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Finding the Right S.P.E.E.D.





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Cover Photo:

*The Stimp meter provides
information to evaluate the
effects of different practices
on the playability of
putting surfaces.*

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Dr. Fred Grau (left) and Johnny Farrell (1928 U.S. Open winner) used a mechanical putter in 1933 to test the putting quality of USGA grasses located at the Arlington turf garden, Arlington, Virginia. The mechanical putter eliminated the human factors when measuring drift and ball speed.

S.P.E.E.D. — Consider What's Right For Your Course

by **PAUL VERMEULEN**
Agronomist, Mid-Continent Region,
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SINCE the humble beginnings of the game, golfers have maintained an immense interest in the quality of the putting surface. This should come as no surprise, considering that almost half the strokes recorded on the scorecard by most golfers are taken on the greens.

Unfortunately, high Stimpmeter readings are often used today as the sole criterion for evaluating putting quality when, in fact, many greens simply were not designed or built with high readings in mind. Depending on such variables as the principal resources available for course maintenance, environmental conditions, the expertise of the golfers who play the course, and the annual volume of play, maintaining smooth, consis-

tent putting greens at slower Stimpmeter readings may be a more practical and worthy objective.

A review of putting green conditions over the past 100 years reveals how green speed became the focal point of most discussions about putting quality. For without some knowledge about how putting green turf was maintained and evolved, it would be easy to lose sight of where the turfgrass industry stands today.

In the spirit of the centennial year of the United States Golf Association, a good place to start looking at the history of putting conditions is at the turn of the 20th century. As there are no detailed records of putting quality, and putting green speed in particular,

the condition of the putting greens can be considered only by examining the golf clubs and mowing equipment used in the late 1890s.

To control long putts, early American golfers needed to get the ball airborne over the tall grass. For this reason, putters were made with a loft as high as 12 degrees. During the past 75 years or so, this measurement has been steadily declining, and today the average loft is between two and four degrees.

Mowing equipment also has changed considerably in the last century. Before the introduction of the motorized mower in the 1920s, greens were cut with crude push mowers set at a quarter of an inch or higher.



With a little ingenuity, high Stimpmeter readings can be achieved without being a detriment to the turf!

As a consequence, the quality of the cut depended greatly on the training and physical condition of the maintenance staff.

Using information about vintage golf clubs and mowing equipment, it's a sure bet that the quality of putting greens when Horace Rawlins won the first U.S. Open Championship at Newport Country Club was a far cry from that of the putting greens on which the U.S. Open is played today. To illustrate the difference between then and now, imagine putting a golf ball on a poorly maintained tee with a one-iron versus putting on the greens at your home course.

Agronomically speaking, much in the past 100 years has changed, from the species and cultivars of turf being grown to the kinds of fertilizer used to nurture its growth. In the beginning, there were no fungicides to control diseases like Dollar Spot and Brown Patch, no 2,4-D to kill dandelions, and crabgrass had to be plucked from the putting greens by hand or it would have taken over by Independence Day. It was quite simply a bare-fisted superintendent

against an irate Mother Nature, with golfers putting on the battlefield.

From the 1920s to the 1950s, things started changing for the better. During this era, new products for controlling major pest problems, new turfgrass varieties, new equipment, and synthetic fertilizers gave superintendents the means to maintain putting greens similar to what golfers see today. For the first time, golfers could begin to recognize the difference between well-maintained putting greens and sparse turf damaged by disease and infested with weeds.

One individual who wrote to the USGA to describe a procedure to distinguish good putting greens from bad was Edward S. Stimpson. In 1936, Stimpson developed a prototype of the Stimpmeter that is used today.

The Stimpmeter is a 36-inch extruded aluminum bar with a grooved runway on one side. A notch in the runway is used to support a golf ball until one end of the Stimpmeter is lifted to an angle of roughly 20 degrees. The average distance the golf ball

travels after two opposing rolls down the Stimpmeter is referred to as the speed. The farther the ball rolls, the faster the green.

Stimpson learned through personal use of his prototype Stimpmeter that there was great variation in the speed of greens where competitive golf was played. He also found great variation in the condition of greens on the same course, and between hole locations on the same green.

He believed, and the Green Section staff agrees, that without some form of quantitative measurement, superintendents and course officials cannot evaluate playing conditions, discuss maintenance practices, and establish reasonable goals with respect to green speed. Indeed, superintendents who wanted to do a better job of managing the putting conditions on their courses were the first to approach Stimpson for his device.

After the USGA introduced the current version of the Stimpmeter in 1978, it was not long before a new philosophy developed. "The faster the better" became the rallying call that bonded golfers across the country. The basis for this new philosophy was the



A research project at the University of Nebraska evaluating green uniformity uses a precise tool to measure green speed. This research tool (above) uses photo cells located in a PVC tube to measure the speed of a golf ball as it passes by the series of photo cells. The information is automatically stored on a data logger for analysis.



Before attempting to increase Stimpmeter readings, an in-depth analysis should be made of the turf and soil conditions. Without ideal growing conditions, attempts at fast Stimpmeter readings should not be made during unfavorable weather conditions.

observation that as speed increased, the roll of the golf ball across the surface was more true. A meaningful translation is that the greens became more enjoyable to putt as they got faster, at least to a point.

This one-size-fits-all mentality, having evolved from an era when green speeds were considerably slower than today, has grown into a real problem. Many golfers fail to realize the importance of the fact that no

two golf courses are physically alike, and that the players at each course are different with respect to their golfing abilities.

Given the major differences between courses and their players, what factors can be used to evaluate how fast is fast enough? To help you analyze your situation, consider the following five criteria represented by the acronym S.P.E.E.D. The limit for putting green speed should be set by using the two or three criteria that produce the lowest speeds.

The acronym S.P.E.E.D. stands for:

- Status of the turf
- Principal resources
- Environmental conditions
- Expertise of the golfers
- Design

To illustrate how the five-letter acronym S.P.E.E.D. can be used in various situations, Table 1 shows the optimum putting green speed for two examples. Example one,



Many putting greens are designed with dramatic surface contours, challenging the skills of all golfers. Somerset Hills Country Club, Bernardsville, New Jersey.

showing an optimum speed of eight feet six inches, is a new course planted with a new creeping bentgrass variety. The moderately contoured putting greens were built according to USGA Specifications and the resources available for course maintenance are not limiting. The expertise of the large majority of golfers is characterized as less than accomplished, and the prevailing environmental conditions are somewhat unfavorable. The optimum speed in this example is set by the contouring of the greens and the expertise of the golfers.

Example two, showing an optimum speed of eight feet, is a course built in the late 1950s that was established with Colonial bentgrass which has given way to *Poa annua* during the past 40 years. The contoured putting greens were built with soil native to the site, and three inches of sand has accumulated from regular topdressing. The resources available for course maintenance are not limiting. The expertise of the average golfer is characterized as accomplished, and the prevailing environmental conditions are somewhat favorable. The optimum speed in this example is set by the status of the turf as dictated by prevailing weather conditions.

Status of the Turf

Historically, the agronomic status of the turf has set the upper limit for green speed. For decades superintendents under the direction of course officials did everything in their power to increase Stimpmeter readings until they reached the biological

limit of the turf. Beyond this limit the turf would perish.

In 1977, when detailed records of putting green speed were first kept, most courses measured between five feet six inches and seven feet six inches. Some find this difficult to believe, as the speeds at several famous courses were purported to be so fast that stopping a putt near the hole was like rolling a golf ball down a staircase and stopping it on the last step. But by examining putting green mowers used in the mid-1970s, it is known that they were adjusted to a height-of-cut between $\frac{3}{16}$ " and $\frac{1}{4}$ ".

It is not so much that superintendents 20 years ago were concerned about killing the turf by mowing lower than $\frac{3}{16}$ ", but the bedknives available for the mowers were so thick that they could not be adjusted any lower. The only exception was when the golf course mechanic used a grinder to reduce the thickness of the bedknives. As a point of reference, the "thin" or "championship" bedknives used by most courses today were not sold until the 1980s.

Some believe that the introduction of the Stimpmeter in 1976 produced a speed war. This war was fought by mowing greens lower and lower and practicing other techniques in order to establish bragging rights for having the fastest greens in the territory.

There were many casualties in the so-called speed war. Eventually, greens slowly deteriorated from low mowing and excessive grooming; in some cases, they died completely. In some areas of the country, it is sad

but true that battles in this war are still being fought. With human pride being what it is, this war could rage on into the 21st century.

In the 1990s, advances in technology have significantly increased the tolerance of the turf to those practices that must be used to produce high Stimpmeter readings. Probably the most meaningful technology is the bulldozer, which has transformed poorly drained putting greens, incapable of supporting turf at speeds greater than eight feet, into ones that can be groomed to roll nine feet plus if necessary, other conditions being favorable.

