

Kentucky bluegrass fairways still have a place in American golf. They are quite applicable to the game played by weekenders, vacationers, and those who just enjoy a round of golf in the great outdoors. If sod density can be kept high, the sweepers will enjoy the extra margin for error provided by a ¾- to $^{15}/_{16}$-inch cut (under an inch!). Adequate aeration and core breakup can minimize thatch buildup and add firmness to the playing surface for would-be strikers. Overall operating costs can be lower than bentgrass or perennial ryegrass, since disease and insect pressures are generally lower, flaws are less visible, and reseeding is not a daily (divot repair) or annual (ryegrass) affair. Like any other facet of golf course maintenance, however, you get what you are willing to pay for, and you can't get champagne out of a beer keg.

Many years of turning heavy tractors and gang-mowers on the approach to the green created severe compaction in this dense soil. The approaches to greens are often double irrigated, from both the green and fairway programs. The Poa annua *which overran the bluegrass just couldn't withstand disease and environmental extremes.*

'So You Want to Rebuild Your Greens': A Step-By-Step Survival Guide

by J. MICHAEL VERON
Member, USGA Sectional Affairs Committee

THE PUTTING GREENS of golf courses built many years ago were appropriately called "push-up greens" because they were nothing more than native soil pushed around and shaped into whatever configuration was desired. Not surprisingly, this method of construction produced a wide variance in quality. As the game advanced, it became clear that the old method of construction could not produce the consistent quality, smoother and faster putting greens that were being demanded.

As a consequence, the USGA Green Section conducted scientific research to determine how optimum putting greens could be constructed. In 1960, that research culminated in the publication of the Green Section's *Specifications for a Method of Putting Green Construction*. These specifications have proven over the years to be so successful that many new golf courses follow them religiously, or at least they should.

When the USGA introduced the Stimpmeter in the mid-1970s, the average "speed" throughout the country was 6' 6". With today's technologies and golf course maintenance expertise, even average courses can produce green speeds of 9', 10', or more for special events. During the intervening years, it became increasingly clear that well-built greens were easier to maintain in top form.

During the same period of time, older clubs with greens constructed by inferior methods were finding that the game was leaving them behind. As a consequence, many of them undertook to rebuild their greens to conform to USGA specifications and thereby make them competitive with newer courses. Today it takes some looking to find a prestigious older club that has not rebuilt its greens, at least in some parts of the country.

While rebuilding old push-up greens can be both necessary and desirable, it is also (unfortunately) expensive. Current estimates for the cost of construction run about $5 to $6 per square foot or more. Assuming that the average putting green is approximately 6,000 square feet, this equates to $30,000 to $36,000 per green, or $570,000 to $684,000 for 18 greens plus the practice putting green. It is essential, therefore, that any greens reconstruction project be undertaken with care. What follows is a step-by-step survival guide to assist any club considering such a project.

1. Make certain that rebuilding your greens will solve your problem. If your club or course does not subscribe to an annual Turf Advisory Service visit by a Green Section agronomist, it should do so. A Green Section agronomist can provide you with an unbiased expert opinion about the conditions of your putting greens and whether reconstruction is the only method to alleviate your complaints, or if other less costly techniques should be tried first. Many Green Section agronomists have witnessed the reconstruction of greens at various clubs throughout their region, have learned the pitfalls, and can share the benefit of that experience.

2. Hire a competent golf course architect. You should first prepare a short list of candidates for the job. There are many sources from which you can obtain information about available architects. *The Golf Course*, a book written by Geoffrey Cornish and Ron Whitten and first published in 1981, contains a directory of golf course architects throughout the United States, with a listing of all courses on which they have worked. The American Society of Golf Course Architects (ASGCA), which was formed in 1947, publishes a roster of its members. The National Golf Foundation (NGF) also publishes a list of golf course architects, including many who are not members of the ASGCA. In addition, you may be aware of other courses in your region that have been constructed or rebuilt recently. The professional, superintendent, or green chairman at each of these facilities can provide you with the names of architects who were responsible for those projects.

You should interview each architect on your short list. At the outset, it is important to inquire about professional fees (they might range from $100,000 or less for an unknown to $500,000 or more for a world-famous celebrity), his experience in reconstructing greens on existing courses, his familiarity with turfgrasses used in your region, his knowledge of potential contractors, his design philosophy, and his ability to assist you in selling the project to your membership.

If possible, have each candidate tour your course. Listen to his comments about what he might do to improve it. Is he sensitive to the character of the course, or does he simply want to impose his own *look*? For example, if your course is relatively flat, does he propose dramatically mounded greens that will appear artificial and out of place? If your course is short but compensates for lack of distance with tight fairways and small greens that require accurate shotmaking, does he recommend large greens that would compromise those values? Finally, ask the architect about his recent work, and call his clients. It is important to know whether they are satisfied.

After making your final selection, reduce your agreement with the architect to writing and, at a minimum, set out with specificity his fee, the number of visits he will make to the site during construction, and whatever other responsibilities you ask him to assume. In short, spell out what you expect of him.

3. Sell the project to your membership. You should work hand-in-hand with your architect during this process. It is vital that the architect have marketing and political skills, as every club has its share of members who are likely to be negative about the project. Usually, these are older members who, as the saying goes, don't even buy green bananas anymore. They become upset at the prospect of shutting the course down for the six months or so that is required for reconstruction.

Most good architects can present a slide show to the membership with dramatic pictures of their work and drawings or renderings of the proposed new greens. This will enable the membership to visualize the results of the project.

Greens reconstruction can be time-consuming and expensive, but if done properly can provide decades of good turf and cost-effective maintenance.

If your club is member-owned, it is possible that a greens reconstruction project cannot be undertaken without the approval of the membership. The experience of most clubs indicates that any vote on greens reconstruction will be a close one. In fact, many proposals are defeated when first submitted for a vote. However, the deliberations that lead to the unsuccessful result often provide constructive criticism that, if heeded, can result in a better project that is approved when it is resubmitted.

Selling the project is an educational process. Members first must be shown why new greens are needed. In addition to presentations by the architect, it often is helpful to have representatives of other clubs that have undergone reconstruction speak to the members. Moreover, the Green Section agronomist in your region, who is familiar with your course and with greens reconstruction, can also be an effective speaker and advocate for the project.

After the members are persuaded that new greens are needed, they must be convinced that the proposed method of funding the project is fair. Ultimately, most clubs have found that a straightforward assessment is the most equitable way to fund the greens reconstruction.

A project that is shown to be agronomically and architecturally desirable and responsibly funded will meet little, if any, legitimate criticism. There will, of course, be the usual "parade of horribles" by doomsayers who predict a drastic loss of membership if the project is pursued. However, clubs that have rebuilt their greens have consistently experienced increases in membership following completion of the project. The doomsayers then are nowhere to be found; everyone then claims to have been for the project "all along." As the saying goes, success has a thousand fathers.

4. Let bids to contractors. Once the project is approved, your architect will prepare an invitation to bid. A good architect will include in the bid invitation a set of detailed plans and specifications. These are critical because they define the project and the scope of work. Any work not included in the plans and specifications likely will cost extra.

A sample contract with the contractor should be included with the bid specifications. A form of such a contract can be obtained by contacting the USGA Green Section (908-234-2300) or your regional Green Section office. This form was used, for example, by the Lake Charles Country Club of Lake Charles, Louisiana, in its recent greens reconstruction project. It is drafted with the object of protecting the club. The

invitation to bid should make it clear that submission of a bid constitutes an agreement to be bound by the terms of the contract if the bid is selected.

