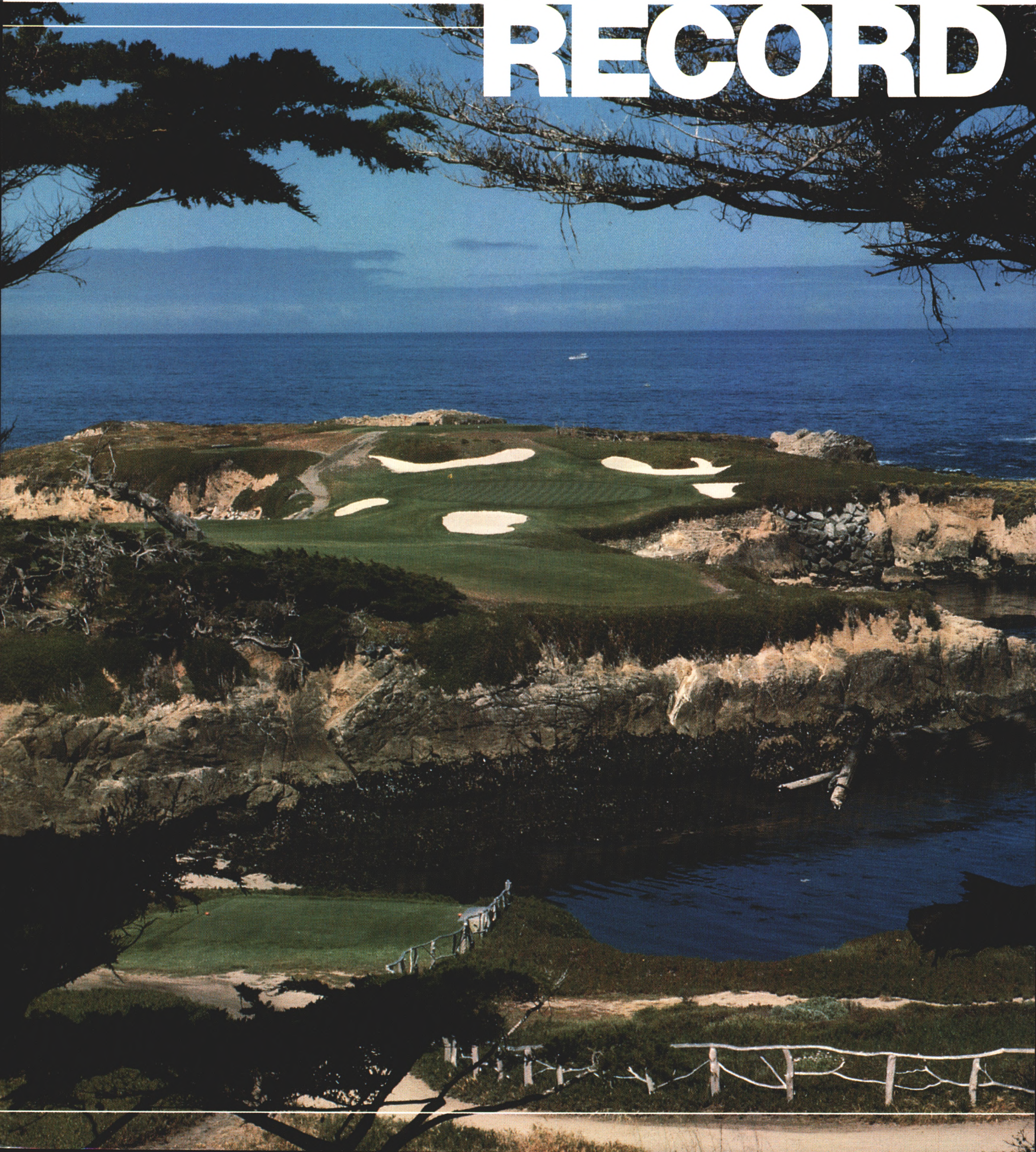
A Publication on
Turfgrass Management by the
United States Golf Association®

July/August 1988

USGA®

Green Section RECORD



USGA®

Green Section RECORD

EDITORS:
William H. Bengeyfield
James T. Snow
MANAGING EDITOR:
Robert Sommers
ART EDITOR:
Diane Chrenko Becker

Vol. 26, No. 4
JULY/AUGUST 1988

Cover Photo:
Cypress Point — the 16th hole.

GREEN SECTION RECORD (ISSN 0041-5502) is published six times a year in January, March, May, July, September and November by the UNITED STATES GOLF ASSOCIATION®, Golf House, Far Hills, N.J. 07931. Subscriptions and address changes should be sent to the above address. Articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, Golf House, Far Hills, N.J. 07931. Second class postage paid at Far Hills, N.J., and other locations. Office of Publication, Golf House, Far Hills, N.J. 07931. **Subscriptions $9 a year. Foreign subscriptions $11 a year.**

Golf House Management Philosophy — It's a Matter of Quality

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

HOW OFTEN has this happened to you? There's an important decision to be made at a golf club between Method A, which will cost more money but without question will produce the best long-term results, and Method B, a lower cost option with only reasonable promise of improvement. Those who choose Method A are rewarded with improved playing conditions and far fewer golf course maintenance headaches. This article is dedicated to those who choose Method B.

On subjects ranging from long-range golf course planning to the proper upkeep of cup liners, the lower priced Method B approach often costs more in the long run. As you read on, ask yourself: 1) Is my golf course maintenance operation a Method A or a Method B operation? 2) Are the decision makers given every opportunity to educate themselves before they make a judgement or decision? 3) Are those paying the bills (private membership or public fee players) receiving their money's worth when improvements are made?

Long-Range Planning

The foundation, and some would say the absolute rock, on which any golf course maintenance operation is founded is in a well-thought-out, long-range plan. Long-range plans should include:

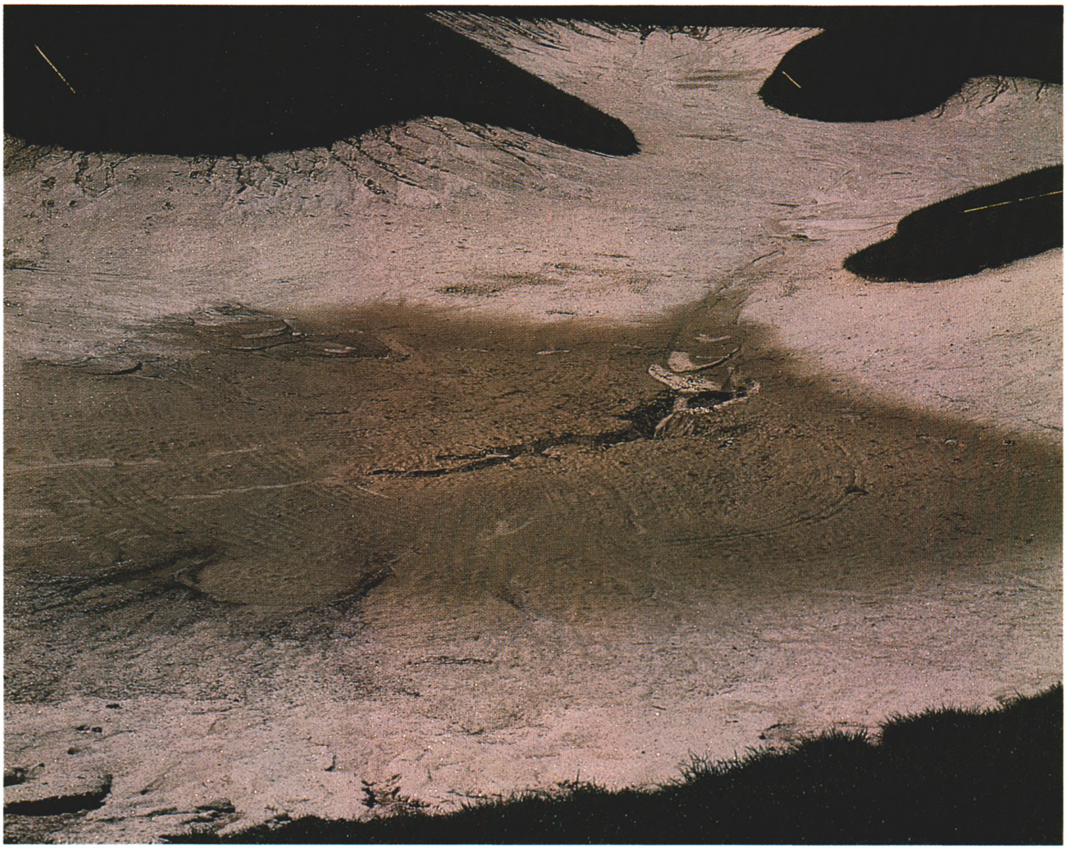
1. All the objectives specifically stated in a hole-by-hole analysis. These items should be prioritized, taking into account

