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# Green Section RECORD

## Management on the Edge

USGA®

# Green Section RECORD

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*Cover Photo:*
*Chemicals are invaluable tools but not substitutes for good agronomic principles and practices.*

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*Choose the right turf species for your climate, budget, use, water supply, etc.*

# Management on the Edge

**by JAMES F. MOORE**
Mid-Continent Director, USGA Green Section

"MANAGEMENT on the edge of what?" you ask. Unfortunately, many superintendents are on the edge of failure. A rapidly growing number of superintendents find themselves in situations where they are under excessive stress, in constant fear of losing their jobs, and truly only a step away from failure. On the other hand, a small but growing number of superintendents know their work, and have a great deal of justified confidence in themselves and in their positions.

What are the primary differences between these two groups of individuals? What do the successful superintendents do differently? Although the answer may be complex, the overriding common ingredient is that these superintendents avoid putting themselves into situations where failure is a greater possibility than success. They are basically sound in turfgrass agronomics and the requirements of golf. At least four agronomic trends in the industry of golf course management have greatly increased the chances of failure.

### Turfgrass Selection

In a backward sort of way, the tremendous success of breeders has also brought about a new set of problems. With improved varieties of nearly every type of grass used on the golf course, there is a growing tendency to ignore the regions of adaptation for each species. Without question these regions have stretched quite a bit, providing greater flexibility in grass selection. Unfortunately, consultants, golf professionals, architects, and even superintendents are convinced you can grow anything you want, anywhere you want, as long as you spend enough money and hire the right superintendent.

One notorious example is the broad-scale planting of bentgrass greens in

climates far better suited to bermudagrass. Certainly those rare clubs with limited play, excellent construction, and large budgets may do just fine. In truth, however, very few clubs have such an ideal set of circumstances. In most instances, the greens end up under severe stress for four to six months of the year. Such greens are obviously susceptible to failure due to pests, weather, and excessive traffic. Minor problems normally become major losses of turf. This failure is almost always attributed to mistakes by the superintendent, and the inevitable parade of one superintendent after another begins.

**Chemical Usage**

Just a few years ago, it seemed like the turfgrass industry was losing chemicals faster than new ones were being introduced. Today, it seems like a new chemical is unveiled in a trade journal every month. If you collect all the labels available at a turf conference, you can find claims to solve every turf problem in existence. With so many cure-alls, you would think *Poa annua, Pythium*, and mole crickets would all be on the endangered species list. There is a trend to substitute chemicals for good judgement, good construction, good management, and properly designed and maintained irrigation systems.

Combine excessive chemical use with improper turfgrass selection and superintendents find it necessary to make more and more pesticide applications a year. On these courses, it is only a matter of time until resistant organisms develop or the turf overdoses on the chemicals. Too often it is a combination of the two.

Another trend in the industry that concerns chemicals is the use of recently introduced products in a manner prohibited by the label. All good superintendents should experiment with new products, and often their work leads to changes in the manufacturer's original recommendations. However, such work should be carried out on the nursery and in a controlled manner, not on the greens, where unpredictable results often lead to disaster — and usually a change in superintendents.

**Fertility Practices**

The third trend concerns fertility practices. In the interest of putting green speed, nitrogen has been reduced to bare minimums. In our efforts to discourage *Poa annua*, phosphorous fertilization is often completely eliminated. In spite of significant research that indicates the value of potassium, too many greens remain well below recommended levels. There is a tremendous difference between greens that are lean and mean and those that are undernourished to the point that they are unable to carry out vital plant functions, such as photosynthesis.

Such undernourishment often occurs when there has been a significant change in topdressing practices. After prolonged sand topdressing over a soil base, it is common to see major changes in nutrient availability. When the bulk of the plant's roots are confined to a sand zone of very low CEC (cation exchange capacity), fertility practices must be increased accordingly.