Your architect should assist you in investigating and selecting the contractors you invite to bid on the project. As you did with the architects on your short list, you should investigate previous jobs undertaken by any contractor you consider.

5. Select the lowest responsible bid. It is important to understand that the lowest bid is not necessarily the lowest *responsible* bid. As a condition of the bid, each contractor should be prepared to furnish a surety bond that guarantees both the contractor's faithful performance of the contract and its prompt payment for all labor and materials. This will assure that the club's liability for the project is limited to the price set in the contract.

If the contractor walks off the job for any reason or fails to pay a subcontractor or materials supplier, the club is responsible only up to the amount set in the contract. Any additional sums needed to hire a new contractor to finish the job or to pay for labor or materials become the responsibility of the surety.

6. Sign a contract with the contractor. No project this size should be undertaken on a handshake. Without a written contract that limits the club's liability and spells out the contractor's responsibility, the club is at the mercy of the contractor and is usually responsible for contingencies beyond its control that can dramatically affect the cost of the project.

The sample contract mentioned previously is designed to protect the club from these contingencies. It should be understood, however, that the sample contract is a suggested form and is not to be followed blindly. There is no substitute for consulting with an attorney to determine if all of its terms are best suited for you or are enforceable in your jurisdiction.

There is not much worse than rebuilding your greens and then finding out that it was done incorrectly. There are examples of clubs that have had to rebuild their greens several times in a 10- to 15-year period. By following through with the steps outlined in this article, you will be on your way to ensuring the best possible greens for the long-term enjoyment of the golfers at your club.

The author is a past president of the Lake Charles Country Club, Lake Charles, Louisiana, and is associated with the law firm of Scofield, Gerard, Veron, Hoskins & Soileau, Lake Charles, Louisiana.

Be sure you need to rebuild and that rebuilding will actually solve your problem. Sometimes deep-tine aerification or some other practice can overcome the problem.

WASH RACK BLUES

by LARRY W. GILHULY
Director, Western Region,
USGA Green Section

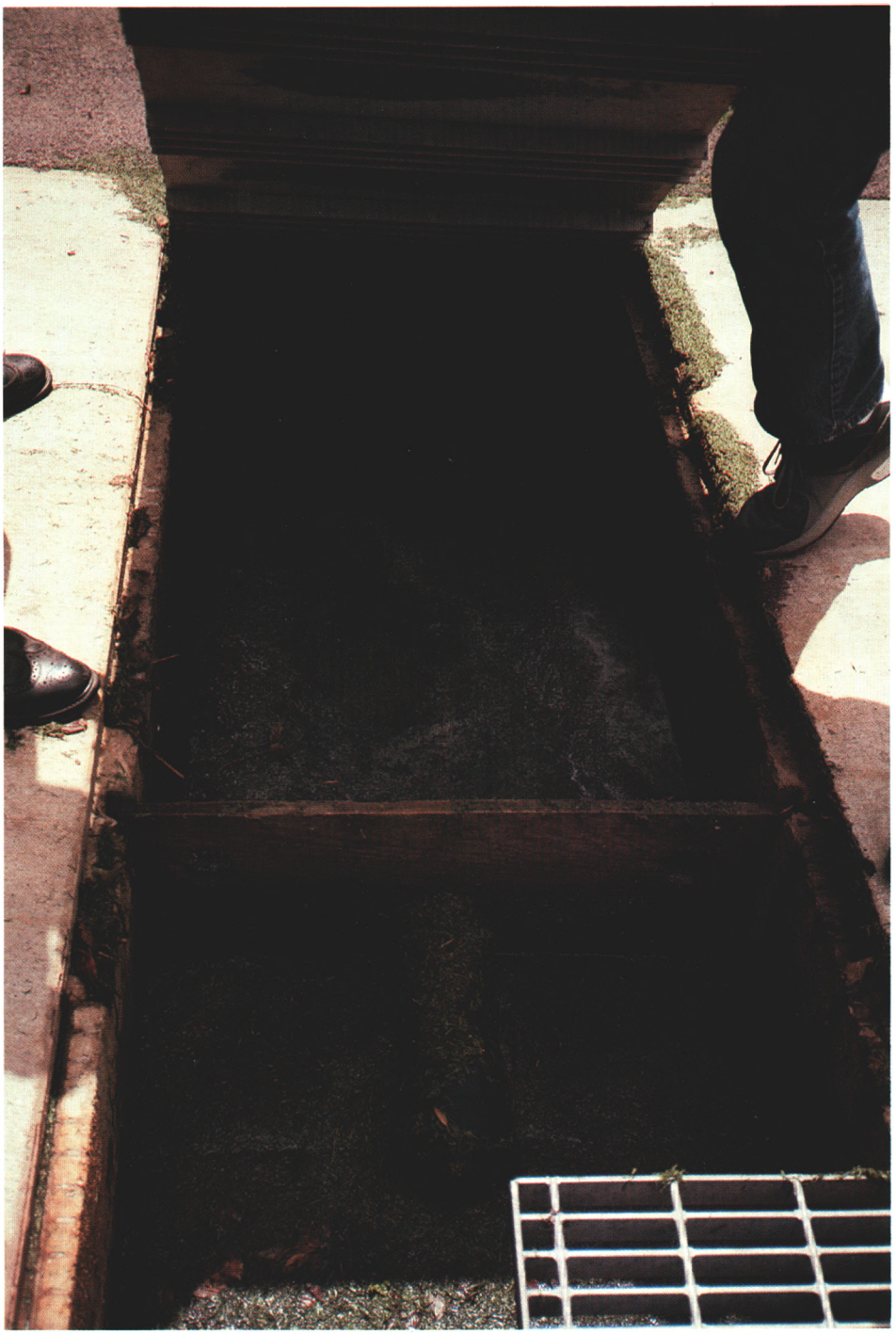
DRIP, DRIP, DRIP. You have heard it thousands of times, at thousands of locations. With the possible exception of the air we breathe, no other compound in the world is more necessary or valuable than water. Its components provide the very lifeblood to virtually all living creatures. To golf courses, it is the single most important part of a successful operation. It also represents the greatest hazard!

The greatest what? How can such an important aspect of a golf course be a hazard? It can if you are not paying attention to a potential time bomb of environmental concern — the wash rack area.

The Problem

During the past several years, the USGA has committed considerable funding to answer questions concerning golf courses and the environment. Do the pesticides we use pose a real threat? Are nitrates from golf courses entering potable water sources and causing problems? While answers will be derived from this fundamental research, the *one* area that has received far less attention is the maintenance facility. More specifically, the area where mowers are cleaned and sprayers are washed represents one of the greatest potentials for nutrient and chemical escape into nearby streams or water sources.

For a moment, consider the conditions of the wash area. Rarely is there turf to capture fertilizer washed from spreaders. There is no thatch to immobilize residues from sprayers. Often there is nothing to catch the clippings washed from mowers. In short, if you currently have a wash area that allows water to flow freely into a waterway or simply "disappear" into the soil, you are facing a potential problem. With this situation in mind, consider the following types of wash areas.



At the very least, try to capture all of your clippings.

Lost and Forgotten

Unfortunately, this type of wash area is among the most common. They usually are characterized by the lack of a permanent surface, with water and residues entering a stream, forest, lake, or the soil. These wash areas must not be forgotten. They must be eliminated and lost! For those who possess this type of wash area, steps should be taken to improve the situation. These could include:

• Establishing multiple on-course wash sites. Nearly every golf course has several areas that can withstand the washing of mowers and spreaders for approximately one week. These sites can be assigned on a rotational basis to minimize accumulation of clippings.

