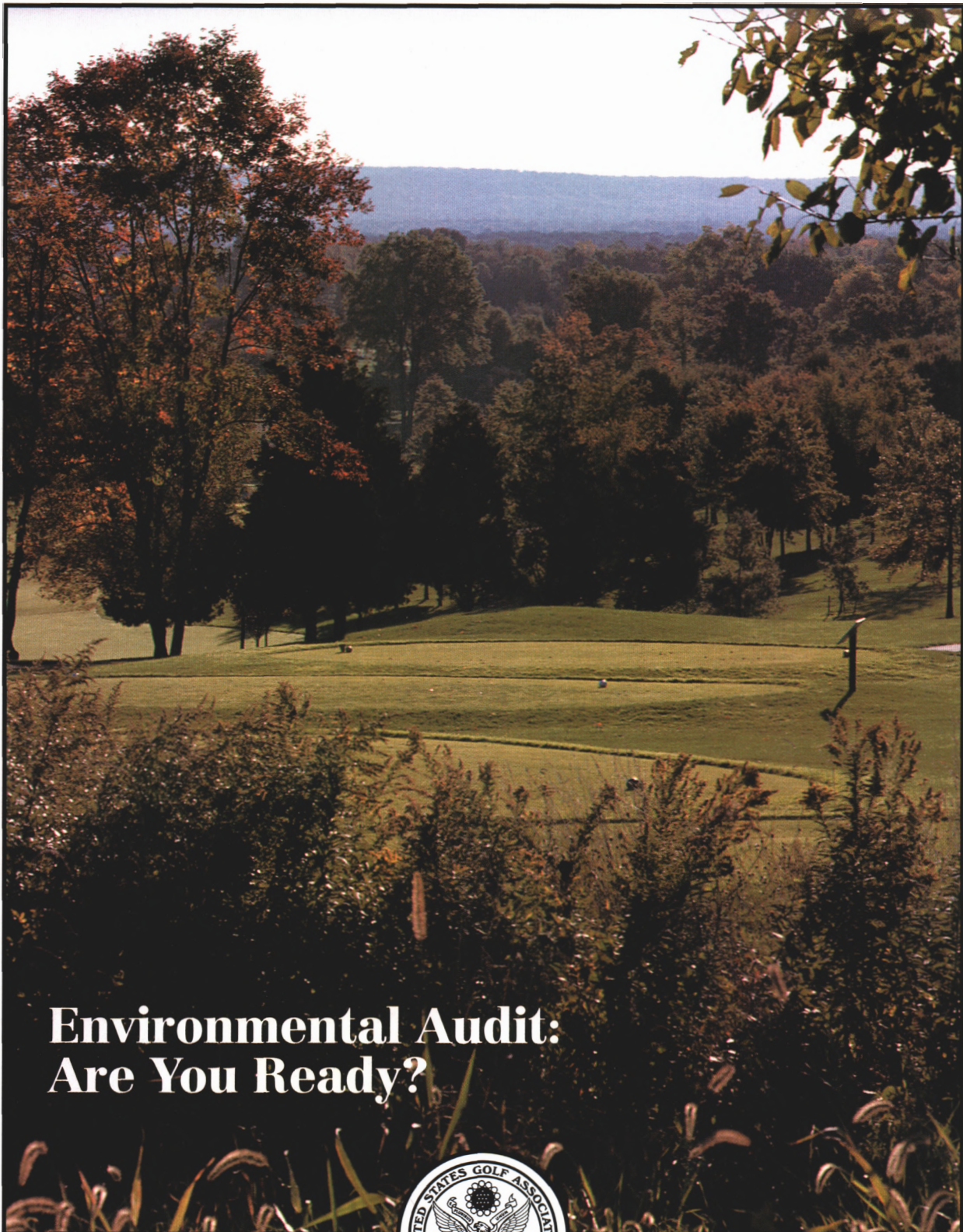


# USGA® GREEN SECTION **Record**

Volume 34, Number 1

January/February 1996



**Environmental Audit:  
Are You Ready?**



A PUBLICATION ON TURFGRASS MANAGEMENT

BY THE UNITED STATES GOLF ASSOCIATION®



Cover Photo: Environmental awareness should be reflected throughout the golf course (Barton Creek Country Club, Austin, Texas).



Nest boxes are good projects on the golf course and in your backyard. See page 1.



The Golf Club at Las Campanas in Santa Fe, New Mexico, held an Audubon Fair to educate members about their environmental efforts on the golf course. Wildlife enhancement kits were distributed and experts provided advice about implementing projects at home. See page 16.

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*Simply blowing the equipment clean eliminates most of the clippings from the unit.*

# Environmental Common Sense — A Sample “In-House” Audit

*Some simple steps are all you need to start.*

by JAMES FRANCIS MOORE

**W**HENEVER superintendents gather for an educational meeting, it's a sure bet that environmental issues will be discussed. Although most superintendents are aware of the need to improve the environmental aspects of their courses, it is often an uphill battle to convince their employers that action should be taken. This hesitation on the part of the course leadership to address environmental issues is due to their failure to clearly understand the problems, the belief that their course really is not much of a threat to the environment,

and the fear that any action might invite closer scrutiny from *outsiders*.

It is the superintendent's responsibility to make his or her employers aware of environmental problems that exist on the property. Although they probably have raised the subject at meetings and indicated a need for the organization to take action, many superintendents have not taken the step of completing an in-house environmental audit for their employers. The purpose of this article is to give the superintendent a starting point for accomplishing such an audit. Follow-

ing is a sample report to the leadership of a fictitious course. This report provides a good format that can be customized to meet the needs of your course.

\* \* \*

To: The Green Committee

From: John Smith, Golf Course Superintendent

Date: 1/15/96

The following report has been prepared for the Committee to provide information about the environmental aspects of our golf course operations.





*It's better to replace old tanks **before** they cause problems. Fuel tank storage can be improved by the use of safer and cleaner alternative tanks that are available on the market.*

Many aspects of course management that have environmental ramifications are detailed in this report, including our current state of affairs and options for improvement. This report is an *in-house* effort for the sole use of the Committee.

There are six major areas in which our course operations have the potential to impact the environment:

- Fuel Storage
- Pesticide and Fertilizer Storage
- Equipment Washing and Pesticide Mixing Area
- Water Use
- Pesticide and Fertilizer Use
- Wildlife Habitat

## Fuel Storage

### Concerns

Fuel storage is a major environmental issue for most golf courses. The major problem areas are fire safety and the potential for soil and/or ground water contamination. Although safety issues are fairly straightforward, soil and water contamination is potentially a much more difficult and expensive issue. Leaking storage containers can cause tremendous environmental damage, and the cleanup of contaminated soil can be extremely costly.

### Current Situation

We presently are storing two types of fuel — gasoline and diesel. Our gasoline is stored in an underground tank that is more than 20 years old. We have followed federal guidelines for leak

detection and monitoring, and so far we do not have leakage problems. Our diesel fuel is stored in a 500-gallon above-ground tank. The tank is not leaking, but it is in poor condition overall. It is mounted on a metal frame about eight feet above the ground to raise the tank high enough for fueling our equipment by gravity feed.

I am concerned about both tanks. Should a leak occur in our underground tank, the cost of repairing the environmental damage could be extremely high. Removal of the tank before problems occur is a far better option. I have checked with a local contractor on the cost of removing our existing 1,000-gallon tank. Assuming there is no leakage, removal and disposal of the tank and refilling the cavity with the same soil should cost less than \$3,000.

Our diesel tank also should be replaced. The frame supporting the tank has been damaged by equipment bumping into it, and the tank itself has been damaged by corrosion because it is fully exposed to the weather. Again, assuming no soil contamination, removal of the diesel tank should cost less than \$200.

### Options

There are at least two good options for improving our fuel storage situation. Both options include removing and replacing the existing storage tanks — before they cause us problems.

Underground tanks are being replaced on many golf courses with pro-

fessionally designed and constructed underground structures that greatly reduce the possibility of leakage. These structures are extremely durable and safe. We would need to purchase either one unit that includes two internal 500-gallon storage chambers (one for gas and the other for diesel) or two 500-gallon structures. The advantage of purchasing two structures is that federal guidelines are much simpler for units smaller than 1,000 gallons. The disadvantage is that the two units will take up more space in our already limited maintenance facility area. Regardless of the exact design, the units typically are installed on a concrete slab and include collision barriers.

These units provide very good prevention against leakage, greatly simplify leakage monitoring and cleanup, if necessary, and are far less objectionable from a visual standpoint than our existing diesel tank. I have checked with the local fire marshall and have been assured the units will exceed all local environmental and safety codes. I also contacted several suppliers of these types of storage units and obtained estimates of the purchase price, including installation. Total cost for the two 500-gallon units (including pumps, monitoring devices, slab construction, etc.) would be about \$15,000.

The second option is less expensive and, for the most part, could be accomplished in-house. We would build a containment structure consisting of concrete flooring and walls large enough to completely surround two tanks (similar in appearance to our existing diesel tank). The structure would prevent leakage from contaminating the underlying soil, and would serve as a barrier between the tanks and our equipment. A roof would be constructed to help prevent corrosion of the tanks. The tanks themselves are built with interior and exterior walls to provide additional protection against leaks.

The two skid-mounted tanks and electric transfer pumps would cost approximately \$4,000. I estimate we can build the containment structure and roof for about \$1,500, bringing the total to approximately \$5,500 for the entire project. Again, I have checked with our local fire marshall and found this option will meet local code requirements.

### Recommendation

Although we can build our own storage structure for less money, I



suggest we purchase the prefabricated units listed on the attached literature. These units will meet all of our storage needs and will ensure that we have addressed the environmental concerns in the best manner possible. Also, since they are completely self-contained, they can be moved if necessary.

## **Pesticide Storage**

### **Concerns**

The storage of pesticides also has become a prominent issue in golf course management. Improper storage increases the possibility of soil and water contamination, theft and/or vandalism, or injury to maintenance workers.