Determining the biological limit of your own greens can be difficult and has been the subject of many articles in the *Green Section Record*. But rest assured that if your greens die every other summer while rolling nine feet six inches, you have gone too far. At that point, there are two choices. The first is to raise the height of cut on the mowers and grow healthy turf at a slower speed. The second is to reconstruct the greens with the goal of maintaining faster speeds in mind. Depending on what the golfers expect in regard to speed, either choice can be appropriate.

Principal Resources

As important as the current status of the turf are the principal resources available for maintaining the greens. To produce greens that are both consistent and fast requires intensive maintenance using the most sophisticated technology available. It cannot, and should not, be accomplished by simply lowering the mowers one afternoon and going out the next morning to shave the greens down to the crowns.

In preparation for U.S. Open Championships, greens are placed on an intensive schedule of light topdressing, vertical mowing, brushing, rolling, spiking, aerification, fertilization . . . you name it. It's all required to produce a consistently fast putting surface. Such a schedule requires manpower, a large stockpile of materials, and plenty of equipment.

Under no circumstances should "life on the edge" turf management be attempted without the required resources. The results will always be short-lived, because the turf will invariably experience problems. The best-managed courses use the resources available to them, and they do so to their fullest potential.

Environmental Conditions

Ask any superintendent who has been knocked out in the first round. The true champion of the turfgrass industry is Mother Nature. During certain times of the year, depending on location, prevailing environmental conditions can dramatically reduce

the ability of the turf to survive. During these periods, Stimpmeter readings should be reduced without hesitation by raising the cutting height.

When common sense doesn't prevail, some people desperately want to believe that because today's technology can place a man on the moon, greens can be maintained at a speed of 11 feet regardless of the stress on the turf. This assumption is, of course, ridiculous. At the time of year when Mother Nature is in control of the fight, it is clearly unwise to consider risking the survival of the greens for a few extra inches of speed.

Because at the present time there are still no guaranteed means of successfully maintaining fast putting speeds during unfavorable environmental conditions, a few words seem in order about scheduling special events. Ideally, it would be best to plan tournaments, such as the Club Championship, during a time of year when the turf can handle a temporary increase in speed. The U.S. Open Championship, for example, is scheduled in mid-June.

Mindful scheduling would create an opportunity, if desired, to give the greens the extra attention required to bring them into championship condition. If tournaments must be scheduled when Mother Nature is in control, then playing the greens at a slower speed would be better than jeopardizing their condition through excessive mowing or grooming.

Expertise of the Player

Clearly, a few golfers at every course have a higher level of expertise than the majority of golfers. When highly contoured greens are maintained at Stimpmeter readings in excess of eight feet six inches, the expertise of a professional golfer can be required to sink a putt in two strokes. Taking this into consideration, it stands to reason that greens should generally be maintained in a manner that best suits the vast majority of users of the course.

At courses where the handicaps of many golfers are in the single digits, it would be appropriate to maintain fast putting greens, other conditions being favorable. But at courses where the large majority of golfers have high handicaps, the greens would be more enjoyable to the majority if they were maintained at or near eight feet six inches.

Design

Because the game of golf has become so popular, the damage caused by traffic should always be considered when determining the optimum putting green speed for the course. According to their design, the number of available hole locations decreases as the speed of the greens increases. The reason is that some contoured or sloped areas of the putting surface can no longer be used for hole locations. In short, a putt that misses the hole placed on a slope on a fast putting green will not come to rest near the hole. By

reducing the number of reasonable hole locations, the greens can become subject to damage caused by heavy golfer traffic.

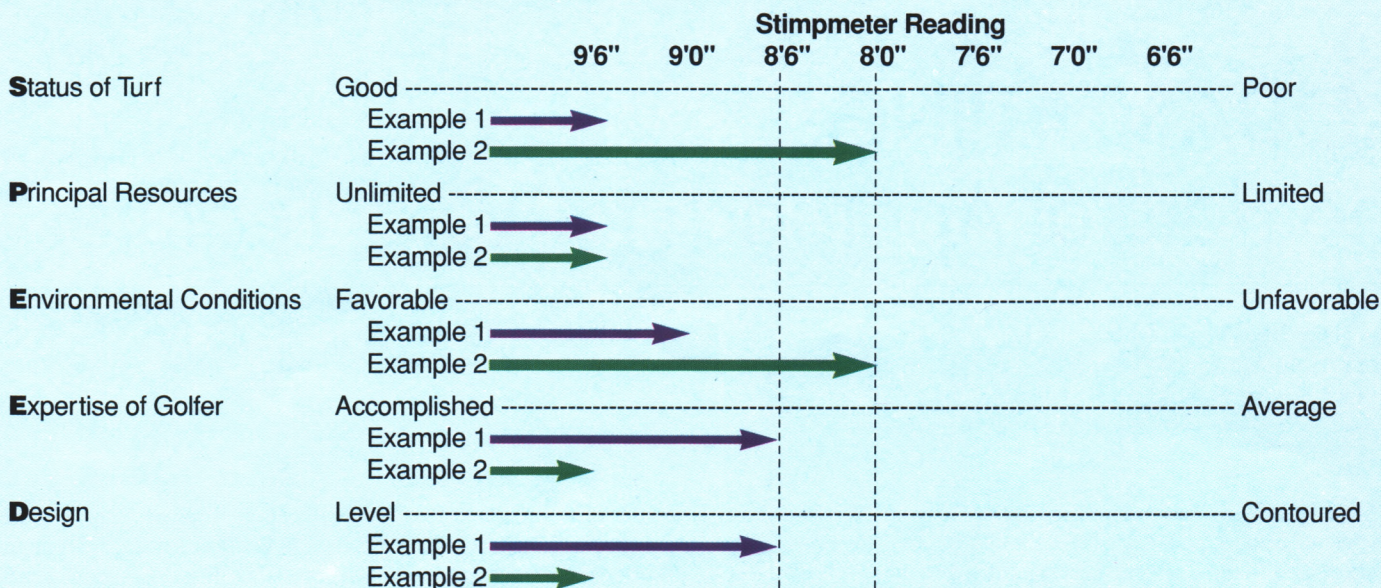
And, if the number of reasonable hole locations drops below seven or eight per green because they are being maintained too fast, the course may become less enjoyable to play regularly because the setup is always similar. For example, a green that would have seven or eight hole locations at a speed of eight feet six inches might have only three to four at a speed of ten feet six inches. For a three- or a four-day tournament at a speed of ten feet six inches, this would be adequate. However, for daily play the hole would end up in a particular location more than once per week.

In conclusion, every golf course is unique because of its agronomic status, principal resources, environmental conditions, golfer expertise, and physical design. In determining the optimum green speed, course officials should seek input from the superintendent, the golf professional, and outside sources, such as the USGA Green Section staff.

It is incorrect to state that only fast greens are good and that all slower greens are bad. Also, because the hallmark of a good course is consistent putting, the Stimpmeter is as important for maintaining putting greens at ten feet as it is for eight feet. Gone are the days when fast was always good, and faster yet was even better!

Table 1

To determine the optimum Stimpmeter reading for each course, analyze the criteria represented by the acronym S.P.E.E.D. The limit for putting green speed should be set by using the lowest speed of all five criteria.



Example 1 — Optimum speed set by the contouring of the putting greens and the expertise of the golfers.

Example 2 — Optimum speed set by the status of the turf as dictated by prevailing weather conditions.



*Windsor Golf and Polo Club (Vero Beach, Florida) maintains a cordgrass (*Spartina bakeri*) shoreline with a littoral shelf consisting of duck potato (*Sagittaria lancifolia*) to accent the water feature next to the 17th fairway.*

AQUASCAPING: The Natural Approach to Water Features

by **STEVE BEEMAN, M.S.**
Marine Biologist
President, Ecoshores Inc.

FOR THE PAST several years, I have designed aquatic landscapes for shorelines and shallow water edges on golf courses in the southeastern United States. A few years ago I worked on a project near Vero Beach with Bob Snyder, an oceanographic engineer from Jupiter, Florida. "Most

people don't see this," Bob said. "They don't get to experience wetlands. They miss all the colors, noises, beauty and critters that live here. We need to bring wetlands into backyards and onto golf courses where people will interact with them and come to appreciate the dynamics of aquatic ecosystems."

Historically, golf course water hazards have been open bodies of water with manicured turfgrass shorelines. In recent years, however, golf course designers have begun to work more with natural features to incorporate native habitats into their designs. For example, specimen trees may be left in the

middle of fairways or wetlands utilized as natural hazards.

There are several advantages to building wetlands and planting aquatic vegetation on golf courses. Shoreline grasses stabilize slopes and control erosion. Emergent aquatic plant communities along the banks provide habitat, nesting sites, cover, and food for a wide variety of animals, ranging from invertebrates, like shrimp and frogs, to wading birds, big lizards (alligators) and mammals such as otters and manatees. Wetlands and vegetated shorelines also have an important function in the improvement of water quality. Aquatic plants, when properly arranged and blended, are also an attractive addition to the landscape. There are tall and short species of broad-leafed, flowering herbaceous plants, rushes, and grasses that can be planted in monotypic stands or in mixed aggregations for different effects.