• Minimizing sprayer cleaning. The old practice of dumping the remains of a spray tank should long ago have gone the way of the dinosaur. Many golf courses now rinse their spray tanks with water and apply the diluted material back onto the best filter available — turfgrass. To expedite this operation, the use of a single, high-volume

nozzle can empty a 150-gallon sprayer in a matter of minutes. The tank then can be rinsed with a neutralizing agent at the wash area. Obviously, this does not apply to certain herbicides that can cause damage to the turf.

The Honey Pot

Ah, the sweet aroma of accumulated clippings that are cleaned from the wash area after one or two weeks of 90°F temperatures. The smell can best be described as *ripe*! This type of wash area usually has a permanent base of asphalt or concrete that directs all water, clippings, and residues to a catch basin. In some cases, they drain into a leach field, but often the end result is water movement into waterways or into the soil. Fortunately, various types of screens and baskets are used to capture clippings for disposal or composting.

This wash area is preferred to the previous type; however, it also is usually associated with chemical residues flowing with the water. Minimizing potential problems with this type of wash area includes establishing on-course cleaning sites and a spray tank cleaning program with rinsates sprayed on turfgrass areas.

The Newer Sewer

The previously mentioned wash racks comprise the great majority of those found on most golf courses. Both are inherently flawed due to their limited ability to capture various chemicals or nutrients derived from mowers, spreaders, sprayers, and petroleum products. Both can be significantly improved if there is access to a sewer or if a more refined method of filtration is added.

Some golf courses are linking into sewer outlets with simple, yet effective, filtering systems. This type of wash area is comprised of four important components.

1. A large concrete apron to collect all water, clippings, and residues from chemicals and petroleum products.
2. A catch basin or series of basins to capture all clippings. These are cleaned on a weekly basis.
3. An oil/water separator. The removal of petroleum products is another area that should be addressed. These can be easily installed and the filters replaced on a regular basis.
4. Access to a sewer. Even if a sewer is not available, careful cleaning of spray equipment, capturing clippings, and filtering petroleum products will minimize potential problems.

Lost and forgotten — you may be asking for trouble.

The Future

There is a very high probability your golf course has one of the previously mentioned types of wash racks or a variation. In one form or another, all have the potential to directly impact water resources. So what can be done to address this situation? Easy — don't let any of the water escape from the wash area.

As with other facets of the golf industry, manufacturers have heard the call of environmental awareness. Prefabricated units are becoming available that can capture all of the water for reuse. The advantages of these systems include:

- No movement of water from the site.
- Complete capture of all petroleum products by an oil/water separator.
- Complete capture of other fertilizer residues and chemicals.
- Reduction of water use.
- Improved cleaning by the use of a pressure washer.
- Improved efficiency for the mechanic, chemical applicators, and mower operators.
- A reduction of unpleasant odors.
- Total spill containment by combining a pesticide storage building and petroleum waste building. This represents the ultimate in minimizing or completely eliminating the escape of chemical residues from the maintenance facility.

What does the future hold for wash areas? Don't be surprised if this becomes the next area of regulation. To avoid a situation of being forced to comply, consider the following steps now:

1. Educate those responsible for funding.
2. At the very least, install a wash pad with a catch basin or series of basins to collect clippings.
3. Use areas on the golf course to maximize turfgrasses as an effective filter.
4. If possible, install various filters to minimize the outflow of petroleum products and pesticides.
5. Seriously consider a self-contained system to greatly reduce the potential for a problem.

It is true that water can be hazardous, but you can control what happens at one of the worst outflow areas on the golf course. Don't you be caught singing the "Wash Rack Blues."

RESEARCH UPDATE: Potential for Natural Zeolite Uses on Golf Courses

by A. MARTIN PETROVIC
Associate Professor of Turfgrass Science, Cornell University, Ithaca, New York

THERE ARE MANY IMPORTANT characteristics of a desirable turfgrass root zone material, namely: minimum compaction tendency, good water infiltration and percolation rates, adequate aeration for deep rooting, high cation exchange capacity (CEC), and adequate moisture retention. However, due to the heavy traffic that putting greens and tees receive, sand is the major mix component. If properly chosen, it provides for good drainage, resistance to compaction, and good aeration. By itself, though, it generally lacks adequate cation exchange capacity and water-holding capacity, and it allows excessive percolation rates.

Typically, sands are amended with some form of organic matter to create a root zone mix, and peat is the most widely used organic amendment. In some situations, locally available organic matter sources are used. Rice hulls, sewage sludge, and lumber waste materials are all possibilities. The advantages of amending sand with organics include increased water retention, increased nutrient retention (cations), and some pesticide binding (reduced pesticide leaching). On the down side, organic amendments decompose with time and are of limited effectiveness in retaining nitrate from leaching. Though not routinely used, some inorganic amendments, including fired clay, colloidal phosphate, sintered fly ash, vermiculite, perlite, and calcined clay have received some attention. Inorganic amendments can increase moisture retention to a limited degree, but generally do not improve nutrient retention. Some break down over time as a result of weathering or traffic. Thus, there is a need for an amendment that will increase water-holding capacity and nutrient (especially nitrogen) and pesticide retention while still remaining stable over time. A natural zeolite like clinoptilolite may be such an amendment.

Zeolites are alumino-silicate minerals first discovered in 1756 by Swedish mineralogist Baron Axel F. Cronstedt, who named the porous mineral from the Greek words meaning "boiling stones." There are more than 40 natural zeolites, six of them in large deposits: anacline, chabazite, clinoptilolite, erionite, mordenite, and phillipsite. Clinoptilolite is of importance in agriculture because of its abundance and its chemical properties. Extensive deposits of clinoptilolite are found in the western United States, the former Soviet Union, Bulgaria, Hungary, Yugoslavia, and Japan. It has a crystalline structure with many minute internal pores that retain water and nutrients such as ammonium and potassium. It has a very high cation exchange capacity (from 100 to 230 cmol/kg). The pores are large enough to allow cations to pass in and out, but are too small for bacteria, especially bacteria that convert ammonium to nitrate. Water and nutrients held in the pores remain available. Thus, clinoptilolite amendment of sand acts as a mechanism for slowly releasing nutrients and water.

As seen in Figure 1, clinoptilolite is a rock that can be ground into sand-size particles. It can be mixed with sand, as shown in Figure 2, for the purpose of increasing both the efficiency of water uptake and nutrient utilization while reducing nitrate leaching.

Other Research Findings

Several other researchers have studied the effects of clinoptilolite on creeping bentgrass growth and establishment. Research conducted at Washington State University (Nus and Brauen, 1991) studied the effects of various amendments (sawdust, sphagnum peat, and a gravel-sized clinoptilolite) at several amendment volumes on the establishment of creeping bentgrass on sand-based putting greens. They added sawdust at 5%, 10%, and 20% by volume; peat at 20% to 33% by volume; and clinoptilolite at 33%

Figure 1. A piece of clinoptilolite zeolite before processing.