### **Current Situation**

We currently store pesticides in our maintenance building. This building also houses equipment, the mechanic's work area, crew facilities, and my office. Although the building is locked at night, it is unsecured during the day for reasons of practicality. Products are stored in a locked closet labeled *pesticides*, located adjacent to my office. The closet is neither vented nor does it provide containment should a pesticide container leak or be knocked over. Although we do have an eye and face washing station near our restroom, the station is not near the pesticide storage area. Finally, since the products are stored within the confines of our maintenance building, the fire department may be hesitant to tackle a fire should one occur in the building. In addition to the extra risk of injury to fire fighting personnel, the water used to extinguish a fire in a building that contains pesticides can itself become a hazardous waste product. For these reasons I feel it is important to take immediate steps to improve our pesticide storage facilities.

### **Options**

As is the case with fuel storage, there now are prefabricated pesticide storage structures available that address each of the concerns expressed above. These units are fire rated, secured, ventilated, and lighted, and protected against contamination of soil or water should leakage of a container occur. They are stand-alone units that can be placed easily in our existing maintenance area.

The better units have a wide variety of options, including heating and air conditioning, fire suppression systems, and eye/face washing stations. I con-

tacted a number of suppliers and found that prices range from about \$9,000 to \$12,000 for top-quality structures. The smaller figure represents a basic 8' x 8' unit. The larger figure will purchase a unit that is 8' x 12' and fully equipped with ventilation, lighting, shelving, insulation, and an eye/face washing station.

The second option is to construct our own storage unit. We can purchase a 10' x 12' metal storage building complete with locking door and lighting for about \$1,500. We would finish the interior and install ventilation for another \$500. A stainless steel floor (to provide containment in case of spills) would cost about \$800. Containment shelves are another \$500. Eye and face washing equipment and an emergency spill containment kit would add another \$500 and bring the total cost for our homemade structure to approximately \$4,000. I have checked with the fire marshall, who has agreed to review the plans for this structure should we choose this option.

Until we are able to significantly improve the way in which we store chemicals, we plan on keeping the amount of pesticides (and fertilizers) on hand to an absolute minimum. This should not be viewed as a long-term solution since we would not be able to count on the availability of the required product when problems arose on the course. We also would be unable to take advantage of discounts that are offered for seasonal and quantity purchases.

### **Recommendation**

Without question, the ideal option is to purchase a prefabricated unit. They are much better constructed than the home-built structure and are more likely to meet future code requirements should they be made more stringent. However, if this option proves too expensive, I am confident we can construct our own building in good manner.

## **Equipment Washing Area**

### **Concerns**

Mowing is one of the primary tasks accomplished on any course. During the washing of equipment, grass clippings and other residues are discharged into the drainage area. The clippings contain nutrients and may contain some pesticide residue as well. Fertilizer and pesticide equipment also is washed following use. For these rea-

sons, equipment washing areas are being closely scrutinized for their possible environmental impact.

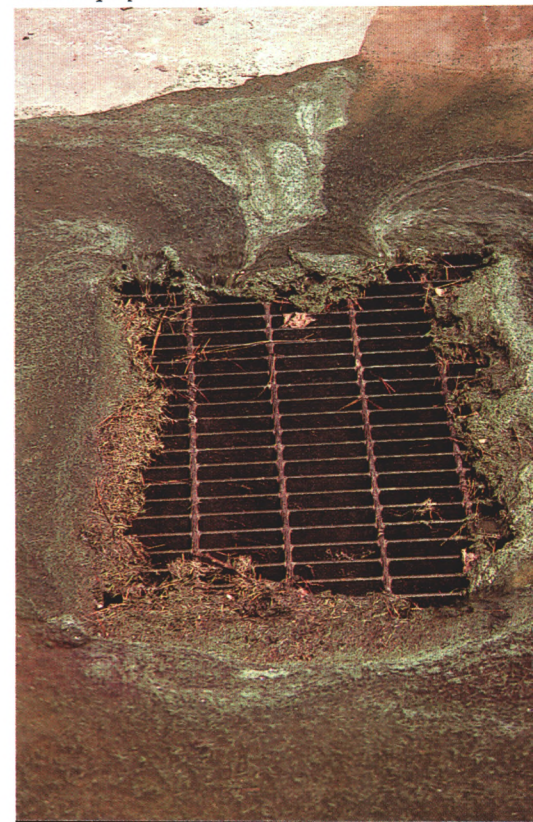
### **Current Situation**

We currently wash our mowing equipment on a concrete pad behind the shop. There is a drain inlet in the center of the pad that collects rinsate water, as well as clippings and other debris. The drain pipe extends from the pad and surfaces in a small drainage swale that then drains into the lake on the eighth hole. Prior to the construction of the wash pad, we discharged all rinsate into the local city sewer. Although I feel retaining our rinsate on the property by virtue of discharging it into the lake on the eighth hole is a better option than the previous practice, the nutrients in the rinsate have increased the severity of algae blooms, which affect the ecology of the pond and make it extremely unattractive. Also, since the lake overflows into a neighborhood creek, I am concerned about the possibility of contaminating that creek.

### **Options**

This issue has become such a concern throughout the country that rinsate recycling equipment is now available for golf courses. This equipment is similar in design and function to the filters used for swimming pools, although special modifications are in-

*Where do your clippings end up when equipment is washed?*







*Good pesticide and fertilizer storage structures can be built or purchased. These structures should be secure, ventilated, lighted, fire rated, and provide protection in case of spills.*

cluded for neutralizing chemical residues and removing solid debris such as clippings. Since contamination of the soil and/or water with chemicals occurs most often during mixing (spills, overflows, etc.), the unit also includes a mixing area. Predictably, this equipment is very expensive (as high as \$40,000).

The next option is to reconstruct our existing washing area. One design includes a concrete washing area that slopes to a collection pit. The pit itself includes a trap area and screen at the deepest end that collects as much of the clippings as possible. This pit is built to include a layer of gravel overlaid with sand to provide additional filtering. Finally, the collection area itself is constructed to allow our front-end loader to scoop out the majority of the debris, which then is added to our compost pile. I have obtained an estimate to build this type of wash pad. The total cost will be approximately \$7,000.

I have also instituted a number of steps to make an immediate reduction in the amount of material we wash into the lake. First, we have installed five

quick-coupler valves in rough areas throughout the course. These areas serve as "pre-wash" sites for our mowers that accumulate the most clippings. A different site is used each day to avoid creating an overly wet area and to keep odors to a minimum. The vast majority of clippings are removed in the pre-wash area. The equipment then is steam-cleaned on our existing wash pad. We also are considering using handheld blowing equipment to remove excess clippings from our mowers prior to the final steam cleaning.

To reduce the possibility of chemical contamination during the washing of pesticide application equipment, we no longer discharge any rinsate from this washing operation into a drain system of any kind. All spray solutions are applied to the course. We calibrate the equipment closely to keep left-over solution to a minimum. Any excess material is applied to the course. The equipment is then repeatedly rinsed, and

the rinsate is applied to the course as well. We also keep *spill kits* on hand to immediately clean up any contamination that may occur during mixing.

### **Recommendation**

Although there is no question that the unit that combines storage, rinsate filtration, and a contained mixing area is the most complete solution to our equipment washing and chemical mixing needs, this may not be economically feasible for our club at this time. Therefore, unless the club can find money for the more expensive option now, my suggestion is to proceed with the modification of our wash pad area as described in the second option.

### **Water Use, Pesticide and Fertilizer Use, and Wildlife Habitat**

#### **Concerns**

I have combined the last three areas of concern into one category since they are closely related. Golf courses can be heavy users of water. In many parts of the country, water use by golf courses is being closely regulated. Fertilizer

and pesticide use on golf courses continues to be one of the most volatile issues in golf course management today. Although university research indicates there is little to fear as long as these products are selected and applied properly, many people are concerned about their use. Finally, properly managed golf courses are starting to be recognized as excellent sites for a variety of wildlife. There are many courses in the country that have made concerted efforts to further improve this environmentally positive aspect of golf course management.

There is a trend in golf maintenance to increase wildlife habitat by allowing areas of the course that seldom come into play to return to a more natural state. This is accomplished by reducing or eliminating irrigation, fertilizer and pesticide applications, and mowing. In addition to creating nesting habitat and sanctuary for wildlife, courses are finding it possible to save money and labor that can better be used elsewhere on the property.