Erosion Control

Planting shoreline grasses on slopes and emergent aquatic plants below the waterline can effectively control erosion. The roots stabilize the soil substrate, and the plant stems in the water column act as wave buffers. Establishing native shorelines also significantly reduces the requirements for expensive hand maintenance on slopes that are too steep for conventional mowers. While it may not be practical to have wetlands along shorelines that regularly come into play, planted slopes and littoral zones can provide efficient and cost-effective erosion control around tees, greens, and in out-of-play areas.

Wildlife Habitat

Natural areas, created by planting shoreline grasses, rushes, and trees, provide habitat and shelter for a variety of upland creatures that live or forage near water. An extensive shoreline community provides corridors for animals traveling between areas of natural cover. Marsh rabbits, raccoons, fox, birds, reptiles, and amphibians utilize these low-growing canopy areas.

The shallow water littoral zone provides

room and board for a diverse array of birds, fish, crustaceans, reptiles, amphibians, and mammals. Some species feed directly on the plant materials. Herbivorous fish, invertebrates, and mammals (the West Indian manatee, for instance) graze on emergent stands of herbaceous plants. As aquatic plants die, they produce soluble carbon compounds that feed plankton and microbial populations in the water. Obviously, such plants play an important basic function in the aquatic food web.

Another important function of shallow water plants is to provide shelter from predation for small animals, including the juvenile forms of some species that will grow up to become predators upon the residents of the marshes. Because wetland fringes provide cover for prey species, predators feed along the edges. Wading birds patrol the shoreline, stalking and spearing. Carnivorous fish species cruise the borders in search of smaller animals that may stray from the protective screen of emergent plants. Raccoons watch the landward edges of shoreline marshes for fish and crustaceans that venture into shallow pockets of water where they can be isolated and caught.

Some animals nest exclusively in thick stands of aquatic vegetation, usually some distance from the uplands. Marsh hens build nests in bulrush thickets, and river otters use

matted aquatic plants to form nests that are accessible through submerged passageways.

Water Purification

Perhaps the most important but least understood or appreciated function of vegetated wetlands is their role in water quality improvement. This feature can be beneficially exploited in lakes around golf courses. Ponds and lakes that do not have vegetated shorelines or wetlands associated with them frequently experience problems with floating algae mats or blooms that inhibit water clarity and are unsightly. Rooted aquatic plants assist in the removal of nutrients from the water column. In fact, constructed and natural wetlands are now commonly used by water treatment facilities to treat wastewater effluent.

When nutrients such as nitrogen and phosphorus occur in excessive quantities, they fuel population explosions among several species of algae. Wetland plants help control these nutrients. One way that nitrogen (and phosphorus to a lesser degree) is taken out of the water is through assimilation into plant tissues by vascular plants and the microbes that adhere to them. Microbes (bacteria, fungi, algae, and protozoa) that are attached to the underwater portions of aquatic plants and submerged soils account for a substantial reduction in dissolved phosphorus and nitrogen. The more attach-

Shoreline grasses help stabilize slopes and control erosion while providing habitat and nesting sites for a wide variety of animals.



ment surfaces for microbial populations, the more potential there is for nutrient removal. As the vegetation slows water flow, sedimentation occurs, trapping phosphorus in the layers of fine mineral soils, where it is immobilized by metallic ions like calcium, aluminum, and iron.

The principal pathway for the removal of nitrogen from aquatic ecosystems is a process called denitrification, which is dependent upon rooted aquatic plants. Most submerged soils are oxygen poor (anaerobic), but the area surrounding the roots of aquatic plants (the rhizosphere) is rich in oxygen (aerobic). Dissolved nitrogen is converted to nitrate in the aerobic rhizosphere and then changed by microbes in the adjacent anaerobic soils to nitrogen gas that rises to the surface and leaves the water column permanently.

Wetlands alone can't completely purify a water body that is receiving excessive nutrient runoff, but they can help maintain a balance, especially if incorporated into an integrated plant management (IPM) program for the surrounding golf course.

Aquascaping for Aesthetics

Aside from the benefits to wildlife and the aquatic environment, planted shorelines can enhance the beauty of a golf course in the same way upland landscaping does. Waving fields of cordgrass (*Spartina bakeri*)

*The shorelines at the par-3 eighth hole at Grand Harbor in Vero Beach, Florida, combine a cordgrass (*Spartina bakeri*) hedge bordered by a band of pickerelweed (*Pontederia cordata*), duck potato (*Sagittaria lancifolia*) and blue flag iris (*Iris virginicus*) along a shallow littoral shelf.*

blending into shoreline hedges of rushes (*Juncus* or *Eleocharis*) form native plant savannahs that bridge the aquatic and terrestrial zones. Flowering herbs like duck potato (*Sagittaria*), pickerelweed (*Pontederia*), canna lily (*Canna*), and blue flag (*Iris*) provide bright colors at different times of the year, framed by variable shades of green foliage. Tall plants like bulrush (*Scirpus*) or fire flag (*Thalia*) can be used as accents or to warn golfers of hidden hazards.

While many people appreciate the beauty and value of wetlands, others question my

sanity when I begin to discuss aquatic landscaping. Questions like, "Why would you want to plant those weeds in our lake?" or "Do you really plant weeds for a living?" are common. Well, as James Taylor once wrote in a song, "It ain't always easy for a weed to grow," I hope that someday aquatic plants will be widely recognized as useful and attractive additions to water features, and not simply thought of as weeds. But I'm glad more and more golfers are beginning to appreciate the beauty and function of these plants.

All of the storm water from the Hammock Dunes development in Palm Coast, Florida, including the golf course, flows through lake interconnects to several "kidney wetlands." The water is treated by these marshes prior to moving along the chain of lakes and ponds, eventually entering the estuary via percolation.



AW NUTS! AND BOLTS, TOO

by MIKE HUCK

Agronomist, Western Region,
USGA Green Section



Individual storage bins should be labeled with all the necessary information to make locating a part as efficient as possible.

HOW MANY TIMES a week do you find you need to go out chasing around town for a small part — a nut or bolt, perhaps a spark plug? How much time is wasted in the process? Does the person retrieving the parts have something more productive to do with that time? The smaller the part needed, the more frustrating the whole situation is. Granted, no one can have every part ever needed in inventory, but assorted hardware, filters, fluids, and regular wear items should be stocked to accomplish normal maintenance.

Starting with the Nuts and Bolts

Searching through a box of mixed hardware is not much of a storage system. A supply of nuts and bolts, common to any

repair shop, should be in a well-organized storage cabinet. Clearly labeled bins that designate fractional size, threads per inch, and overall length are a necessity. Labeling would read, for example: “ $\frac{1}{4}$ -20 $\times$ 1. This designates a $\frac{1}{4}$ " diameter bolt with 20 threads per inch and an overall length of 1 inch. Multiple cabinets or bins may be required to organize both fine and coarse thread sizes, along with metrics commonly found on turf equipment. Since $\frac{1}{4}$ ", $\frac{3}{16}$ ", and $\frac{1}{2}$ " diameter bolts are the more popular dimensions found on turf equipment, a larger assortment of these sizes should be kept on hand.

Do Your Bolts “Make the Grade”?

The Society of Automotive Engineers (SAE) sets standards on the tensile strength

rating of bolts. These ratings are identified through a series of lines radiating outwards on the bolt head. Plain-headed bolts without markings, commonly found at the hardware store, are grade 1 or 2. These are lower-standard bolts considered adequate for fastening of accessories (lights, etc.) or sheet metal covers. If you are purchasing bolts at a hardware store, though, you may be causing yourself and your mechanic unnecessary grief through a higher than normal failure rate!

Bolts with three lines on the head are grade 5, generally recognized as the common replacements in automotive and commercial applications. Grade 5 bolts have approximately double the tensile strength of the plain-headed grade 1 or 2 bolt. Grade 6 and

7 are marked with four and five lines, respectively, and offer only a slightly higher strength rating than grade 5. Topping off the list for standard commercial use is grade 8, with six lines marking the head. Grade 8 bolts are found at high-stress points, and are commonly used on heavy-duty trucks and construction equipment. Allen head cap screws are unmarked, but usually are grade 8 or higher. Carriage and stove bolts are not recommended for replacement of even the lowest SAE grade bolts for commercial equipment applications.

Machine screws with special heads, such as flat, round, and pan designations, are not usually marked except in aircraft grades. Sheet metal screws, another special item, may look like a common wood screw; however, this particular variety is hardened, to allow threading into a punched hole. That kind of abuse would twist off the head of an ordinary wood screw. Other fastening items such as set screws, self-locking "nylock" nuts, and flat and lock washers should be available to the mechanic in all popular sizes. Other essential small hardware items are key stock, woodruff keys, roll pins, and cotter pins.

