

USGA®

Green Section RECORD



The Quest for Great Fairways

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*Cover Photo:
The quest for
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Uniform precipitation rates and precise irrigation control are critical to great fairways. Garden City Golf Club, New York.

The Quest for Great Fairways

by JAMES T. SNOW

Director, Northeastern Region, USGA Green Section

ONLY A FEW years ago terms like aerifying, verticutting, overseeding, grooming, triplex mowing and clipping removal were restricted to discussions about putting green maintenance, but today, these and many other previously limited-use terms are applied to fairway management, the result of technological innovations and golfers' demands for closely cut, uniform, and consistently good quality fairway turf.

The challenge for the golf course superintendent is obvious, for it is one thing to maintain intensively and expect perfection from two acres of putting green turf growing on modified soil, and yet another to seek perfection from 25 to 40 acres of fairway turf growing on rolling terrain and unmentionable soils. Additional pressure comes from golfers who see the manicured, crisscross-

striped fairways on television each week and don't realize not only that they are probably at their peak for the season but also that the cost of developing fairways that approach the quality of putting green turf is enormous.

Whether most golfers would even like to play on manicured fairways cut at less than half an inch is debatable. As with many other golf course standards, what constitutes desirable fairway turf is certainly in the eye of the beholder. While most professional and good amateur golfers look for dry, closely cut, uniform fairway turf that allows them to strike down at the ball, most average and high handicap golfers like to scoop the ball. They prefer turf with good density but maintained at a higher cutting height. Despite these differences in playing standards, however, most golfers would agree that top-quality fairway turf

should be dense, uniformly healthy, with a minimum of thatch, and maintained in as dry a condition as possible.

Is it possible for a golf course superintendent to provide these conditions day after day, month after month? Of course it is! Though the vagaries of nature are always present, given the tools to do the job and the labor to follow through with the appropriate management programs, almost any golf course can enjoy consistently good fairways. Therein lies the hitch; relatively few golf courses are financially able or willing to provide these resources to the superintendent.

A review of the prerequisites for producing consistently good-quality fairway turf should help shed some light on how certain golf courses always seem to be in great shape while others tend to fall apart in August. These prerequisites include:



- Good drainage
- A good irrigation system
- A thorough pest control spray program
- Regular aerification cultivation
- Use of lightweight mowers
- Use of practices that promote desirable grass species at the expense of *Poa annua*.

Certainly some golf course superintendents rarely aerify their fairways, continue to use large mowing units, proclaim *Poa annua* as the only truly dependable grass in the business, and have very respectable fairways from year to year. Nevertheless, *most* of the golf courses with consistently great fairways by today's standards are those that use the aforementioned tools and practices as the framework for their fairway maintenance programs.

A closer look at these practices and why they work should provide some insight as to how golf course superintendents can provide their golfers with the best possible fairway turf.

Good Drainage

The old saying that the three most important qualities in producing good turf are drainage, drainage and more drainage, certainly applies to fairways. No other single factor is more important, for poorly drained soils can never produce consistently healthy turf and the proper playing characteristics.

Good soil drainage is necessary for good soil aeration, which is critical for

healthy turfgrass root growth. In addition, poorly drained soils tend to compact easily under moderate traffic, further restricting soil aeration and root development. And finally, persistently wet soils are usually very soft and produce playing conditions that are far from ideal.

Because drainage installation over large areas can be time consuming, costly, and messy, too many golf courses like to ignore it and instead try to develop good fairways by instituting more sophisticated (and often expensive) maintenance programs, which they hope will compensate for the lack of drainage. This sometimes includes installing extensive cart path systems, the switch to lightweight mowers, and the use of expensive chemical and cultural management programs. Frankly, this approach is a waste of time and money. The best advice is to spend money on a good drainage system. There are no shortcuts. For those who are contemplating drainage work but aren't sure how to proceed, plenty of good information is available from the USGA Green Section and other sources.

A Good Irrigation System

While providing good drainage is unquestionably the first priority in producing great fairways, the availability of a good irrigation system is certainly second. The ability to apply irrigation water when and where it is needed and in precise quantities is essential at courses

where standards for fairway turf are high. A good irrigation system that provides uniform coverage will use less water during the course of a season than a weak, inefficient system. What constitutes a good system? Where consistently good-quality turf is desired, important characteristics would include:

- An adequate source of water.
- An automatic pumping system of sufficient flexibility and capacity to enable the course to be irrigated reasonably quickly.
- A properly designed and installed automatic field system with individual head control wherever necessary.
- A skeleton manual snap valve system for greens, tees, fairways, and other areas where special applications or hand watering might be required.