### **Current Situation**

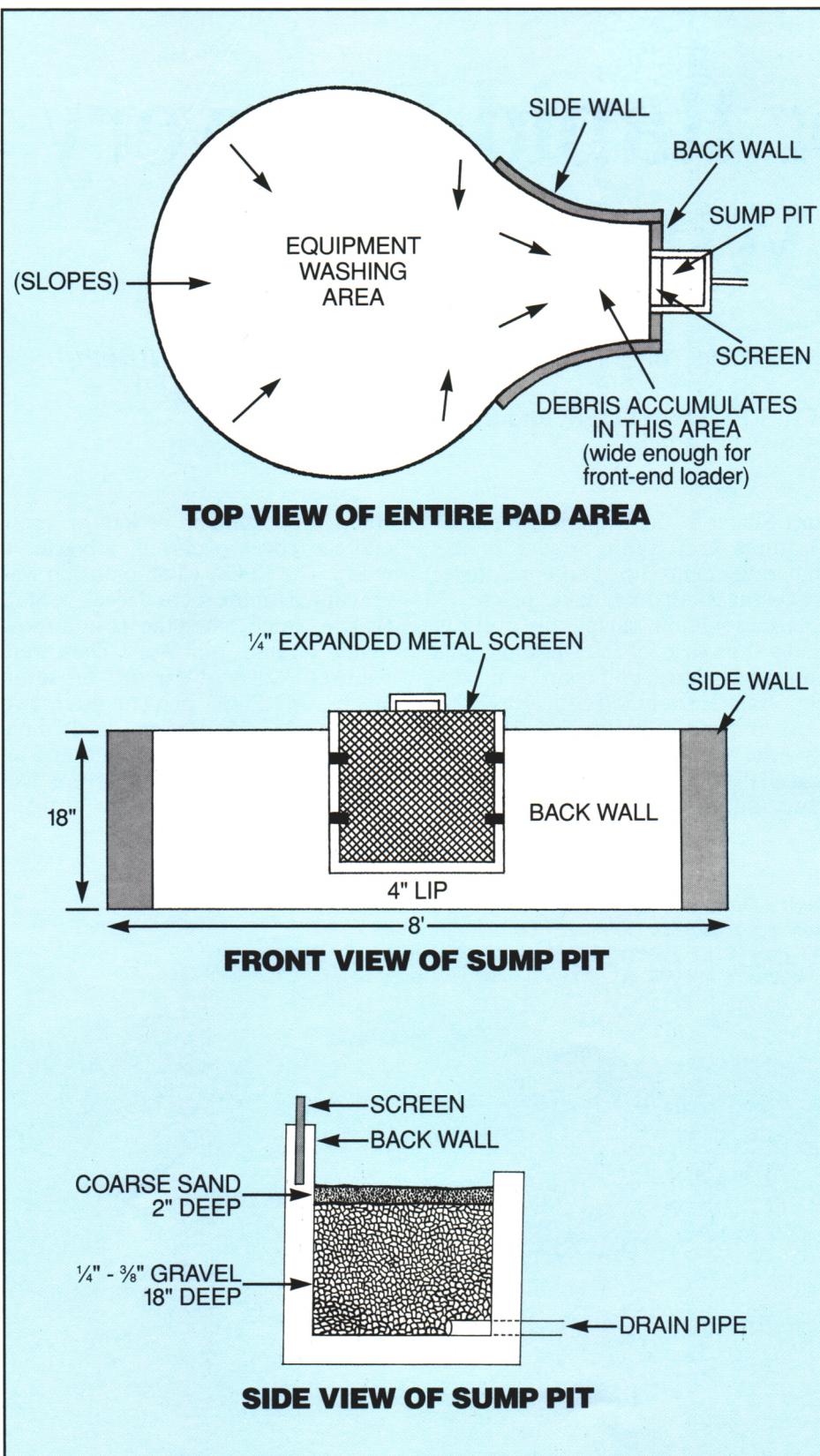
In my estimation, there are eight to ten acres on our course that seldom come into play. At least six of these acres are irrigated once or twice per week. We fertilize these areas twice per season. A pre-emergence herbicide is applied to the entire acreage each fall (for winter weeds), and two post-emergence applications are made during the spring and summer. We presently are mowing the irrigated acreage twice per week and the non-irrigated area once per week. Also, the turf areas surrounding all of our lakes are being mowed at fairway height.

### **Options**

Common sense dictates that any reduction in input (in terms of water and chemical usage) will prove a positive step from an environmental standpoint.

Since we apply about 12 inches of water per year to this acreage, eliminating irrigation over eight acres would result in a savings of two to three million gallons of water per year. Eliminating the pesticide and fertilizer applications would save approximately \$4,000. By reducing the mowing of the roughs around the lakes, we could channel 800 to 1,000 labor hours per year into other course maintenance activities. Allowing the turf around the lakes to grow to a height of four inches or more would provide a buffer strip





*An illustration of a simplified wash rack.*

of higher cut turf to further reduce the possibility of fertilizer or chemical runoff into the lakes.

Perhaps the most important gain would be the encouragement of wildlife on our course. I'm sure many of our

players have already noticed the bluebirds in the boxes we mounted on number 14 and purple martins that constantly patrol our lakes for mosquitoes and other insects. By promoting another eight to 10 acres of nesting habi-

tat, we can expect to enhance both the variety and numbers of birds and other wildlife on our course.

### **Recommendation**

My recommendation is to begin establishing our naturalized areas as soon as possible. We can allow these areas to return to a native or natural state by essentially reducing all maintenance. Since we have promoted turf-grass in these areas for years, it will take a season or two for native grasses to once again flourish. We can speed this process up by sowing native grasses, wildflower seeds, and other native plants. However, it should be pointed out that the areas definitely will look unkempt for a while. There are likely to be some players who will feel the appearance of the course has suffered by reducing the maintenance of these areas. A good educational effort will be required to illustrate the advantages of this and other changes in our maintenance programs. Our first step should be to enroll in the Cooperative Sanctuary Program developed through a joint effort of the USGA and the Audubon Society of New York State. I contacted the USGA and received information about this program, which I have attached to the end of this report.

### **Summary**

We should consider hiring a professional environmental consultant to perform a more thorough review of our maintenance facility. The company would provide us with a comprehensive report, including suggestions for improvement and options to obtain detailed drawings for the construction of storage facilities, wash pads, etc. We can obtain such a review for approximately \$1,500.

There are many other environmental aspects of the care of our course that have not been covered in this brief report. Please review the information I have included with this report, summarizing recent research sponsored by the USGA and conducted at major universities across the country. Although I have made every effort to ensure our course is professionally managed, we do have opportunities to improve our maintenance operations for the benefit of the environment and the game of golf.

JAMES FRANCIS MOORE is the Director of the Mid-Continent Region of the USGA Green Section.



# Recipe for Rapid Recovery from Winter Injury

*What to do if you have only 40 days to get the course ready for a championship.*

by EARL SHAFER, KEITH SNYDER, and STANLEY ZONTEK

**E**ACH YEAR, the DuPont Country Club plays host to the McDonald's LPGA Championship, one of the four major events on the LPGA Tour. The prize money is more than \$2 million, and the event raises \$2 million each year to support McDonald's children's charities. Most notable are the Ronald McDonald Houses. Also, the tournament is nationally and internationally televised on CBS, the Golf Channel, and Tokyo Broadcasting.

Earl Shafer is the Superintendent of Grounds and Keith Snyder is the Superintendent of the DuPont Course, where the tournament takes place.

It goes without saying, the event is also a showcase for the DuPont Company and its three golf courses. It is an important event for all concerned.

As Superintendent of Grounds, I have the responsibility for these courses and all the events associated with them. Thus, during the winter of 1993-94,

when an extended period of snow and ice cover occurred, I began to worry. The LPGA Championship was scheduled for the second week in May. By late March, when the ice and snow finally cleared, our worst fears were realized. Much of the turf on seven greens was 80-95 percent dead, two greens were 70 percent dead, three greens were 60 percent dead, and all but one of the remaining greens had lesser amounts of winterkill. Virtually

*The before and after photos of the par-3 17th hole at DuPont Country Club (Wilmington, Delaware) bear witness to the amount of work that went into renovating the damage from winter injury.*





all of the damage was to *Poa annua*. With the LPGA Championship only 40 days away, we had our work cut out for us. With this background, here's the story of how we quickly brought these greens back from the dead.

The *first step* in any recovery program is to convince yourself that the grass is dead. After all, winter injury associated with ice sheet cover and crown hydration can be deceiving. Roots can look white and healthy. The grass even retains some amount of green color coming out of winter, and many golf course superintendents believe the grass will come back. They think it just can't be hurt that badly. After the first few warm days, however, damaged plants attempt to function but soon wilt and begin to decay.

After consulting with our regional USGA agronomists, Stan Zontek and Keith Happ, any optimism we had was dashed. Soon the odor of the grass (it smelled like rotten grass clippings) and the changing of the grass's color each day, from shades of green to yellow-green to tan, more than convinced us that a recovery program must be started, and quickly. Our fears were

communicated to our management and the LPGA. We felt that if we did not disrupt the surface of the greens too much with the renovation process, we probably could provide a satisfactory surface for the event, even though the turf cover might be thin. Obviously, we wanted grass but we prepared for the worst.

The *second step* of our recipe was seedbed preparation. To accomplish this, we used a combination of spiking, shallow aeration (using the Job Saver attachment on a Ryan Greensaire unit), and topdressing. Greens were spiked four ways and seeded in one direction at 2 lbs./1,000 sq. ft. with Redi-seed mix, which is primed seed Pennncross. Two pounds of this product equates to one pound of actual seed.

The seedbed preparation continued with shallow aerification with the Job Saver. The greens were seeded again in a cross direction, at the same rate, and were lightly topdressed with an 80 percent sand/20 percent organic matter material at 1 cu. yd. per green. All of this was dragged in and then rolled with a Salsco roller. A few days later, the greens were spiked again and

seeded at 2 lbs./1,000 sq. ft. with unprimed Dominant bentgrass.

As you can see, we used a combination of primed and unprimed seed. Primed seed was new to us. It's a new technology that is supposed to allow for seed to germinate at soil temperatures where conventional seed might not germinate and could rot. We hedged our bets by using both primed and unprimed seed.

*Step three* was to effect germination during a cool, cloudy, and damp spring. These were not good conditions for obtaining quick germination and growth. Our strategy was to use covers. The first was clear 4-mil plastic, and we used 150,000 sq. ft. of it! This cover quickly raised the soil temperature by 7-10 degrees. In seven days we saw the first signs of germination, and at that time we removed the plastic and switched to geo-textile fabrics. This material breathes better than plastic, and we covered the greens each night to conserve heat and protect the seedlings from frost.

*Step four* was labor intensive, involving the daily removal of these geo-textile covers. Each day they were re-





moved in the morning and replaced in the late afternoon. Our labor expenditure for this operation was 40 man-hours per day.

*Step five* was the post-germination grow-in recipe:

4/2/94: Sprayed greens: Chipco 26019, 4 ozs./M.

4/14/94: Sprayed greens: Chipco 26019, 4 ozs./M; 0.2 lb. N/M Par-Ex 20-20-20 and 2 ozs./M Ferromec.

4/15/94: Spot seeded thin areas with Redi-seed. Topdressed greens twice with Lesco hand cyclone spreaders, set wide open. Fertilized greens: 0.5 lb. N/M Milorganite.

4/17/94: Topdressed greens twice over with Lesco spreaders.

4/19/94: Sprayed greens: Astron 1 oz./M (Astron is a growth stimulant).

4/20/94: Sprayed greens: .2 lb. N/M Par-Ex 20-20-20.

4/21/94: Fertilized greens: .5 lb. N/M Pro-Lawn 14-22-14. We saw a phosphorus response.

4/22/94: Sprayed greens: .2 lb. N/M urea 46-0-0. The seedlings were not responding to the 20-20-20 material, so we switched to a more available nitrogen source. This quickly accelerated the growth of the new seedlings.

4/23/94: Sprayed greens: .1 lb. N/M urea, 2 ozs./M Ferromec. Spot seeded Redi-seed mix before topdressing. Topdress greens twice over with Lesco spreaders.

4/24/94: Sprayed greens: .1 lb. N/M urea, 4 ozs./M Daconil, 2 ozs./M Fore, and 1 oz./M Roots plus iron.