Ignition and Electrical Supplies

One replacement set of spark plugs for each engine found in the equipment inven-

tory should always be on the shelf. Contact points and condensers may also be necessary on early vintage units not equipped with electronic ignitions. Fouled spark plugs should be considered throwaway items, as the cleaning of fouled spark plugs with sand blasters is frowned upon by most mechanics. Using a sand blaster can lodge sand into the cavity of the electrode that later may free itself during the combustion cycle of the engine. You don't have to be a master mechanic to realize the damage caused to the piston, rings, and cylinder wall when sand is introduced into the picture!

Electrical supplies such as fuses, fusible links, crimp connectors, and wire should be available in various sizes. Electrical wire, like irrigation pipe, must be properly sized to handle the flow of current. Sizes ranging from #10 gauge through #18 gauge are most commonly found. However, if battery cables are to be fabricated on site, other sizes from #6 gauge to #0 may also be required. Kits to make battery cables and spark plug wires can prove very convenient, as turf equipment often requires odd sizes not commonly found over the counter at auto parts stores.

Belts

Belts found on turf equipment come in two basic varieties — standard automotive

An organized storage area for miscellaneous hardware such as sheet metal screws, cotter pins, roll pins, and key stock is essential.



type V-series and fractional horsepower (FHP). Automotive V-belts are primarily found on engines driving the water pump, alternator, or an auxiliary hydraulic pump. Fractional horsepower belts are commonly found driving reels, rotary blades, and other power-driven implements. The dimensions of these two types of belts differ, and they should not be considered interchangeable. The FHP belt has a more broad shape, allowing for a greater transfer of horsepower at lower RPMs.

Hoses

Radiator hoses for key pieces of equipment generally should be stocked. Flexible *universal* type hoses can be found at auto parts stores to help get by in a pinch. Regular equipment inspections by the turf equipment technician should spot failing hoses ahead of time. In a real emergency



Having the right parts on hand in a well-stocked repair shop can assist in getting equipment out on the golf course instead of waiting for repairs.

the world famous roll of duct tape may be able to bail you out for an afternoon! Hose clamps of various sizes are often used in a variety of quick fixes around the golf course, and an assorted supply should be kept on hand.

Do-It-Yourself Hydraulic Hoses?

Hydraulic hoses offer two options. The first is to purchase hoses of every shape, size, and configuration from your equipment distributor. This could cost thousands of dollars, depending on your needs. The second option is to purchase the necessary equipment to make hoses on site. This equipment, including a selection of fittings and hose, can be purchased for approximately \$2,500. It requires 10 to 15 minutes to make a hose at a savings of 40% or more. This specialized equipment is available through automotive and industrial supply houses.

Filters and Fluids

It has been said that changing the oil without changing the filter is like taking a bath without soap! Complete sets of filters for each unit should be on hand at all times. Not having a filter available guarantees that the fluids will not be changed on schedule, or that changing the filter itself will not occur. Air, fuel, oil, transmission, and hydraulic filters all should be *on-the-shelf* items.

A one-month supply of anti-freeze, greases, hydraulic oil, transmission fluids, and motor oils would be a minimum to keep stocked at all times. It is very important that fluids specified by the manufacturer or of equal quality are used. Failure to use specified fluids can result in major mechanical failures. Bulk dispensers can eliminate the hazardous waste disposal problems associated with small containers. Many equipment technicians now opt for synthetic lubricants

because of lengthened change intervals and the superior wear protection. This reduces labor requirements for fluid changes and the quantity of waste oil generated for recycling.

Tire Repair Supplies

Patches, plugs, replacement valve systems, and sealant are commonly found in most repair shops. A *plug gun* can allow the repair of a tire without removal from the rim, saving a considerable amount of time. Sealant in a pressurized can is expensive, but can save you in an emergency situation.

OEM and Aftermarket Parts

Certain parts and supplies must be purchased from the turf equipment distributor, also known as the OEM (original equipment manufacturer). Selected parts, including bedknives, reels, and bearings are also available through

aftermarket suppliers. Experience has shown that specialized applications such as bedknife retaining screws require OEM replacements for optimum performance. Local industrial suppliers and auto parts stores can provide a majority if not all of the small hardware items; however, the best advice is to shop around. Prices on nuts and bolts alone can vary greatly, and be sure you are receiving the quality that is needed. If you are looking for service, auto parts distributors often have outside sales staff who can call on the mechanic. They will help set up reasonable stocking quantities and then regularly check inventory levels, relieving the mechanic of this duty.

Stocking the shop with the basic essential hardware items results in a more efficient operation. So stop running around town, and take a little time to get your parts supply stocked right down to the nuts and bolts.



The pots at left and center were not watered for four days in the greenhouse study of drought tolerance in mycorrhizal and non-mycorrhizal creeping bentgrass. The pot on right (control) was watered daily. Note the severe wilting in the non-mycorrhizal plants (center pot) in comparison to the mycorrhizal plants (left pot).

MYCORRHIZAL FUNGI BENEFIT PUTTING GREENS

by R. KOSKE¹, J. N. GEMMA²,
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ENDOPHYTIC microorganisms occur in most species of plants as inhabitants of above- or below-ground organs. Their presence in the tissues either elicits no apparent effect in the normal functioning of the infected plants, or the endophyte may confer various benefits to the host. Grasses are no exception and present intriguing examples of these associations that can have application in turf management.

Fungi are the most frequently encountered partners with grasses, and several species that colonize leaves and stems are now known to confer protection from herbivores

and environmental stresses. These properties are being exploited for turfgrass species, where resistance to depredation from surface-feeding insects is a major benefit. Unfortunately, these fungi do not inhabit root tissues, but, as in most plant roots, grass roots harbor other endophytic fungi; in particular, many species of vesicular-arbuscular mycorrhizal (VAM) fungi can be found. VAM endophytes have been extensively documented, and their beneficial effects on growth and development of a range of plant species have been demonstrated. However, the species involved and their biology and

impact in the turf environment have received only cursory examination. In fact, there is a common belief that VAM fungi are of little importance in highly maintained turf where the extensive fine root system of the grasses receives ample water and nutrients that eliminate the requirement for the symbiosis. With the generous support of the USGA, a research project to investigate the subject of VAM in turfgrasses commenced at URI in 1990.

We sampled turf throughout New England and performed a variety of greenhouse and field trials to assess the incidence and im-

portance of VAM fungi in golf greens. Our efforts were focused on creeping bentgrasses (*Agrostis palustris* cv Penncross) and velvet bentgrass (*Agrostis canina* cv Kingstown). Initially, we needed to determine how frequently the fungi occurred in association with these turfs and what species of fungi were involved.

In our four-year study we found 29 species of VAM fungi occurring with these bentgrasses, several of which were new species. None of the species have previously been studied for any particular impact on bentgrass turf, yet virtually every one of the more than 200 root zone samples examined contained VAM fungi.

We performed numerous growth experiments where bentgrasses were inoculated with different species of VAM fungi. All experiments were carried out in a medium meeting USGA Green Section specifications for sand greens. The fungi were added to the mix before seeding. The fungus that we used most frequently was *Glomus intraradices*, the only species for which sufficient inoculum was commercially available. Results of inoculation were striking. Establishment of young turf was enhanced by inoculation with mycorrhizal fungi, and differences were apparent within three weeks after seeding. Turfs older by several months continued to grow more vigorously with mycorrhizal. In addition to improved growth, mycorrhizal turf was greener than non-mycorrhizal turf and possessed up to 60% more chlorophyll.

Phosphorus fertilization rate affected how well the VAM fungi performed. The most vigorous mycorrhizal turfs were those that received frequent applications of a low-P fertilizer solution. When the P concentration was too high or too low, mycorrhizae did not enhance growth.

Mycorrhizal fungi are sensitive to a range of pesticides (e.g., Benlate, Aliette, Phaltan, Diazinon), and the benefits to the turf may thus be lost temporarily if suppressive materials are applied.

In both field miniplots and greenhouse trials in pots, mycorrhizal turf of Penncross survived drought conditions far better than did non-mycorrhizal turf. After a five-day drought, mycorrhizal turf in the field study showed 39% less water stress than did control turf, and after eight days, the difference was 60% (Figure 1).

In the greenhouse study, turf without mycorrhizae began wilting after three days, but mycorrhizal plants were wilted only after five days (Figure 2). Mycorrhizal turfs also recovered more rapidly, producing three times as much leaf matter as the controls (Figure 3).