Maintenance personnel must always please the golfers first.

(Above) Proper care in construction can make the difference between success and failure.

(Right) Basic drainage and good architecture? Not in this case.

(Opposite page) The prevalent problem of shade and roots can be avoided with good planning.



monies that are available and the impact on turf quality and golf course playability.

2. Once the objectives have been stated, sound recommendations can be made for each area of improvement. A timetable can be set up for completing each objective and permitting a check of progress in each area.

3. Incorporate a comprehensive tree care program. Trees are often forgotten on a golf course, and their value is often far higher than perceived. Tree pruning and root pruning can eliminate a great many turf problems if it is done regularly.

4. Include architectural changes in any long-range plan. It is vital that an experienced golf course architect be involved in the long-range program. In choosing an architect, you will want to look at his previous work and perhaps even discuss previous client satisfaction.

5. Keep a yearly progress report tracking all the work from the hole-by-hole objective list. In this manner, a five- or 10-year long-range program can be continually updated with new ideas added by changing leadership.

This long-range concept describes the main points to consider to ensure continuity and direction. The goal is focused, the leadership consistent, and the program is carried out by the golf course superintendent in a methodical and timely manner.

The important question is, Does your club actually plan for its future in this manner? Too often golf course operations have no long-range plan in force. Changes occur haphazardly through the personal desires of green committee chairmen or members. Often they do not have or are not given enough information to make the right decision. Every now and then, changes are made simply to place a personal stamp of one individual on his "home golf course." This situation can be avoided by establishing a long-range plan.

Another important aspect in long-range planning is the utilization of a professional golf course architect for making all architectural changes. The Method B approach often is to state, "That costs too much money, and we can save by doing it ourselves!" This may work in very rare cases, but it is far better and far safer to hire an experienced golf course architect. In the long run, he will save money by doing the job right the first time. There is no substitute for experience.

Irrigation and Drainage

It has been said that "the two most important things to remember while building a golf course are: 1) always use common sense, and 2) always provide good drainage. If there is not enough of Number One, be sure to provide that much more of Number Two."

This maxim applies not only during the wetter months of the year, but during the dry summer as well. Why is it then that so many golf courses exist where drainage is either ignored or improperly done, or when it's properly done, covered over with a layer of sod? Whether your method of removing excess surface water is through good surface contouring, through standard drainage techniques that have been used successfully for years, or through thinner type slit-injection techniques, the main point is to provide drainage to eliminate excess surface water from playing areas quickly.

More importantly, do not cover drain lines with sod if you wish to remove surface water through a tile system rapidly. While it may be unsightly, the amount of surface drainage accomplished by an open drain line will far exceed those covered over so they look better. A buried tile line will certainly carry water, but only after it has slowly percolated through the soil profile.

While drainage is extremely important, it is the irrigation system that provides the life-blood for the crop you grow. The proper and controlled application of water is and will always be the single most important element pertaining to golf course maintenance. Without it, golf courses as we know them in the United States would not exist. Even with an irrigation system, the superintendent's job is very difficult, unless he has close control of the irrigation system.

Perhaps your golf course is facing the question of wholesale upgrading and reinstallation of its irrigation system. Judging from visits to many courses, it is in this area where Method B can be devastatingly expensive. At the same time, a Method A irrigation system definitely requires close attention through its planning and installation phase:

1) Use the services of a qualified golf course irrigation engineer. Check his experience closely, and definitely visit other courses where he has worked. Receive as much input as possible before you make your choice. Bids will vary greatly, but remember, your choice of an experienced golf course irrigation design engineer with a good record can be the single most important decision concerning the ultimate success of the new system. Whenever possible, avoid design and installation done in-house. You are far better off with proven experience in this important area. This does not mean that the golf course superintendent should be left out; indeed, he provides an essential function in guarding the club's best interests by overseeing the installation and providing quality inspection and correction when it is needed.

2) If the cost of a top-grade irrigation system seems too high, do not cut corners and install a system that will be merely OK. Improperly spaced heads, lack of isolation valves, a reduction in coverage and controlability, and inadequate pressure are just some of the areas where shortcuts can be taken but will end up costing the club money in the future.

3) Use the latest technology for reducing electrical and water costs. Variable-frequency drive pumping and low-pressure irrigation systems are becoming more widely used, and tremendous savings of money are being realized. Strict water consumption laws are already in effect in Arizona, and similar laws are just around the corner in many other states.

If your club or golf course has the funds to proceed, then definitely use Method A. If funds are not available, it would be better to install just a portion of the system properly, or wait until money is available, through loans, dues increases, or assessments, to do the complete job the right way. This decision is extremely important. The playability of the golf course and the life expectancy of the superintendent will improve immeasurably if you go first class.

Construction

Within the long-range plan, the membership will surely want architectural changes. When embarking on a putting green rebuilding program or the improvement of bunkers and teeing surfaces, here are some important steps that a Method A advocate will follow:

Greens

1) Choose the right material. Select and test all of the available local sand and organic materials that will be used in construction. Have the materials tested by a reputable soils laboratory with experience in providing consistent results and recommendations for putting green construction.

2) Build the greens the right way. There are many different methods for building putting greens, yet only one method for repairing an improperly built green — a bulldozer. While the USGA Putting Green Specifications are not the only way for building putting surfaces, they have proven to be the most dependable way. Insist on following these specifications to the letter.

The USGA Putting Green Specifications are specific by nature and include off-site mixing, using some organic material for establishment and growth purposes, the installation of a two- to four-inch coarse sand layer to provide a perched water table, and 12 inches of topmix material. All of these factors should be covered by the testing laboratory.

3) Use your money wisely. If money is available to rebuild four greens using a less-expensive technique, it is better to rebuild fewer greens but rebuild them properly. Putting green construction is a hefty investment, and when they are built properly, it is money well spent.

Bunkers

1) As you should with putting greens, carefully select available sands and have them completely tested before you use them. In addition to physical testing at a qualified laboratory, actual testing in the field for at least five to six months is suggested. If the sand proves to be playable and drain well after a period of time, then a wise choice is assured.

2) While the use of a qualified golf course architect is recommended for putting greens, many outstanding bunkers have been done by talented golf course superintendents. If a golf course is fortunate enough to have such an individual, use his talents as long as the members accept his work. However, if there is any negative impact, it is far better to hire a golf course architect for bunker design. This is particularly true if the bunker is being done in conjunction with new putting green construction.