Naturally, all the important details cannot be mentioned in this brief discussion, but even taking these characteristics at face value, it is apparent that a majority of the 12,000 golf courses in the United States make do with weak irrigation systems. Many more golf courses in the hot, humid South and the arid West have decent irrigation systems because of the consistent penalties imposed by weather extremes where poor systems are used. Courses in the temperate northern states generally install less sophisticated (but expensive, nonetheless) systems that in many instances are simply not suited to handle midsummer

(Opposite page) Lightweight mowing is setting new standards. Pine Valley, New Jersey.

(Right) Disease is everywhere and control measures essential.

(Below) Fairway aerification provides many benefits, and modern equipment leaves no reason to ignore it. National Golf Links, New York.

(Bottom) How fast are your fairways? Superintendent R. Bator, Pine Valley, New Jersey.



stress. Many courses do not even realize how weak their systems are, blaming summer turf failure on diseases or other problems, when in fact the irrigation system deserves most of the fault. If an irrigation system cannot comfortably handle the worst day of the summer, then it is not the one for golf courses where top-quality fairways are desired.

Precise water control is one of the major keys to good turf management, and in this regard, good drainage and a good irrigation system go together. A golf course with both is 90 percent of the way to great fairways. Courses that lack one or both will never have consistency.

Pest Control Spray Program

Of significant importance in many regions of the country is the damage done to fairway turf by diseases, insects, and nematodes. In areas where long hot summers and humid weather are normal, damage from these pests is easily recognized, and most golf courses have devised thorough, generally effective, and regular spray programs. However, in the northern tier of states and in the

more southerly mountain areas, where summer weather is not as extreme, these diseases take their greatest toll! Diseases such as dollar spot, red thread, and leaf spot are active but hardly devastating, and only a few clubs are inclined to spend thousands of dollars to control diseases that are apparently doing little damage. It is common to hear summer questions like, "why don't our golf balls sit up on the fairway like they do on television?"

In these areas, dollar spot, leaf spot, and other diseases can be active for nearly the entire growing season, gradually thinning the turf and reducing its density. Often, crabgrass, *Poa annua*, and other weeds take advantage of these openings and become widely established. This cycle is usually not easily recognized by even the most experienced turf managers. What's most telling is that the establishment of even a minimal disease control spray program often shows dramatic results in improving turf density.

Obviously, golf courses in quest of great fairways should establish a thorough pest control program.

Aerification/Cultivation

Whether it is called coring, core cultivation, or just plain aerification, removing cores from the soil is widely regarded as a beneficial practice. Aerating helps to relieve soil compaction, encourages water infiltration and air penetration into the soil, promotes turf root growth, and brings soil to the surface of the turf, which acts as a topdressing for thatch control. This practice has been an integral feature of the management of putting green turf for a long time, and for several reasons it is now enjoying a revival.

As fairway turf culture approaches that of putting green management, superintendents are recognizing that the benefits of aerification on greens are equally helpful in efforts to upgrade fairway turf. The role of aerification in controlling fairway thatch, achieved by breaking up the cores and intermixing the soil with the thatch layer, is so especially critical that by itself it makes coring worthwhile. The rising popularity of fairway aerification is also closely linked to the availability of effective new equipment that features closer tine spacing, good penetration, and less disruption to the playing surface compared to fairway aerifiers of the past.

Aerification cannot be done too often for the health of the turf. Some golf courses are now aerating fairways once a month, especially where poor soil conditions, heavy traffic or thatch problems exist. For most courses, once or twice per season may be all that time allows. If it's possible to double aerify on each occasion, however, so much the better.

With the recognized importance of aerification in turfgrass management and the advent of a new generation of aerification equipment, there's no excuse for golf courses not to increase the number of times they aerify their fairways. It must be done if consistently top-quality turf is desired.

Lightweight Mowing

The introduction of the riding triplex mower in the early 1970s brought about a revolution in the design and maintenance of putting greens. The recent use of these triplex machines and other maneuverable, lightweight mowing units on fairway turf has led to even greater changes in the design and maintenance of fairways.

In no uncertain terms, the results of the widespread and growing use of lightweight mowers on fairways has been dramatic, and it continues to look



Good drainage is a prerequisite for good turf. Tile and stone-filled trenches are topped off with coarse sand and then seeded at Cherry Hills Club, Ontario, Canada.

more impressive each year. The significant reduction in soil compaction and turfgrass wear problems, the ability to make most turns in rough areas, the flexibility of changing mowing patterns, the ability to reduce the cutting height on the fairways, and the recognizable but not totally understood advantages of clipping removal are among the positive effects thus far. One of the major benefits has been a distinct increase in the population of bentgrass and other desirable grasses at the expense of *Poa annua* on fairways where lightweight mowers have been used for several years. This effect is even more dramatic where clippings are routinely removed.