Preliminary trials indicated that mycorrhizae may provide some protection against the take-all fungus *Gaeumannomyces*

Figure 1

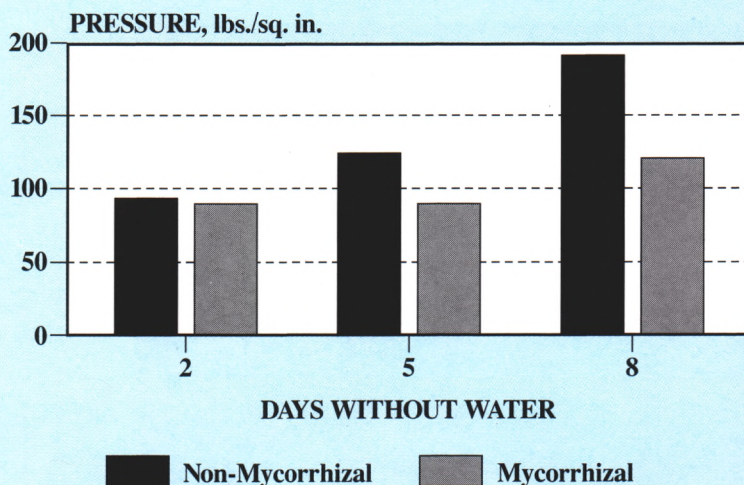


Figure 2

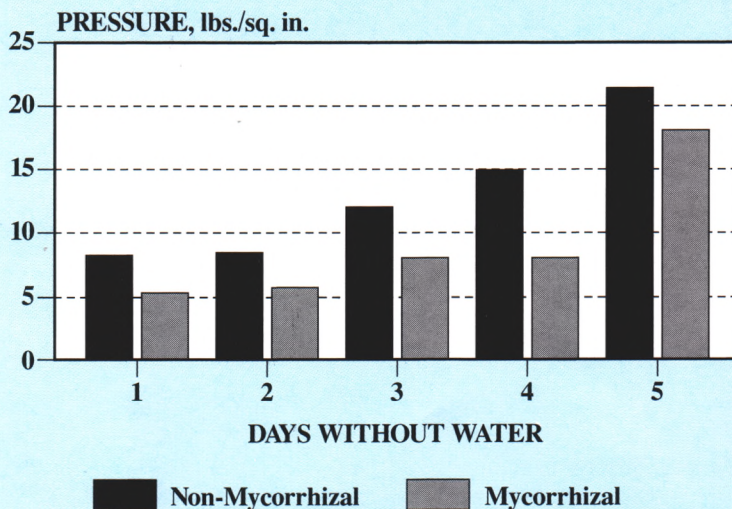
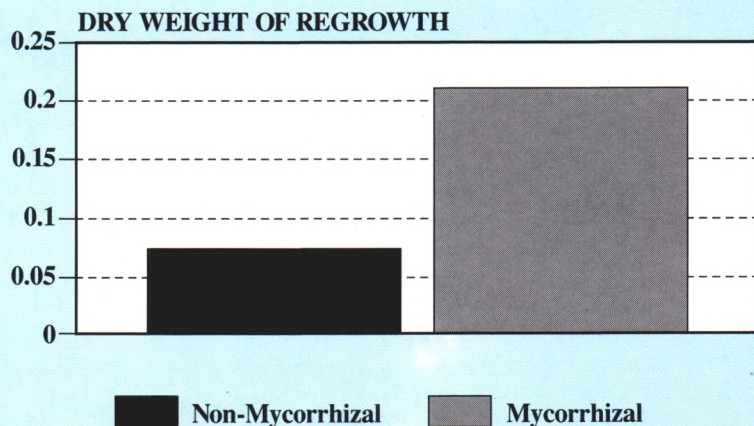


Figure 3





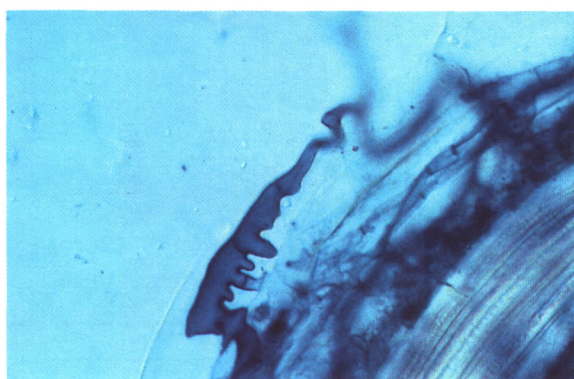
The study site of the drought experiment at the U.R.I. Turf Research Station contains creeping bentgrass in 12" pots that were filled with the sand/peat mixture and buried in a plot of existing turf. *Glomus* intraradices spores were added to half of the plots. Mycorrhizal fungi hyphae in the roots of the surrounding turf were prevented from associating with bentgrass by the side wall of the pots. The experiment was performed in July when the turf was 14 months old.

graminis. As noted in the growth trials, however, this benefit was present only when P concentration was moderately low. At higher levels of P, mycorrhizal turfs tended to be susceptible to take-all.

Conclusions

The presence of mycorrhizal fungi in putting greens constructed according to USGA Green Section specifications offers potential benefits to the turf. Improved drought tolerance and related rapid recovery from wilting appear to be the most significant benefits, but increased growth and establishment rates, greater chlorophyll content, and a lowered phosphorus requirement also are worthy of note. A probable result of these benefits may be manifested in an increase in resistance of mycorrhizal turf to foot traffic (wear), although this was not measured in our studies.

During our four-year investigation of mycorrhizal fungi in greens turf, we made several discoveries that were not the main object of our study but have importance to the practical use of mycorrhizal fungi in greens. First, mycorrhizal fungi naturally colonize new greens turf without being added as inoculum. While inoculation of a new green at the time of seeding is likely to



The fungal hyphae from a velvet bentgrass root colonized by the mycorrhizal fungus *Glomus intraradices* were stained blue. Up to 70% of the length of the root systems of turfgrass may contain mycorrhizal fungal hyphae.

result in a more rapid establishment of the green, in the longer term it may not be necessary. We examined a variety of one- to four-year-old greens where VAM fungi had not been intentionally inoculated, and in most of them the turf roots were already highly mycorrhizal. It is not clear how the fungi arrived in the root zone of these greens. Spores of VAM fungi are relatively large and are formed underground. Thus, they should not move readily into non-mycorrhizal situations (e.g., sand/peat greens) unless as soil-borne inoculum. It seems likely that the VAM fungi that were found in these greens were present in soil

that was deliberately added to or contaminated the sand/peat medium during green construction, or the fungi invaded the green from the adjacent native soils. The VAM fungi are ubiquitous in soils but generally are absent from clean sand and peat.

The ease with which the VAM fungi invade new greens may be just as well because commercially available inoculum is not yet readily available. Premier Peat, Quebec, Canada, does offer a limited supply of Mycori-Mix, a product that contains *Glomus intraradices*. As we learn more of the biology of these fungi, it appears that selected, effective species or biotypes may be incorporated into greens during construction. A protocol may be determined so that established greens can be managed to obtain the full benefits of the symbiotic association. More effective VAM species are likely to be found than the ones that invade by chance, and these may be matched to particular turfgrass species or cultivars for specific climatic and growing conditions.

Ultimately, it may prove to be biologically, environmentally, and economically feasible to use mycorrhizal fungi in putting greens to reduce requirements for fertilizer and water while achieving a greener, more vigorous, disease-resistant turf.

Creating an Environmental Road Map

by **RONALD DODSON**

President, Audubon Society of New York State, Inc.

AN OLD PROVERB professes, "A journey of 1,000 miles begins with one step." Although this is logical, the 1,000-mile journey will be even more pleasant if you take that first step in the correct direction — preferably toward your ultimate goal. Creating an environmental "road map" gives direction to your environmental efforts. It helps you figure out where you're going and how to most effectively get there. It keeps you *on course*, so to speak.

An environmental road map is more than simply a method of keeping an inventory of resources, although that is an excellent beginning. The purpose of an environmental plan is to help you:

- Define goals.
- Plan strategies.
- Assess what works.
- Assess what needs fine-tuning.
- Assess new directions.

It will help to establish written goals, detail timeliness, and assign tasks to appropriate personnel so that what you want to accomplish really gets done.

Although your environmental plan can be relatively simple or very complex, it should be comprehensive and include a range of environmental areas such as habitat and wildlife enhancement, water conservation, water quality management, and integrated pest management (IPM). Your environmental plan might also include an element of education. Let's look a little more closely at these environmental areas.

Define Overall Objectives

As you consider your environmental plan, think about the property, its specific characteristics, and your human and

financial resources. These steps will help you define your overall objectives. Start by writing a paragraph describing the strengths, weaknesses, and unique qualities of your property. Define in broad terms what you want to accomplish.

As you consider each of the environmental areas, start by simply writing a paragraph or a checklist or chart — whatever makes it easiest for you to begin. Try to define what projects you'd like to implement, who will be responsible for implementing the projects, and develop a time-

line for when projects will be initiated and completed.