3) Provide good drainage. Not only should excellent drainage be provided in the bunker, but contouring around the bunker must be developed in a manner to avoid surface runoff into the bunker areas.

Tees

1) Use the same care in construction of tees as you would with a putting green. Quite often, the money used for tee construction is inadequate, soil testing is not accomplished, and the resulting teeing surface is unsatisfactory and must be completely redone. While a teeing ground does not need to be built according to USGA Putting Green Specifications, the topmix should be tested, organic matter mixed off-site, and at least eight to 10 inches of the topmix used for the surface. Complete drainage should be installed under the tee, combined with a four-inch gravel blanket around and over the drain lines.

2) Take your time to reduce settling problems. As the tee is constructed, compact the material as much as possible using physical and water techniques to reduce future settling. Do not try to

Proper equipment storage is a must.

build a tee overnight. Rather, allow several weeks for settling and, if possible, depending upon your region, construct tees before winter and complete the seeding operation in the spring. This allows settling during the winter. Also, to assure good drainage, try to construct tees with an imperceptible grade toward the rear. Perhaps one of the best techniques for developing a Method A tee is to consider the teeing surface somewhat like the foundation of a house. Use wood framing to establish a slight grade toward the rear, and use cross pieces to ensure the same degree of slope throughout the surface. This method may take a little longer, but the results are exceptional.

3) Provide plenty of teeing area. As a general rule, there should be approximately 100 square feet of usable teeing area per 1,000 rounds of golf per year on par-4 and par-5 tees. Par-3 tees need double this space. With some golf courses with more than 100,000 rounds per year, the required teeing area can reach half an acre or more. This amount of area is not available in most cases, and the construction must occur on available area. In every case, try to make the tee as large as possible, depending on the amount of present play or that expected in the future.

Equipment and Buildings

Another area where important differences can be seen between Method A and Method B is in equipment and storage. The Method A approach is to provide up-to-date equipment that is maintained regularly, replaced regularly, and stored properly to preserve its value for resale purpose. Method B, on the other hand, often uses the baling wire and tape technique that is inefficient, time consuming, and not to the benefit of the golf course or the players who pay the bills.

While every golf course has different amounts of capital to invest, every Method A club should include the following:

1) A long-range equipment replacement program. This will include every piece of equipment in the operation with scheduled life expectancy and depreciation for regular replacement.

2) Having the right equipment for the job. It is surprising to find golf courses that operate with little or no equipment for a particular maintenance job. For example, it is common to see golf courses gather leaves and debris by hand when sweepers and vacuums can greatly aid the cleanup process. Taking this idea one step further, the use of a large tractor-mounted blower greatly speeds up course cleanup operations and should be included in any equipment inventory, especially if debris from trees is a problem.

3) Provide adequate equipment storage and working conditions for the employees. Does your maintenance building include proper pesticide storage, locker facilities, a clean and well-lit lunch room, an adequate-sized superintendent's office, and shower facilities for emergencies? Does the mechanic's work area provide adequate space for his important function, and is there enough storage space in the maintenance building to keep equipment under cover through summer and winter? It is important to remember that the maintenance program of every golf course begins and ends at the maintenance facility. If you expect a well-maintained golf course, begin with the maintenance building.

4) Use a full-time mechanic. It is not uncommon to find a golf course operating with hundreds of thousands of dollars' worth of equipment and not find a trained mechanic on the staff. Besides being invaluable for preparing and maintaining equipment on a daily basis, the mechanic is absolutely necessary when breakdowns occur. There is nothing

more frustrating, time consuming, and inefficient than a golf course without a good mechanic.

Maintenance Programs

Let us assume that a club has established a long-range plan, provided an excellent irrigation system, constructed everything properly, purchased and maintained excellent equipment, and provided adequate labor to reach its maintenance goals. It is now up to the most important person in the golf course operation to produce results. Excellent golfing turf can be produced in many ways. Nevertheless, when viewing successful superintendents on Method A programs, some distinct similarities come to the surface. These include:

1) Attitude. Successful golf course superintendents are usually goal-oriented, positive individuals who care deeply about their product. They have the attitude of producing whatever the client wants, as long as it is within reason. As Riley Stotten, the past president of the GCSAA, states, "You have to know when to hold and when to fold!" The successful superintendent knows when to bend to the wishes of the membership and when to stand firm.

2) Communication skills. It is becoming more and more evident that growing turf is frequently the easiest part of the superintendent's job. Over 50 percent of the job requires communication skills with members, employees, and in areas outside the club. Writing articles for the membership's monthly newspaper is an important part of a superintendent's communications.

3) Education. Successful golf course superintendents take advantage of all educational opportunities. Currently, computers, effective public speaking, and business management rank high on the list of desirable acquired skills.

4) Use outside sources of information. No one person has all the answers to every situation. However, the wise superintendent uses extension agronomists, irrigation engineers, qualified golf course architects, and the USGA Green Section. The Green Section in particular can prove an invaluable information source, and can be used as an excellent tool for advancing improvement programs.

5) Playing the game of golf. "Our superintendent believes we should use this type of bunker sand in our reconstruction efforts. Of course, he doesn't play golf, so he doesn't really understand the problem." This statement may be totally untrue, but everyone has heard it many times. Therefore, it is important for the golf course superintendent to play the game, no matter at what level of skill. A superintendent relates far better to the membership when he plays his own golf course.

6) Paying attention to detail. It is still the little things that directly reflect on a Method A or Method B type golf course. Are the cup liners always freshly painted? Are the flagsticks and flags in good condition? Are the benches kept in good condition and always placed in the proper place when the tee blocks are moved? Is the club entrance always kept clean to develop a good first impression when the owners enter their club? These are small areas that the successful superintendent covers daily just to keep his course and his operation in top shape.

The next time a decision must be made at your golf course between Method A and Method B, consider the following from Sidney J. Harris:

"One of the most serious mistakes we can make is to confuse the thing we call intelligence with another thing called judgement. The two do not always, or necessarily, go together; many persons of high intelligence have notoriously poor judgement."

Pledge yourself to good judgement. If you do, you will always be correct in the future.

Superintendent Ray Davies, Candlewood C.C., California, knows a quality temporary green is still needed when rebuilding an old green.

A LOOK AT TURFGRASS WATER CONSERVATION

by DR. ROBERT N. CARROW
University of Georgia

WITHIN THE PAST ten years, water conservation under turfgrass situations has become increasingly important. A number of factors have brought this about, including increasing competition for water recources, water shortages from periodic drought, awareness by turf managers that high fertilization and irrigation are not necessary to maintain a good-quality turf and often lead to other management problems, and the increasing cost associated with obtaining water.

The United States Golf Association has provided research funding in water conservation strategies for turfgrass managers and applied research to implement these approaches. To achieve maximum water savings while maintaining an adequate turfgrass for a particular site requires integration of a number of different strategies. A grower on a particular turfgrass area may not be able to use all strategies, but when relevant ones are incorporated into his management program, considerable water conservation can be expected.

Water Conservation Strategies

A primary, but long-term approach to decreasing water use is through the development of grasses with lower water use requirements. This requires a) developing cultivars of turfgrass species that have lower water use rates than current cultivars, b) developing improved cultivars of native species that already can provide reasonable quality turf under minimal water but are limited in natural adaptation range, and c) determine whether grass species not currently used as turfgrasses have a place in turfgrass management in a manner that would reduce water use.