4/25/94: Sprayed greens: .1 lb. N/M ammonium nitrate.

4/26/94: Sprayed greens: .1 lb. N/M ammonium nitrate and 2 ozs./M Fore. Applied Redi-seed on thin areas before topdressing. Topdressed greens twice over with Lesco spreaders.

4/27/94: Sprayed greens: .1 lb. N/M ammonium nitrate and 2 ozs./M Fore.

4/28/94: Sprayed greens: .1 lb. N/M ammonium nitrate and 2 ozs./M Fore.

4/29/94: Sprayed greens: .1 lb. N/M ammonium nitrate and 1 oz./M Roots.

All spraying was done with the Toro Workman boom sprayer, with raindrop nozzles. We felt that with so many young seedlings, we had to be careful about fertilizer burn. These light, frequent sprays worked just fine. The grass was dark green and growing rapidly.

This work took us to the beginning of *advance week* before the tournament. The greens were completely covered with turf; we had brought the greens from dead thatch to living grass in 40 days. The greens continued to

stemmy due to the heavy fertilization schedule. We felt we had to cut some of these runners with the tournament less than two weeks away. I am not sure I would have risked it under normal conditions, but we still had to prepare a putting surface for a major golf event and for normal member play after the tournament. It was carefully done; we set the groomers/verticutters only  $\frac{1}{64}$ -inch deep.

We also were careful with our topdressing applications. With tender grass, we very lightly brushed in the topdressing and then watered afterwards.

*Step seven* was traffic control. During this grown-in and recovery period, the greens were not in play. *We strongly feel this was a key to our success.* The course was open for play, but temporary greens were used.

The before and after photographs perhaps tell our story better than our written words. In less than six weeks we went from dead grass to greens that rolled 9'6" to 10' on the Stimpmeter. I feel our recipe worked to perfection under these circumstances.

Recovery from this type of devastation took a true team effort. It required a lot of understanding

and cooperation from our management and members, along with a tremendous amount of hard work by our staff. It should be stressed that a maximum effort was put forth. We did not have the luxury of time. We needed to use all tools available to effect this recovery. If extensive winterkill ever occurs on your course, I hope these details of our experience help you produce a timely recovery.

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EARL SHAFER is the Superintendent of Grounds at DuPont Country Club, Wilmington, Delaware; KEITH SNYDER is the Superintendent of the DuPont Course, and STANLEY ZONTEK is the Director of the Mid-Atlantic Region of the USGA Green Section.



*The Job Saver tines helped produce a good seedbed without disrupting the surface.*

improve daily, and by the start of the championship on May 9, 1994, a very satisfactory playing surface was provided for the players.

*Step six* was management. Initially, we lightly syringed, sometimes hourly, to maintain moisture on the surface of the soil where the seed and seedlings were. The surface was never allowed to dry out. When the grass was tall enough to mow, we mowed the greens with a triplex mower set at  $\frac{1}{4}$ -inch, using solid rollers. We mowed every two to three days.

The grass on the greens even required some light grooming. The reason for this was that the bentgrass in our greens that had survived the winter became coarse-bladed and



A USGA-SPONSORED RESEARCH PROJECT

# The Environmentally Sound Turfgrass of the Future

*Seashore paspalum can withstand the test.*

by DR. RONALD R. DUNCAN



*Seashore paspalum (Paspalum vaginatum) is native to coastal environments. The species has the ability to withstand a wide variety of harsh conditions, ranging from salt spray to severe drought.*

**SEASHORE PASPALUM.** This name gives one the impression that this turfgrass is or should be grown only on seaside golf courses or recreational areas. Indeed, this grass is native to coastal environments, where salt water limits plant growth and survival. It can be found on sand dunes located immediately back from the wave action. This indigenous species is subjected to periodic salt spray, high wave inundation during storms, prolonged cloudy, rainy days, severe drought, minimal nutrients, and ocean salt water. However, the potential for seashore paspalum goes well beyond the limited niche of a seashore area.

## Environmental Compatibility

Seashore paspalum has the *potential* to be one of the most environmentally compatible turfgrasses for the year 2000 and beyond: a) It will require minimal pesticide applications. b) It will require approximately 25-35% the annual fertilizer that is currently applied to bentgrass greens and 20-40% the fertilizer required for hybrid bermudas. c) It has a phenomenal adaptability range of pH (4.0 to 9.8). d) Seashore paspalum also has potential as a bioremediant, withstanding factory-contaminated effluent, while naturally cleaning up the environment. e) It can be irrigated with sewage plant

effluent (recycled water) or combinations of ocean water and recycled water. Some ecotypes are known to withstand up to 14,000 ppm of sodium chloride. Consequently, it is one of the most salt-tolerant turf species available. f) It has acid soil stress tolerance down to pH 4.0. g) It is as drought-resistant as bermudagrass and centipedegrass. h) The grass is not affected by soil type, having the capability to root rapidly in sandy soils, mucks or bogs, and high bulk density, heavy clay soils. i) It can withstand periodic inundation from heavy rains or high tides without losing stand density. j) Seashore paspalum has moderate shade tolerance (maximum



up to 35% light reduction), which is important in those environments with tree-dominated fairways, tees, greens, or roughs, and in areas where prolonged rainy seasons (monsoons) reduce light over extended periods of time.

### Origin

Grasses in the genus *Paspalum* are notorious for adaptation to extremely harsh environments. *Paspalum dilatatum*, or dallisgrass, is a persistent bunch-type weedy species that plagues tropical and subtropical environments. *Paspalum notatum*, or bahiagrass, is a bunch-type forage grass and stoloniferous turfgrass for use in southern tropical regions. *Paspalum vaginatum*, or seashore paspalum (also called saltwater couch, siltgrass, or sand knotgrass) is a stoloniferous/rhizomatous prostrate-growing turfgrass for wet, salt-affected ecological zones. It is predominately found between 35°N-S latitudes in the Americas, many islands of the Caribbean-Atlantic-Pacific rim areas, and the Mediterranean-African coastal areas. South Africa may be a dual center of origin with the Americas, particularly Argentina-Brazil and Georgia. A companion species is *Paspalum distichum* (knotgrass, freshwater couch, or eternity grass), which is found in freshwater swamps in the tropics and subtropics. *Distichum* is also stoloniferous/rhizomatous, but can generally be found further inland than its saltwater counterpart.

### Morphology

The genus *Paspalum* includes more than 400 species that are as diverse

morphologically as the stress environments in which they evolved. Most are quite complex genetically, being tetraploids (four sets of the basic chromosome number) and apomictic (true breeding types with limited within-cultivar diversity). Seashore paspalum is a sexual diploid with 20 chromosomes, but it is self-incompatible, meaning that it will not produce a high percentage of viable seed unless crossed with other *P. vaginatum*s from completely different genetic backgrounds.

Seashore paspalum produces a two-pronged, V-shaped spike inflorescence that ranges from 10mm to 70mm in length. This inflorescence is similar in appearance to *Cynodon transvaalensis*; however, *Cynodon dactylon* or *C. dactylon* x *transvaalensis* bermuda hybrids have 3 to 5 spikes. Another distinguishing trait for the paspalums is the extreme hairiness, or pubescence, around the leaf sheath collar and occasionally on the edge of the leaf blade. On mornings with a heavy dew on the grass, seashore paspalum can be readily distinguished from bermudas by the amount of water retained on the leaf blades. Less moisture will accumulate on seashore paspalum than on the bermudas, and the visual appearance is distinctly different.

### Texture

Seashore paspalum ranges from very coarse, rapidly growing types that look like St. Augustine grass to extremely fine-textured "Tifdwarf" or "Tifgreen" bermuda-types. Of course, the finer-textured types receive major research emphasis for golf course usage. Col-

lection trips and evaluation/developmental studies also search for slower growing, highly dense types for greens and tees. These finer-textured types have been found on greens and tees that were maintained at 1/8- to 1/4-inch mowing heights.

### U.S. Distribution

The oldest known natural source of seashore paspalum in North America can be found on Sea Island, Georgia. The first golf course there was built in 1925, and the finer-textured type established itself on fairways closest to the inland marshes and on those fairways subjected to periodic high-tide inundation. The Hawaiian source of seashore paspalum originated from Sea Island. During the mid-1960s, a cultivar of seashore paspalum ("Adelaide") was introduced into southern California by Pacific Sod from Adelaide, Australia. All Australian seashore paspalums originated from South Africa, being introduced during 1935 via normal quarantine regulation channels. The Australian source was dispersed throughout Southern California and Arizona, from Texas along the Gulf Coast region to Florida, and finally along the Atlantic coastal areas of Florida, Georgia, South Carolina, and the Outer Banks of North Carolina. Most of the Florida sources of seashore paspalum originated from the Australian source, but Sea Island ecotypes can be found dispersed throughout that state.