Wildlife and Habitat Management

Use this category to explore the management of non-play areas to provide habitat for wildlife on the golf course. The property size and diversity of existing habitats will impact what you are able to do. The objective is to maximize the available space to provide the best possible habitat given the location, size, layout, and type of property. In order to assess your success over time, you should also begin and maintain a wildlife inventory. Consider projects that will enhance the food, cover, and water sources for birds, mammals, and amphibians.

Water Conservation

Having a comprehensive water conservation program in place helps to demonstrate commitment to judicious water use and environmental stewardship. It is a key environmental concern for golf courses across the country. Consider your irrigation practices, choice of turfgrasses and ornamental plantings, and gardening practices.

Water Quality Management

Water quality is an important issue for governing agencies, environmental groups, and the public. Concerns are often raised about the impact of golf course chemical use on the water quality of lakes, streams, and groundwater. It is important to be able to demonstrate that you have a strategy in place to monitor water quality, improve conditions if warranted, and deal with any problems that arise. Establishing baseline data for water quality is a necessary

A comprehensive environmental plan that is written with clear goals and specific projects provides excellent direction for golf course staff and volunteers to implement the plan.



first step in assessing the success of any future projects.

Integrated Pest Management

A comprehensive IPM program will help to ensure a healthy environment for both people and wildlife, along with good quality turf for the game of golf. Your IPM program should include efforts to manage turf areas with environmental sensitivity, educate workers and members about responsible plant management, and provide a clean and efficient maintenance area.

Education

If you want to gain recognition and support for your environmental programs, you need to increase golfer understanding of wildlife and environmental quality on your golf course. Let the public know that golf courses can be valuable community assets. You can do this by setting up a Resource Advisory Committee that includes your own members, members of the community with special interests (gardeners, birdwatchers), local university or college faculty, or students. They can help you develop an environmental plan of action. You can publicize your efforts through newsletter articles and press releases, or by involving your members in helping you keep a wildlife inventory, inviting scout troops or school children to build nest boxes and monitor them. The idea is to develop visibility for what you're doing



Environmental efforts can result in many satisfied participants.

and include others in a joint effort toward environmental awareness.

In the Spotlight

Fiddler's Elbow Country Club is a Charter Member of the Audubon Cooperative Sanctuary Program for Golf Courses. They joined the program in 1991 and returned their Resource Inventory in 1992. At that time they had very few natural areas, no nest boxes, no vegetative buffers around water features, and no member or public involvement. By June 1995, they became a fully certified Cooperative Sanctuary with over 100 acres of natural area, extensive vegetative buffers at all water features, nest boxes for a variety of birds, and an extensive list of member and public involvement projects.

Members of the Resource Committee played an invaluable part in obtaining certification by developing an Environmental Plan that established goals and specific projects for each category. The projects were described in a way that was easy to implement, and feasible for course staff and volunteers to complete. The plan also discussed projects that had already been completed as well as the current status of the course specific to particular projects.

Outside organizations working with the Resource Committee were a factor in the success of many of Fiddler's Elbow's projects. Staff from the Great Swamp National Wildlife

Refuge lent their expertise to help begin an inventory of plants and animals on the course. The North American Bluebird Society assisted the course in designing and implementing a bluebird nest box trail. Raptor Trust and Hawk Watch International helped get the course involved in raptor projects, including adopting injured raptors and releasing rehabilitated raptors on the course.

With a diverse Resource Advisory Committee, strong support from the community and local organizations, and a thorough and well-written environmental plan, Fiddler's Elbow met its goals and developed plans for the future. The club has taken the initiative and provided the leadership to visibly demonstrate its commitment to the environment.

Local environmental organizations worked closely with the Fiddlers Elbow Country Club (New Jersey) Resource Committee to successfully develop naturalized areas, buffer zones, and nest boxes throughout the property.



AUDUBON COOPERATIVE SANCTUARY



Baltimore Oriole

Registered for Year: 1995-96

Does the name of your golf course appear on the following list? If not, it should! Why? This list represents facilities that actively participate in the Audubon Cooperative Sanctuary Program for Golf Courses (ACSP), and have achieved certification in one or more of its categories.

Registration requires only a modest \$100 fee. In return, you'll have the chance to enhance your course's maintenance program and help your facility achieve recognition as an environmental leader in your community.

Experts from the Audubon Society of New York State will work with you to formulate strategies designed to complete six achievement categories:

- environmental planning
- public/member involvement
- wildlife and habitat management
- integrated pest management

- water conservation
- water quality management

And, if you have plans for a new golf course on the drawing board, consider the Audubon Signature Program. It helps landowners assess and develop appropriate strategies for natural resource issues during the planning and development phases of construction. Two Florida courses, Colliers Reserve and Summerfield Golf Club, have successfully completed the program.

This list of Audubon participants, while impressive, represents only a small portion of the golf courses in the United States. Others must do their part and join the ranks. Contact the Audubon Society of New York State at (518) 767-9051 or the USGA Green Section to receive additional information about these programs. Help your golf course start down the path toward becoming a recognized and admired land steward, both within the game of golf and your local community.

AUDUBON COOPERATIVE SANCTUARY PROGRAM FOR GOLF COURSES

Fully Certified Courses

HINDMAN PARK GOLF COURSE	Little Rock	AR
FOREST HIGHLANDS GOLF CLUB	Flagstaff	AZ
LINKS AT SPANISH BAY	Pebble Beach	CA
MORRO BAY GOLF COURSE	Morro Bay	CA
APPLEWOOD GOLF COURSE	Golden	CO
BRECKENRIDGE GOLF CLUB	Breckenridge	CO
CASTLE PINES GOLF CLUB	Castle Rock	CO
HOP MEADOW COUNTRY CLUB	Simsbury	CT
WOODWAY COUNTRY CLUB	Darien	CT
HOLE-IN-THE-WALL GOLF CLUB	Naples	FL
LOBLOLLY PINES	Hobe Sound	FL
TAMPA PALMS GOLF & COUNTRY CLUB	Tampa	FL
STANDARD CLUB (THE)	Duluth	GA
KAPALUA LAND CO. — BAY COURSE	Maui	HI
KAPALUA LAND CO. — PLANTATION COURSE	Maui	HI
KAPALUA LAND CO. — VILLAGE COURSE	Maui	HI
GLYNNS CREEK GOLF COURSE	Long Grove	IA
AURORA COUNTRY CLUB	Aurora	IL
CANTIGNY GOLF CLUB	Wheaton	IL
EVANSTON GOLF CLUB	Skokie	IL
IVANHOE COUNTRY CLUB	Mundelein	IL
ST. CHARLES COUNTRY CLUB	St. Charles	IL
VILLAGE LINKS OF GLEN ELLYN	Glen Ellyn	IL
PRAIRIE DUNES COUNTRY CLUB	Hutchinson	KS
HYANNISPORT CLUB	Hyannisport	MA
EAGLE'S LANDING GOLF COURSE	Berlin	MD
EGYPT VALLEY COUNTRY CLUB	Ada	MI
FOX HILLS COUNTRY CLUB	Plymouth	MI
TPC OF MICHIGAN	Dearborn	MI
TREETOPS NORTH — SYLVAN RESORT	Gaylord	MI
MINIKAHDA CLUB	Minneapolis	MN
MINNESOTA VALLEY COUNTRY CLUB	Bloomington	MN
APPLE CREEK COUNTRY CLUB	Bismarck	ND
FIDDLER'S ELBOW COUNTRY CLUB	Far Hills	NJ
TPC T SUMMERLIN	Las Vegas	NV
OLD WESTBURY GOLF & COUNTRY CLUB	Old Westbury	NY
SCHUYLER MEADOWS CLUB	Loudonville	NY
FOWLER'S MILL GOLF COURSE	Chesterland	OH
OREGON GOLF CLUB (THE)	West Linn	OR
SALISHAN LODGE INC.	Gleneden Beach	OR
CHESTER VALLEY GOLF CLUB	Malvern	PA
LAKEVIEW COUNTRY CLUB	Houston	TX
SEMAHMOO GOLF & COUNTRY CLUB	Blaine	WA
OZAUKEE COUNTRY CLUB	Mequon	WI
CRANBERRY RESORT GOLF COURSE	Collingwood	Ontario, Canada

