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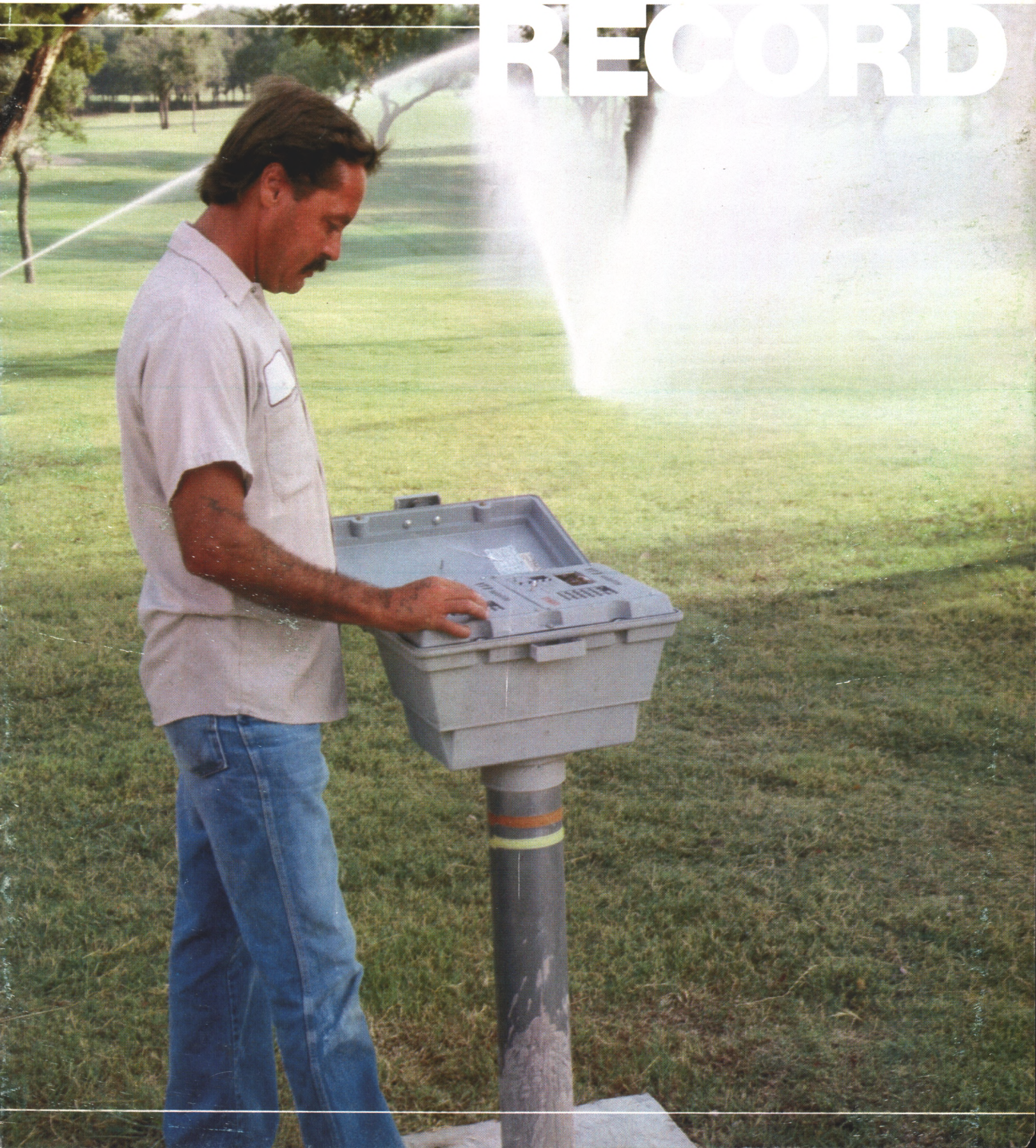

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Computers on the golf course.

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Personal Computers - A New Chip for the Course

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

AT FIRST GLANCE, micro-computers and the art of golf course management seem to have little in common. The sensitive touch of a superintendent determining soil moisture and the need for irrigation is not the same as the inhuman logic of a semi-conductor. In similar fashion, the ability to sense the likelihood of an outbreak of a particular disease even without the weatherman's sophisticated instruments seems impossible for even the most advanced computer.

Golf course superintendents have been given credit for insight of the workings of Nature. Can this special insight be captured on the magnetic media of a floppy disk and distributed by the computer? Can a clever programmer create a cookbook for the care of a golf course and all it entails? Can you grow bermudagrass in full shade? The obvious answer to all three of these questions is no. However, in growing numbers superintendents employ the computer in their maintenance operations. There are applications where this combination of chips, circuit boards, and plastic excels. The simple truth is, the computer is an excellent tool whose potential is not yet realized.

Actually, computers are not new to the golf course. Superintendents have used less recognizable computers for years. Although the first irrigation controller, made up of springs and gears, bore little resemblance to the sleek desktop machines we see in offices, it, too, was a computer. The argument can be made that pump stations are actually servo-mechanical computers that control pressure and flow to the irrigation system. Pressure switches, relays, timers, and valves are all decision-making entities — just as is the transistor. Modern pumping plants react to constantly changing parameters quickly and efficiently. They are very computerlike. By strict definition, even the board on the shop wall used to keep track of the maintenance schedule is a form of computer.

Although desktop computers have been in industry for many years, only recently have they shown up in the superintendent's office. This is surprising, since golf course superintendents are notoriously innovative. Many of the new pieces of equipment introduced each year are the offspring of a superintendent's idea. When a maintenance problem is identified, usually some superintendent modifies or builds a piece of equipment suitable to the task.

In recent years the superintendent's role has expanded to include many other responsibilities besides mowing, watering, and fertilizing. His new charges now include budget development and control, personnel management, chemical management and possible environmental impact, and the proper maintenance of equipment inventories that can quickly exceed half a million dollars. Again the superintendent has adapted the computer as a tool to help him accomplish his goals more efficiently. Superintendents find this new technology can help them to be more efficient, accurate, and effective.

The computer is especially well suited to particular areas of golf course management:

Preventive Maintenance of Equipment

Most superintendents are aware of savings that can be realized by preventive or periodic maintenance. Scheduled maintenance not only reduces down time of equipment, it often significantly prolongs the life of that equipment and results in a tremendous savings to the club. If all the equipment on a golf course was the same, preventive maintenance would be relatively simple to schedule. It is quite common, however, for a course to have 30 or more different types of equipment, each requiring its own schedule. The computer is extremely well suited for such diversified scheduling.