### Limitations

The main reason that seashore paspalum was not widely dispersed

*Seashore paspalum can withstand up to 35 percent light reduction. This feature is important in areas with long rainy seasons and reduced solar radiation.*

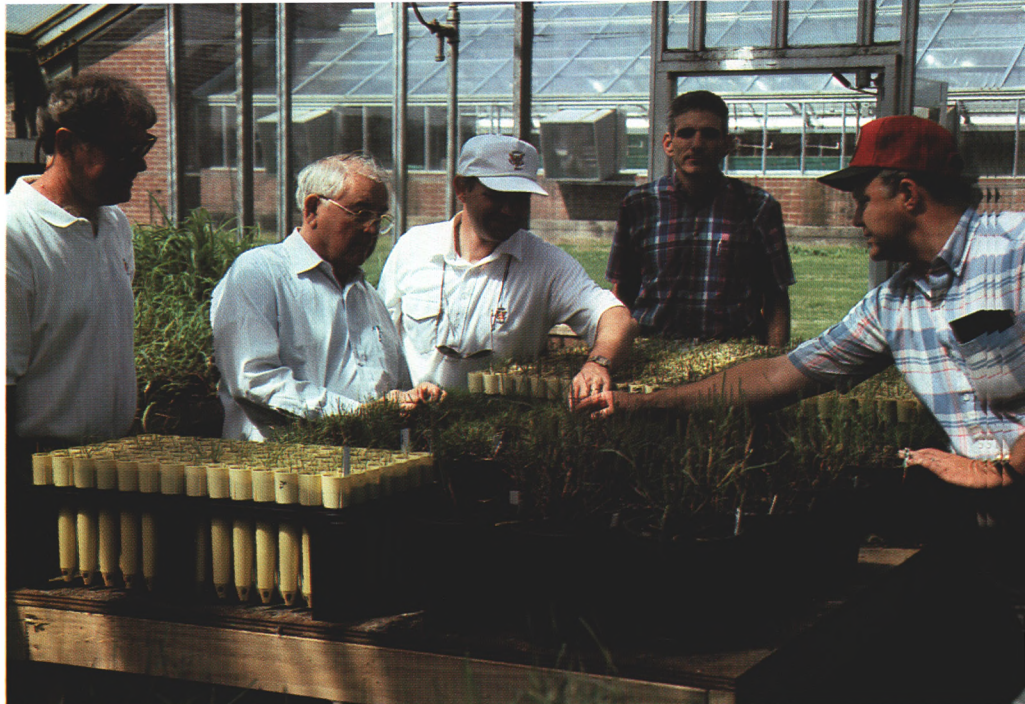




throughout the southern coastal U.S. during the 1970s and 1980s was the lack of any management protocol. Most golf courses that tried to establish and maintain seashore paspalum treated it the same as hybrid bermudas. They applied too much fertilizer (especially nitrogen) and irrigation water. Seashore paspalum produced mainly shallow-rooted stolons that scalped easily, built up serious thatch problems, had limited traffic tolerance, and was cosmetically unappealing. Neither the golf course superintendents nor the golfers were happy with the grass. Superintendents who stopped trying to *fight* the grass as a weed and started managing it with centipede-like management strategy (i.e., reduced maintenance) are the ones who still have seashore paspalum on their courses and are pleased with its performance. Seashore paspalum is extremely competitive with other grasses, including the dwarf bermudas, as long as they are managed properly. Also, superintendents who have used the dense, dark-green, fine-textured seashore paspalum ecotypes (rather than the intermediate-textured Adelaide) have had very good success. This is the case with courses in Hawaii that are currently managing seashore paspalum on *problem* fairways and greens.

A major adaptation limitation is the lack of winter hardiness. Most of the early research on this grass was based on the Australian source, which was killed at 17°F. Subsequent evaluations of ecotypes collected from various areas of the world have shown several ecotypes that survived a -3°F blast (non-hardened) of cold air plus continuous soil freezing conditions for three weeks in an Appalachian mountain research location during January 1994 (many bermudas died from exposure). A cold-shock and recovery strategy is being used to identify additional winter-hardy types; evidently, the genetic diversity for improving cold tolerance is available in the species.

Another area of concern for this grass is resistance to insects and diseases. Mole crickets and fall armyworms plague most warm-season grasses in the southern U.S. Genetic diversity for resistance has been found for both insects among the ecotypes of seashore paspalum collected thus far. Monostands of seashore paspalum may require minimal insecticide applications at peak insect population development, but genetic resistance will be a viable option. Other insect problems may



Dr. Ron Duncan (right) shows members of the USGA Turfgrass Research Committee selections of seashore paspalum from around the world.

develop as the acreage of seashore paspalum monostands increases on golf courses or on recreational areas.

Curvularia, dollar spot, and pythium blight have been observed on seashore paspalum. However, all were located in very specific ecological niches and were neither widespread nor spreading to other areas. In fact, the fungal colonization appeared to be localized, almost to the point of a symbiotic (mutually beneficial) relationship between the fungi and seashore paspalum. Much more research must be conducted using monostands of this grass to understand the pathogen relationships and to eventually develop a disease management protocol.

### New Research

The United States Golf Association initiated funding of a breeding program on seashore paspalum at the University of Georgia during 1993. Initial objectives included collection of ecotypes and initial evaluation of fine-textured, turf-type paspalums. The University of Georgia program started with five genotypes in 1992, but now has more than 300 ecotypes from many parts of the world in collection. Eighteen ecotypes currently are being evaluated under green conditions. Irrigation and nitrogen use studies on fairways, as well as judicious herbicide application strategies, will begin in 1995. Overseeding studies began during 1994 involving tall fescue, perennial ryegrass, *Poa*

*trivialis*, and creeping bentgrass. Seashore paspalum is a warm-season grass and parallels bermudagrass and zoysiagrass as to winter dormancy. In general, seashore paspalum goes dormant about two or three weeks later than other warm-season species, but takes about two or three weeks longer in the spring to green up. However, ecotypes vary in their dormancy and green-up responses.

Mole cricket, fall armyworm, and spittlebug research is continuing to identify the most resistant ecotypes. Other insect resistance studies (such as cutworms and white grubs) will be initiated when research funds become available. Genetic analysis by several molecular marker techniques of the ecotypes is underway to provide definitive genetic fingerprint data on all ecotypes in the collection and for eventual new releases.

This grass truly has a very promising future, as pesticide application regulations increase and mandated use of nonpotable or recycled water is implemented on recreational turf. The grass is not a utopian grass (for there is no such thing), but it definitely has a role to fill and will offer an environmentally sound alternative to some of the major turfgrass species being used today.

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DR. R. R. DUNCAN is professor of turfgrass science at the University of Georgia in Griffin, Georgia.





*Alkaline soil conditions are often responsible for chlorotic turf. A high soil pH can tie up nutrients, particularly iron and phosphorus.*

# *Acid — To Inject or Not to Inject*

*You don't need a Ph.D. to know your pH.*

**by HAROLD F. HOWARD, Ph.D.**

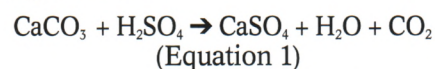
**I**T HAS BEEN generally accepted for decades that pH is the single most important chemical factor that influences soil suitability for successful agriculture. Turfgrass managers have long strived for pH 7.0, the *neutral* pH at which the soil is neither acidic nor basic. The benefits of adjusting a high or low soil pH value to neutral abound in literature, and include increased nutrient availability, reduced sodium hazard, increased water infiltration, and increased tilth.

A quick chemistry refresher reminds us that pH is a measure of the hydrogen ion ( $H^+$ ) concentration in a soil solu-

tion. Acidic soils (pH below 7.0) have a high concentration of  $H^+$  ions while basic soils (pH above 7.0) have a low concentration of  $H^+$  ions. A turf manager in a temperate climate, where soils are typically acidic, will add lime ( $CaCO_3$ ) to the soil to raise the soil pH. The added lime reacts with the  $H^+$  ions and removes them from the soil solution, raising the soil pH toward neutral.

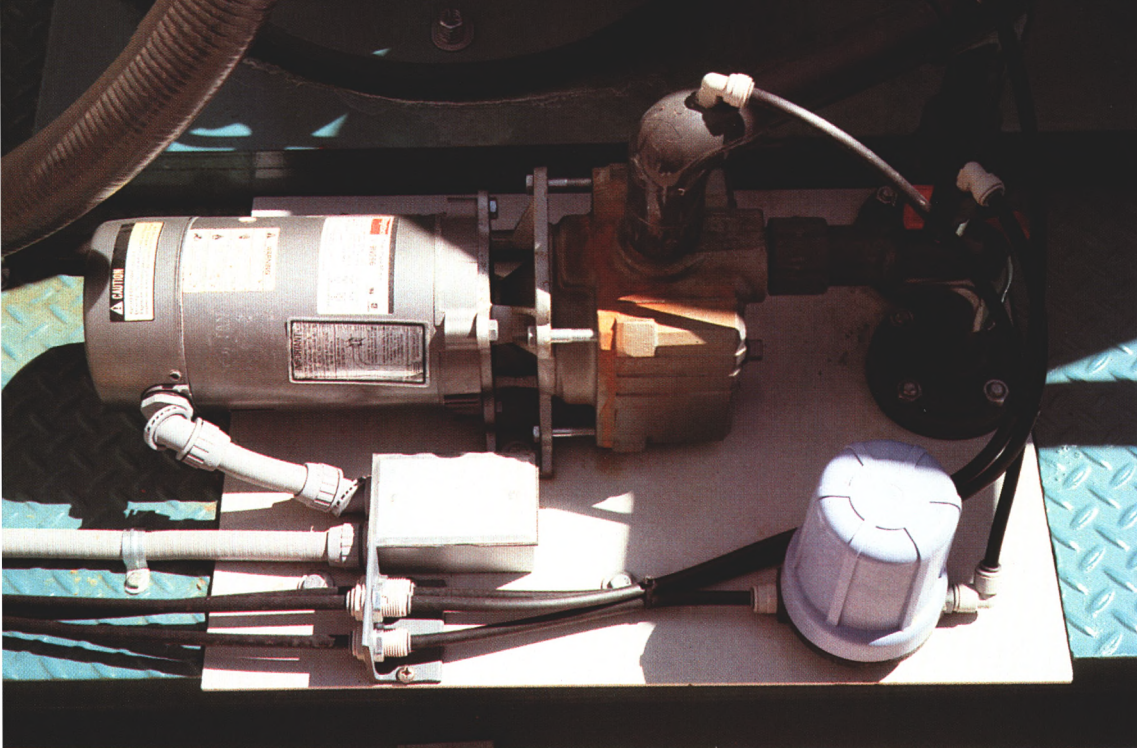
Turf managers in arid climates, such as the southwestern United States, usually find the opposite situation. Typically, their soils are basic, with pH values above 7.0 and often as high as 9.0. These soils usually contain a high

lime content as well. To lower soil pH toward neutral, the turf manager will add either acid or an acid-forming amendment to increase  $H^+$  ions in the soil solution. When the amendment is added, the acid reacts with the lime in the soil and is consumed by the following reaction:



Such soils are said to be buffered because they resist a lowering of pH when acid is added. When dealing with a high pH soil, the best that the turf manager can hope for is to lower the





To avoid damage, the pH electrodes should be mounted in a remote location. When the microprocessor control system detects different readings between two electrodes, the system automatically shuts down.

pH of the surface layer. To neutralize the soil to a great depth would require an unreasonable quantity of acidifying amendment.