TABLE 1

Physical properties of clinoptilolite zeolite-amended sand (CZ-sand) and sand used in the greenhouse experiment

Property	CZ-sand*	Sand
Hydraulic conductivity, cm hr^{-1}	40.53	39.58
Total porosity, % (by v)	46.92	43.44
Water availability, % (between -0.003 and -0.1 MPa)	12.60	6.37
Aeration porosity, % (at -0.003 MPa)	34.11	36.53
Bulk density, g cm^{-3}	1.38	1.48
Particle density, g cm^{-3}	2.59	2.61

Particle size analysis	mm	% (w/w)	
Gravel	>2	0	0
Total sand:	2 ~ 0.05	97.3	98.0
Very coarse	2 ~ 1	2.9	0
Coarse	1 ~ 0.5	5.6	2.9
Medium	0.5 ~ 0.25	65.7	70.6
Fine	0.25 ~ 0.1	21.0	22.5
Very Fine	0.1 ~ 0.05	2.0	2.0
Silt	0.05 ~ 0.002	0.2	0
Clay	<0.002	2.5	2

*Sand amended with 10% CZ (w/w)

Miniature putting green profiles were used in the greenhouse to investigate using zeolite as a soil amendment and its effect on water use and nitrate leaching.

to 37% by volume to the unamended sand. For both peat and clinoptilolite, the establishment rate was greater as the amount of amendment increased. In this study, clinoptilolite was as effective as peat in improving the establishment of creeping bentgrass on sand-based putting greens. They also observed that clinoptilolite increased the moisture-holding capacity of the sand mixtures and had high CEC levels with particles less than 0.64 mm in diameter.

A similar establishment and growth study with creeping bentgrass was conducted at the University of Arizona (Ferguson et al., 1986). In this case, a sodium-enriched finer textured (< 1 mm) clinoptilolite was used. Establishment was slowed when a 10% clinoptilolite by volume mix was compared to the 5% mix. At about six months the sodium was leached out of the root zone and there was improved shoot and root growth and fertilizer nitrogen and phosphorus accumulation in the bentgrass clippings observed in both the 5% and 10% volumes of clinoptilolite-amended sand.

Current Research

The results reported here are from the Ph.D. dissertation of Dr. Arthur Huang, who recently completed his Ph.D. degree at Cornell University. The hypotheses tested in his research were: 1) zeolite would increase the fertilizer nitrogen retained on sand/zeolite putting greens, more of the fertilizer nitrogen would be available to the bentgrass plant and, therefore, there would be less nitrate leaching from the greens; 2) zeolite-amended sand putting greens would retain a greater amount of plant-available water than straight sand greens. A series of highly controlled laboratory and greenhouse studies were conducted to test these hypotheses. The physical and chemical properties of the clinoptilolite and sand used in these studies are shown in Table 1.

Nitrogen Studies

In laboratory studies it was found that the addition of clinoptilolite (5% or 10%, by weight) in a sand with a particle size range characterized by 97% of the particles between 1 mm and 0.05 mm in diameter, significantly increased the plant-available water (doubled) and increased the cation exchange capacity (from 0.08 cmol/kg of sand to 13 cmol/kg of the sand/clinoptilolite mixture), while still maintaining a high saturated water flow value comparable to the unamended sand.

Miniature putting green profiles were constructed, with the root zone media having 10% by weight of clinoptilolite, and sodded

with Pencross creeping bentgrass for the greenhouse studies. The green profiles were fertilized with ammonium sulfate as the nitrogen source at yearly rates of 2, 4, and 6 lbs. N/1,000 sq. ft. Unfertilized profiles were used as check treatments. Ammonium was selected as the nitrogen source because it is easily retained on the zeolite. The profiles were 1) properly watered and 2) watered to excess (to produce leachate) on a weekly basis. To track the applied fertilizer nitrogen in the putting green system, the profiles were mowed weeky at ¼-inch and the amount of fertilizer nitrogen retained in the clippings was determined. The weekly leachate samples were analyzed for concentrations of nitrate and ammonium.

As seen in Figure 3, the amount of fertilizer N that accumulated in the clippings varied with the N application rate and zeolite amendment. As the amount of N applied increased, the percentage of applied N that accumulated in the clippings decreased. For the sand profiles, the percentage of applied fertilizer N that was recovered in the clippings ranged from 62% to 70%. The addition of zeolite to the sand resulted in a greater amount of the fertilizer N ending up in the bentgrass clippings (75% to 93% of the applied N). This difference was most noticeable at the lower N application rate.

As seen in Figures 4 and 5, adding zeolite to sand also resulted in substantially less nitrate leaching. The concentration of nitrate in the leachate from the putting green profiles, as shown in Figure 5, reveals that in no case was the nitrate level in excess of the drinking water standard (10 mg/1) when the sand was amended with zeolite. However, water with much higher nitrate levels was noted leaching from the sand-only putting green profiles at all N application rates, especially at the highest N rate (6 lbs. N/1,000 sq. ft.). In this case, the leachate had nitrate concentrations in excess of drinking water standards at least one third of the time.

Water Use Studies

In the same greenhouse experiment described above, the amount of water used by the creeping bentgrass plants was determined three times per week by measuring the change in weight of the lysimeters. As seen in Figure 5, applying N to creeping bentgrass increased the shoot growth rate nearly ten times with little or no effect on the water use rate. Shoot growth was also increased by the addition of clinoptilolite to sand, without a substantial increase in the amount of water used by the plant. Thus, better shoot growth can be achieved in pure sand putting greens with the addition of clinoptilolite, and this can be accomplished with less water and less total N.

Summary and Concerns

Amending sand putting greens with a zeolite like clinoptilolite was shown, from these studies, to result in several important advantages. First, nitrate leaching from sand-based putting greens can be reduced. Second, the shoot growth rate and the amount of fertilizer N that ended up in the clippings was enhanced by the addition of clinoptilolite to sand. Third, the improved growth of

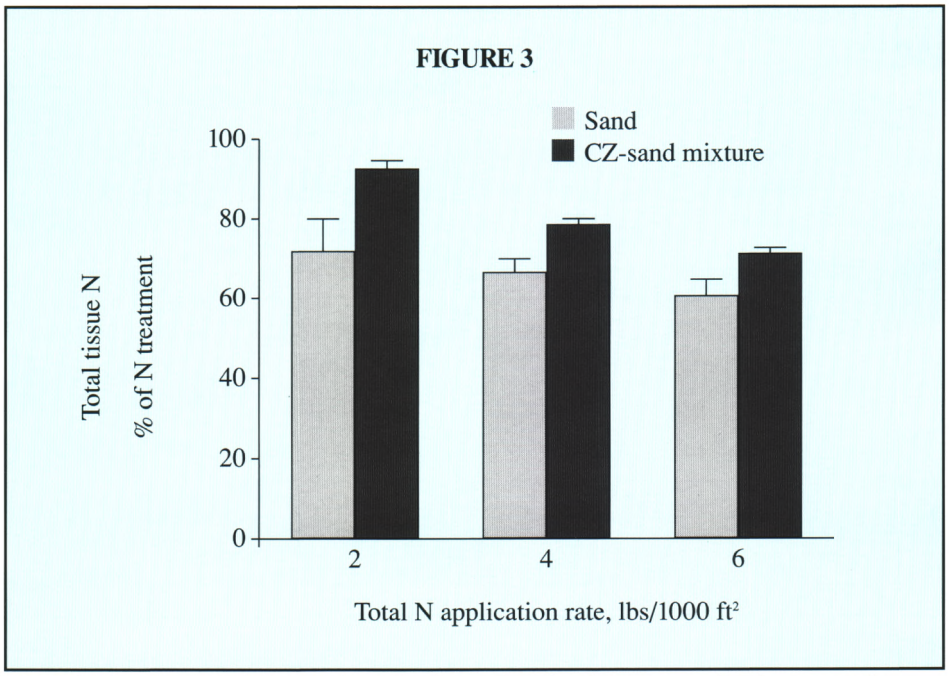


Figure 3. The influence of clinoptilolite amendment of sand and nitrogen application rate on the amount of nitrogen accumulate in the clippings of creeping bentgrass.