A golf course need not make the relatively expensive commitment to the triplex greensmowers with clipping removal to realize the benefits of a lightweight mowing program. A wide variety of triplex and five-unit mowers are available today that will do the job more quickly. Many courses move into this type of mowing program slowly, buying a single lightweight mower and using it on par-3 fairways, problem fairways,

approaches, etc. As resources allow, additional units are added, and the program is expanded.

Needless to say, a lightweight mowing program presents its own problems that should be considered before making major commitments. It is significant, though, that many medium- and low-budgeted golf courses are using lightweight mowers and improving their fairway turf. For a club committed to great fairways, such a program cannot be ignored.

Promoting Desirable Grasses

The debate over whether turf management programs should be geared toward eliminating or promoting *Poa annua* is one of the oldest battles in the business. There are certainly golf courses maintaining very respectable *Poa annua* fairways, but where the goal is to develop consistently great fairways, there are two good reasons for gearing the maintenance program toward eliminating *Poa annua*.

1. It is very difficult to achieve consistency with *Poa annua*. *Poa* is unforgiving

in its maintenance requirements and in its tolerance of weather extremes compared to the cool-season grass alternatives. Simply stated, the chance for periodic failure with *Poa annua* is high, and consistently great fairways cannot be dead fairways.

2. When the weather turns hot and *Poa annua* roots take their customary place at the surface of the soil or in the thatch layer, *Poa annua* fairways will inevitably be *wet* fairways. Shallow rooted turf requires frequent irrigation or syringing, and great fairways cannot be *wet* fairways.

Deciding that *Poa annua* should be eliminated is one thing, but establishing a more desirable grass in its place is something else. Over the years, superintendents have had varying degrees of success in reducing *Poa annua* and keeping it out of their fairways by manipulating cultural practices to favor the desirable species. It was a painstakingly slow process, however, and many superintendents simply gave up and decided

to live with or cultivate *Poa annua*. Today, results of the use of lightweight mowers and of the newer plant growth regulators offer more of a promise for controlling *Poa annua*. Very briefly, the following should be taken into account in establishing programs to promote or keep desirable turf species at the expense of *Poa annua*. Specific recommendations would vary depending on location and the species being grown.

- Use irrigation water carefully and prudently.
- Carefully time and use light to moderate rates of fertilizer.
- Time cultivation practices to avoid primary *Poa annua* germination periods.
- Monitor pH. Bentgrass, for example, competes better against *Poa annua* at pH levels below 6.0.
- Overseed desirable species on weak fairways.
- Establish a lightweight mowing program and collect clippings, if possible.

- Investigate the use of the newer plant growth regulators.
- Limit golf cart use on fairways when the soil is wet and subject to compaction, and when the temperatures are high and the turf is likely to wilt.

It really doesn't matter what species of grasses are being grown. Taken together, the essential principles and important practices outlined here form the framework for successful fairway management programs regardless of the species of grass.

For the majority of golf courses that perhaps lack the resources but nevertheless want better fairway turf, aiming to upgrade their facilities and programs in each of the categories discussed here will give them an opportunity to enjoy very respectable fairways most of the time. For golf courses with the resources, commitment and desire, following these guidelines faithfully can result in fulfilling their quest for consistently great fairways.

More on "Pesticides — Changing an Image"

by GARY A. WATSCHKE

Agronomist, Northeastern Region, USGA Green Section

QUESTION: I read with interest your article "Pesticides — Changing an Image" in the January/February issue of the GREEN SECTION RECORD. What are the legal ramifications of such a pesticide disposal system? Also, is there more information about how to build and install a micro-tank pesticide treatment system such as the one described in the article? (New York)

ANSWER: With regard to legal concerns, the best place to start is by checking with your state and local EPA and DEP offices that are concerned with pesticide and toxic wastes. Treatment systems, such as the micro-tank, appear to be illegal in some states, while other states have adopted federal regulations of pesticide disposal as developed by the U.S. EPA. Currently, the U.S. EPA is recommending the storage of excess dilute pesticide mixtures and equipment

rinsates for use with subsequent spray operations. Toxic wastes are not generated using this approach. Nevertheless, the EPA looks upon micro-tank type systems as a possible solution, depending on such factors as location, type of chemicals involved, and what testing methods and procedures are being provided.