RIVERWOOD GOLF CLUB	Port Charlotte	FL
ROYAL PALM COUNTRY CLUB	Naples	FL
TPC AT EAGLE TRACE	Coral Springs	FL
CHICAGO GOLF CLUB	Wheaton	IL
COUNTRYSIDE GOLF COURSE	Mundelein	IL
FLOSSMOOR COUNTRY CLUB	Flossmoor	IL
NAPERBROOK GOLF COURSE	Plainfield	IL
NORTH SHORE COUNTRY CLUB	Glenview	IL
OLYMPIA FIELDS COUNTRY CLUB	Olympia Fields	IL
PINECREST GOLF & COUNTRY CLUB	Huntley	IL
QUAIL CREEK COUNTRY CLUB	Robinson	IL
SILVER LAKE COUNTRY CLUB	Orland Park	IL
ELCONA COUNTRY CLUB	Elkhart	IN
SAND CREEK COUNTRY CLUB	Chesterton	IN
HERITAGE PARK GOLF COURSE	Olathe	KS
TOMAHAWK HILLS GOLF COURSE	Wjawnnee	KS
UNICORN GOLF COURSE	Stoneham	MA
CAVES VALLEY GOLF CLUB	Owings Mills	MD
PORTLAND COUNTRY CLUB	Falmouth	ME
BAY POINTE CLUB	West Bloomfield	MI
CADILLAC COUNTRY CLUB	Cadillac	MI
GULL LAKE VIEW GOLF COURSE	Augusta	MI
BAKER NATIONAL GOLF COURSE	Medina	MN
IZATY'S GOLF & YACHT CLUB	Onamia	MN
TOWN & COUNTRY CLUB	St. Paul	MN
WOODHILL COUNTRY CLUB	Wayzata	MN
BLUE HILLS COUNTRY CLUB	Kansas City	MO
BILTMORE FOREST COUNTRY CLUB	Ashville	NC
CARMEL COUNTRY CLUB	Charlotte	NC
LAKE HICKORY COUNTRY CLUB	Hickory	NC
TPC AT PIPER CLEN	Charlotte	NC
BEATRICE COUNTRY CLUB	Beatrice	NE
CEDAR CREEK GOLF COURSE	Dayville	NJ
RIDGEWOOD COUNTRY CLUB	Paramus	NJ
ATLANTIC GOLF CLUB	Bridgehampton	NY
MARRIOTT'S AT WINDWATCH	Hauppauge	NY
STAFFORD COUNTRY CLUB	Batavia	NY
TWIN HILLS GOLF COURSE I	Spencerport	NY
WESTCHESTER COUNTRY CLUB	Rye	NY
DETWILER PARK GOLF COURSE	Toledo	OH
HERON LAKES GOLF COURSE	Portland	OR
PUMPKIN RIDGE GOLF CLUB	Cornelius	OR
QUAIL RUN GOLF COURSE	Sunriver	OR
HUNTSVILLE GOLF CLUB	Shavertown	PA
LORDS VALLEY COUNTRY CLUB	Hawley	PA
NORTH HILLS COUNTRY CLUB	North Hills	PA
PITTSBURGH FIELD CLUB	Pittsburgh	PA
SAND SPRINGS GOLF COMMUNITY	Drums	PA
CHEROKEE COUNTRY CLUB	Knoxville	TN
SPRINGHOUSE GOLF CLUB	Nashville	TN
BENTWATER COUNTRY CLUB	Montgomery	TX
LAKE HOUSTON GOLF COURSE	Huffman	TX
RIVERSIDE COUNTRY CLUB	Lake Jackson	TX
ROBERT TRENT JONES GOLF CLUB	Lake Manassas	VA
EQUINOX: GLENEAGLES GOLF COURSE	Manchester Village	VT
COUNTRY CLUB OF WISCONSIN	Grafton	WI
MAPLE BLUFF COUNTRY CLUB	Madison	WI
MONROE COUNTRY CLUB	Monroe	WI
SENTRYWORLD GOLF COURSE	Stevens Point	WI
EDGEWOOD COUNTRY CLUB	Sissonville	WV
KING VALLEY GOLF COURSE	King City	Ontario, Canada
OAKDALE GOLF & COUNTRY CLUB	Downsview	Ontario, Canada
PETERBOROUGH GOLF & COUNTRY CLUB	Peterborough	Ontario, Canada
POINT GREY GOLF & COUNTRY CLUB	Vancouver	B.C., Canada
VALDERRAMA GOLF CLUB	Cadiz	Spain

As of October 20, 1995

NEWS NOTES



A group from the Golf Course Superintendents Association of New South Wales, Australia, took time to visit Golf House and golf courses in the Northeast during August. Their tour through the United States included golf courses and research institutions across the country.

INFORMATION SOURCES

Where can you go to get reliable, authoritative information about turf and golf course maintenance practices? It's always difficult, and sometimes risky, to single out a few places to go for such assistance, but we'd suggest the following four groups as excellent starting points. All feature a wide range of materials that are too numerous to mention in this article, so a good way to start with any of them might be a telephone call to determine the scope of available titles and services.

First, in our book at least, remains the **United States Golf Association**. Besides this magazine, we offer many book titles about turf, the environment, putting green construction, irrigation, and wastewater re-

use. In addition, we also have several pamphlets that outline issues as diverse as our Turf Advisory Service to the Audubon Cooperative Sanctuary Program for Golf Courses. You can call our Order Department at 800-336-4446 to receive a detailed listing of offerings, or to ask questions about these resources.

Another excellent information source is the **Golf Course Superintendents Association of America (GCSAA)**. They feature an exhaustive list of books, brochures, and videos on nearly every conceivable turf topic. The GCSAA also has compiled information packets to answer their most frequently asked questions. If you already know a title you want, just call the GCSAA's bookstore at 800-974-2722. If you're not sure

what's available through the GCSAA, or if you want them to perform a topical information search for you, call the GCSAA main number at 800-472-7878.

The next stop on the information road you may want to consider ends at the **National Golf Foundation (NGF)**. The NGF has produced more than two dozen InfoPacs, which are full-text collections of articles, reports, and studies compiled by the NGF's Library/Information Center regarding topics of interest to the golf industry. Among the titles that may be of interest to turf professionals are:

- Slow Play Solutions
- Accommodating Disabled Golfers
- Caddie Programs
- Renovating Your Golf Course

- Golf Course Design
- Storm and Disaster Preparedness

The NGF has plans to augment this current list with additional titles this fall. Contact the NGF's Information Services Department at 800-733-6006 with your questions or orders.

Finally, don't overlook the **Turfgrass Information Center** at Michigan State University, particularly its Turfgrass Information File (TGIF) bibliographic database. This database includes a myriad of better than 30,000 records pertaining to all kinds of turf topics gleaned from publications throughout the world. Better than 95% of the entries have appeared since 1968, reflecting an emphasis on more recent materials. It can be accessed through computer hookup or telephone, or through the Internet.

TGIF also has published a vast array of "Turf TOPICS," a compilation of current and more widely available publications on a specific issue in turf culture or turf facility management. More than 60 TOPICS are now available and cover subjects as diverse as:

- Canada Geese
- Dollar Spot
- Erosion Control
- Green Speed
- Groundwater Issues
- Leaching
- Mole Crickets
- *Poa annua* Control
- Runoff
- Salinity
- Topdressing
- Winterkill

Place a call to TGIF at 800-446-TGIF to find out more about this vast archive of information.

WANTED: GROUPS OR INDIVIDUALS

No, we haven't added a law enforcement mechanism to the Turf Advisory Service visit. What we're actually looking for are copies of old Green Section publications to augment our archives at Golf House.

Before you conclude that you don't have any, let's review a brief history of Green Section publications that have appeared under several different titles through the years. First came *The Bulletin of the Green Section*, from 1921 through 1933, followed by *Turf Culture*, which appeared sporadically during the late 1930s and then more regularly from 1939 until 1942.

If that seems somewhat confusing, you won't like to hear that another publication was introduced in 1940 under the title *Timely Turf Topics*. Then, in 1948, the publications were consolidated into the *USGA Golf Journal* combining *Timely Turf Topics*, adopting the name *USGA Journal and Turf Management* in 1950. This format and name endured for more than a dozen years until Vol. 1, No. 1 of the *Green Section Record* was published in 1963.

What years are we looking for back issues of these various publications? Anything prior to 1970 is needed. We're pretty well stocked up on back issues published since 1970 except, curiously, 1985 (maybe George Orwell was onto something after all, but a year early).

If you have any copies of pre-1970 magazines, or any from that mysterious year of 1985, we'd be most grateful to hear from you at the Green Section (908-234-2300). Your donation would help ensure that future generations of turf specialists will know what problems others struggled with in previous decades at golf courses around the country.

CENTENNIAL TIME CAPSULE

The final, and perhaps most novel, event of the USGA Centennial celebration took place at Golf House on Friday afternoon,

October 13th. This ceremony featured a ground-breaking experience, but not in the sense you probably think. Instead of starting the construction of a new building, the USGA entombed a time capsule on Golf House's front lawn that will be opened during the USGA's Bicentennial celebration.

Since most of us, to put it kindly, won't be able to attend the grand reopening in 2095, we've thought we'd reproduce for your perusing pleasure a couple of items placed in the capsule demonstrating the Green Section's role in improving playing conditions during the organization's first century of existence. These items included two vials containing two varieties of grass seed developed through USGA funding, and the following narrative:

"Developing better grasses for the game of golf has been the major focus of the USGA Green Section's Turfgrass Research Program since its inception in 1920. By the year 2000, the USGA will have awarded more than \$15 million in research money to university turfgrass research programs across the country.