Once the necessary records are entered into the computer, the superintendent can determine what equipment is due for maintenance over whatever period he chooses. Scheduling becomes a simple matter of searching the computer's memory for the equipment due this week

or this month. A search that may take only seconds is as accurate as the information put into the computer.

The list of equipment due maintenance can be printed for the mechanic. Maintenance records are easy to keep and can be as detailed as necessary. Periodic review of such records can often help the mechanic spot trouble before it happens.

If it's wanted, cost of replacement parts, mechanics time, and depreciation can all be monitored to develop the cost-per-hour of operation. All this can be done on paper, but it requires considerably more time, paperwork, and effort.

Budget Development and Control

The term number crunching is used to describe the computer's ability to manipulate budgets. A good budget that provides guidelines for the year's expenditures is flexible. It should be prepared and presented in a professional manner. At the same time, it should be constantly monitored and updated. The computer is better adapted to these criteria than the ledger and the eraser. Budgets can be modified to reflect the current financial state. Projected figures based on current spending allows the superintendent to adjust accordingly. It is a relatively simple matter to determine how much is spent on a particular piece of equipment, with a particular company, or on a specific maintenance task.

Record Keeping

Good superintendents already have detailed records of every chemical application they make. They also record employee performance, purchase orders, daily events, weather information, and a wealth of other data. The collection of this type of information is referred to as a data base. The computer does not necessarily make the recording of this data easier; rather, it allows the extraction of the data according to particular criteria.

Questions like: "How many man-hours have we spent on bunker repair and maintenance?" or "How many air filters part #123 will we need over the coming year?" or "How much nitrogen, phosphorous, and potassium have we applied to #11 green this year versus previous years?" can be answered quickly. Any type of record system should allow you to answer these questions. With a computer you find the answers much easier and faster.

Even the best kept records are of little use if they cannot be found easily. Record keeping is a task most superintendents do not enjoy. As a result, there is a tendency to keep as few (if any) as possible. Again, the computer can be a big help. Some types of records superintendents are currently using the computer to keep are:

1. Equipment maintenance
2. Pesticide and fertilizer applications
3. Daily maintenance tasks
4. Personnel records
5. Purchase orders
6. Weather information
7. Tournament schedules
8. Irrigation

This list grows as more superintendents acquire computers.

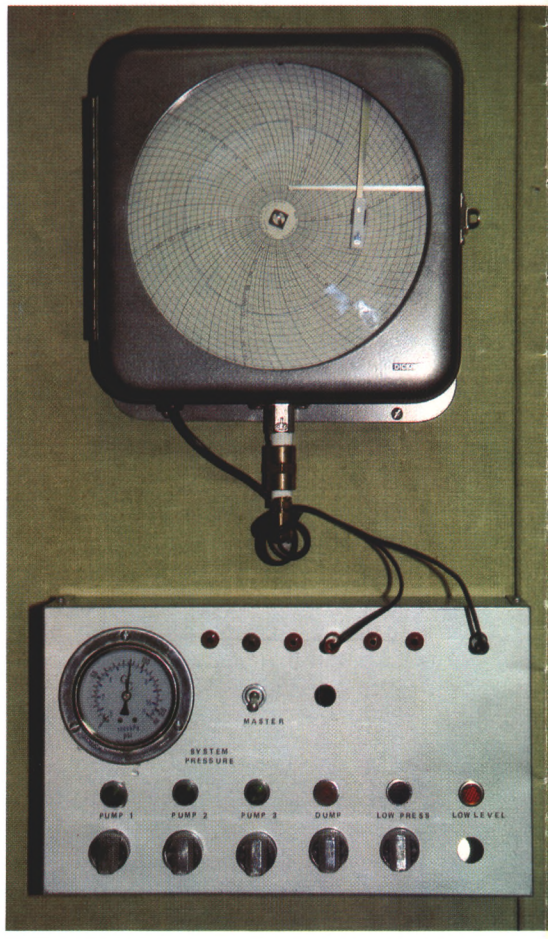
Irrigation Management

Hopefully we are aware of the desperate need to make better use of water, perhaps our most valuable natural resource. The development of automatic irrigation controllers provided a valuable tool for watering the golf course. The computer can now provide far greater control. Instead of merely turning the heads on and off, the computer can provide valuable information about the current status of the irrigation system and produce printouts detailing irrigation practices over specific time periods.

Tracking system pressure can help identify overloaded zones and satellite controller operation. By monitoring the gallon per minute demand and supply, pump station performance can be evaluated throughout the night.

The computer also makes it simple to track how much water is applied to various areas of the course and to shut the irrigation system off if sufficient rain falls during a water cycle. Remote operation of the system is possible through the use of a telephone modem — a device that allows one computer to exchange information with another over the telephone lines. In this manner the system can be shut down or even monitored from the superintendent's home.

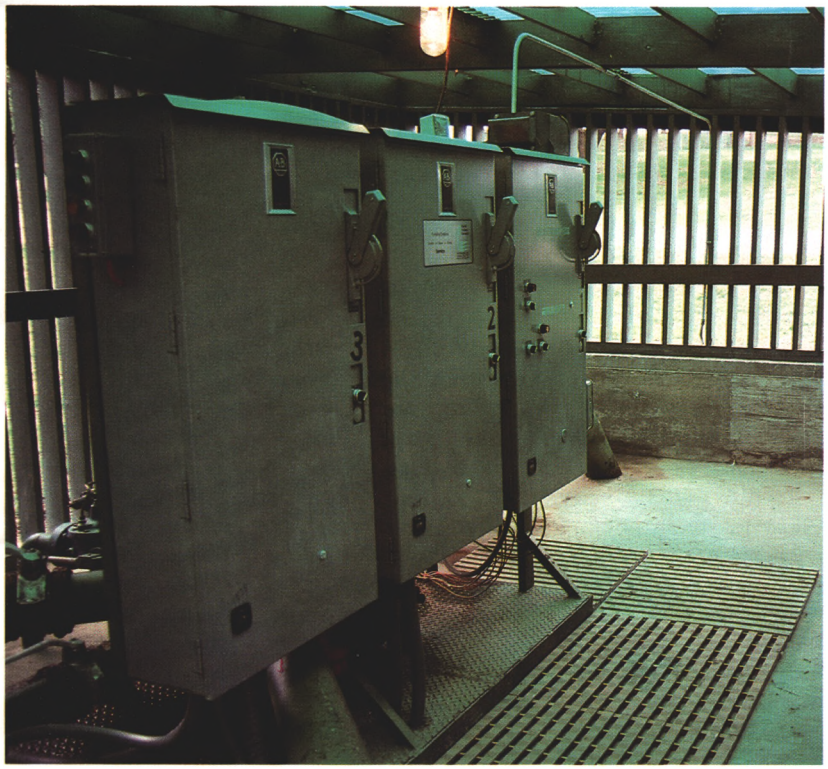
Obviously, the potential for improvement of watering practices is great. Just as great, however, is the possibility of careless water management. Even the best computer graphic display is no substitute for a keen eye and a soil probe. The computer should be viewed as a tool to help improve water management, not as a replacement for common sense. The overused phrase "the computer is down" may work for other industries, but not for the golf course.