At least one commercial water treatment company is developing a charcoal filtration system that could allow limited reuse of tainted water. The proposed system would be relatively inexpensive and licensing would be much more economical than that of a hazardous waste treatment facility. Some agencies have taken the position that a micro-tank, such as the one mentioned in the article, are hazardous waste treatment facilities rather than pesticide disposal systems, thus making licensing cost prohibitive.

As far as the micro-tank mentioned in the article is concerned, Iowa State University's Horticulture Department is said to be working on a bulletin that should provide more details as to the construction and installation procedures. With the micro-tank system, more emphasis may be placed on providing a means of sampling and testing the system, where it is best located, what evaporative requirements are imposed and perhaps what license, if any, will be required. The Federal EPA is fully aware of the Iowa State University system and believes it to hold potential.

As more is learned about the micro-tank and other new methods of handling dilute pesticide wastes, the EPA may, in all likelihood, develop new regulations to keep up with technology. For now, it may be better to hold off doing anything until the regulating agencies can catch up with industry advancements.

Can We Cope with Salty Water?

by **CHARLES H. PEACOCK**, Assistant Professor, Ornamental Horticulture Department, IFAS, University of Florida, Gainesville, Florida

IN THE PAST few years, just about every trade journal has featured articles that focus on water problems. No place is this more prevalent than in the Sunbelt areas of the U.S. Population increases have placed unforeseen pressure on natural resources, especially potable water. The Florida water management districts are focusing on water supplies, and permits for irrigation are reviewed carefully. With some 60 percent or more of the potable water for irrigating turf areas drawn from wells or lakes, the time is coming when poor quality water sources will be used for turf and landscape irrigation.

Salinity problems come primarily from two sources. Along coastal regions of the country, seawater is intruding into fresh water supplies and contaminating them by increasing the level of soluble salts. In interior regions, ancient salinity marine deposits in geological layers add soluble salts to groundwater as it passes through the layers.

Recent research has focused on identifying those turfgrass species and cultivars that are most tolerant of saline conditions. Saline water can cause salt stress and injury to plants in several ways. The primary response is a reduction in growth as a direct result of water stress. Plant nutrient deficiencies are indirectly caused by suppression of nutrient absorption. A prime example is the antagonism of sodium on the potassium uptake by the plant.

Turfgrass species have been classified according to salt tolerance based on salt levels that cause a 50 percent reduction in top or root growth. Zoysiagrass, seashore paspalumgrass, and bermudagrass have proven to be the most salt-tolerant species to grow in saline water (Table 1).

Among the bermudagrass varieties, there is a differential response to salinity (Table 2). The most salt-tolerant are Tifdwarf and Tifgreen. Surprisingly, Tifway II, which is a selection from Tifway, is not as salt-tolerant.

Most of the salinity tolerance work on turfgrass species has been conducted in solution culture experiments, which means the plants are constantly exposed to exact salinity and nutrient conditions. This would not be the case under

golf course situations. Conditions would change daily, depending upon the irrigation regime, rainfall, fertilization schedules, and soil temperature.

In order to evaluate the effects of applying saline water through the irrigation system, Dr. A. E. Dudeck, of the University of Florida, has been studying salinization for several years at a specially designed field installation. With this facility, turf plots can be irrigated with salt water of varying concentrations while maintaining the turf under field conditions.

INITIAL STUDIES have been conducted to determine the effects of using saline irrigation water to supplement natural rainfall. Turfgrass growth rates, salt buildup in the root zone, and soil fertility status were all taken into consideration. Saline irrigation was applied at twice evapotranspiration rates. No effect was seen on the growth

rate or turf quality of Tifway bermudagrass at the highest salinity rate, of 3,500 ppm.

While turfgrasses can tolerate saline water for irrigation, none of them prefer it for growth. Where salinity is a problem, several measures can be taken to provide every benefit to the plant. Select the most salt-tolerant turfgrass and the best quality water available. Provide excellent drainage so that salts may be leached from the rootzone, and use excess irrigation to flush any accumulation away from the roots. Aerify, spike, and vertical mow to keep thatch to a minimum, and alleviate soil compaction so that water infiltration rates are high. Monitor soluble salts routinely in the soil and irrigation water. Research will continue to determine how saline irrigation interacts with turfgrass cultural practices, especially nutrition, and how detrimental salinity may be to immature, newly establishing turf areas.