*Failure to choose the right turf species places the turf under constant stress much of the year. Failure is likely.*

**Player Demands**

A final trend involves the players themselves. Think of how the game has changed in the past 15 years. Many players demand on a daily basis the same type of conditions normally reserved for championship events. Too many self-appointed experts base their assessment of a course strictly on the speed of the greens. These individuals demand greens that measure 10 feet or higher on the Stimpmeter, ignoring the fact that 8½ feet is considered fast for member play. Speed is demanded regardless of the budget, amount of play, climate, or construction of the greens. These same factors that make it difficult to maintain healthy turf at ¼ inch can prove insurmountable at ⅛ inch, and often result in major losses of turf and putting quality. The parade of changing superintendents grows longer.

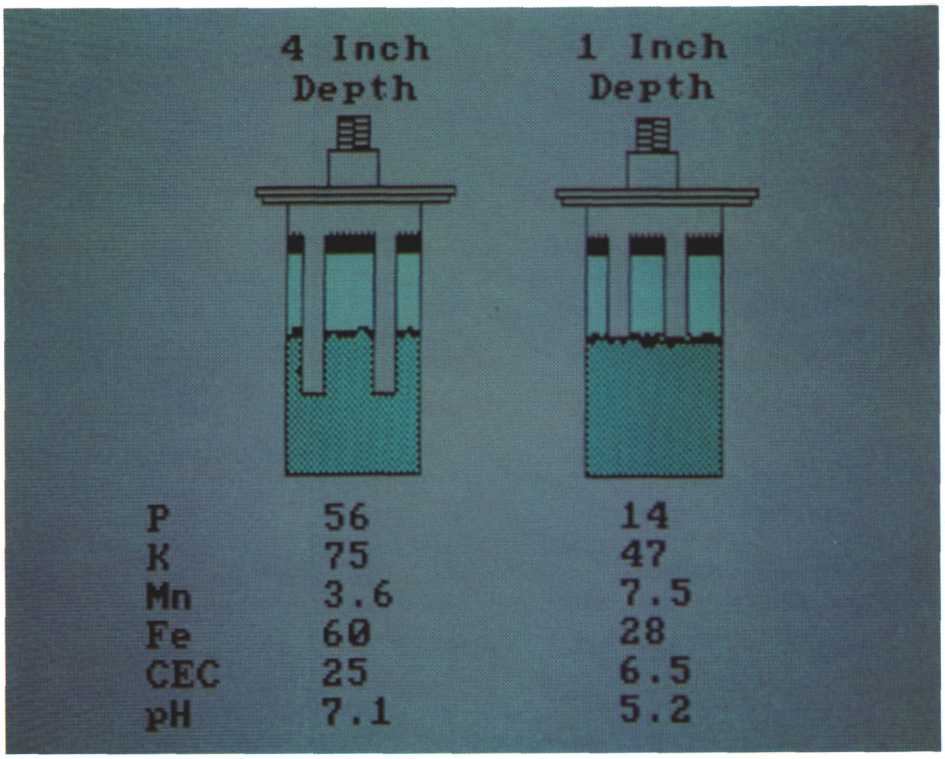
Today, Green Section agronomists seldom see major losses of turf from a single cause. Usually a whole spectrum of events must be recognized and corrected individually. When the four trends discussed above are combined, it is easy to see how the superintendent may be in the high-risk category for failure.

How can a superintendent avoid "Management on the Edge?"

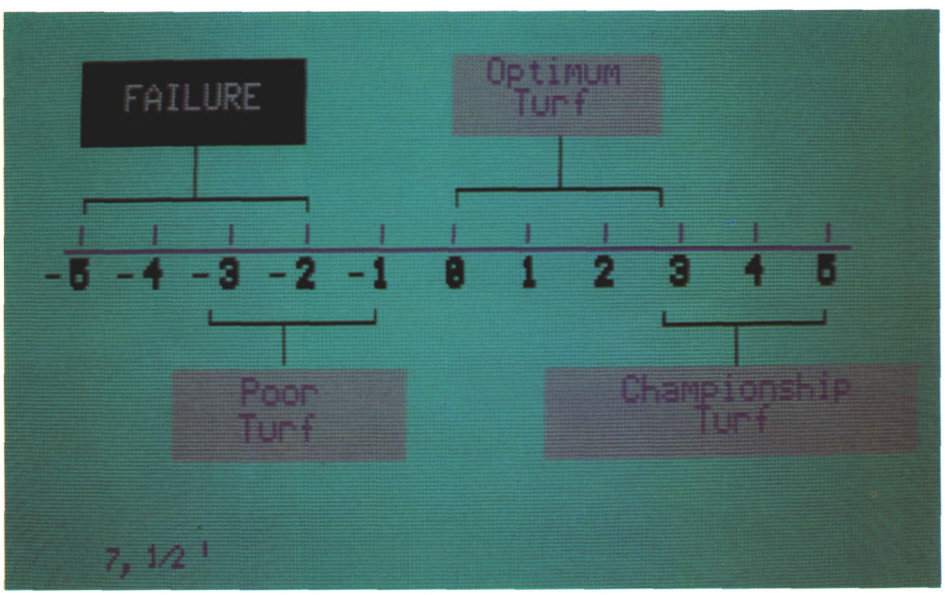
1. Examine and document all the factors that must be considered when choosing a turf for your course. These include the irrigation system, budget limitations, green construction, type of membership, your ability, and, of course, the grasses' zones of adaptation.