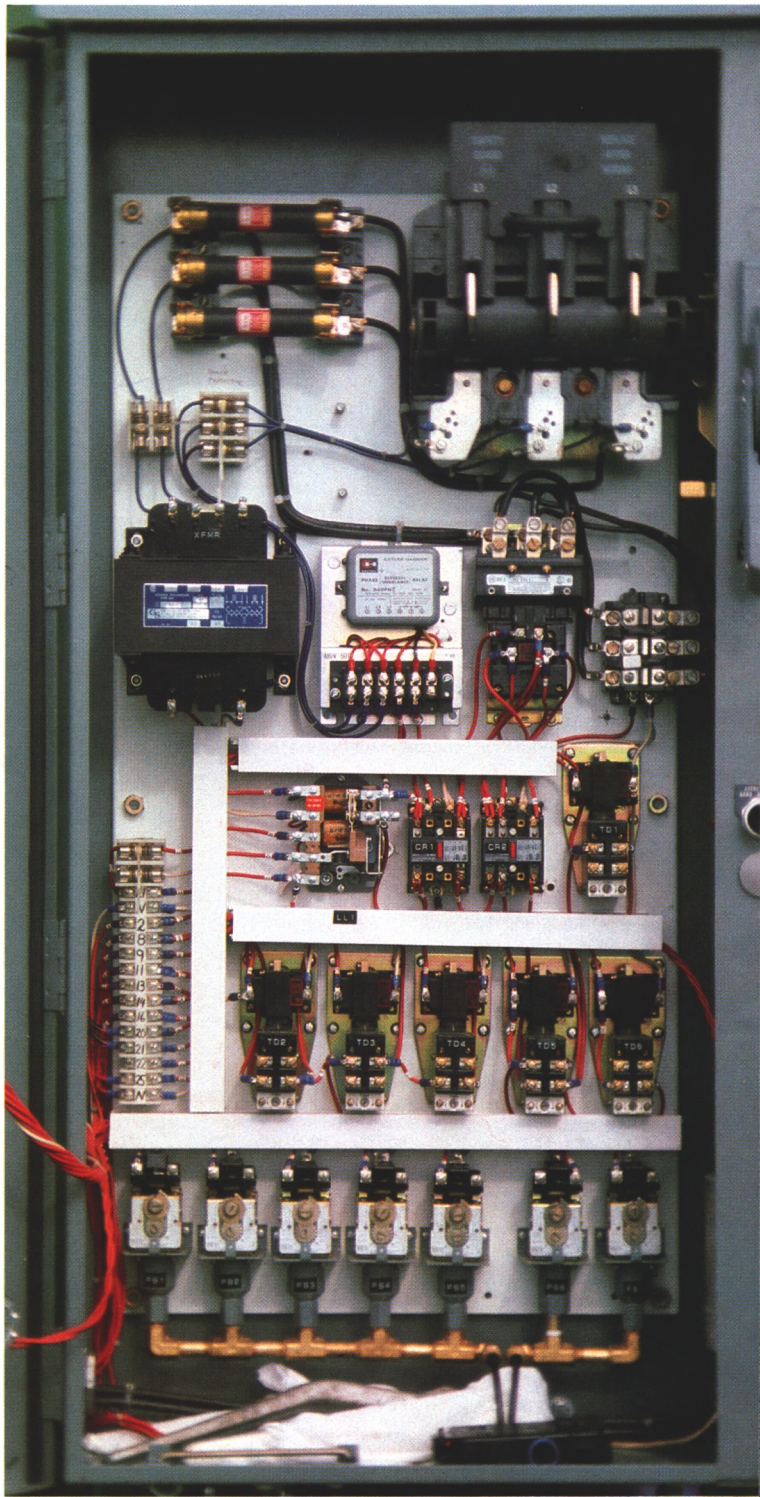


Turfgrass Information Center

In the future, the personal computer will connect the superintendent directly to the USGA Turfgrass Information Center, located at Michigan State University. In addition to the extensive O. J. Noer Memorial Turfgrass Collection, nearly all journals and newsletters devoted specifically to turfgrass will be available for review. Information on practically every aspect of turfgrass research and maintenance will be as close as the telephone. The superintendent will be able to locate the most current information on a wide variety of turfgrass subjects.

Another aspect of the service being developed at MSU will be the bulletin board, a program that allows users to trade information through the host computer. This exchange of information and ideas with other professionals should be useful to the turfgrass manager.





(Opposite page) What did the irrigation system do last night?

(Top, left) Computers can monitor the weather.

(Above) Very "computerlike."

(Left) Pumping stations are a form of computer.

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

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

Robert Sommers, Managing Editor

Possible Pitfalls

Indeed many uses for the computer are being developed by superintendents, programmers, and industry, but before you purchase a computer, consider the following cautions:

1. Disk drives, keyboards, and printers do not function well in dusty environments. They should be placed in a clean, cool, and comfortable work place. You may find yourself spending quite a few hours setting up your system. Mistakes are easy enough to make without constant interruption and mechanical failure of the equipment itself.

2. Power surges can wipe out hours of work and could result in permanently lost records. Most maintenance facilities include electric welders, compressors, and battery chargers. These items and others can cause significant fluctuations in the line current. A surge protector can provide protection for your files and the computer's delicate electrical components. Static electricity can also cause major problems for your system. Inexpensive grounding mats provide excellent protection.

3. Do not expect to benefit from the computer immediately. Preparing and entering the information is time consuming. Learning to use the computer is not difficult, but is absolutely mandatory, especially when it comes time to deal with the glitches that invariably develop. Allow plenty of time to develop your system, time to change it, and time to change it again.

4. Also, be sure to allow plenty of time in your schedule (or your assistant's or secretary's) for the constant entry and updating of your records. The computer slogan "garbage in - garbage out" is appropriate. Remember that computers have no common sense and are only as good as the information you supply.