### Is An Acidifying Amendment Appropriate?

If the pH of your soil is above neutral 7.0, then your turf may benefit from lowering the soil pH. Maintaining a near-neutral pH changes a variety of factors that will affect management conditions.

1. Nutrient availability: Most nutrients become less available as the soil pH deviates from 7.0. Prominent examples are phosphorus and iron. Reducing the pH from 8.0 to 7.0 may result in a many-fold increase in the availability of these nutrients, possibly eliminating the need for supplemental fertilizers.

2. Sodium hazard: Many soils in arid climates contain high levels of sodium, which can cause many problems. One way to reduce sodium is to add gypsum ( $\text{CaSO}_4$ ). The added  $\text{Ca}^{2+}$  ions effectively displace sodium ( $\text{Na}^+$ ) from the cation exchange sites, allowing the  $\text{Na}^+$  ions to leach from the rootzone. However, if your soil is calcareous (high in  $\text{CaCO}_3$ ), as most are, application of gypsum is not necessary. Addition of an acidifying amendment will react with the  $\text{CaCO}_3$  as in Equation 1. In this process gypsum ( $\text{CaSO}_4$ ) is manufactured in the soil and the pH of the soil is lowered. For example, addition of

19 lbs. of elemental sulfur to calcareous soil will produce 100 lbs. of gypsum ( $\text{CaSO}_4$ ).

3. Water infiltration: As sodium is displaced from the cation exchange sites, the soil particles tend to form aggregates. This causes the soil pores to become larger, which in turn increases the rate at which water moves through the pores. After acidification, the infiltration rate of basic (high pH) soils usually increases substantially.

4. Lime reduction: When present in soils, lime acts as a cement between soil particles, just as it binds larger aggregates in concrete. When the lime content of a calcareous soil is very high, the soil is known as caliche, a very hard form of impure limestone. After adding an acidifying agent, lime will be reduced as in Equation 1. Over a period of time, enough lime can be eliminated so that calcareous soil becomes quite soft and agriculturally productive. Also, with high pH irrigation water, lime can precipitate inside plumbing, a situation referred to as *hardening of the arteries*. This leads to reduced flow or even plugging of pipes, sprinklers, and drip emitters. Injection of acid will eliminate these lime deposits.

The above factors are potential benefits from adding acidifying amendments to a basic soil. However, if your soil is neutral or acidic, you do not need more acidification, so don't do it. Ignore salesmen who tell you otherwise. Addition of acidification amendments

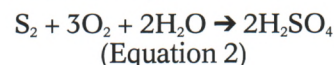
where they aren't needed will cause your situation to take a step backward rather than forward.

### Acidifying Amendments

Acidifying amendments are applied to mature turf in one of two ways: addition of concentrated acid to irrigation water, or the application of an acid-forming material directly to the turf. As a liquid, acid is injected into irrigation water as it enters the pumping system. This addition lowers the pH of the irrigation water, and subsequently the soil pH is lowered. Sulfuric acid ( $\text{H}_2\text{SO}_4$ ) is the most popular material used for this purpose, although other acids (often a blend of sulfuric acid and urea) are sometimes used. The user should examine the cost efficiency per unit of

neutralizing power when using blended materials.

An acid-forming amendment is not acidic when it is applied, so it can be spread directly onto mature turf in dry form. Once in the soil, the amendment undergoes a reaction by which it is converted to sulfuric acid, which then lowers the soil pH. This amendment is commercially prepared as 90 percent elemental sulfur dust combined with 10 percent bentonite clay. The material is compressed into small pellets which can be spread easily. When damp, the pellets disperse into sulfur dust. The sulfur dust is then oxidized by *Thiobacillus*, a soil-borne bacterium, to form sulfuric acid as follows:



Whether supplied to the soil directly or indirectly, the intended results of the acidifying amendment applications are identical — lowering the soil pH. It is worth noting, however, that one pound of elemental sulfur will oxidize into three pounds of sulfuric acid. As a result, spreading one ton of elemental sulfur will have the same acidifying effect as injecting three tons of sulfuric acid. This is important in determining which material is more cost-effective in lowering soil pH at your course. Incidentally, both elemental sulfur and sulfuric acid are byproducts of the petroleum refining and metal ore smelting industries.



## The Spread vs. Inject Decision

Both acidifying amendments and methods will reduce soil pH. The method that is most appropriate for your particular facility is based upon the following considerations.

1. Cost efficiency: If your objective is to neutralize 1,000 lbs. of lime, you have the choice of using either 320 lbs. of elemental sulfur or 980 lbs. of sulfuric acid. A recent survey of vendor pricing indicated that 93 percent sulfuric acid sold for \$115 per ton and 90 percent elemental sulfur sold for \$240 per ton. The cost difference to neutralize 1,000 lbs. of lime would be \$43 using elemental sulfur or \$61 using sulfuric acid. A modern injection system typically costs about \$8,000, but is sometimes provided at no expense by the acid supplier.

2. Labor and intrusion: When using modern injection equipment, minimal labor costs are incurred. Visual inspections of the equipment, ordering acid supplies when needed, and electrode calibration every two to three months are all that is required to maintain the equipment. Acid injection is not visible or detectable to the facility users. Spreading of dry elemental sulfur requires applicator labor costs and the use of equipment. This involves higher costs and also may be intrusive to the golfers.

3. Application uniformity: When using the injection method, the uniformity of the application is only as good as the irrigation uniformity. In many cases this can be quite poor, especially with older, less sophisticated or poorly tuned systems. Under these circumstances, the areas receiving the least irrigation coverage are usually those needing the most amendment.

With dry materials, application uniformity should be excellent. In practice, the application is only as good as the skill and effort of the operator and the quality of the equipment.

4. Segregation of areas: Based on the site conditions, it may not be necessary to apply amendment to the entire facility. For example, the turf manager may

not wish to apply amendment to the greens or locations where the soil pH does not need lowering. When routine injections are made, these areas will not be segregated and will receive the amendment. With dry application, the manager has better control over which areas receive the amendment.

5. Risk of overdose: When making a dry application, there is a risk of overdose. If the buffering capacity of the soil is low or if the application technique is poor, it is possible that the pH can be reduced to undesirably low levels. For this reason, application of dry materials to a high-sand-content green could be very risky. On the other hand, modern injection systems are designed to lower the pH of irrigation water to approximately 6.5. Given proper equipment function, there is no potential for lowering the soil pH below 6.5.

## Modern Injection Systems

With the recent advent of modernized equipment, acid injection has changed from a very risky to a relatively safe endeavor. For example, when John Szklinski became superintendent of the Desert Highlands Golf Club, he inherited an injection system that consisted of little more than a pH electrode in the wet-well, a controller, and a pump to deliver acid from a storage tank to the wet-well. During his second week, John noticed that the 1,000-gallon acid storage tank was nearly full one day but empty the next. He discovered that the electrode had broken and the controller had dumped

the entire acid supply into the wet-well. The wet-well then backflowed into the reservoir and lowered the reservoir pH to 2.4. Employees told him that the reason no fish had died was because they were all killed by a previous malfunction. Though no turf loss resulted, a multitude of ductile iron fittings had begun leaking and concrete in the system had likely eroded. This experience is typical of early systems with inadequate safety features.

John contacted Werecon, Inc., in Scottsdale, Arizona, a manufacturer of state-of-the-art injection equipment for a replacement system. The new system is designed not only for performance, but also for safety. All acid-handling components are installed above the storage tank and are double-enclosed. At no point in the system is the acid under pressure, so there is no opportunity for ruptured fittings or having an uncontained leakage occur. Rather than dumping acid into the wet-well, a circulator pump removes water from and returns it to the wet-well via open discharge. Acid is injected into the downstream flow as needed. The system utilizes two pH electrodes, one in the wet-well and the other in the pump stream. All components are monitored and controlled by a computer, which is programmed to adjust the water pH to 6.5. If at any time the computer detects a component failure, a pH outside the operational range, a discrepancy in readings between the two electrodes, or any other abnormality, the system is automatically shut down. These

modern systems serve their owners with relatively safe and reliable operation.

In summary, if you need to lower your soil pH, two amendment strategies are available to you. However, these should not be employed if your soil is not in need of acidification. A careful evaluation of your particular circumstances will aid in selection of the most appropriate choice.

*This acid reservoir is located in an underground vault for public protection. By removing the acid through the top of the tank, accidental spills from leaky fittings are avoided.*



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HAROLD F. HOWARD, Ph.D., is on the staff of TurfScience, Inc., in Phoenix, Arizona.



# USING COMMON CENTS!

*Fund regional research with ingenuity.*

by LARRY GILHULY

**H**AVE YOU EVER watched a block of ice melt? It takes a long time and requires great patience, yet eventually the end product is usable. Much the same can be said about turfgrass research. It also requires patience; however, without fundamental research during the past several decades, nearly all of the current grasses would not have been possible. In a nutshell, turfgrass research is vital and must continue!

While the USGA Green Section continues to fund projects throughout the United States, every portion of the country has different agronomic problems. This fact has been a concern with turfgrass research funding, as most projects are given the highest priority if they have a national impact. Regional research is generally addressed with money raised by local turf associations, superintendent groups, and the turf industry. Generally, the amount of money raised is not adequate to conduct large-scale research for the local golf community. The question remains, where can larger sources of funding be found for regional research?

In the Pacific Northwest, an answer may be at hand. During the past several decades, turfgrass research in the Pacific Northwest has been allocated through grants from the Northwest Turfgrass Association and other organizations. Occasional USGA grants have also been received; however, completing meaningful regional research with limited funding has been difficult. With this in mind, a new approach has proven successful with the recent announcement of a 50¢/player/year allocation for turfgrass research by the Washington State Golf Association Board of Directors. This levy will amount to an annual contribution of nearly \$43,000 beginning in 1996. How and why this was accomplished is a good lesson in organization, timing, and hard work.

## The Plan

During the past several decades, golf associations in the Pacific Northwest

had been approached to provide funding for turfgrass research. For various reasons, all efforts had been unsuccessful. Using this situation as a platform, Tom Christy, CGCS, Riverside Golf and Country Club in Oregon, devised the T.U.R.F. (Turfgrass University Research Fund) program with other turf professionals in the Pacific Northwest. The plan was to spend at least two years educating the region's golf association board members and club representatives about the need for regional turfgrass research and programs at Washington State University and Oregon State University.