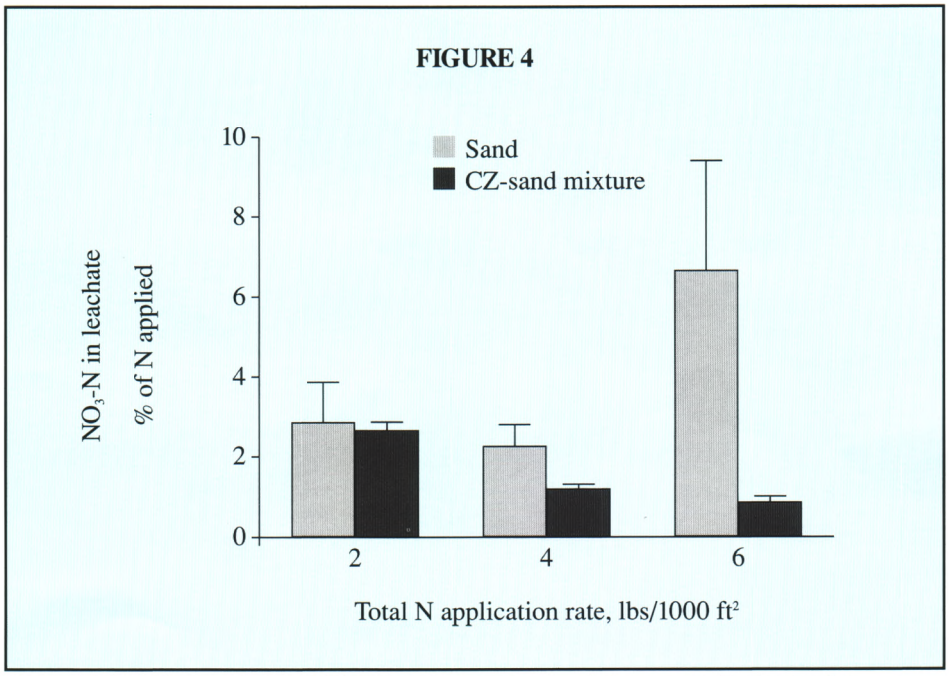


Figure 4. The influence of clinoptilolite amendment of sand and nitrogen application on the percentage of fertilizer nitrogen leached from putting greens.

FIGURE 5

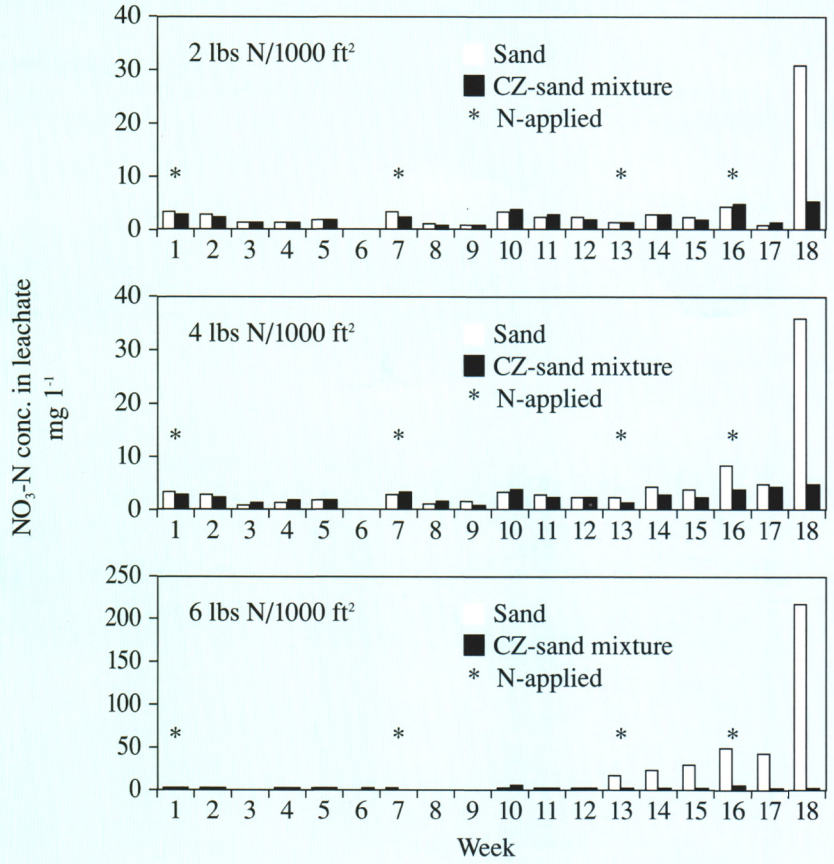
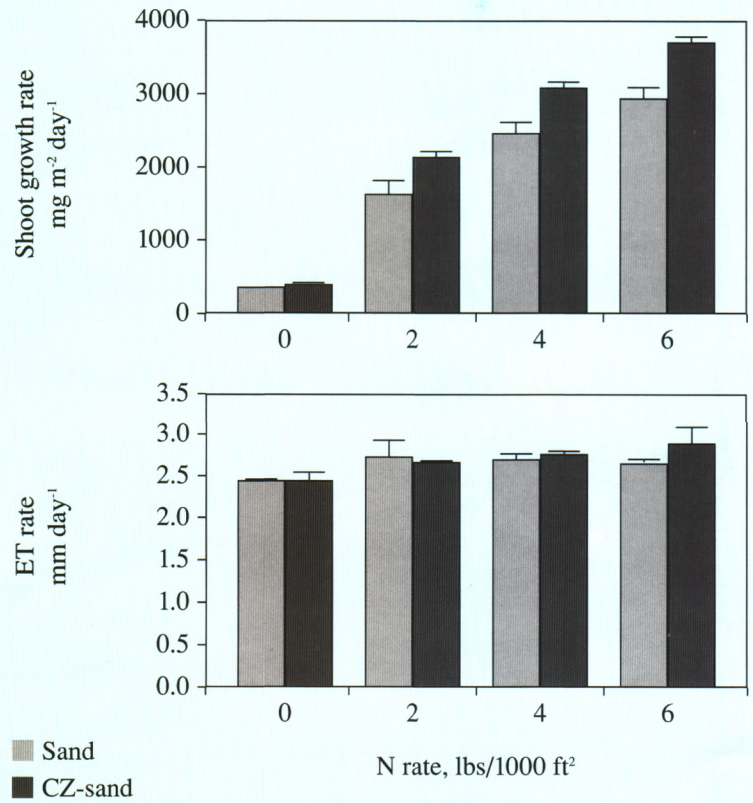


FIGURE 6



expense of using more water. The creeping bentgrass plants were more efficient in using water and N to produce growth.

With such strong findings, coupled with the results from previously published research, it appears that clinoptilolite could make an excellent amendment of sand for putting greens. Some words of caution should be noted, however. To my knowledge, only a handful of golf courses have used clinoptilolite to either amend new greens or to use as a topdressing on existing greens. To date the results have been encouraging. The long-term stability of the crystalline structure is one major question that still needs to be addressed. If the zeolite weathers or is crushed by traffic, will it remain a sand-size particle or become silt/clay size, clogging the highly pervious sand? We are initiating several short- and long-term studies to answer these questions. Long-term evaluation on actual golf courses with clinoptilolite-amended sand greens is necessary.

Another point to consider is that the properties of clinoptilolite can vary between, and possibly within, deposits. There are some deposits that are naturally high in sodium, potassium, or ammonium, and some can contain some clay. High-sodium-content clinoptilolite should be leached to remove the sodium before using it with low-salt-tolerating grasses. The hardness of the clinoptilolite also varies with each deposit. Some are very hard and would be less likely to be damaged by traffic, whereas others are soft and are more easily crushed. The results of the next series of studies will help establish guidelines in selecting a source of clinoptilolite based upon measurable properties.