5. Keep only pertinent and valuable records. Superintendents find themselves spending hours accumulating information that may make impressive graphs but have little practical value. Used properly, the computer can free many hours of your time for other things. However, it is not uncommon for a person to become so interested in the machine and its uses, they spend whatever free time they have developing new records to keep.

Conclusion

Are you a candidate for a computer? Ask yourself the following questions:

1. Do you keep good records now? If not, don't expect a machine to change your ways. It can help organize your methods, but it can't enter the information for you. If you have tried to keep records but never seem to have time to write the information, you probably will not have time to type it either. If your problem is finding the necessary information when you need it, the computer is the right tool.

2. Do you know enough about the machine and its abilities to make a wise purchase? Unless someone is available who knows exactly what your requirements are, you will have to determine what equipment is right for your situation. Be prepared to learn a new language. Most computer salesmen know as little about maintaining a golf course as superintendents know about computers. Don't expect to find the right machine the first time you walk into the store. Do expect to find someone who is convinced he has the right machine for you. The best bet is to contact other superintendents using computers in their operation. Resist the temptation to buy quickly.

3. Have you identified exactly what you intend to use the computer for? This can be very difficult to someone new to computers. How do you identify these areas if you don't know what the machine is capable of doing? Software (the programs that actually run the machine) is as important as the equipment itself.

A number of programs could be right for you. Software is available written specifically for the golf course. These programs allow you to be up and running in a relatively short time. However, they are somewhat limited in that you must rely on someone else's ideas of what applications you need.

Many programs are not industry specific and extremely versatile; using these programs, you develop the applications specific to your operation. To do so, however, you must become proficient with the program (you do not have to become a programmer). This will require time, effort, and patience. Budgeting (spreadsheets), filing (data base management), and word processing programs are available. Finding the one best suited to your operation can be difficult. Again, contact others for their opinions.

It has often been said that being a good golf course superintendent requires a special blend of art and science. There are aspects of managing a golf course that cannot be learned in school, written down in a book, or stored into a computer's memory. These skills require both hard work and time. Technology, however, has always been important in our industry. The computer is a promising new tool.

Figure 1. Heat bench to create high soil temperatures, a facility developed to screen large populations of plants for survival under high soil temperature.

Quality Turf in the Natural Environment — Enhanced Through Genetic Improvement

by M. C. ENGELKE, Associate Professor, Turfgrass Breeding and Genetics,
Texas Agricultural Experiment Station, Dallas, Texas,
Texas A&M University System

THERE ARE those who believe water will become a major limiting factor in the production and maintenance of quality turf. Water availability has already been reduced throughout many regions of the United States because of the dry cycle in our weather pattern. Greater demands on water supplies have also resulted from increased agricultural production, industrialization, and urbanization.

Restrictions in water use are felt throughout the nation, but they are further complicated by recent population shifts to more arid regions. Urbanization has placed excessive demands on municipal water districts, and the construction of water treatment plants and distribution systems falls far short of projected requirements. Because statistics for Texas in 1982 indicate that over 50 percent of the municipal water supply was applied to the landscape, it is easy to understand why, when they come, the first restrictions are applied to turf. If they are imposed for prolonged periods of time these restrictions can cause permanent damage and create a much broader environmental impact, including erosion control, air quality, energy consumption, health problems, and recreational activities. The effect would be a decline in the general quality of life.

National policy makers concerned with water use and availability predict that water demands will increase 35 percent within the next 15 years. These predictions suggest that restrictions on the use of our water, especially potable water, will increase greatly and may result in the exclusion of potable water for turfgrasses and ornamentals regardless of their purpose. Turf managers are already faced with increasing costs for pumping and purchasing potable water.

Brackish and effluent water offer an alternative. Effluent water is now used in increasing quantities to supplement existing supplies for golf courses, park and recreational areas, and for sod and seed production throughout the southern and western United States. Generally, the quality of non-potable water is less than desirable. It often contains high salt concentrations, toxic compounds, undesirable microbes, and heavy metals. The quality is often unpredictable and therefore difficult to manage. Continued use of such water may result in an accumulation of salt and heavy metals within the root zones of the turf which can create additional stress problems, with eventual loss of stand.

Few turfgrass cultivars can persist without supplemental water; they are not adapted to natural environmental conditions. The environment is defined as any and all external forces and substances which influence the growth, structure, and reproduction of the plant. The only elements of the environment that cause us concern are those that produce a negative performance in the plant. When such negative forces occur, this is considered a stress situation. Specifically, such forces

may include: biotic factors (diseases, insects, nutrient deficiencies, excessive traffic); edaphic factors (soil compaction, soil salinity, pH shifts); or climatic factors (temperature extremes, moisture deficiencies, light, and wind).

The performance of turf in terms of quality, persistence and playability is determined by the genetic composition of the plant and by the environment in which the plant grows. A change in any of the components of the environment will result in a change in turf performance.

A PLANT can survive moderate levels of stress so long as the critical levels of its biological system are not exceeded for a prolonged time. These biological limits are under genetic control, and they influence the physiological state of the plant, which changes in response to environmental changes. Since many of our cultural practices alter the environment, the intensity and duration of these external forces can often be reduced or even eliminated. Such practices result in a more favorable environment for the growth and performance of the plant. Unfortunately, many of the commercially available turfgrass cultivars were designed for moderate to optimal environmental conditions. Full utility of these cultivars often requires that the turf manager modify the environment with frequent fertilization, irrigation, and pest control in order to compensate for the plants' biological deficiencies. Once the turf is established, the performance of the grass is directly dependent on the environment and the cultural practices. If supplemental irrigation or the use of good quality water is restricted, as anticipated, then the plants' performance will be less than acceptable.

The question remains, can we have quality turfgrass with minimal supplemental irrigation? If our cultural practices are impractical, then it becomes imperative to change the turfgrass plant to be more compatible with the environment, rather than trying to modify the environment to fit the plant. A change in the plant can be accomplished by identifying, selecting, and combining characteristics that perform well under stressed or natural environmental conditions *(Figure 2)*. These characteristics or biological limitations are under genetic control and can be manipulated to improve performance in the desired environment. We must recognize that each species has a region within which it is adaptable. To place the plant outside this region may not be practical or even possible. Many species today are marginally adapted to their environment and they require intense culture to survive. It should be possible, however, to select individual plants within these marginally adapted species that will survive without intense culture.