2. Avoid looking for chemical solutions to every problem. Although chemicals are some of our most valuable tools and as yet we cannot avoid using them altogether, they are not a substitute for good agronomics. By far the best chemical pest control programs are those that are as simple as possible. Also, far too many superintendents rely strictly on systemic fungicides and fail to include in their spray regime contact fungicides that have proven effective for years. Rotation of pesticides is still a must in any pest control program.

3. Utilize the unbiased services of the Green Section to help you and your membership identify and reach your course's maximum potential. A second opinion is simply good business. The Turf Advisory Service is available to all USGA Member Clubs. See the inside cover of this magazine for the address and phone number of your regional office.




*Layered greens brought about by a change in topdressing practices can significantly alter soil fertility.*




*There is a middle ground between championship conditions and poor turf. Strive for it for daily play.*

4. Finally, remember, you are dealing with Nature, and your turf is subject to stresses beyond your control, regardless of your education or the maintenance budget. Attempting to maintain today's championship quality on a daily basis is an invitation to disaster. Select a level of maintenance that provides good playing quality and addresses the agronomic needs of your turf.

What is the difference between the successful superintendent and the one who is on the edge? The successful superintendent has found the proper balance between the two powerful and unpredictable forces — the demands of the players and those of the turf. He can shift his efforts to correspond to a temporary increased need by one without abandoning the other, because his programs are consistent and based on sound agronomic principles. He, too, is always on the edge — but of success rather than failure.