Plant breeding obviously plays a dominant role in this approach. Breeders make plant explorations to obtain new genetic material. They evaluate new selections for quality, water use, and drought resistance. Hopefully, they will release some of the better selections after wide testing and also utilize them for breeding purposes to develop even better second-generation cultivars.

In order to evaluate grasses for their potential drought resistance and low water use, plant breeders must rely on rapid screening techniques. Plant physiologists enter the picture here and identify key plant morphological, anatomical, and physiological characteristics that impart drought resistance and reduced water requirements of turfgrasses. Once the most important characteristics are known, physiologists must then identify rapid, reliable ways for the plant breeder to screen for these characteristics.

Unfortunately, drought resistance is the most complex of all environmental stresses. Table 1 summarizes the many plant mechanisms that contribute to drought resistance. Determining which of these mechanisms are important for a particular turfgrass species or cultivar is a monumental task. Such basic information not only will enhance the efficiency of breeding programs, but also will provide criteria to develop more water-efficient cultural programs.

To put it in different terms, the soil-plant-atmospheric-continuum (SPAC) is composed of many factors, each of which affects water use. In this SPAC, least is known about the influence of the plant, particularly when an individual species and cultivar are considered.

A second strategy for water conservation is for turfgrass managers to alter current cultural practices to reduce water use. This will be a continuing process as more information comes forth on how specific cultural practices influence water use individually and in conjunction with other practices on a particular species and cultivar.

Cultural practices most likely to affect water use are mowing, N-P-K nutrition, irrigation practices, cultivation, plant growth regulators, thatch control, and certain pesticides. In addition, improved root growth by correcting soil physical, chemical, or biological properties will greatly enhance water conservation.

As more basic knowledge evolves about how plant and soil aspects are altered by individual or combinations of cultural practices, we can develop much better regimes. To be most effective, this will need to be done at the cultivar level, because within species, cultivars may vary substantially.

Third, breeders must develop turfgrasses that can tolerate high soil salt levels and poorer water quality. These grasses would be used with lower water quality, effluent water, and saltwater intrusion areas. Research by breeders, physiologists, and soil scientists on these problems is greatly hampered by location of the experimental site. Only a few of the current research facilities have soils with high salt content or poor water quality from ground water, effluent, or saltwater sources. Locations away from the established research facility are often not desirable because of the intensive management of turf and the necessity to obtain research data frequently. Problems associated with saline/sodic soils and poor water quality will increase in the future.

A fourth strategy closely associated with the previous one is the use of effluent water. This has been a common practice in arid regions. In the future,

TABLE 1

Turfgrass Morphological, Anatomical, and Physiological Characteristics Contributing to Drought Resistance

Drought Resistance — various mechanisms that a turfgrass plant may have to withstand periods of drought. Two major types of drought resistance are:

1. *Drought Avoidance* — ability of a plant to avoid tissue damage in a drought period by postponement of dehydration. The plant is able to maintain adequate tissue water content and thus avoid or postpone the stress. Plant characteristics contributing to drought avoidance are:

- Deep, extensive root system
- High root length density
- High root hair density
- Good root viability
- Rolling, folding of leaves
- Thick cuticle on the leaves
- Hairy leaf surfaces
- Reduced leaf area through smaller leaves
- Reduced leaf area through death of lower leaves or tillers
- Slow leaf extension rates after mowing
- Leaf densities and orientations contributing to high canopy resistances
- Stomatal closure
- Stomatal density
- Stomata that are located so as to reduce transpiration
- Smaller conducting tissues
- Smaller mesophyll cells in leaves
- Possibly proline or betaine accumulation

2. *Drought Tolerance* — ability of a turfgrass to tolerate a drought period. Two potential ways are:

a) *Escape* — where the plant has a life cycle such that it lives through the drought in a dormant state or as seed.

b) *Hardiness* — where a plant develops a greater hardiness (tolerance) to low tissue water deficits. This process normally involves a greater drought tolerance of protoplasm and protoplasmic membranes from alterations in their properties, and binding of water to protoplasmic constituents. Osmotic adjustments to aid in maintaining adequate tissue water content may also be involved during long-term or short-duration stress periods.

this practice may spread to humid regions, especially in urban settings where potable water is at a premium. As this occurs, problems will develop that may not appear in arid or semi-arid regions. Refinements in cultural practices will be required to insure efficient, safe use of effluent water.

Water harvesting is a fifth alternative that may be applicable in certain locations. This is already practiced in the form of runoff ponds on some sites. Contouring and sealants (mechanical or chemical) to promote runoff on selected areas while collecting the runoff for irrigation may prove practical in some cases.

A sixth approach is by improved irrigation scheduling. Technology is developing rapidly in this area and can assist the grower in reducing water runoff, leaching, and excess evaporation losses. Technological tools assisting turf managers in irrigation decisions are a) soil-based — to monitor soil water status; b) plant-based — to monitor plant water status; and c) atmospheric — to monitor atmospheric conditions.

Examples of soil-based tools are an increasing array of soil moisture sensors in addition to tensionometers and moisture resistance blocks that have been available for many years. Often these sensors work on different principles than tensionometers or moisture blocks and may not have the limitations of these instruments.

The oldest plant-based irrigation guide is observation for wilt, but being able to determine stress before visual wilt symptoms would be very beneficial. Systems that monitor canopy temperatures are now available and can be used to help schedule irrigation.

Examples of atmospheric-based tools are weather pan evaporation and estimating evapotranspiration (ET) by various environmental-based formulas (Penman equation, others). State-of-the-art irrigation controllers, coupled with weather-monitoring devices, are now available from major irrigation manufacturers. Further improvements in atmospheric-based approaches can be expected as the data base builds and growers begin to use the full capabilities of these systems.

Irrigation system design and engineering offers a seventh water conservation approach. Essential factors that improve water use in irrigation design are:

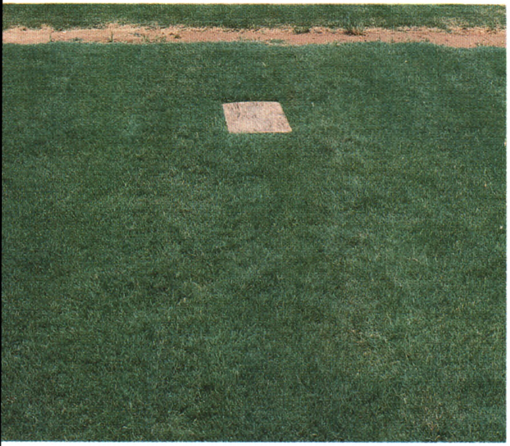
- Designing for application uniformity and thereby minimizing wet and dry spots; zoning irrigation heads of similar areas together.
- Using fewer sprinkler heads per zone but adding more zones; matching application rate to soil infiltration by using low-volume heads on heavy soils or multiple irrigation applications.
- Providing the turf manager with sufficient data and controller flexibility to develop the most efficient irrigation program.

An eighth strategy is development of specific water conservation and drought contingency plans at all levels — specific turf site, city/county, water district, and state. A review by the turf manager of the previous strategies will reveal how water conservation measures can be incorporated into such plans. Just as with pesticide issues confronting the lawn-care industry, input into regulatory and governing agencies before plans are developed has been the most successful tactic.

A manual detailing how to develop plans and incorporating data to calculate projected water saving through implementing specific water conservation measures would be a valuable tool for turf managers, regulatory personnel, and governmental officials.