For example, bentgrasses have been used for more than 40 years in the southern United States for overseeding warm season grasses and provide a playable surface during the winter. In more recent times, permanent bentgrass greens have been established. During this time, natural selection has occurred, as is evidenced by numerous local ecotypes of bentgrasses that survive within or adjacent to old bermudagrass greens. This is particularly true where seaside and the old German bentgrasses have been used. Many of these adaped plants have the genetic and biological mechanisms to cope with the natural environmental stress. These natural environmental conditions often include prolonged periods of high temperatures and drought.

The bentgrass cultivars most frequently used for greens in the southern United States include "Penncross," "Penneagle," and "Seaside." In general, they all lack sufficient heat tolerance and drought resistance and require special culture to maintain acceptable quality turf. Syringing bentgrass greens during the heat of the day enhances a biological process known as transpirational cooling and reduces the heat load on the tissue of the plant. Syringing causes an increase in the humidity of the turf microclimate and, in conjunction with high temperatures, creates a favorable environment for disease. To complement the syringe program, the superintendent includes a routine fungicide program against disease attack. Although these practices appear to be effective, they add considerable cost to the general management and operation of the course.

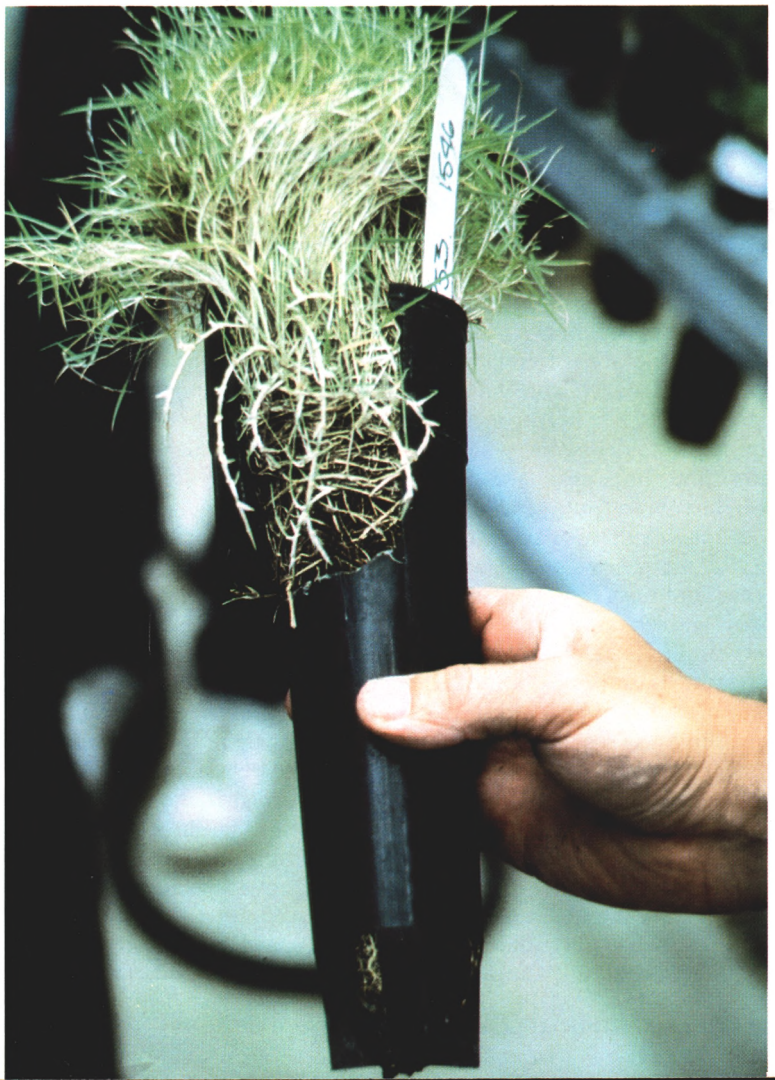
THE BENTGRASS breeding program at the Texas Agricultural Experiment Station - Dallas, in cooperation with the United States Golf Association Green Section and Bentgrass Research Inc. -

By combining deep, vigorous, perennial rooting characteristics with plants that can survive and continue to grow under high soil temperatures, we should be able to develop cultivars better able to survive the intense summer heat of the southern United States, plants able to use a larger soil moisture reservoir for transpirational cooling, which should reduce or eliminate the need for syringing. This in turn will reduce the humidity within the turf canopy. Lower humidity is less favorable for disease development and should therefore create a healthier plant.

Similar objectives related to heat stress, water use requirements and water quality are simultaneously being pursued in zoysiagrass, buffalograss, St. Augustinegrass, and tall fescue. Considerable genetic diversity exists within each of these species. It is the intent of this breeding program to identify, select, and concentrate those characteristics into a germ plasm resource pool with traits compatible with the natural environment. Through hybridization, individual plants will be created and identified that have the characteristics necessary to cope with the natural environmental stresses. These plants will have a broader biological region of adaptation, and they should experience less stress and provide a higher quality, healthier turf with fewer cultural requirements.

Figure 2. (Opposite page) Drought tolerant zoysiagrass growing on the banks of a king's tomb in South Korea.

Figure 3. (Below) Root observation tubes, a technique developed to observe the rate, distribution and depth of rooting in individual plants.



Dallas, has identified its major objective as the need to develop bentgrass cultivars with superior heat tolerance for both high soil and high ambient temperatures. Most bentgrasses exhibit a definite degeneration of root tissue and shortening of roots under high soil temperatures, close frequent mowing, and heavy traffic. These conditions impair the transpirational cooling process. Therefore, selection and development of plant materials whose improved biological characteristics cope with these environmental stresses are of primary consideration.

Research in turfgrasses and other plant species supports the concept that root distribution, rate of root development, and total root mass differ significantly among individual plants and is under genetic control. Special greenhouse and laboratory procedures permit close observation of plant growth with respect to root development. Of special interest is identification of individual plants that produce more roots faster and deeper in the soil profile *(Figure 3)* and can maintain active root systems under high soil temperatures *(Figure 1)*.

Figure 1. Bentgrass spread into Poa annua *colonies develops fluffy, thatch-prone turf.*

Lightweight Mowing... The Rest of the Story

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

FAIRWAY MOWING practices have come a long way since single unit putting green mowers were used on narrow approaches to greens in the early 1960s. One of the first superintendents to do this was Nelson Monacle, at Portage Country Club, in Akron, Ohio, where bunkers shielded some greens to the extent that the approaches were almost too narrow for pull-behind gang mowers to navigate. Monacle simply continued the collar mowing height outward to the front of the bunkers, giving the fairway mowers a broad turning radius and eliminated the poor playing condition immediately in front of the greens. This has evolved into widespread use of lightweight, self-propelled 3- and 5-unit mowers today. In regions where cool season fairway grasses predominate, their use has encouraged the spread of bentgrass into areas colonized by *Poa annua*. The speed of this takeover is amazing, far exceeding expectation.