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Huang, Z. T. 1992. Clinoptilolite zeolite as an amendment of sand for golf green root zones. Ph.D. Thesis. Cornell Univ., Ithaca, NY.

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(Above left) Figure 5. The influence of clinoptilolite amendment of sand and nitrogen application rate on the concentration of nitrate in the water draining from putting greens.

(Left) Figure 6. The influence of clinoptilolite amendment of sand and nitrogen application rate on the shoot growth rate and evapotranspiration (ET) rate of creeping bentgrass.

The use of 2" x 4" planks proved most effective for installing a uniform intermediate layer on the new 15th green.

USGA Greens - On a Limited Budget

by STAN and PETE McLEAN
Proprietors, Genegantslet Golf Club, Greene, New York

WHY SPEND the money to build greens according to the USGA method? Perhaps the money can be better spent on new equipment, an additional employee or a new parking lot. We found ourselves faced with that question, as do proprietors of many small golf course operations when undertaking a major greens renovation program. The decision for us really was not so difficult. For the past 10 years we had taken hours cutting cups, using a chisel and hammer to penetrate the compacted clay and gravel underlying the greens. We had watched our more recently constructed sand-on-soil greens rapidly wilt on hot summer days, and we have seen brief thunderstorms leave the greens unplayable for hours.

These factors helped persuade us to use the USGA method of green construction for a green renovation project. We would like to share our experiences and perhaps provide a different perspective on this construction technique.

The original nine holes at Genegantslet Golf Club were built in 1954 by my father on a portion of his farm. The construction was done with his farm equipment. Green construction consisted of disking sand and peat moss into the native topsoil. Today, these greens have a decent root zone mix in the upper 3" due to our aeration and topdressing programs. Below that level lies the mix of gravel, clay, and sand which hardens during the summer to the consistency of concrete. When the golf course was expanded in 1964, the newer greens were constructed with 12 inches of a sand root zone mix placed upon the ground. The greens average about 2,500 sq. ft. and receive approximately 35,000 rounds of golf during our relatively short season.

Several of the original holes were constructed along the state highway, and this was a major factor leading to our decision to

renovate. Our main concern was the par-3, 200-yard 10th hole, which played to incoming traffic. Traffic on the highway had increased, along with play, and was creating a major hazard. We decided to completely reposition this hole to end the potential hazard and to reposition other holes to better utilize 20 acres of available land and provide a more interesting design.

We realized that a project of this magnitude would require the services of an architect, but our limited budget made us afraid of the cost. We were fortunate to find Larry Reistetter, a local architect who had worked with the late William Mitchell. Larry agreed to work with us on an hourly basis in designing the new greens and holes. Our plan called for holes to be relocated and lengthened where possible. A master plan was developed, detailing the design of greens, fairways, and tees, and showing the location of drainage berms, mounding, bunkers, and ponds. Green design was detailed to scale, providing size, shape, contouring, and drainage. Mr. Reistetter also convinced us of the merits behind the USGA method of green construction. The design cost for each green was between $600 and $800.

We decided to keep the majority of work in-house to limit costs. A local paving contractor, and club member, offered his crew for work in the fall when his business slowed. This was very beneficial to both parties. We were fortunate with respect to equipment, as we had a small dozer, backhoe/loader, stone rake, and roller in our possession. We did purchase a leveling transit to help with the contouring work, and later we purchased a larger D-3 dozer that became available at a very good price. The large dozer now enables us to complete the major shaping work required. The money for construction originates from each season's profits and from past years' savings, so outside funding is minimal. The layout for the new nine holes was planned to minimize interference with existing play. We hope to construct at least two greens per year, completing the project within five years.

Green construction work was initiated late last summer. Completing the green's subgrade to the final contour was most challenging. Initial shaping grade work was done with a D-3 dozer rented daily for the operation. Final shaping was completed with our small dozer. This portion of the operation was closely monitored by the architect and me to assure that contouring conformed to the design plan. The subgrade

Turf covers have been a valuable tool for establishment on newly seeded greens.

contour was completed and hand raked to finish the surface, and the grade was rechecked. The subgrade was watered and rolled for compaction. We knew this phase had been successful when we attempted to manually install drainage trenches. The installation required three men and eight hours of labor to complete a 40-foot trench. We quickly realized that a power trencher was in order. Polyethylene pipe was installed in the trenches on a small layer of crushed stone. The trench was then backfilled with stone to cover the pipe and trench. Grade stakes were then marked in preparation for the gravel and coarse sand layer installation. With the part-time labor and unpredictable weather, it required two to three weeks to complete the shaping and trenching for both greens.

The pea stone and coarse sand layer were purchased from a local concrete plant. The materials matched USGA particle size specifications. This worked well for us because we were able to get a good price and quick delivery. With the grade stakes in place, we began to install manually the gravel and coarse sand layers. This proved very time consuming with our sporadic labor. However, four men completed the installation of the pea stone for the two greens in two days. The loader was used to place the pea stone around the greens' perimeters, where it was then carefully spread manually and with the help of our small dozer. The coarse sand was initially dumped in piles along the greens' perimeters and spread manually using 2"-by-4" studs and the grade stakes as a guide. We have since used our small dozer to help spread the coarse sand from the perimeter areas. Care is taken to avoid operating the dozer directly over the drain trenches.

The root zone material was purchased premixed, as we knew we would not have the time or people available to complete the mixing properly. Several samples from various vendors were obtained and sent to Cornell University for physical and chemical analysis. The cost for each sample was approximately $50, which we considered minimal for the help it provided in selecting a proper mix. Again, a local vendor was able to provide a mix meeting specifications at $25 per cubic yard. We made room in the parking lot to store the material, which then could be used whenever labor was available.

The paving contractor's 5-yard dump truck was cleaned and used to transport the mix to the greens. The mix was roughly spread and compacted with the small dozer, according to the grade stakes. Too much mix was used on the first green constructed, as we found we had overcompensated for anticipated compaction. We have since adjusted our grade marks to a 14" depth, assuming compaction during installation. The mix was feathered from the collar into the rough. We smoothed the surface with landscape rakes and used the float to complete the final grade.

The greens were irrigated and rolled with a small hand roller in preparation for fertilization and seeding. I think the best part of the finished job was looking at the smooth contoured surface and watching water actually coming out of the drain tile following irrigation. We then knew that something had been done right!

A blend of certified Penncross, PennLinks, and Putter creeping bentgrasses was seeded at the end of September, which is late for our region. Knowing that the growing season was nearly complete, we installed protective covers over the seeded greens. Within two weeks we had decent growth and the blankets were removed until late November, when the new greens were covered permanently for winter. The greens survived the winter well under the covers, and mowing was initiated in spring at ½-inch. The greens matured slowly until we became more familiar with their fertility requirements.

The two new greens and fairways are expected to be ready for play by early next summer.

The cost of each new green was about $15,000 to $16,000, including materials, equipment rental, and outside labor. Our greatest savings could be attributed to the availability of local sands and gravel which met specifications, as well as our arrangement with the architect and use of seasonal outside labor. Yes, we are fortunate to have the materials and labor available at reasonable cost. However, a lot of leg work and preparation were required to locate the materials, an architect, and labor without compromising quality. So, do not be intimidated when it comes to constructing a USGA green. With a little ingenuity, close scrutiny, and patience, this method of construction is within reach of any golf course. The extra effort and cost are not too high for a green that should be trouble-free for many years to come.