A ninth strategy, but not of least importance, is education. Individual turf managers will be increasingly challenged by more sophisticated technology (*i.e.*, infrared thermometers for canopy temperatures and complex controllers with tremendous ability to provide detailed information); the need to refine management programs to smaller and smaller units (green by green, tee by tee); pressure to incorporate all possible water conservation tactics; expectations to provide data on the degree of water saved; the necessity to alter many management practices for a specific cultivar in order to achieve maximum benefits; and other similar challenges.

To this base of knowledge, managers will need to understand new technological and scientific advances in turfgrass science in order to intelligently incorporate these into their management schemes. At the industry level, the USGA Green Section, manufacturers, and university personnel must find efficient ways to transmit the latest knowledge rapidly and in a comprehensive, understandable manner.

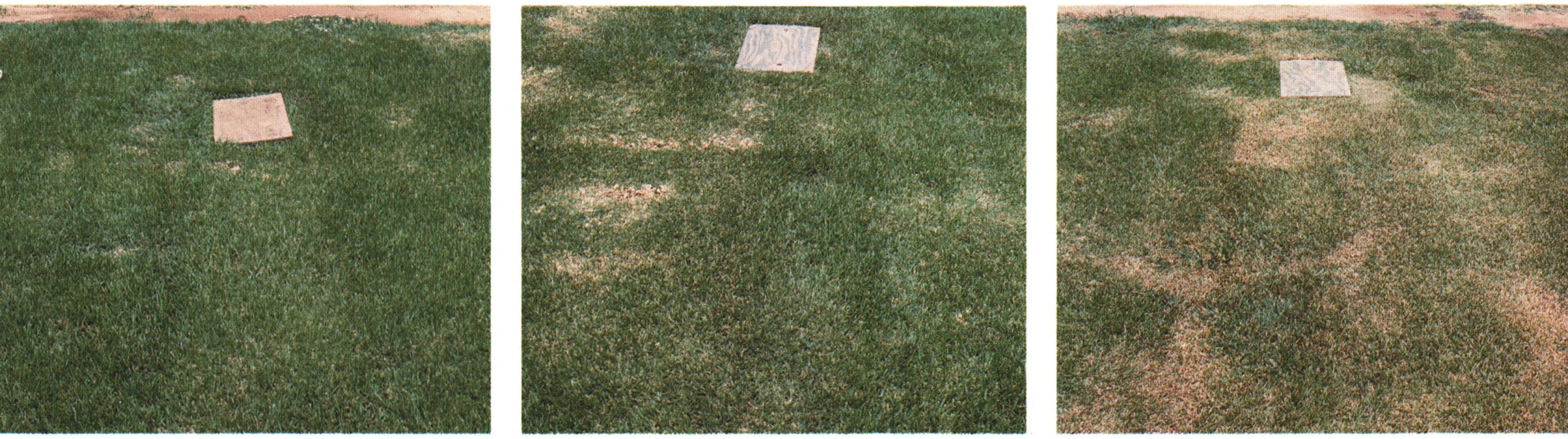


Well-irrigated example for high-quality turf on tees, athletic fields, etc.

Moderate water stress. An example of common irrigation practices for fairways, most athletic fields, business grounds and good home lawns.

Severe water stress. An example of infrequently irrigated turf, roughs and for survival of grass.

Zoysiagrass under the same irrigation regimes as described above.



Centipede grass under the same conditions.

The Six Seasonal Stages of Bentgrass Nitrogen Fertilization

by DR. RALPH E. ENGEL
Professor Emeritus of Turfgrass Science, Rutgers University

NITROGEN FERTILIZATION is necessary for the best performance of bentgrass, and how we use it has profound effects on quality and survival. The purpose of this article is to give guidelines on the use of this nutrient that are based on my research and observations on many different golf courses in the northeast.

It seems some golf course superintendents have little or no interest in the intricacies of nitrogen fertilization. Yet, this part of the turfgrass program ranks with the first five or six causes of success or failure in the profession. Possibly we do not maintain adequate awareness of the subtleness of this nutrient. There is little research now being conducted on the questions that remain on nitrogen and bentgrass management.

Some growers have the attitude that every golf course is different — that nitrogen use is a wide-open procedure of their choice. Or on occasion there is failure to appreciate the special or delicate benefits of nitrogen use. Possibly more superintendents have walked out of lectures dealing with nitrogen use than any other turf subject.

While there are many different programs with nitrogen, and you may be happy with yours, evaluate comments of others and observe results obtained by those growing bentgrass in your region and elsewhere. All this gives more perspective on what can and cannot be done with nitrogen on bentgrass.

Since harm from high nitrogen use has been implied, a brief review of these types may help maintain a balance of favorable results. While several turfgrasses have high tolerance for nitrogen, bentgrass has a comparatively poor tolerance. In general, diseases, heat injury, cold injury, and drought injury are increased by high-nitrogen programs. More specifically, encroachment and dominance of annual bluegrass in bentgrass turf is one of the certain and most objectionable results of generous nitrogen (Figure 1).

Basic Guideposts on Nitrogen Fertilization of Bentgrass

1. Maintain slow, steady growth as the weather permits. Bentgrass does not need high totals of nitrogen. With good growing conditions, it grows well with comparatively low levels of nitrogen.
2. Since medium to low annual totals of nitrogen are best, use nitrogen only to regenerate bentgrass and maintain a satisfactory putting surface. Reach the seasonal total with smaller but more frequent applications.
3. The season of nitrogen application affects results. Unless more growth is needed for the playing surface, limit nitrogen application to seasons that cause the least failure and annual bluegrass encroachment.

The "Six Seasons" of Nitrogen Application on Bentgrass Turf

The four seasons of the calendar are inadequate to delineate the seasonal reactions of bentgrass to nitrogen fertilization, at least in the New Jersey area. The following six bentgrass seasonal stages will help planning of the bentgrass nitrogen program for the New Jersey area and similar weather patterns.