Two reasons lie behind this sudden dominance, first, reduced soil compaction, resulting from lighter equipment, and, second, many superintendents collect the clippings. Weight reduction results not only from lighter weight machines, but in the pounds-per-square-inch of the load-bearing tires and mowing units. It is incredible that this in itself allows soil to de-compact in a short period. Recent research in agriculture shows that simple freeze-thaw cycles in winter do little to benefit soil structure.[1]

The collection of clippings may help reduce the amount of viable *Poa annua* seeds returned to the soil for future infestations. Clipping removal may also lessen the mulching effect they have in maintaining high humidity in the microclimate where the turf is growing, since the ideal habitat for disease development is disrupted to a degree.

Perhaps all three of these phenomena have a cumulative effect on helping bentgrass growth invade *Poa annua* colonies. It is difficult to believe, however, that such rapid, radical population changes can be credited to these actions alone. After all, *Poa annua* is subject to the same disease stresses as bentgrasses, so reduction of the clipping mulch is beneficial to both species. If the *Poa annua* density is high and the bent density is high, of what immediate value is seed removal?

WHEN BENTGRASS growth so rapidly invades *Poa annua*, are we not seeing it achieve dominance? The lightweight mowers float on the turf. This allows the lateral spread of bentgrass stolons to grow over the top of the more soil-bound *Poa annua* so that the takeover is from the top down. The roots formed at the stolons' nodes are functional in the surface thatch, and as long as it is moist, the bent runs happily along.

Now comes the problem. As the floating mowers ride over this growth, rather than through it, as the heavier gang mowers did, fluffy turf growth with the subsequent thatch development is inevitable *(Figures 1 and 2)*. Furthermore, if

most of the bentgrass roots are above the soil surface, just how stress resistant is that turf? *(Figure 3.)* The lightweights present the opportunity to achieve the goal, but a price must be paid.

The price is large area thatch management through close irrigation control, thoughtful fertilization, and cultivation. From the start the most important part is cultivation. Mechanical dethatching as we know it today is not yet a viable alternative on 25 acres or so of fairway turf. As viable as it is, cultivation is still a hard sell in many golf operations, so preventive thatch management rather than curative renovation is the most sensible approach.

Turf cultivation means the use of aeration machinery. Hole punching and core dispersal are currently the most programmable thatch management operations. The machines vary widely, but core aeration is the goal *(Figure 4)*. It accomplishes two important things. First, it creates a hole in the compacted soil surface which allows roots to grow downward into the soil. Perhaps more important, it provides a means for oxygen to enter the root zone. A root system cannot develop without it. Compacted soils reduce root growth because of inadequate air space, not excessive water.

THE SECOND benefit of core aeration is bringing soil to the surface which is usually rich in organisms capable of decomposing the thatch. Most of the microorganisms in natural soils subsist on dead things — plants and animals —

Figure 2. (Top, left) The fluffy, over-the-top growing habit permits root development (at right) above the soil surface.

Figure 3. (Left) More advanced thatch development shows increased root formation at the surface.

Figure 4. (Above) Soil cores brought to the surface by four passes with a fairway aerator provides both topdressing soil and three-inch deep holes for root penetration.

both macroscopic and microscopic. When mixed with the dead leaves, stems, and roots in the turf, they can thrive if other conditions are right.

The other conditions, incidentally, include a little moisture and a near neutral pH level. The microorganisms cannot grow under totally dry conditions, but should not be soaking wet, either. Because decomposition of organic matter generates some weak acids, light liming may be a great help in some instances. When in doubt, check the pH of the thatch layer. An old practice is to apply hydrated lime sparingly. This has nothing to do with changing the soil pH, just ameliorating the growing medium of the decomposition organisms. Thatch management is *not* aided by sulfur application except perhaps under highly alkaline circumstances.

Core aeration is not the best-loved turf management practice on any golf course — by either the players or the maintenance staff. It is, therefore, a great deal easier to begin thatch management early when large equipment, frequently used, will do an adequate job. Equipment sized for greens undoubtedly does a more thorough job, but it is very time-consuming and requires several machines to accomplish the desired end. These add up to a high cost that might be averted by preventive use of properly sized equipment.

Most fairway aeration machines do not have enough tines to cut enough cores with one pass over the area, but nothing is wrong with going over a fairway several times — like four — if the turf is adequately rooted. Poorly rooted areas may require a different regime, or the initial use of green-size machines, until deeper roots are developed.

Aeration creates problems with core breakup and trash removal. Dragging with chain harrows, steel dormats, or pieces of chainlink fencing has been the standard procedure used to break up the cores and disperse the soil. Timing is critical on heavy soils, because if the cores are too wet, breakup is poor and a lot of mud is dragged around. If the cores become too dry, they can't be broken up by drags at all. Some superintendents now use the verticut units in triplex putting green mowers for core breakup after removing some of the blades. Others use an adaptation of large hammerknife mowers. Choice of equipment depends largely on how smooth the terrain might be.

Trash remaining on the surface must also be dealt with. Leaf sweepers and vacuums seem to do best, although some superintendents simply blow the material into the rough.

A COMPLETE PROGRAM also must include turf recovery and prevention of weed establishment. Recovery should be initiated before the damage is done. Fertilizer should be applied a week or two before aeration so that all grasses are growing vigorously and their top growth and root growth are not inhibited. All that soil brought to the surface will provide escape for any number and type of undesirable seeds. They will certainly make the best of the opportunity, unless their germination is controlled by preemergence herbicides. Their application should immediately follow cleanup.

The holes are delightfully adapted as daytime hiding places for cutworms and other insects. If their presence is anticipated, the proper insecticides should be used, those that will control the surface or root feeders selectively and will not seriously affect the earthworm population. These wonderful animals are the best thatch controllers, topdressers, and soil aerators we have, even though their castings are a problem in closely cut turf *(Figure 5)*.

These comments are made not to discourage lightweight mowing of fairways to help bentgrass encroachment into *Poa annua* turf but as a reminder that bentgrass requires careful preventive maintenance to provide high quality playing conditions. Remember that curative treatment of heavily thatched bentgrass turf is much, much worse.

Bentgrass is preferred to *Poa annua* because of its ability to withstand a wider range of environmental stress, especially those that occur during the golf season. In general, bentgrass is more resistant to heat, drought, disease, and salinity than annual bluegrass. It is also more cold-tolerant. The playing qualities of the two species are quite similar when both are well maintained and in a vegetative mode of growth. Simply put, bentgrass is more dependable than *Poa annua*, even though it demands more stringent maintenance practices.