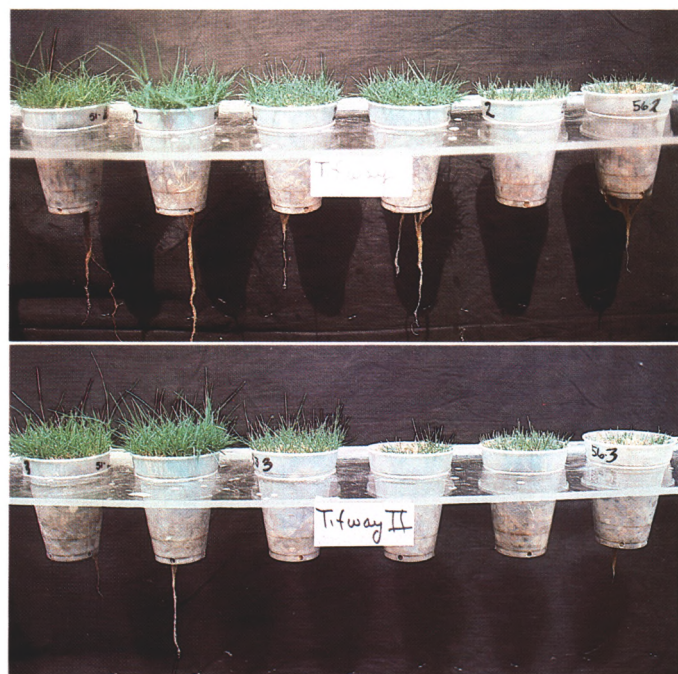
Table 1. Salt Tolerance of Turfgrass Species

Salt Tolerance	Species	EC at 50% Yield Production*
Excellent	Zoysiagrass	37
	Bermudagrass	28
	Seashore paspalumgrass	26
	St. Augustinegrass	24
Good	Tall fescue	13
	Perennial ryegrass	12
Fair	Bahiagrass	9
	Centipedegrass	9

*Electrical conductivity necessary to effect a 50% yield reduction.

Table 2. Salt Tolerance of Bermudagrass Cultivars

Salt Tolerance	Bermudagrass
<div style="text-align: center;"> Most ↑ ↓ Least </div>	Tifdwarf
	Tifgreen
	Tifway
	Tiflawn
	Tifway II
	Common
	Ormond



(Top) Response of turfgrasses to saline irrigation or "salinization" are studied at a specially constructed field installation. Here the grasses are subjected to varying concentrations of saline water. Interactions between salinity, nitrogen levels, and mowing heights are studied, as well as the effects on soil conditions.

(Left) Turfgrass species and cultivars are evaluated for relative salinity tolerance under controlled conditions in the greenhouse.

(Above, center) Differential responses of cultivars to increasing salinity have been found. Tifway bermudagrass is more tolerant than Tifway II (above) as salinity levels increase. Note the reduction in topgrowth and rootgrowth under higher salinity levels for both cultivars, but more so with Tifway II.

Golf Course Safety — Pay Attention Now or Pay (and Pay) Later

by JAMES M. LATHAM

Director, Great Lakes Region, USGA Green Section

ONCE UPON a time safety in golf course operations amounted to little more than the humane concern for a person's well being. The crews were a rather close-knit group of pretty macho outdoorsmen, used to long hours in the field, usually alone, taking care of their section of the golf course. They worked steadily and carefully to mow the greens, rake the sand, set the cups and tee markers, and pick a few weeds. If they skinned a knuckle or scratched an arm, it waited until they got back to the barn.

More serious injuries caused a great deal of alarm, because many operations had no salary protection for unworked

time, regardless of cause. A lot of people worked hurt, but they learned to be more careful. Those were the times when being one's brother's keeper really meant something.

Those were just the mechanical things. Chemicals? It's a wonder golf course employees ever lived beyond the age of 30. Weed killers were arsenic acid, sodium arsenite, potassium cyanate. Lead arsenate was used for bugs and some weeds. Disease controls were largely compounds of metals such as mercury or cadmium with some thiram thrown in for safety (for plants, not people).

Winter work involved mixing these chemicals with sand, topdressing, or

organic fertilizer so they could be spread more easily and uniformly than with a sprayer. This was done in the little old barn by a wood stove. Dusty? If the chemical was lead arsenate, everyone turned pink.

There were no respirators or dust masks, much less protective clothing of any kind. There were no hoods or enclosures on machinery. If engine fumes bothered you, work outside. Strangely, however, there seemed to be few health problems related to these close encounters with danger. That's just an observation, not a whitewash of poor working conditions. Ignorance was bliss. (Figures 1 and 2.)

Figure 1.



(Above) This facial rash was caused by sodium arsenite drift, in 1940. Protective clothing was rare, except (right) to keep the tractor driver dry while mowing wet grass. Personal comfort, rather than safety, was most important in the mid-1950s.