"These vials contain two varieties of grass seed that were developed as a result of research funding provided by the USGA. In recent years, the plant breeding effort has focused on developing heat-tolerant bentgrasses, cold-tolerant bermudagrasses, and seeded zoysiagrasses, and identifying alternative grasses for use on golf courses.

"During the 1980s, buffalograss (*Buchloe dactyloides*) was developed for use in golf course roughs and out-of-play areas. USGA funding was responsible for such varieties as 609, 315, and Cody. Its minimal irrigation, fertilization, and maintenance requirements met the goals of the USGA's research program. Seashore paspalum (*Paspalum vaginatum*), with its excellent drought and salt tolerance, has been identified as the next potential alternative turfgrass to impact the golf industry.

"The golf industry's desire for bentgrass putting greens has had a significant impact on research surrounding this species. Pennlinks, Cato, Crenshaw, and Providence are just a few varieties developed during the 1980s and 1990s at universities that received research funding from the USGA. October 5, 1995."

It's nearly impossible to imagine what those folks of 2095 will think of the "innovations" so proudly displayed in the 1995 time capsule.

"Crenshaw" bentgrass and "609" buffalograss seed, developed with funding from the USGA Turfgrass Research Program, was placed in the USGA centennial time capsule to be opened in 2095.



STATEMENT OF OWNERSHIP,
MANAGEMENT, AND CIRCULATION

(Act of October 23, 1962; Section 4369, Title 39, United States Code.) 1. Title of Publication — USGA GREEN SECTION RECORD. 2. Date of Filing — September 29, 1995. 3. Frequency of issue — Bimonthly: January/February, March/April, May/June, July/August, September/October, and November/December. 3A. Number of issues published annually — 6. 3B. Annual Subscription Price — \$15.00. 4. Complete mailing address of known office of publication — USGA, Golf House, P.O. Box 708, Far Hills, Somerset County, N.J. 07931-0708. 5. Complete mailing address of the headquarters of general business offices of the publisher — USGA, Golf House, P.O. Box 708, Far Hills, Somerset County, N.J. 07931-0708. 6. Names and addresses of Publisher, Editor, and Managing Editor: Publisher — United States Golf Association, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708. Editor — James T. Snow, USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708. Managing Editor — James T. Snow, USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) — United States Golf Association, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708; President — Reg Murphy, USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708; Vice Presidents — Judy Bell and F. Morgan Taylor, Jr., USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708; Secretary — Gerald A. Stahl, USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708; Treasurer — Trey Holland, USGA, Golf House, P.O. Box 708, Far Hills, N.J. 07931-0708; 8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities — None. 9. For completion by nonprofit organizations authorized to mail at special rates — The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes has not changed during preceding 12 months. 10. Extent and nature of circulation —

	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies (Net Press Run)	19,300	18,000
B. Paid and/or Requested Circulation		
1. Sales through dealers and carriers, street vendors, and counter sales (not mailed)	508	None
2. Paid or Requested Mail Subscriptions	16,424	16,635
C. Total Paid and/or Requested Circulation (Sum of 10B1 & 10B2)	16,932	16,635
D. Free Distribution by Mail (Samples, Complimentary, and Other Free Copies)	648	598
E. Free Distribution Outside the Mail	133	300
F. Total Free Distribution (Sum of D and E)	781	898
G. Total Distribution (Sum of C and F)	17,713	17,533
H. Copies Not Distributed		
1. Office Use, Leftovers, Spoiled	1,587	467
2. Return from News Agents	None	None
I. Total (Sum of G, H1 and H2)	19,300	18,000
Percent Paid and/or Requested Circulation	96	95

I certify that the statements made by me above are correct and complete.

JAMES T. SNOW, Editor

ALL THINGS CONSIDERED

The Need For Teamwork

by JAMES F. MOORE

Director, Mid-Continent Region,
USGA Green Section

IN CASE YOU HAVEN'T NOTICED, people are tired of *gridlock*. They have had it with those who will not work together, constantly snipe at each other, and are so driven by self-interests that they are unable to contribute meaningfully to a common goal. By the way, I'm not talking about politics — I'm talking about a relationship that is, unfortunately, all too common between the golf course superintendent, golf professional, and general manager.

At a time the GCSAA, PGA, and CMAA are making a greater effort than ever before to work together for the betterment of the golf industry (which benefits everyone concerned), I seldom visit a course where the three individuals represented by these organizations manage to get along. On that rare occasion when I encounter a management team that is truly a team, the predictable result is a golf clientele that greatly enjoys their course, their game, and their facility — regardless of the stature of that facility. Not surprisingly, there also will be at least three employees who enjoy their work.

Obviously, the benefits of teamwork in any management scheme (as well as the drawbacks of the lack of same) are well recognized, given the thousands of books written on the subject. I doubt that there's a superintendent, golf pro, or manager at any course who would dispute the worth of this goal. But how many of these individuals make an honest effort to be part of a team? Instead, it's all too common to visit courses where each individual complains about the others, usually along the lines of "they don't deserve their salary," "they don't do anything except sit around all day," "they say one thing to your face and just the opposite to the golfers," or "without me, this place would fall apart." The most damaging complaints are those voiced to the golfers in a not-too-subtle effort to undermine the credibility of one of their co-workers. Where does teamwork fit into this picture?

All three of these key individuals share a desire to be viewed as "pros" in their respective fields. Jack Burke, of the Champions Golf Club in Houston, Texas, has revealed the secret of being a professional in this industry. To paraphrase Jack, the abbreviation "pro" should not stand for *professional* but rather for *promote*. Superintendents, golf professionals, and managers should *promote* their facility, each other, the game of golf, and anything that increases the enjoyment of those who use the facility. If you do this honestly and actively, you indeed are a professional. You enhance the credibility of your co-workers and yourself, and in the process make your course more enjoyable for everyone.

Much has been written concerning the inevitable changes facing this industry as a result of environmental concern and legislation. For most parts of the country, course operations have already been affected through the restriction or complete loss of pesticides that offered lengthy and broad-spectrum control. At the same time, the cost of running a golfing facility has continued to rise. Golfers are just beginning to find out that they may soon be getting "less for more." However, this does not have to mean they have to accept less enjoyment from the game itself. It *does* mean that the team of professionals responsible for providing that enjoyment must work together better than ever before. Those responsible for hiring the course superintendent, golf professional, and manager, should seek out individuals who honestly are willing to be part of a management team. I believe that this general requirement is as important as the specific skills associated with each position. I also believe that any employee who cannot participate as a team member is a liability who threatens the success of the entire facility and should be replaced.

TURF TWISTERS

OPINIONS

Question: Everyone who plays our golf course seems to have a different opinion on which sand is best for the bunkers. Is there a "best" sand? (Illinois)

Answer: In a word — no. Bunker sand selection is one of the most subjective decisions made on any course. From a size standpoint, use the USGA's guidelines for sands used in the rootzone of a green for a starting point. Since the sand will be thrown onto the green during play, be certain the bunker sand is not finer than that used in the construction of the green. Also, keep the percentage of particles above two millimeters to a minimum, since they are too small to pick up by hand but just the right size to dull a mower. Hopefully, you can find two or more sands that meet these criteria. If so, the next step is most important. Construct a practice bunker with partitions for each type of sand. Let your players practice from the various sands for at least a month so they can get a feel for what they like best. A good sand may seem a bit fluffy at first, but will settle down in several weeks or months.

REGARDING NEW BENTGRASSES

Question: With all the new bentgrasses on the market, how do we decide which is best for our course? (Texas)

Answer: There are a number of steps that should be taken — and the Green Section can help you with each. First, contact your regional Green Section office and speak with the agronomists. They see virtually everything on the market and will gladly share their experiences. They can also put you in touch with the nearest university that conducts turfgrass trials so you can arrange for a visit to see the grasses in the research environment. The next step is to visit courses that have already planted the new bentgrasses and evaluate the greens in action. Once again, the Green Section can help you identify the courses and which grass they have planted. The ultimate test (and one every club should employ before replanting to a large extent) is to establish your own nursery with the grasses you are considering so you can see how they perform on your site.

CREATES A RUNNING DEBATE

Question: Our golf committee has had a running debate on the proper positioning of bunker rakes. Is there a rule? If not, what is the USGA's policy on the subject? (Maine)

Answer: Just remember "down and out." There is no specific rule regarding placement of bunker rakes; however, for the USGA's championships we request that bunker rakes be placed outside of the bunker, lying down (not stuck in the turf vertically), and parallel to the direction of play. In most cases, this arrangement has the least objectionable impact on play. However, for regular play, the best placement is the one that the majority of golfers prefer.