Figure 5. Topdressing by normal earthworm activity mixes soil with surface growth. The newest cast is at center of this plug, above the two vertical worm tunnels.

John H. Foy is New Green Section Agronomist for Florida

John H. Foy of Madison, Georgia, has been named as the new USGA Green Section Agronomist for the Southeastern Region. His appointment was effective October 1, 1985, and he will be responsible for Turf Advisory Service visits in Florida, assisting Charles (Bud) White, Southeastern Regional Director. John will be based in West Palm Beach.

With Florida leading the nation in golf course construction and turf maintenance activities, the need for an experienced, unbiased consultation service for USGA Member Clubs is evident. John Foy brings practical and academic experience. A 1977 University of Georgia graduate, he returned for his masters degree in 1980 in plant protection and pest management. He served as a turfgrass sales representative for five years in the Southeast. USGA Member Clubs and Courses and their superintendents throughout Florida will soon come to know, appreciate, and benefit from the talents and knowledge John Foy brings to his new post. We are pleased to have him on the Green Section staff.

1. Dickey, Elbert C.; Peterson, Thomas R.; Eisenhauer, Dean E. and Jasa, Paul J. Soil Compaction I — Where, how bad, a problem; *Crops and Soils*, August - September, 1985.

18th hole (from the tee) — Old Course.

Reflections on a Recent Journey to Scotland

by DANNY H. QUAST
CGCS, Milwaukee Country Club, Milwaukee, Wisconsin

THIS PILGRIMAGE started with an opportunity to attend the Scotland International Golf Greenkeepers Association (SIGGA) Conference in St. Andrews, Scotland, in early October, 1985. I was accompanied by my colleague Wayne Otto, Superintendent of Ozaukee Country Club, Mequon, Wisconsin, as well as Stanley Zontek and Patrick O'Brien, agronomists with the USGA Green Section.

We arrived at Prestwick airport on the morning of October 6th. In the rain we drove to St. Andrews, arriving around noon, and checked into a bed and breakfast called West Park. Throughout Scotland people open their homes to visitors for a night's sleep and breakfast at a very reasonable cost. We ate lunch, got our cameras and walked to the Old Course. When we got there, no one was playing golf. Old Tom Morris, Curator of St. Andrew's Old Course from 1865 until his death in 1908, once said to a critic of the custom, "The Old Course needs a rest on the Sabbath, sir, even if you don't." It has been that way for over a century — golf is not played on the Old Course on Sunday.

What a breath-taking view! The Royal and Ancient Golf Club, the first tee and the 18th green are nestled along the narrow street and shops of St. Andrews. There is no other scene on earth quite like this.

The Links was part of the inheritance of the burgh of St. Andrews bestowed upon it in the 12th century. No one knows the exact age of the Old Course or the exact age of the game of golf, but the inhabitants of the town have been accustomed to playing golf over the links since the 15th century, and the earliest historical reference to the games is in an edict of 1457 issued by James II of Scotland. To play St. Andrews is like entering another time — a journey back in history.

That night we attended a wine tasting reception, a kick-off for the SIGGA Conference. At the reception I met Walter Woods, Links Superintendent of St. Andrews. Walter is Vice President of SIGGA and a most gracious host. James Neilson, President of SIGGA, Greenkeeper at Muirfield, also greeted us and the directors and committee people did an excellent job of putting this conference and tournament together. We were flattered by being invited to Ransome's Greenkeepers/Superintendents Golf Tournament banquet. The tournament was played on the Old Course and was won by Canada. Scotland was second and the USA third.

At every course and club we visited, we found people proud of their heritage and in love with the game of golf. This was exemplified by Tom Shiel, who took us for a walk through Carnoustie Golf Course after we played there. A native of Scotland who lived some years in the United States, Shiel is the professional at Panmure Golf Club and a member of Carnoustie. He can recite what happened in every one of the five Open Championships played there.

OUR NEXT STOP was Gleneagles — a great golf course in superb condition. Gleneagles is set amid 610 acres and is surrounded by unspoiled countryside. We played the Kings Course. Its beauty is beyond description. After golf we met Jimmy Kidd, estate and golf course manager, and he took us on a tour of the hotel and exceptional grounds.

Postage Stamp at Troon.

Anyone who has been to the Midwest Regional Turf Foundation meeting at Purdue University has met John Souter. John, a landscape architect involved in sports fields and golf course remodeling, has now designed and is building a golf course in Ballindalloch, Scotland. We all share his enthusiasm, and it appears to us that this course will take its rightful place in Scottish golf.

We next visited Royal Dornoch — home of Donald Ross. A great golf course that you must see. It is entrenched in history. This was not just a round of golf — it was an adventure! We played many other great golf courses and could easily write an article on each one; Muirfield, Royal Troon, Prestwick, and Turnberry. We played 16 rounds of golf on 15 golf courses in 14 days. We played 288 holes of golf, never found a weak course or played a poorly designed golf hole.

Turf in Scotland

The turf in Scotland is bentgrass on greens; bentgrass, annual meadow grass *(Poa annua)* and fine leaf fescues on tees and fairways. Bentgrass was predominant over *Poa annua.* This should tell us something. Soil pH was 4, and this seemed to be a goal that many try to achieve. Lies on fairways were tight. Greens were not as fast as we were accustomed to, but many courses were spiking and/or topdressing. Much rain had fallen in the previous weeks. They were still very good, and when dealing with the severe surface contours, the greens were in keeping with the average golfer's ability.

Bunkers on the golf course were magnificent. They were mostly deep with straight faces made of stacked sod. To hit a ball in them was a lost stroke.

Gorse, contrary to my earlier thinking, is not a feathered bird. It is a bush that grows everywhere — in the roughs, on the links golf courses. Gorse has a yellow flower in spring, is about three to six feet high with very *sharp* needles and very thick growth. To hit a ball in a patch of gorse is like hitting it out of bounds. Just tee it up again because the chance of having a shot or even finding the ball is almost non-existent.

Golf in Scotland as I See It

Golf is a way of life in Scotland. Changes come only with much deliberation. Golf is accessible and affordable to everyone. Scotland has kept golf much the same since the 19th century. You see no golf carts. When you play the great courses in Scotland, take a caddie. Their local knowledge will mean a lower score and an enjoyable round of golf.