Figure 2.





Figure 3. (Top, left) Steep slopes in playing areas must be fenced, before being put into use.

Figure 4. (Above) This cloud of agricultural limestone dust may appear to be dangerous to urbanites.

Figure 5. (Left) The "permanent temporary" greens on Milwaukee County Parks golf courses absorb play damage in bad weather and also enhance the safety of both players and workers during maintenance operations. Play is shifted off the regular green during mowing, spraying, aerating, etc., onto the alternate. It, then, gets the same maintenance treatment when play is returned to the regular green.

Figure 6. (Top, right) Never understate a safety message.

The voluntary move toward safe working conditions began, it seems, with increased mechanization and smaller crew sizes. More seasonal workers were used and constant retraining was necessary. To some, a guardless rotary mower was great, since it would cut small trees easier than a sling blade or scythe. Of course, as the cost of carelessness, toes and fingers went, too.

These summer kids found golf work delightful because of the suntanning potential. Rocks thrown from the neighboring rotary mower occasionally stung the almost bare body, but what a *tan*! As the modern chemical pest warfare escalated, however, drift worried some superintendents, especially since 2,4-D killed flowers downwind. Because DDT, chlordane, and other substances like them had been thrown around like so much talcum, they no longer worked. The effective substitutes, though, carried some pretty stiff warnings, even though they attracted little attention.

When environmental concern became popular, people got attention along with the birds and fish. Safety committees began throwing their weight around and finally the feds got into the act with the Occupational Safety and Health Administration. Safety was no longer a game for kindly folk. Surprisingly few golf courses were ever inspected by these people, but the message was clear and compliance with the rules was generally good.

THE PRIMARY source of safety information for golf course operations was the insurance companies. Many of them made safety inspections of maintenance operations centers (no more barns) and clubhouses, pointing out basic deficiencies in wiring, machinery, and tool inadequacies and indicating the need to place guards on moving machine parts. These safety experts gave lectures on protective clothing from steel-toed shoes to respirators, rubber suits, and hard hats. Golf coped with overregulation in the workplace, for a while.

With these problems out of the way, turf problems could again rate first priority for golf course superintendents.

OSHA did, however, point out just how slack golf course and clubhouse operational safety was. It was not that no one cared; they just had the priority set too low.

Naturally, with the governments involved, a lot of silliness got into the rule book, but in retrospect, the rules did a lot for accident prevention. Today those OSHA rules may be the salvation for many golf courses. They will need expansion to include golfers as well as employees, however.

The reason for this is an epidemic of extravagant court or insurance awards to claimants of various maladies and injuries incurred on or near golf courses. It would be untrue to call all such claims frivolous or even greedy, but they have certainly raised the cost of golf operations. As our litigious society carries this plague into the gentle game of golf, the threat to fiscal stability is indeed real. Insurability itself may be as great a problem as meeting its cost.

For employees, the safety *suggestions* of the past must become the hard and fast work *rules* of today. Noncompliance must bring punishment — even to discharging someone if necessary. Paperwork will explode, because today everything pertaining to personal safety should be documented. Physical discomfort in protective clothing is unfortunate, but to sweat in a rubber suit is better than to perspire in a lawsuit.

Golf course superintendents today have more people to worry about than their crews. They used to get a chuckle out of the golfer who fell or drove the golf car into the lake. It is no longer funny because that golfer may cite an unsafe roadway, lack of adequate warning devices, or any number of idiotic reasons that he or she was an innocent party to negligent golf course maintenance. How about your unguarded roadways on hilly courses? (*Figure 3.*)

Worse yet, how about someone who is allergy prone and feels ill after walking through the drift of plain water used to calibrate a sprayer. It's all poison to them. (*Figure 4.*)

SAFETY TODAY may mean survival of a golf course operation. Even doing one's best to improve the safety of an operation may not be enough, but consider these thoughts for employees:

1. Pull out your old OSHA checklist and get serious about the little things. For instance, in Japan, where cremation is mandatory, funeral halls report that an average 10 workers a year are injured by exploding heart pacemakers. Debris from the explosions blow out the observation holes in the furnaces.

2. Believe and abide by the Right to Know laws. Get a product description of every chemical or fertilizer you have or may have.

3. File the necessary hazardous material lists with your local fire department and make sure they know where the materials are stored.

4. Make sure the locked pesticide storage room meets or, better yet, exceeds state regulations.

5. Be mean about machinery or shop tool operation.

Really mean!