## The Approach

Rather than approaching the golf associations with a gun to their heads and an extended hand, representatives from WSU, OSU, USGA, local golf course superintendent associations and the industry began educating golf associations about funding problems within the turf industry. As several board members of the Washington State Golf Association mentioned, "It just makes common sense! Golfers funding turfgrass research that will provide direct benefits back to the game can see results with their small dues increase."

## Education

During 1994 and 1995, education of the general golf community was also necessary. This process was accomplished through presentations at the annual meetings of both golf associations. These presentations discussed in great detail the environmental concerns that our industry faces, as well as regional research that could be funded. As with the boards of directors for the golf associations, the response was overwhelmingly positive, with most in attendance also claiming, "It just makes good sense!" In addition to these formal presentations, a professional brochure was developed that describes

the intent of the program and the organizations involved.

## Follow-Up

Once the presentations were completed, communication has continued between the Northwest Turfgrass Association and various golf organizations. Yearly meetings are held with representatives of each golf organization that determine where the funds will be spent and on which projects. This aspect of the organization was extremely important as there are representatives on the T.U.R.F. program from Washington State Golf Association, Oregon State Golf Association, CMA, PGA, the three local chapters of the GCSAA, USGA Green Section, Washington State University, Oregon State University, and the golf industry. By pooling these interests and talents, the whole will be greater than the individual parts!

## Summary

Can this same idea work in your area of the country? Absolutely, if you have individuals who are willing to put in the necessary time to educate the public about local concerns. Such an effort also requires local golf association executives who will listen and understand the needs of our industry. For this, a large debt of gratitude is due to John Bodenhamer, Executive Director, Washington State Golf Association, and Jim Gibbons, Executive Director, Oregon State Golf Association. Without these understanding gentlemen, turfgrass research in the Pacific Northwest would not be proceeding forward with a bright future. In Washington and Oregon, the funding of turfgrass research will now be completed with "Common Cents!"

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LARRY GILHULY is the Director of the Western Region of the USGA Green Section.



# Involving the Public and Your Members

*Hang out a welcome sign for John Q. and others who want to help.*

by RONALD G. DODSON



*Morro Bay Golf Course (California) has worked with an impressive list of environmental, service, and research organizations to maintain monarch butterfly sites on the golf course.*

**G**OLF COURSE managers across the country have expressed their desire for the general public, as well as their members, to understand what it really takes to manage a golf course. They would like everyone to develop an appreciation for the value that a well-managed golf course can provide for wildlife and the environment.

It is often difficult, however, for people to understand or fully appreciate something unless they have an opportunity to experience or participate in what they are attempting to understand. It is for this reason that one of the certification areas of the Audubon Cooperative Sanctuary Program for

Golf Courses is **“Public/Member Involvement.”**

This category and certification requirement was created to encourage course managers to undertake a necessary action that at first glance may not seem comfortable to them. To many course managers the first thought may be, “Oh, man! That’s all that I need. Another person — or even worse, a committee — looking over my shoulder.” However, this is neither the goal nor the intention of the public/member involvement category. Remember, if your members or the public do not know what you do, how can they possibly understand or appreciate it? In addition, you just might discover

several people who actually want to help with projects in positive and constructive ways.

There are many ways that you can start this process, but the first, logical step is to contact the golfers at your course. A newsletter article or announcement on the bulletin board requesting help from individuals to assist with conservation projects such as wildlife surveys, nest box construction, or monitoring may result in more positive responses than you may think.

After you prepare a list of possible conservation projects for the course, think about people in the community, organizations, and agencies who might be interested in helping. This list could



(Below) Garden kits to attract bluebirds, hummingbirds, and butterflies were distributed at the Las Campanas Santa Fe Audubon Fair

(Right) Even the youngest environmentalist likes to help out with new homes for the birds.



include a local school teacher and a class, 4-H groups, and garden or bird clubs. For bigger projects, consider college interns, the local fish and wildlife agency, the cooperative extension service, a local utility company, or an area solid waste agency. In some cases, you will find individuals who are interested in getting involved and learning about your efforts. In fact, you may be surprised to find out that for some of these people it is actually their job.

Whether or not you are a member of the Audubon Cooperative Sanctuary Program for Golf Courses, you will find that pursuing public-member involvement is an important effort that will pay large rewards to the golf course, the environment, and to you.

### In the Spotlight

**Morro Bay Golf Course:** When it comes to incorporating outside help in projects on the course, an excellent example is the fully certified Audubon Cooperative Sanctuary at Morro Bay Golf Course in California. One of the most impressive components of their public/member involvement efforts is the diversity of environmental, education, and research organizations they involved in their planning and implementation efforts. They worked with

the Boy Scouts of America, Native Plant Society, California Conservation Corp., University of California Cooperative Extension, California Parks Service, Santa Monica Community College, and California Polytechnic University, and several others. The Morro Bay Boy Scout Troop built, mounted, and monitored nest boxes on the course. The California Polytechnic University, Santa Monica Community College, and California Park Service are leading a combined effort in maintaining and improving monarch butterfly sites on the course. A native tree reestablishment program was developed in cooperation with the University of California Cooperative Extension.

**Las Campanas, Santa Fe:** An important component of the Audubon Cooperative Sanctuary Program is the emphasis on bringing projects implemented on the course to the backyards of course members. Las Campanas decided that a unique way of informing and involving their members was to hold an Audubon Fair Day at their maintenance facility. They offered their golfers free wildlife enhancement kits during the fair. During that day, demonstrations were arranged and experts were available to provide guidance to

help members enhance their own backyards. The wildlife enhancement kits the members could choose from included a bat house, a bird house with a songbird garden kit, and a butterfly or hummingbird garden kit. Members could take the kits home or else donate the bird house to the course if they agreed to maintain and monitor it during the summer.

**TPC at River Highlands:** Another approach to member/public involvement is in the planning stages at TPC at River Highlands in Connecticut. They are making plans for a *kids day* that will involve children of members building a nest box and a bird feeder under the direction of course management staff. The kids will take the bird feeders home with information about the Audubon Backyard Program and how their yard can benefit wildlife. In addition, they will put their name on the nest box, and along with their parents, they will place, monitor, and maintain the box on the course. This excellent project helps link backyards to the golf course, and links members to the conservation efforts of the course management.

RONALD G. DODSON is President of the Audubon Society of New York.



## In Memoriam: Al Radko

ALEXANDER M. (AL) RADKO, a mainstay of the USGA Green Section from 1947 until his retirement in 1981, passed away on October 31, 1995. During his career, Radko received many honors, including the 1983 USGA Green Section Award.

Radko joined the USGA in 1947 while completing his studies toward a bachelor of science degree at the University of Maryland. Originally hired by Dr. Fred Grau, then head of the USGA Green Section, as a research assistant, Radko later became an agronomist and eventually the Director of the Eastern Region. In this capacity, he made several thousand Turf Advisory Service visits, drove more than a million miles on USGA business, and was responsible for hiring many well-known agronomists on the USGA staff, including Stan Zontek, Director of the Green Section's Mid-Atlantic Region.

Radko became National Director of the Green Section in 1974, a position he held until his retirement in 1981.



Al Radko

Throughout these years, Radko maintained involvement in various research projects and contributed articles to a variety of professional publications, including the *Green Section Record*, which he edited for five years. In the early 1980s, he was instrumental in convincing the USGA Executive Committee to expand significantly its funding for turfgrass research. The USGA has subsequently spent more than \$12 million on turfgrass and environmental research.

His duties extended overseas as well. Following World War II, he served golf

in Japan by spearheading the rebuilding and rehabilitation of several golf courses in that nation for use by U.S. occupational forces. One of his pupils, Pete Nakamura, later became one of Japan's greatest golfers.

Jim Snow, current National Director of the Green Section, lauded Radko's contributions to the game and the USGA. "For those of us fortunate enough to have worked with Al, we knew him as a kind, thoughtful person who led by example and always had the very best interest of the USGA, the Green Section, and the golf course superintendent at heart. He loved the game of golf, and he lived by the highest principles the game has to offer. Al will be greatly missed by his many friends and colleagues in the turfgrass industry and the game of golf."

Radko is survived by his wife, Anne, and three sons. His family requested that memorial donations be made to the USGA Foundation in support of its Youth and Education Program. Donations may be sent to the USGA Foundation, P.O. Box 5000, Far Hills, NJ 07931.

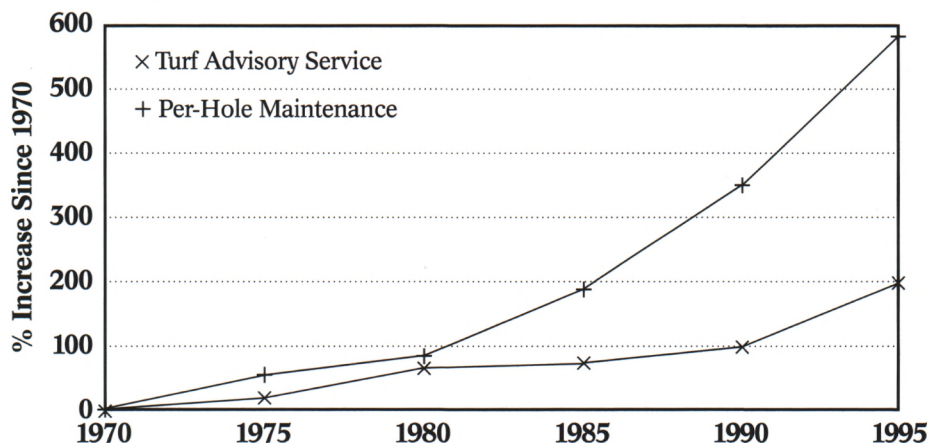
## TAS Still Best Buy

CAN YOU REMEMBER back 25 years ago? If it all seems a little hazy, perhaps a few financial comparisons will jar your memory. The dollar you held in your hand in 1970 would today require \$3.66 to equal it in terms of real purchasing power.