There are no yardage markers on the golf courses. I've heard golfers in the U.S. say "if we put yardages on every sprinkler head we could speed up play." Yet, on the unmarked courses of Scotland, even with their deep roughs and Gorse, the 16 rounds of golf we played were played in four hours or less. In fact, after the visit, I'm not sure that yardage markers don't create slow play. The perception of depth or distance to the flag stick is a part of the challenge of the game — and it still is in Scotland! At St. Andrews, as well as many of the links courses, the wind blows so hard that exact knowledge of distance means very little in club selection. I can't believe some courses in the U.S. put markers on flag sticks to show hole location. I wonder what Old Tom Morris would say if he could see that?

This has been an experience of a lifetime for me as it was for Wayne, Stan, and Pat. We all agree these courses are a page back in history. Several were built as far back as the 15th century, and yet they have not been intimidated by new equipment or modern golfers. I don't think they ever will be.

The people we met and the new friendships we made are all gratifying to us. We appreciate the hospitality shown by our colleagues in Scotland and thank each and every one for sharing with us their love, knowledge, and personal commitment to the Royal and Ancient game of golf.

FOR GREEN COMMITTEE CHAIRMEN, SUPERINTENDENTS, CLUB OFFICIALS:

The Green Section 1986 Educational Program

Monday, February 3, 1986, Moscone Convention Center, San Francisco, California

Golf Course Management — It's Not All Agronomics!

8:00 - 8:10 Welcome and Introductions
Chairman, USGA Green Section Committee

8:10 - 8:30 The Best Turf Tips of 1985 — Part I
Nine Green Section Agronomists have consulted with 1100 golf courses and their superintendents this past year. They have been hunting the Best Turf Tips of 1985. Here are the first three; Part I.
James M. Latham, Jr., Great Lakes Regional Director, Brown Deer, Wisconsin
Karl Ed Olson, Northeast Agronomist, Dudley, Massachusetts
Patrick M. O'Brien, Mid-Atlantic Agronomist, Richmond, Virginia

8:30 - 8:50 Everything You've Always Wanted to Know About Putting Green Soil Mixes, but Didn't Know Who to Ask
It has been 25 years since the Green Section Specifications were first published. Still, not everyone understands the procedures and their limitations. These facts are as important today as they were a quarter century ago.
Judith Ferguson Gockel, President, Agri-Systems of Texas, Inc., Tomball, Texas

8:50 - 9:10 Research — Pulling Together, Not Apart
By the end of this year, the USGA/GCSAA Research Committee will have placed over $1 million into the development of water conserving, minimal maintenance turfgrasses for golf. Why should this joint effort be continued? Why do YOU have a stake in it?
Dr. James R. Watson, Vice President, The Toro Company, Minneapolis, Minnesota

9:10 - 9:30 Reflections on Golf's Future
What will The Game be like 50 years from now? The Rules? What of costs and economics, private and public courses, governmental influences? What role will the USGA and the GCSAA play? What of the growth of golf worldwide? Where are we headed anyway?
C. Grant Spaeth, Vice President, USGA, Menlo Park, California

9:30 - 9:50 The Best Turf Tips of 1985 — Part II
Charles B. White, Southeastern Director, Athens, Georgia
James T. Snow, Northeastern Director, Far Hills, New Jersey
Larry W. Gilhuly, Western Director, Tustin, California

9:50 - 10:00 Break

10:00 - 11:00 A Critical Look at Contemporary Golf Course Architecture
There's a vast difference between America's golf course architecture of the 1920s and the new designs being built today. Has something been lost to The Game in the transition? Will contemporary architecture stand the test of time? Here is a free exchange between free-thinking and concerned individuals on the subject.
Ben D. Crenshaw, PGA Tour and Member USGA Museum Committee, Austin, Texas
Moderator:
Frank Hannigan, Senior Executive Director, USGA
Panel Members:
Gene Baston, President GCSAA, CGCS, Waco, Texas
Rees Jones, Golf Course Architect, Montclair, New Jersey
Jerry Tarde, Executive Editor, Golf Digest, *Trumbull, Connecticut*

11:00 - 11:20 The Amateur Golfer and the Superintendent — Golf's Ultimate Partnership
Professionalism has pervaded all of sports — even the Olympics. But amateurism still holds forth in golf and there are good reasons why it should continue to be that way.
Frank D. Tatum, Jr., Past President, USGA, San Francisco, California

11:20 - 11:35 The Best Turf Tips of 1985 — Part III
James F. Moore, Mid-Continent Director, Waco, Texas
Gary A. Watschke, Northeast Agronomist, Far Hills, New Jersey
Stanley J. Zontek, Mid-Atlantic Director, West Chester, Pennsylvania

11:35 Closing Remarks
Chairman, USGA Green Section Committee

TURF TWISTERS

DEVELOPING AN INTEREST IN

Question: How can I develop greater interest in my problems by my green committee? (Arkansas)

Answer: A superintendent in Texas had a great idea! Instead of the usual meeting in the clubhouse, green committee meetings were held in the maintenance facility. This allowed committee members to see equipment and facility needs.

LOOKING FOR POA ANNUA

Question: I understand the USGA/GCSAA Research Program is looking for samples of perennial type *Poa annua*. I have some and would like to include it in the research effort. What do I do? (Pennsylvania)

Answer: Dr. Donald White, University of Minnesota, is collecting samples of perennial *Poa annua* from across the country. He is looking for darker green varieties, definitely perennial, and hopefully creepers. The samples can be collected during a Green Section Turf Advisory visit, or you can send them directly to Dr. Donald White, Department of Horticulture Science, University of Minnesota, St. Paul, MN 55108.

Send them via regular first class mail with a letter identifying the sample. DO NOT tightly enclose the sample in a wet plastic bag. Rather, send it with a moist root zone, open to the air and cupcutter size if possible. Dr. White will then do his thing!

WITH A SHEEPS-FOOT ROLLER

Question: In "Golf Shoes and Turf Wear" (July/August, 1985 RECORD), no mention is made of the regular type golf shoes having countersunk spike shoulders; i.e., only the metal spike protrudes from the sole of the shoe — not the base or shoulder of each spike. Surely more damage is done by spiked golf shoes where the shoulders protrude than by spiked shoes without exposed shoulders. Have you given up on this type of shoe? (West Virginia)

Answer: Not at all! In fact, if metal spiked shoes must be worn (for whatever reason), the countersunk or recessed shoulder type is preferred. They are less damaging and wearing to the turf. Shoes with exposed spike shoulders act very much like miniature sheeps-foot rollers and increase soil compaction. Equally important, shoes with countersunk shoulders generally have shorter spikes, and this also makes an important difference in lessening turfgrass wear.