Cost Analysis Per Green (5,800 sq. ft. average)

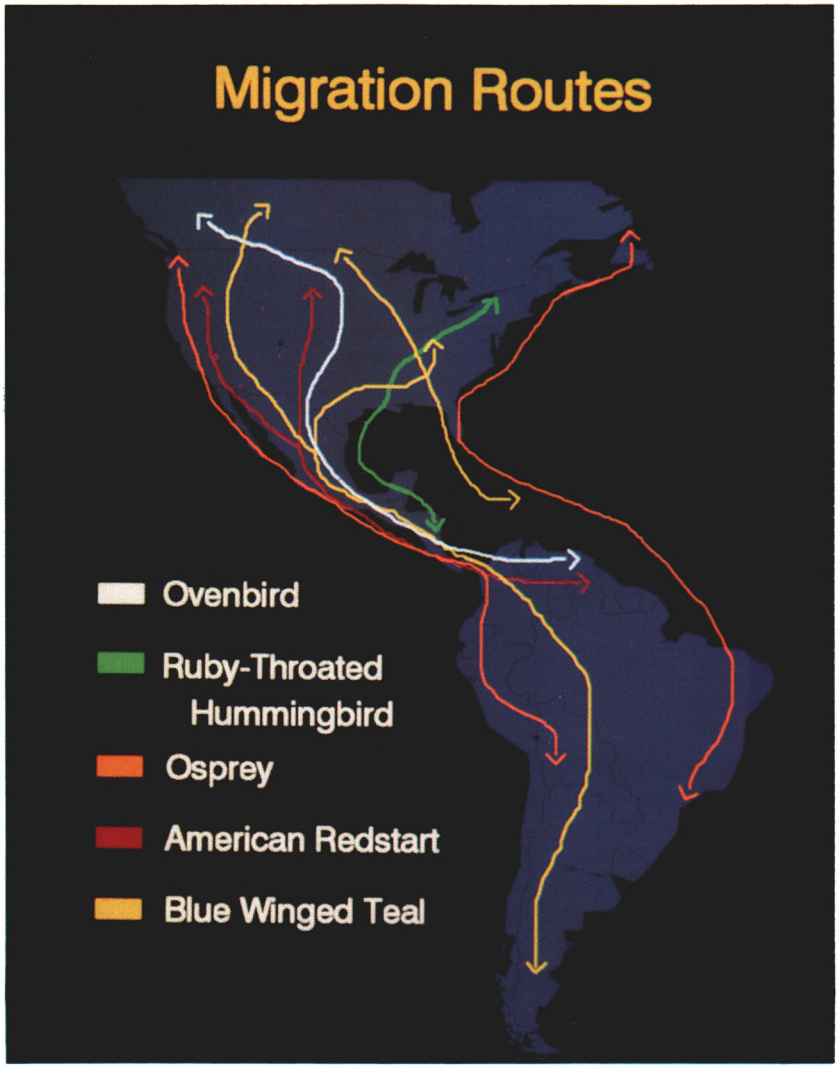
Pea Stone	71 yds. @ $ 8.80	=	$ 625.00
Coarse Sand	63 yds. @ 6.50	=	370.00
Rootzone Mix	270 yds. @ 25.00	=	6,750.00
Drain Pipe	500 ft. @ .44	=	220.00
Covers		=	650.00
Seed/Fertilizer		=	125.00
Labor/Equipment Rental		=	5,500.00
Architect		=	700.00
	Total	=	$14,940.00

To-Do's

- Consult a golf course architect.
- Have all gravel, sand, or organic components analyzed by a reputable laboratory.
- Have delivered mix analyzed to assure it is consistent with the original sample.
- Set grade stakes and check and recheck grades continuously during construction.
- Install sod strip around the perimeter of greens to prevent soil contamination (or install a plastic vertical barrier).
- Use certified seed and proven varieties — this is not the place to cut cost.
- Stockpile materials on a clean site so they are available when labor is available.

MIGRATION: Where Have All The Birds Gone?

by NANCY P. SADLON
Environmental Specialist, USGA Green Section



Migration routes vary between species. These complex and rigorous journeys can be more than 15,000 miles long.

WINTER IS A TIME when many golfers pack up and migrate south in search of better playing conditions, but they are not the only ones. Another two-legged species also leaves cold northern climates each year seeking a milder winter season.

Where do the birds go during the winter? Each species has special needs that must be met for its wintering grounds, so birds have flown to many different southern locations. A large population of birds takes flight each year for a grueling journey from the northern United States to wintering grounds south of the border. This group of long-distance travelers, the neotropical migrants, represents approximately one quarter of all United States birds. Neotropical migrants include many of our songbirds, some of which migrate more than 15,000 miles. It is unimaginable that these brightly colored creatures, full of song and only a few grams in weight, are able to make annual trips of great distance, complexity, and rigor, only to return north each year, often to the same tree or bush. Unfortunately, many birds return to their breeding grounds to find that the habitat has been altered or completely eliminated.

Habitat is the single most important need of migrating birds. The energy required for migration is substantial. Without suitable habitat in which to make stopovers, birds cannot forage, rest, and avoid predation.

For many years, protection efforts have focused on protecting breeding and nesting habitat, but this is not enough. This strategy helps with only one third of the birds' needs. Habitat in the tropics, where northern birds spend the winter, represents an important need for another third of the birds' life. Habitat protection efforts also have been focused in this area. What is left and what has been largely overlooked in our protection strategy is the importance of habitat *during* migration.

Golf courses can play a vital role in protecting and enhancing habitat for migrating birds. Golf courses located within migration route areas have the greatest opportunity to provide life-sustaining food, cover, and rest for migrating bird species.

Although migration is often thought of as an autumn or spring event, migration spans the calendar. For example, an observer in the northern part of the United States may note an almost unbroken southward procession of birds from midsummer to early winter. Some fall migrants are still traveling south while early spring migrants can be observed returning north through the same locality. For many species, it is believed that the migratory urge is triggered by day-length.

Shore birds and wading birds are tireless fliers with rapid wing beats and take migration pathways over the Atlantic Ocean and the Gulf of Mexico en route to South America. Most land birds and birds of prey migrate over land, though a few exceptions, like the black pole warbler, take to the sea. The tiny ruby-throated hummingbird crosses the Gulf of Mexico at 50 mph, en route to Central America, flying at night and for 10-hour stretches. Traditional flyways (Atlantic, Mississippi, Central, and Pacific) used by waterfowl generally are not used by other groups of birds.

Migration involves complex, crisscrossing migration routes, varying from species to species. Be on the lookout throughout the calendar year to identify species which make their migration journey in your area. Contact your local Audubon Society or the Audubon Society of New York State to obtain more information about habitat requirements for the bird species you observe on the golf course. By following through with some habitat enhancement work on your course, you can help these feathered travelers survive their grueling migration journey.

Nice Guys Sometimes Finish Last

by JAMES FRANCIS MOORE
Director, Mid-Continent Region, USGA Green Section

THE TECHNOLOGICAL CHANGES in the golf course superintendent's responsibilities over the last decade have forced us to deal with new ethical situations. Can you in good faith dispute the following statements:

- Pesticides should not be used in any manner inconsistent with the label.
- There should be no exceptions, no bending of the rules, and no circumventing the intent of the law concerning the use of pesticides on golf courses.
- Those who obey the rules should profit; those who "cheat" should suffer.

Unfortunately, it often doesn't work that way. Put yourself in the following situations.

Situation 1

You are a golf course superintendent. *Poa annua* is beginning to invade your new greens. There is a new herbicide on the market that very effectively removes *Poa* from greens, but it is labeled only for use on tees and fairways. The manufacturer acknowleges the product is safe for greens, but since only a very small amount of the product must be purchased to treat greens, the manufacturer decides there is simply not enough profit to be made to offset the cost of changing the label and dealing with liability issues.