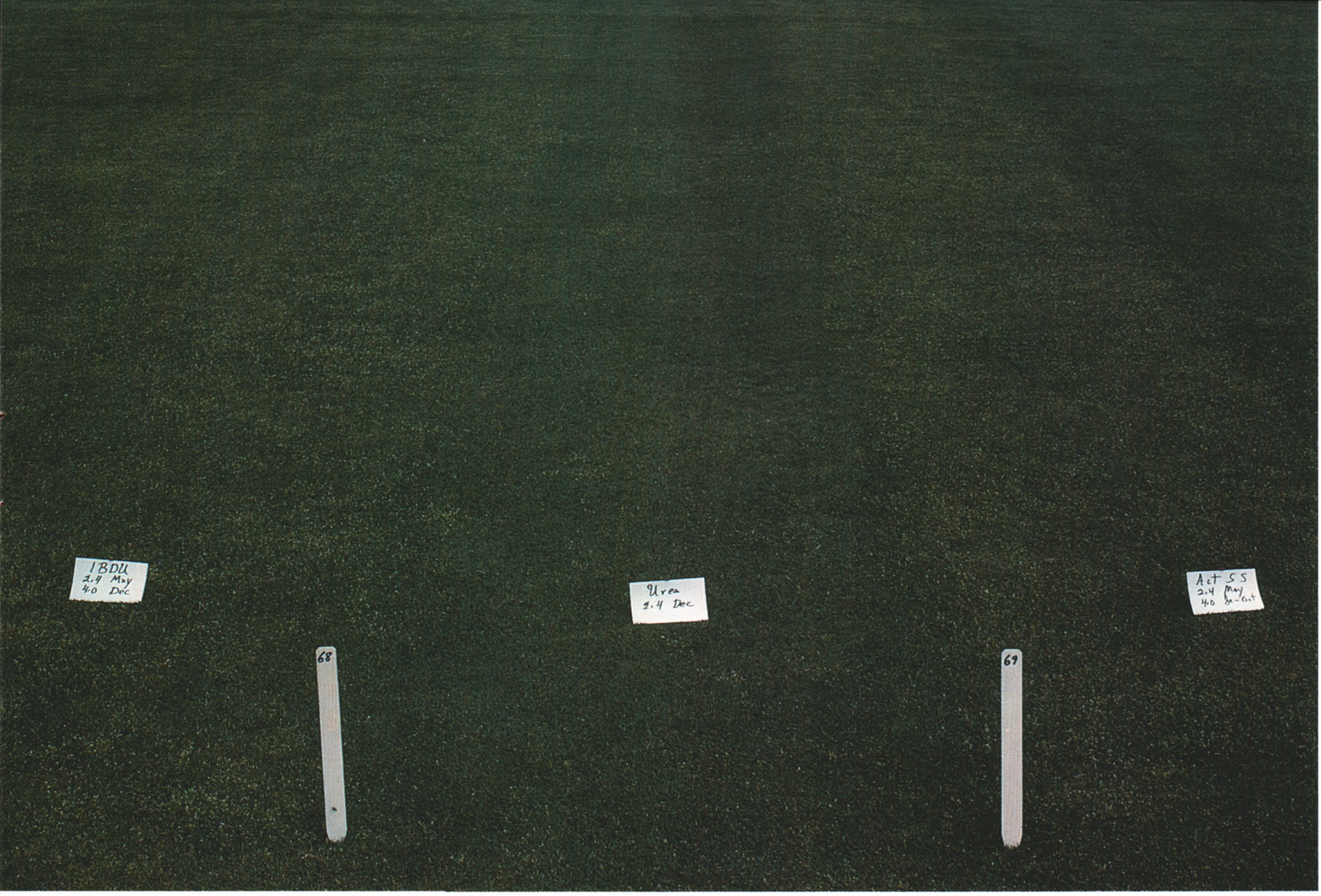
1. *Late winter - early spring (late February - early April)* — Pushing growth response at this season increases tillering and an abundance of annual bluegrass seedhead development in mid-to-late spring. Since roots have not reached maximum regrowth at this early date, it is expected nitrogen use would hinder their optimum development. Use no nitrogen in this very early stage unless major growth is needed for situations such as recovery from winter injury or more growth on a new green.

2. *Mid-spring (last week of April - early May)* — This is a recommended season for starting nitrogen on bentgrass in New Jersey and similar areas. While annual bluegrass seedheads begin in this season, they will not be increased by nitrogen stimulation at this stage. Seedheads are reduced proportionately with increased available nitrogen. Generous amounts of available nitrogen keep annual bluegrass vegetative (Figure 2). Apply ½ to ¾ pound of nitrogen per 1,000 square feet (no more than 25% slow-release nitrogen). Nitrogen only, nitrogen-potassium of N-P-K fertilizer can be used according to soil tests. A second application can be made in May if growth is slow or appearance "hungry." This is usually unnecessary if a topdressing supplies significant nitrogen, such as found in a mushroom soil-base material.

3. *Late spring - early summer (late May - July 10)* — Usually nitrogen is inadvisable in this season (especially until the first prolonged hot, wet, flush period of growth is over). If nitrogen is used, apply lighter rates.

4. *Mid-summer (mid-July - early August)* — A natural organic fertilizer like Milorganite at ¼ pound of nitrogen per 1,000 square feet is suggested. In the New Jersey area, apply one to four applications at one- to two-week intervals as weather permits. Usually nitrogen stimulation of bentgrass is undesirable at this season in the hotter climates. The goal of nitrogen use in the cooler climates is maintaining good bentgrass cover without tender growth.

5. *Late summer - fall (late August - October)* — Carryover nitrogen in the soil and topdressing nitrogen have con-



(Top) Less annual bluegrass with a dormant application of urea nitrogen for four years as compared with higher annual totals of nitrogen with varied seasons of application.

(Above) Note reduction of annual bluegrass seedheads in the greener nitrogen-treated plot on the left.

siderable influence on nitrogen need in this season. Agronomically, low nitrogen is preferred to avoid stimulating annual bluegrass that germinates in this time period. Limit nitrogen strictly to such needs as: a) Growth required for an acceptable putting surface. b) Regeneration of new shoots on bentgrass before cold weather dormancy. Remember, both nitrogen and phosphorus favor young annual bluegrass growth. Thus, use nitrogen, nitrogen-potassium, or N-P-K fertilizers as tests permit at rates of ¼ to ½ pound nitrogen per 1,000 square feet to satisfy growth needs.

6. *Dormant fertilization (early December in the New Jersey area . . . after the last mowing)* — a) Gives growth through open winters. b) Encourages good cover for late winter and early spring play. c) Use of urea in early December in New Jersey has given significant reduction in annual bluegrass as compared with slow-release nitrogen (Figure 3). Rates of one to two pounds nitrogen per 1,000 square feet are commonly used. d) This is a special treatment that is useful on some occasions for courses in New Jersey and other areas.

Suggestions on the "Six Seasons" Nitrogen Program and Others

The main thrusts of the "six seasons" fertilization program are bentgrass survival and minimizing annual bluegrass. As with other programs, it should not be used as a fixed "cookbook" type recipe. Yet some of the principles should be respected on a regular basis. General comments and suggestions on nitrogen fertilization of bentgrass are:

1. Use smaller and more numerous nitrogen applications to reach the annual total of nitrogen.

2. Use of slow-release nitrogen spreads nitrogen stimulation but reduces "watering in."

3. Ease off nitrogen use in cloudy, wet weather.

4. Black layer lectures have led to a surprisingly few remarks on nitrogen use. Without benefit of research on the nitrogen relationship to this problem, it is suggested that small, infrequent nitrogen treatments be used when needed where this concern exists.

5. Watch color and growth through the growing season. Nature's ways of releasing nitrogen for plant use will vary and necessitate occasional adjustments. If growth is good, do not use nitrogen only for a darker bentgrass color to please the eye. Often iron application will suffice and avoid increasing the nitrogen total.

6. If you are in other types of climate, some different nitrogen procedures may be required. Certainly, zero or lower totals of nitrogen will be used in the warm portion of the season in hotter climates. In different climatic areas, some parallels of temperatures and growth pattern regimes will exist as reported for the New Jersey area. These can be used or avoided as needed in your nitrogen program.

7. More research is needed on the best seasons for applying nitrogen stimulation to bentgrasses. Factors such as rainfall, irrigation requirements, day and night temperatures, soil types, amount of play, length of season, and many others all create the need for a superintendent to use and expand his good judgement in bentgrass fertilization. Striking the proper balance and touch with nitrogen on bentgrass is one of the many challenges for the golf course superintendent.

Reduced annual bluegrass seedheads in May of bentgrass turf receiving four different nitrogen carriers for three years in early December versus the same total of nitrogen applied in the months of September, October and November.

A Comparison of 2.4 Pounds of Nitrogen Applied In December Versus September-October-November

	ANNUAL BLUEGRASS, PERCENT	
SOURCE	SEPT./OCT./NOV.	DEC.
Urea	17	9
Ureaform	37	26
IBDU	31	20
Sewage Sludge	39	32

Like a gentle rain, "showering" is the best technique for handwatering.

THE ART OF HANDWATERING

by GARY SAYRE, CGCS
Overlake Golf and Country Club, Washington

"HANDWATERING?" Did someone say, "Handwatering?" In this day of spending hundreds of thousands of dollars on one automatic irrigation system, some believe handwatering on the golf course is passé. Not quite yet.