If you think this example demonstrates that inflation has had a large impact upon the value of the dollar, it pales in comparison to the cost of maintaining a golf course. It took an average total cost (total cost, by the way, includes all salaries and wages, plus all other expenses like equipment and fertilizers) of \$4,924 per hole to maintain a golf course in 1970. This figure may seem, in retrospect, like a huge amount, especially when you realize it was 86 percent higher than a total cost per hole of \$2,641 in 1956. But take a look at the last quarter century. Recent estimates put the per-hole maintenance tab at better than \$33,500, which represents almost a 600 percent increase since 1970.

What has happened to the cost of a USGA Green Section Turf Advisory Service visit in the last 25 years? If you had scheduled a half-day visit to an 18-

## Comparison of Turf Advisory Service Visits Versus Per-Hole Maintenance Costs Over Time\*



\*Half-day visit, prepaid before May 15.

Cost-per-hole figures based on Pannell Kerr Forster surveys

or 27-hole facility in 1970, you would have paid \$300. In 1995, a half-day visit scheduled before May 15 would have required a \$900 expenditure, or \$1,200 for the same service if you booked it after that date. Thus, the TAS cost has increased three or four times (depending upon the promptness of your reservations), which represents a much smaller climb than the rate at which overall maintenance costs have soared.

Today's price represents less than 1/4 of 1 percent of the average course maintenance budget. Putting it another way, the TAS expenditure equals only 3.5 percent of the average cost of maintaining *one hole* of the average golf course.

How do all these costs relate to the USGA's expense in providing this service? First, the money paid by the golf course is a flat fee that covers the



agronomic aspects of the visit, the preparation of a detailed written report, as well as *all* related expenses such as transportation, food, and lodging. (Often, similar consulting services charge a basic fee plus all expenses incurred on a visit.) Second, the direct costs for the salaries, travel, and expenses of the agronomists, when combined with the other costs of TAS like

maintenance of the corresponding regional offices, represents a total yearly TAS cost to the USGA of approximately \$2.5 million. TAS revenues annually run in the \$1.6 million range. Thus, the USGA provides a regular TAS subsidy in the neighborhood of almost \$1 million. The point is not to bore you with USGA accounting procedures or belabor the USGA's finan-

cial commitment to the program, but to highlight TAS's relative economic value to subscribing courses.

This analysis, hopefully, provides some worthwhile historical perspective about the costs of golf course maintenance and the Turf Advisory Service. These numbers bear testimony that TAS represents a wise and cost-effective investment for your golf course to make.

## ALL THINGS CONSIDERED

# Staying on Course

*Think and work long-term to achieve sustainable success.*

by JOHN H. FOY

A COMMONLY USED buzzword today is "sustainable." It is used in conjunction with various practices or principles such as development, agriculture, and resource management. In this context, sustainable could be defined simply as a pattern of activity that can be supported indefinitely. Given the opportunity and adequate time, golf course superintendents can apply the principles of sustainable resource management and help ensure that future generations continue to enjoy the game and the diverse collection of flora and fauna that inhabit our courses.

It should be obvious that consistent leadership and adherence to sound programs are vital ingredients in achieving a sustainable system. Especially in the management of a golf course, several months or even years can be required for the full impact and desired results of changes in management to be realized. Quick fixes seldom result in permanent improvements.

During the summer and fall of 1995, we experienced quite a few weather extremes. A prolonged period of high daytime and nighttime temperatures, along with severe drought, caused widespread turf loss at facilities in the northern portion of the country. In Florida, tropical storm/hurricane activity exceeded all previous records. During July, August, and September, more than 50 inches of rainfall was recorded in most areas of South Florida. The average *annual* rainfall for West Palm Beach, Florida, is 62 inches.

As one would imagine, producing and maintaining healthy turf growth and good quality course conditioning was difficult. With the return of the winter-season golfers to courses that have had problems, rumors of superintendent changes, naturally, circulate.

The South Florida area has long been notorious for "musical chairs" in regard to superintendent jobs. Along with a volatile political scene and excessively high demands for perfect course conditioning, fast growth in the number of courses over the years has resulted in high numbers of job changes. During the ten years that I have worked in Florida, tenure of three years or less seems to be the norm for many superintendents. Today, while new course construction has slowed, budget-cutting at some facilities has resulted in superintendents losing their jobs to help *save* money. A flooded applicant market has not helped matters, either. Unfortunately, other Green Section agronomists across the country are reporting that this lack of tenure for superintendents is not unique to South Florida.

Although a much shorter job tenure seems to be a trend in businesses today, in my opinion, this is a very bad situation for the turfgrass/golf management industry. With regular changes in course superintendents, the likelihood of achieving long-term success is greatly diminished. Integrated Pest Management (IPM), which is an important aspect of sustainable resource management, can serve to illustrate my point.

Monitoring is one of the primary components of an IPM program. In addition to establishing pest threshold levels and scouting a site for pest activity, the tracking of environmental conditions is necessary to determine when and where control measures should be implemented. The effectiveness of control measures also should be evaluated as part of the monitoring process. The accumulation of only two or three years of data is not sufficient to evaluate pest and environmental patterns at a site. Further, most superintendents agree that it takes at least a couple of years to develop a good understanding of the various characteristics of a course.

Far too often today, the *quick fix* solution of changing superintendents is the response to a temporary problem, even in cases that are weather-related and out of the hands of the golf course superintendent. Particularly given the current environmental concerns about golf courses, we must be more far-sighted in management decisions. For successful sustainable resource management, *staying on course* is essential. This is as true of a superintendent's tenure as it is with that of the course leadership and overall club management.

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JOHN H. FOY is the Director of the Florida Region of the USGA Green Section.



# United States Golf Association Green Section Education Conference



**Sunday, February 11, 1996**

## **“Golf Course Management: Past, Present, and Future”**

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

**12:30 Welcome**

Thomas W. Chisholm, USGA Green Section Committee Chairman

**12:45 Back to the Basics**

Jim Latham, former Director, USGA Green Section, Great Lakes Region

**1:15 The Best Turf Tips from the Green Section Staff**

Patrick O'Brien, Director, Southeastern Region  
Jim Skorulski, Agronomist, Northeastern Region  
Mike Huck, Agronomist, Western Region

**1:30 Up to Your Armpits in Alligators**

John Paling, Ph.D., Author, Television Producer

**2:30 More of the Best Turf Tips**

Bob Brame, Director, North-Central Region  
Paul Vermeulen, Agronomist, Mid-Continent Region  
Keith Happ, Agronomist, Mid-Atlantic Region  
Chris Hartwiger, Agronomist, Southeastern Region

**2:50 The First Hundred Years — The Next Hundred Years**

David Fay, Executive Director, United States Golf Association

**3:20 The Last, But Not the Least, of the Best Turf Tips**

Stan Zontek, Director, Mid-Atlantic Region  
Pat Gross, Agronomist, Western Region  
Jim Moore, Director, Mid-Continent Region





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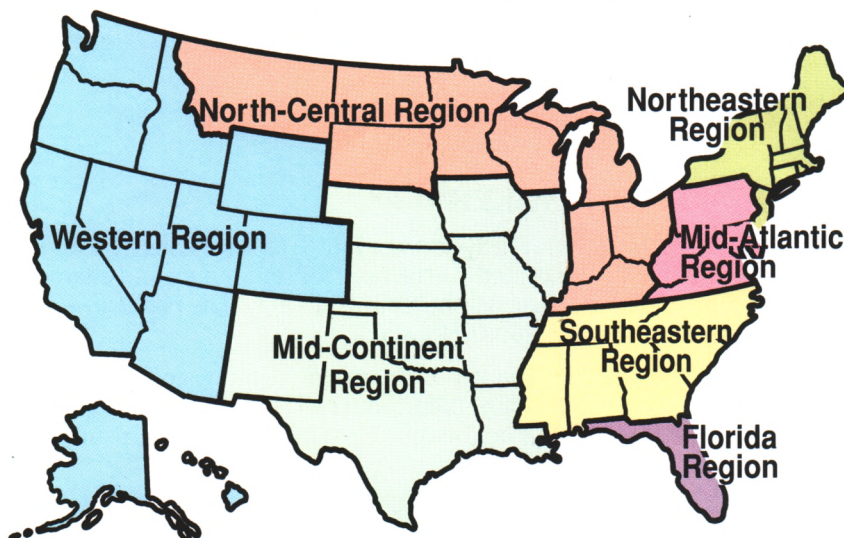
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## APPROPRIATE TEE MARKERS

**Question:** We have recently added a fourth set of tee markers for each hole. The new markers are pink and intended for regular ladies' play. Red will be used for senior men and championship ladies. The traditional white is designated for men and blue for men's championship play. The problem is, we cannot get our senior men to play from the red markers. Any suggestions? (Kentucky)

**Answer:** The problem occurs at more golf courses than just yours. You may want to go with four completely new colors and call them the forward, middle, and back tee markers. This technique should help eliminate the mind-set that occurs with using the traditional colors red, white, and blue.

## AND GOLF CART TRAFFIC PATTERNS

**Question:** Although we know carts should not be allowed on the course when conditions are too wet, sometimes it is almost impossible to keep the carts off the golf course, such as during a member/guest tournament scheduled months before. Is there a way to minimize the damage on a golf course without resorting to cart paths?

**Answer:** When you just can't say no, your best option would be to confine the damage to as small an area as possible. Prior to the day's play, the superintendent should mark a line along the entire length of the course, choosing as dry a path as possible. The carts should then be required to stay on or adjacent to the line. Although the soil and turf next to the line will likely be severely damaged, the rest of the course will be spared. Renovation practices such as aerification, topdressing, additional fertilization to promote rapid recovery, and even complete replanting if necessary, can all be performed on this relatively small portion of the course much more quickly and at reduced cost. If heavy cart traffic in wet conditions becomes commonplace, cart paths are your best bet.

## PROTECT AND ORGANIZE

**Question:** I have several years of back issues of the *Green Section Record* magazine. I refer back to the information frequently, but I am having trouble keeping them organized. Do you have any ideas to help me keep my 1996 resolutions? (Pennsylvania)

**Answer:** As a matter of fact, we do. Binders are now available to hold 12 issues (two years) of the *Green Section Record* for a nominal fee of \$9.95 plus shipping and handling. You can place your order through the USGA Order Department at 1-800-336-4446. These should help keep the magazines protected and make them more easily accessible in the coming years.