As a superintendent, it is easy to rationalize the use of the product since it would be used on greens at a fraction of the rate already approved for fairways and tees. The product is being used by others in town, and their greens are making progress while yours are losing ground. This fact is not unnoticed by your members, and you believe that if you don't do something to keep *Poa* out of the greens, your job is in jeopardy.

Situation 2

Earthworms are causing major problems in your fairways. The very strong pesticides applied years ago by your predecessor have lost their effectiveness, and now the earthworms have returned with a vengeance. The worms are active to the point that the landing areas are severely disrupted, which greatly detracts from the appearance and playability of the course. Again, the players are upset to the point that you are worried about your career.

The guys across town have found that by applying certain fungicides or insecticides to the fairways the earthworm activity can be sharply curtailed. You know that control of earthworms is included on any pesticide label since worms are considered to be beneficial soil organisms. However, it is easy to rationalize that there is bound to be some disease or insect activity in the fairways, and that applying the pesticide is not technically illegal. If earthworms happen to be suppressed as a by-product of the application, all the better.

Situation 3

You are an agronomist making your living as a turfgrass consultant. There are other consultants in the industry who are more than willing to bend the rules to "help" their clients. You are concerned about losing business because your suggestions may not be as effective as your competitor's. You feel strongly that some of the regulations are based more on politics than science. Your clients want answers, and if you will not provide them, they will go to someone who will.

Although things are not as black and white as some would like to believe, there is only one proper choice for the people in these scenarios: Pesticides should not be used or recommended except as specified on the label. As tough as it is, the only good option is to follow the rules, even when we don't like them or feel that they are unreasonable.

As environmental regulations further limit pesticide use, the condition of golf courses will be affected. Golfers will have to accept the fact that there are no simple solutions to these and many other problems. Unfortunately, until they do, the turfgrass professionals who choose to follow the rules will suffer the most.

Earthworms are a problem on this green, but would you apply a pesticide to suppress the population?

1993 GREEN SECTION NATIONAL & REGIONAL CONFERENCES

NATIONAL CONFERENCES

January 30	Green Section Educational Conference	Anaheim, California
March 4 & 5	Golf Course Wastewater Symposium	Newport Beach, California

FLORIDA REGION

March 2	Palm Beach Gardens Marriott	Palm Beach Gardens, Florida
March 4	Orlando Marriott	Orlando, Florida

GREAT LAKES REGION

March 11	To Be Announced	Milwaukee, Wisconsin
March 18	To Be Announced	St. Paul, Minnesota

MID-ATLANTIC REGION

March 25	Congressional Country Club	Bethesda, Maryland
April 15	Oakmont Country Club	Pittsburgh, Pennsylvania

MID-CONTINENT REGION

March 15	Barton Creek Country Club	Austin, Texas
March 24	Indian Hills Country Club	Kansas City, Missouri
March 31	Lakewood Country Club	Denver, Colorado

NORTHEASTERN REGION

March 16	Somerset Hilton Hotel	Somerset, New Jersey
March 18	Colonial Hilton Hotel	Wakefield, Massachusetts
April 13	Country Club of Rochester	Rochester, New York

SOUTHEASTERN REGION

March 9	Forest Lakes Country Club	Columbia, South Carolina

WESTERN REGION

March 16	Angel Park Golf Course	Las Vegas, Nevada
March 23	Industry Hills Resort Golf Course	Industry, California
March 24	Castlewood Country Club	Pleasanton, California
April 5	Waialae Country Club	Honolulu, Hawaii
April 27	Rainier Golf and Country Club	Seattle, Washington
May 6	To Be Announced	Arizona

USGA Green Section Educational Conference

in conjunction with the 64th

GCSAA International Conference and Show

Anaheim, California — Saturday, January 30, 1993

FITTING THE PIECES IN THE GOLF COURSE MANAGEMENT PUZZLE

Moderator: James T. Snow, National Director, USGA Green Section

1:00 p.m.	**Welcoming Remarks** Raymond B. Anderson, Chairman, Green Section Committee, and Member, USGA Executive Committee
1:10	**The Environment: Where Environment, Nature, and the Game Can Coexist** Robert Trent Jones, Jr., President, Robert Trent Jones II
1:35	**The Best Turf Tips from the Green Section Staff** Larry Gilhuly, Director, Western Region Bob Brame, Agronomist, Mid-Atlantic Region George Manuel, Agronomist, Mid-Continent Region
1:50	**Evolving Roles in Golf** William R. Roberts, CGCS, President, Golf Course Superintendents Association of America
2:15	**More of the Best Turf Tips** Jim Moore, Director, Mid-Continent Region Paul Vermeulen, Agronomist, Western Region Jim Latham, Director, Great Lakes Region
2:30	**Television Golf and the Golf Course Superintendent** Jerry Pate, Member, PGA Tour, President, Jerry Pate Golf Design, ABC Sports Commentator
2:55	**The Best Turf Tips Keep Coming** Patrick O'Brien, Director, Southeastern Region Pat Gross, Agronomist, Western Region Dave Oatis, Director, Northeastern Region
3:10	**Turfgrass and Golf Course Benefits — A Scientific Perspective** Dr. James B. Beard, Director, International Sports Turf Institute
3:45	**Last, But Not Least, of the Best Turf Tips** John Foy, Director, State of Florida Region Jim Connolly, Agronomist, Northeastern Region Stan Zontek, Director, Mid-Atlantic Region
4:00	**Closing Remarks** Jim Snow

USGA GREEN SECTION RECORD
JANUARY/FEBRUARY 1993

TURF TWISTERS

YOU CAN'T AFFORD

Question: Our club says they can't afford to pay my way to the national superintendent's conference each year. How can I stay up to date with current issues in the industry? (Texas)

Answer: If there is any way you can afford to attend the national conference, it is well worth the trip. Otherwise, make a point to attend local and state meetings and participate in your state turfgrass association. It also will help to subscribe to the many professional and trade publications available.

You should also subscribe to the USGA Turfgrass Information File (TGIF). Call (517) 353-7209 or any Green Section Office for further details. If you have a personal computer and a modem, you have two more options. You can directly access TGIF and you can also sign on to Turfbyte — the superintendents' bulletin board system. Turfbyte is managed by Duane Patton, out of Lawrence, Kansas. Contact Duane at (913) 842-0146.

NOT TO EDUCATE

Question: My Green Committee changes every year and a new group of people need to be educated about our golf course management practices. This education process can take up to one year, then starts all over again. Is there any way to expedite this process? (Arizona)

Answer: Many superintendents attend field days during the year to learn more about what's going on in the field. Why not conduct a field day for your Green Committee? Give them a tour of your maintenance facility, have your staff demonstrate the various pieces of equipment, and operate the irrigation system so they see firsthand how you maintain your golf course. The Green Section also publishes a booklet entitled *The USGA Green Section Guide*, which explains the role of the Green Committee and how they can better serve the club. For a copy, contact the USGA (908-234-2300) or your regional Green Section office.

YOURSELF FOR THE FUTURE

Question: How do we sort out all the "miracle products" that are flooding the turf industry? (New York)

Answer: Try not to be overly swayed by testimonials. Look for solid university testing. If you want to experiment on your golf course, set up an objective comparison and be sure to run a control (untreated) plot. If you wish to run comparisons, try to compare like products. Comparing a soil amendment to an unamended soil provides only a limited amount of information. A better approach would be to compare a number of different soil amendments at varying rates, side by side, along with the untreated control.