There are many reasons for modern-day handwatering. Perhaps the main one is to compensate for a poorly designed automatic irrigation system. Other reasons include water conservation, soil textural differences, syringing to cool the grass plant, and handwatering makes possible consistent quality putting surfaces under certain conditions, such as severe elevation changes. There are many more.

Handwatering is still the best way to place a specific quantity of water on a specific area of turf. All it takes is a discerning eye, a soil probe, a hose, nozzle, valve key, and, of course, a source of water. It would be interesting to know how many of the 12,000 golf courses in the United States handwater at least some putting surfaces during a growing season. It would also be interesting to know the principal reason for handwatering.

Each of the four golf courses where I have worked handwatered putting greens and occasionally tees and fairways. The membership at Overlake Golf and Country Club appreciates optimum turf conditions. As a result, we put in approximately 300 man-hours each summer handwatering putting greens and tees. It's an important part of our program.

Some of the reasons for handwatering deserve closer scrutiny.

Poor Sprinkler Coverage: Some of us have irrigation systems that are not quite what we would like. We must compensate so that we do not end up with muddy spots or areas that are so dry turf loss is possible. Some of our automatic irrigation systems don't give us proper coverage because of improper spacing, improper operating pressure, poor maintenance practices, and poor or inadequate programming potential. As a result, we must do supplemental handwatering to compensate for the deficiencies in the automatic system.

Soil Texture Differences: Some of the putting surfaces on our golf courses have different textured soils. As a result, we must irrigate for the putting surface as a whole unit. The results vary with dry aprons, wet aprons and even localized dry spots on both greens and aprons. The soils have different permeability rates, which affect our watering schedules. We must compensate, therefore, by handwatering the areas that do not receive enough water. Some of our soils take water so slowly we must water them until runoff occurs, then come back and water them again 30 to 60 minutes later.

Water Conservation: During the summer of 1987, many Seattle golf courses were required to cut back automatic irrigation because of a severe water shortage. This occurs more frequently today, and we must have alternative watering techniques that will apply water in the exact amounts we need at the proper places. Many Seattle golf courses found out in 1987 that handwatering is the best alternative.

To Cool Grass Plants That Are Under Stress: Many times during the summer, temperatures, hours of intense sunlight, and wind combine to dry out turf to the point that it literally wilts. Some courses have added irrigation that will cool the air automatically in the vicinity of the greens. The idea is to lower the air temperature around the leaf surfaces by fogging the air and allowing the grass plant to continue a balanced transpiration rate. Those of us who cannot do this automatically must have experienced personnel who can spot these conditions and act quickly. Remember, we are only cooling off the leaf tissue, not wetting the soil. Technically, this is called syringing.

To Keep Consistent Putting Greens: This is one very important reason for handwatering. I say this because it embodies all the reasons already discussed. As one who provides a service to people who want to enjoy the game of golf, I feel one of my most important goals is to provide the best putting greens I possibly can. This includes a number of cultural practices, one of which is irrigation. It is of the utmost importance that we make every effort to provide putting surfaces that are smooth, true, of consistent speed, and that will hold a properly struck golf shot. Even the best-designed irrigation system will not produce a green with uniform moisture content throughout. They usually provide too much water to the middle of each green. Furthermore, many greens have high areas and low areas which result in localized dry spots and wet spots. Another problem encountered is hydrophobic areas on greens. There is no escaping these without good management, which includes proper handwatering and some type of spiking or aeration.

Is there a right way and a wrong way to handwater? There certainly is. Handwatering the wrong way can do as much damage to the playing surface as no watering at all. A workman is asked to go out and handwater new seed or certain dry areas on greens. All he takes with him is a one-inch hose, a quick coupler, and his thumb. The hose is hooked up. The water gushes under high pressure, and his thumb soon grows tired or cold in trying to break up the flow. He does not apply the water in a showering manner, but instead directs the high-pressure flow right into the turf, as if to force its penetration. The turf soon looks bedraggled and not unlike a gully-washer has passed by. Too much of this and erosion begins to set in and the playing surface is ruined.

Every morning I take a walk on the course while my crew is doing the greens mowing and bunker raking. While I am walking, I look at every green and tee, and take soil probe samples to test the soil moisture level. I also observe the surface for leaf color and hardness of the surface. I watch the mowers and their effect on the surface, and I also ask the person setting cups what the soil moisture level seems to be like to him. This first trip around the course helps me see areas that could become a problem if weather conditions are just right. Throughout the day, I monitor the wind, speed, and temperatures.

I have been at Overlake Golf and Country Club long enough now to recognize where the hot spots usually occur, and we tend to concentrate our observation on these areas.

Each day we usually handwater greens twice and tees once. We must be flexible and do whatever we feel we need to as often as necessary.

I train anywhere from four to six people on my crew on how to handwater so they do it in the most efficient and effective manner possible. We use 100 feet of one-inch hose and a cooling or shower-type nozzle for the majority of our handwatering. At least one person goes out on each nine around 10 a.m. and again at 12:30 p.m. They go in reverse order and occasionally skip around until they have done all of the greens and tees.

Occasionally, we will treat dry spots with wetting agents to aid water penetration. We will spike the areas with ¼-inch aerifier tines to help the water penetrate and keep our greens as uniformly consistent as possible.

When we handwater, we are careful not to apply so much water it lies on the green for longer than one minute. It just so happens that the time of day we must be out handwatering coincides with the time of day our golf course tends to be the busiest, and we do not want to interfere with play any more than necessary.

I have been trying for years to find ideas that can make handwatering necessary only on rare occasions. I have not made much progress so far. Some of the ideas we tried have been successful in cutting down labor, but they don't allow us to eliminate handwatering totally. Most golfers at private clubs want tournament putting conditions, and they do not want to contend with golf course workers when they are on the course. Does this situation sound familiar? We do not exactly have that happening at Overlake, but we seem to be pleasing the golfers, and here's how we do it.

We have a new (1985) state-of-the-art automatic irrigation system that was designed by an excellent engineer. We try to schedule it in a manner that will furnish optimum irrigation at least for the lower and more level areas on the course.

We apply liquid wetting agents through the irrigation system about once every two to three weeks. We aerify greens twice each year, except the dry, hard or too wet areas which get spiked two or three times more.

We topdress our greens with good-quality 30/50 sand eight to 10 times a year during the growing season.

We apply most of our fertilizer at ⅛ to ¼ pound of potassium and nitrogen per 1,000 square feet every other week in a spray solution. We verticut greens very lightly with groomers twice each week. We mow greens every day at 5/32 of an inch during the growing season.

And, of course, we handwater our greens as needed to keep them healthy and, foremost of all, playable.

Our Stimpmeter putting speeds range from 7½ to 8 feet in winter and 8½ to 9 feet in the spring, summer, and fall.

If you want consistent, playable greens, you must consider handwatering as part of your routine putting green maintenance. Try it and I think you'll agree, it's an art worth perfecting.

(Top) Like a sudden downpour, "direct application" is not as effective. One should not try to force the water into the soil.

(Left) A "rose" or "shower" nozzle is essential equipment.

(Above) "The Old Thumb Trick" does not stand the test of time (or cold temperatures).