For golfers, maintain a steady but varying flow of safety information. The USGA publications "Accidents Can Happen — Be Prepared" and "Safety First on the Golf Course" are useful. But —

1. Consider everyone to be a blithering idiot who will not read and who has an attention span of 25 seconds.

2. Assume that you may play a part in a budding get-rich-quick scheme.

3. Believe that members *do* sue their clubs.

Now — YOU go set up the course so that no one can possibly do damage to themselves or others. (*Figure 5.*)

REMEMBER LIGHTNING protection, too, even though only eight golfers were among the 200 deaths from lightning a couple of years ago. Such a statistic in golf is spectacular and much more newsworthy than another eight people who were hit while talking on the telephone.

Next — check the boundaries of the property to determine how high fences should be if they are to keep golf balls from hitting cars, houses, or people outside the property. And don't forget the KEEP OUT signs and similar paraphernalia. A golf course is an attractive nuisance, so you have a responsibility to protect trespassers. Even the vandals. They can't get hurt on the property if you keep them out. (*Figure 6.*)

It is extremely important to put high priority on the correction of *all* unsafe conditions. It is a sad commentary on our society, but the need for physically responsible safety precautions has been far overshadowed by the need for fiscally protective rules. One can barely appreciate the beauty of a golf course without visualizing a number of bizarre ways that people can injure themselves or others. Murphy's Law isn't funny anymore.



Spreading the 2" sand layer was easier and faster than expected.

Building Greens the Right Way — It's Easier Than You Think!

by **HAROLD G. NEAL**

Superintendent, Tulsa Country Club, Oklahoma

THE FIRST inclination that I might be involved with the reconstruction of greens came in my interview with the Selection Committee at Tulsa Country Club way back in 1981. Four and one-half years after answering "yes," we began the reconstruction process.

I'm sure that many clubs face the expensive and difficult task of rebuilding their greens. I am also sure that they too will hear experts claim the process can be made simpler and less expensive by modifying the USGA's specifications for putting green construction. What follows is a chronology of how we at Tulsa Country Club accomplished this major improvement to our course.

On October 13, 1953, Dr. Marvin Ferguson, who was then Director of the Southwestern Region of the USGA Green Section, visited Tulsa Country Club and pointed out that the original greens were built on a heavy, dense soil. As the years passed, various techniques and construction methods were tried in an attempt to help our bentgrass greens survive the searing heat of an Oklahoma

summer. It was finally decided by the green committee in the early 1980s that this time we would build them by the book.

Although our new greens opened for play in March of 1986, the first steps took place nearly two years earlier. Jim Young and Dave Thompson, co-chairmen of the green committee, began selecting an architect. The architect chosen would have the delicate task of preserving the beauty and insight of Albert W. Tillinghast, the original designer. Finally, after many calls and interviews, Jay Morrish and Associates was selected. Our original plan called for rebuilding all the greens. After presenting the plan to the membership, it was decided to rebuild only the four more troublesome greens — the second, fifth, 15th, and 16th.

Now that an architect had been selected and the decision reached as to which greens would be rebuilt, the next step was to select a contractor. Once again, after more calls and more research, we decided on Dewar's company, of Plano, Texas. A legal contract

was drawn up that included requirements to build the new greens in strict accordance to the USGA's Specifications and specifically called for inclusion of the two-inch coarse sand layer, off-site mixing, laboratory testing of the mix by Agri-Systems of Texas, and fumigation of the mix prior to planting. Construction would begin August 19, 1985.

As so often happens, once construction began we realized we had an opportunity to correct other problems at the same time. We decided to include the tees of the third, fifth, sixth, and 16th holes in the reconstruction process. On August 27, Jim Moore, Director of the Mid-Continent Region of the USGA Green Section, arrived for his annual Turf Advisory Service visit. On Jim's recommendation and after approval by the green committee, we decided to rebuild the 17th green as well. We also discussed in great detail the necessity for using the proper mix and frequent testing to insure conformity to the Specifications throughout the construction process.

IN OKLAHOMA we are fortunate to have a wide diversity of soils, sands, and gravels. Samples from each of the local sand companies, along with various peats, were forwarded to the Agri-Systems lab for testing. It was determined that one company had an excellent sand for the mix while another company's sand was ideal for the two-inch coarse sand layer. The final topmix was to contain 85 percent sand and 15 percent peat. All the mix was prepared on an adjacent parking lot and samples again submitted to Agri-Systems to insure the mixing process was adequate.

In the meantime, the construction of the greens base and installation of the drain tile began. To insure proper functioning of the perched water table integral to the USGA method, the subgrade was prepared to match the contours of the final grade as exactly as possible. By doing so, the depth of the topmix would be consistent throughout the green. The drains were installed and the four-inch gravel blanket spread.

As in many green construction projects, the next step was perhaps the most controversial. Both our architect and the construction company suggested we could eliminate the two-inch coarse sand layer to reduce costs. The rationale was that the layer was too difficult to spread and would involve too much hand labor. Personally, I did not want anything less than complete compliance to the Specifications. After all, I would be held responsible for the greens long after everyone else had gone. My green committee chairman called Jim Moore that evening, and the decision was reached to include the coarse sand layer. Beginning the next day, my crew and the construction crew spread the layer. Less than two days later and for only \$1,100, the controversy ended!

As the topmix was moved onto the greens, the crew installed the new perimeter irrigation system. With the aid of Roger Van Leeuwen, our local irrigation distributor, a two-headed system was installed. In Oklahoma, bent-grass greens require much closer water management than the surrounding bermudagrass aprons. By installing two heads back-to-back and on separate controllers, we are able to water appropriately for each turf species.

After all the mix had been installed we again were faced with a controversial decision. The USGA strongly recommends fumigation to eliminate weed, insect, or disease pests that may have

contaminated the mix. The argument was made that contamination was unlikely, since the sand came straight from the plant. Once again I felt that after all this effort, now was not the time to cut corners. Fortunately, Bob Randquist, of Southern Hills, a good friend and fellow superintendent, had recently completed a fumigation and replanting job of his own. Borrowing both his equipment and his experience, we accomplished the job in three days for \$1,500! Another controversy put to rest.

FINALLY, the greens were seeded on September 12, 1985. Six months later and in time for our first spring tournament, they were opened to play. Obviously a project such as this is a major step for any club, and it requires a great deal of effort from all those involved. To insure success at your club, I would offer the following suggestions:

1. Involve professionals every step of the way. The architect, the contractor, the testing laboratory, and the USGA, all should be part of the construction team.
2. Throughout the project, communicate as much as possible with your membership. Giving up part of their course for six months is much more bearable if they feel the end result will be worth the inconvenience.
3. Allow adequate time for the new greens to mature before returning them to play.
4. Take pictures of every phase of the project no matter how minor it may seem at the time. Pictorial records will someday prove invaluable to you or the next fellow.
5. Finally, don't let anyone talk you into cutting corners. Remember, it is your responsibility to protect the best interests of your membership.





(Opposite page) Aerial view of 16th green.

(Above) Mix was prepared and stockpiled off-site . . . and then tested again to insure proper proportions.

(Left) Final insurance — gassing to eliminate pests.

TURF TWISTERS

WHEN IT COMES TO ALLOCATING MONEY

Question: I find it difficult to convince my club to support turf research. They all think it is a good idea, but when it comes to allocating the money, other priorities always seem to come into play. Any ideas? (Ohio)

Answer: Yes. Monroe Miller, Superintendent of the Blackhawk Country Club, of Madison, Wisconsin, has established a separate line item in his yearly maintenance budget for the support of turf research. What an innovative idea! The funds are approved as part of the regular budget process. In this way, it is usually easier to gain approval from the Board. The USGA-GCSAA Research Program needs this kind of continuing support if we are to have better turfgrasses for the future. By the way, such research funds can be sent directly to the USGA at:

Golf House
Far Hills, NJ 07931
Attn: Don Spencer

If you want the donations specifically directed towards turfgrass research, be sure to note this point on your check or in the covering letter.

OVER HALF HAD NEVER HEARD

Question: This is probably a dumb question, but as a golf course superintendent of six years, I need a comprehensive reference book in my work. Can you suggest one? (Australia)

Answer: We certainly can! It is *Turf Management for Golf Courses*, a USGA publication written by Dr. James B. Beard and published by Burgess Publishing Company, Minneapolis, Minnesota. You are not alone. At a recent two-day seminar on basic turfgrass botany for golf course superintendents in the U.S., over half of those in attendance had never heard of *Turf Management for Golf Courses*, first published in 1982.

OF FIBER — IN YOUR DIET AND IN YOUR BUNKERS

Question: We will soon rebuild our bunkers and plan to install new sand. Because of our natural rocky soil, we plan to install a spun fiber material throughout the bunker to reduce contamination from rocks and soil. Is this feasible? (California)

Answer: As long as the fiber material is deep enough, preferably eight to 10 inches for mechanical rake use, and the drain lines are not covered, this is a good means to control contamination problems. Perforate the liner over the drain lines or, better yet, do not place it over the tile line at all so that there is no possibility of its becoming plugged or clogged with fine material over a prolonged period.