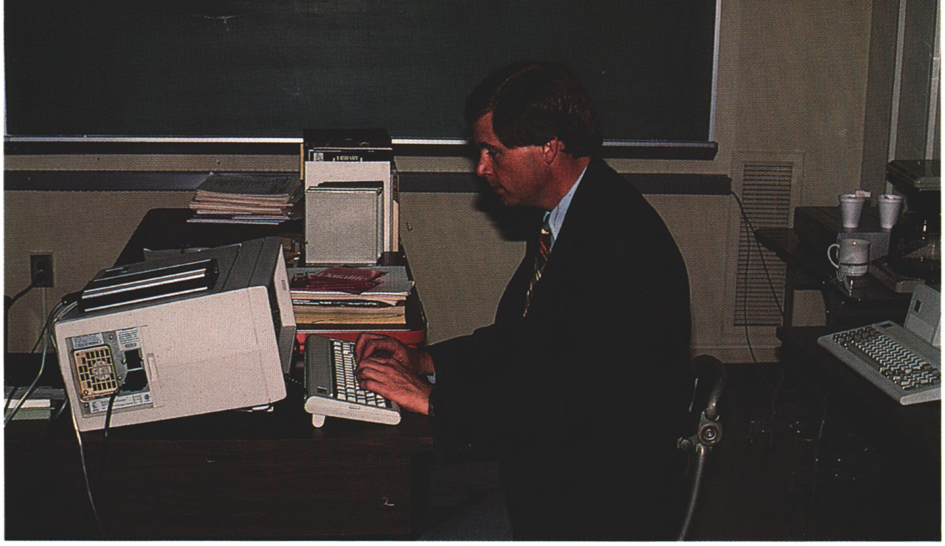
THE USGA TURFGRASS INFORMATION FILE GOES ON-LINE AUGUST 1, 1988

AND NOW it is a reality! The world of turfgrass professionals will never be quite the same. After four years of construction and development, TGIF (the USGA Green Section's Turfgrass Information File) computer at Michigan State University Library goes on-line on August 1, 1988. It will support remote searching and electronic message transmission. Turfgrass researchers and practitioners around the world now have access to over 13,000 research and informational entries stored in the TGIF computer. New entries are added each week.

TGIF can be of significant help in supporting the literature review process for researchers. It can be equally beneficial to the golf course superintendent, green committee chairman, or any professional in the field of turfgrass management as a reference tool. It will become increasingly valuable as new categories are entered. Indeed, it is designed to replace and update all the informational filing cabinets now in turfgrass managers' offices. To the increasingly complex world of turfgrass information management, TGIF offers a practical and simple solution.

(Below) The Michigan State University Library housing the Turfgrass Information File.

(Opposite page) A data retriever — remote personal computer with phone modem.



For further information, complete the enclosed request card, affix a 15¢ stamp, and mail. And for additional information on "How to Make the Right Connections," read Jim Moore's article (of the same title) in the May/June, 1988, issue of the GREEN SECTION RECORD.

An entirely new territory is about to open. Only you can determine if you want to explore and use it to your professional advantage. Send the request card today.

ALL THINGS CONSIDERED

The Winner in the Long Run

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

A PLANT MANAGER for a large company painstakingly completed a long-range plan for future growth. He carefully determined regular maintenance requirements and how they would maximize profits. The plan was presented to his superiors; they approved and immediately placed it in operation. But the following year and every succeeding year, someone else changed the plan, refocused direction, or instituted an entirely different long-range plan. My question is, Do you think this company is still in business with this type of philosophy, or has it filed for Chapter 11?

While this example may not occur often in the business world, it is a common practice in the operation of golf courses. The problem is caused by the constantly changing green committees and green committee chairmen.

The chairman is a vital link between the golf course superintendent and his operations at the club. The frequent changing of this position requires constant re-education. Sometimes philosophical differences occur that in the worst case may lead to outright termination for the golf course superintendent.

We have all seen or heard of horror stories of this kind. Golf course maintenance operations are big business. They should be treated in exactly that manner.

What can be done at a club if this revolving-door policy is in effect? The answer could lie in one of the following:

1. A new green committee chairman should serve as an active green committee member for at least two to three years before he becomes chairman. In this manner, he is acquainted with the golf course superintendent's operations and the club's long-range program. He is less likely to institute changes or personal preferences that could affect the golf course. The constant re-education program of chairmen is one of the major problems facing superintendents today.

2. The chairman should not have to be a board member. A board liaison can be an active participant in every green committee, yet he does not have to be the chairman. In this way the club can assure continuity of effort even though the board of directors is ever changing.

3. Provide longer terms for the chairman. If the superintendent and chairman operate well as a team, work within budgetary requirements, and maintain the golf course to the satisfaction of the members, then changing chairmen is wasteful. A minimum of a three- to five-year term is suggested, unless this key working relationship begins to deteriorate. At this point, it has to be determined if the maintenance operation is being mismanaged or if it is simply a personality conflict between the chairman and superintendent. If the former, the superintendent may be dismissed. The latter requires a change of green committee chairman.

4. Invite the green chairman and golf course superintendent to the monthly board meetings. While this team certainly does not need to attend to other matters concerning the club, they should always be in attendance at every meeting for the discussion of pertinent golf course matters. This is particularly critical if the green chairman is changed on a regular basis and technical questions need to be answered. As any business has its regular meetings for discussing past, present, and future strategies, so should the operation of the golf course maintenance program.

Replace that revolving door with a standard model that is built solidly, yet has some flexibility. The golf course and golf course maintenance operation will be the winner in the long run.

USGA GREEN SECTION RECORD
JULY/AUGUST 1988

TURF TWISTERS

KEEP THE ROCKS OUT

Question: Please clarify the question I have about bunker drainage. That is, are geotextile fabric liners recommended over the entire bunker, or should they be placed under the drain lines? (California)

Answer: Geotextile fabrics can work in an excellent manner to keep rocks and other contamination out of bunker sand. The fabric, however, should always go under the drain lines. By covering an entire bunker with the geotextile, the chances are increased that drainage will reduce over time.

BUT THE COARSE SAND LAYER IS DEFINITELY IN!

Question: Our course was built approximately 15 years ago, and the greens were constructed out of on-site materials generated from the lakes developed throughout the golf course. As a result, there is a great deal of variation among the soil profiles of the greens, ranging from a very fine sand to a heavy organic (muck) type soil. In investigating our future options, strong consideration is being given to following the Green Section's specifications for putting green construction. However, there seems to be a great deal of controversy regarding the necessity of the intermediate or choker layer in this method of construction. The contractor who has been retained for this project says it is an unnecessary additional expense. What is the Green Section's position on the elimination of the intermediate sand layer? (Florida)

Answer: The Green Section is aware of the controversy over the need for the intermediate coarse sand layer called for in the specifications. The following is taken from the specifications, which will be republished soon. "The Green Section has researched this particular specification requirement carefully over the years and now definitely concludes and *positively recommends* the intermediate sand layer be included in all USGA Green Section greens. It is an integral part of the "perched water table" concept. Its function is undeniable, and serious functional consequences may result if it is eliminated. Failure to adhere to this requirement means you are not building a USGA Green Section green." This statement should adequately cover the Green Section's position on the importance of the intermediate coarse sand layer.

As for the question of cost, in relative terms, the additional material and labor required to install the intermediate layer is insignificant, compared to the total cost of building or rebuilding a modern putting green.

HOW'S THAT AGAIN?

Question: Our most recent water analysis expressed the results in "decisiemens per meter (dS/m)." Our previous test used "millimhos per centimeter (m mhos/cm)." What is the difference? (Colorado)

Answer: Actually, there is no difference. The two values are the same and are means of expressing electrical conductivity as it relates to water salinity. Test results are expressed occasionally in micromhos per centimeter (u mhos/cm) as well, which can add to the confusion. Remember, 1 dS/m = 1 m mho/cm = 1000 u mhos/cm.