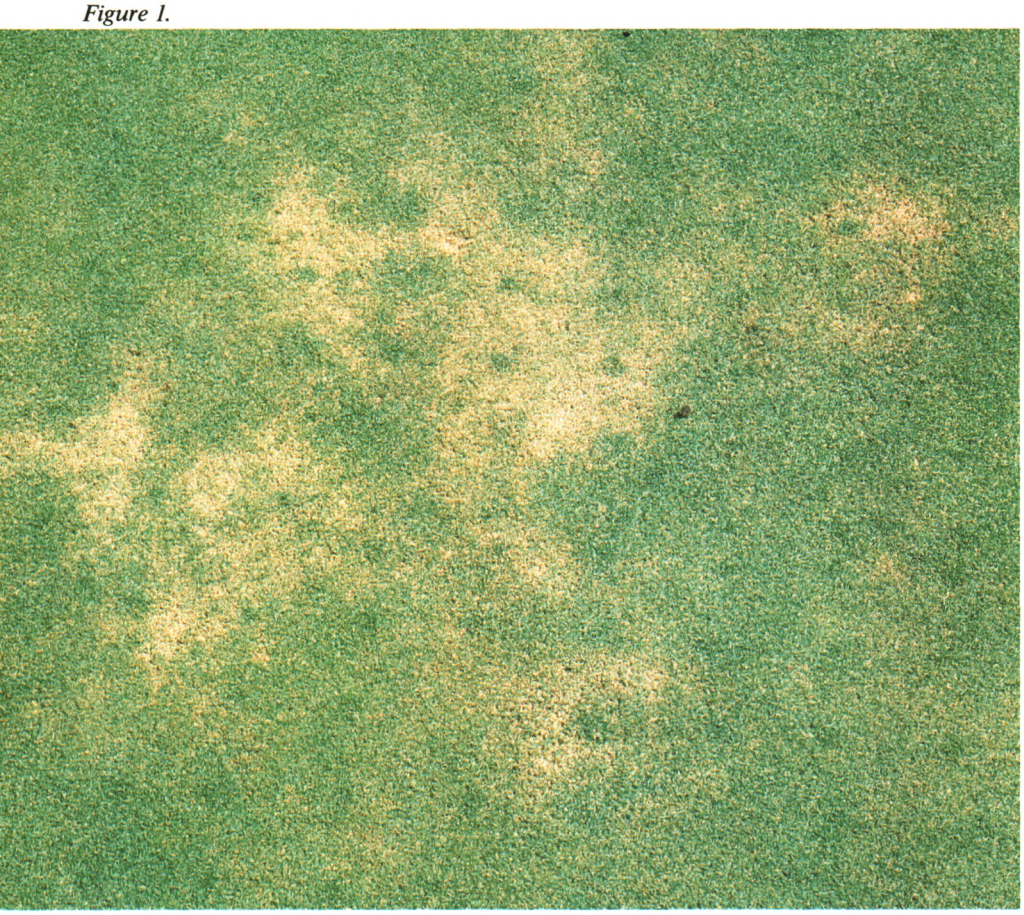
# The Nematode Problem in New England

**by DR. STANLEY R. SWIER**
Extension Entomologist, University of New Hampshire, Durham, New Hampshire

PLANT-FEEDING nematodes have never been considered a problem in New England turf. We knew they existed, but the prevailing wisdom dictated that populations rarely reached damaging levels in the northern as compared to the southern United States. However, recent research is changing our thinking about these pests. Here's some background information on nematodes.

Nematodes are microscopic worm-like parasites from 1/70 to 1/10 of an inch long. They have two general types of habitat: Plant parasitic nematodes have a stylet that is used to pierce the cell and feed on its contents. Turf nematodes are mostly root feeders, and can occur in extremely large numbers. We have found several thousand per 100cc of soil, though nematode counts are often much higher in the South. Death of the turfgrass plant is rare, but nematode feeding can put a severe stress on turf. The extent of the damage will depend on the initial vigor of the plant and the population of nematodes.

*Figure 1.*



Turf stressed by nematodes has symptoms resembling those caused by other problems, such as fungal diseases, nutrient, or moisture problems. These symptoms include stunting, yellowing, poor vigor, malformed roots, poor root growth, and root galls. Not all symptoms will be expressed, depending on the population pressure and species of nematodes. *Figure 1* shows typical symptoms of nematode damage on a velvet bentgrass green in New Hampshire.

I became involved with nematodes in 1983, when a local golf course was having a severe problem on certain greens. We eventually ruled out every insect, environmental, cultural, or other disease problem. As our last effort, we took soil samples and had them diagnosed for parasitic nematodes by the Cornell Nematode Diagnostic Laboratory. As you might guess, the lab report showed high counts of nematodes. From then on, I was taking nematode counts on every stressed green where no other problem could be found. Commonly, nematode populations were high and apparently a significant factor in turf decline.

Drs. Rob Wick (plant pathologist) and Pat Vittum (entomologist), at the University of Massachusetts (Suburban Field Station, Waltham), also began extensive nematode sampling and reached similar conclusions. In 1985 we teamed up to coordinate our research efforts. Our research had three main objectives: 1) to survey golf course greens to determine which nematodes are present; 2) to determine seasonal population fluctuations; and 3) to determine how many nematodes of each genera it takes to cause damage (economic threshold).

In the population survey, 13 golf courses (three greens each) were sampled every two weeks from spring until fall. The golf courses represented a large geographic area, from Massachusetts to Maine. Each green was extensively

sampled, taking 20 cores per green per sample period. Core size varied from ⅜ to 1 inch, depending on soils. The small core would often plug up in heavy soils, making it necessary to use the larger core, but we tried to be as consistent as possible.

*Figures 2* and *3* show a typical population trend for four genera of nematodes. Note that the populations tended to peak in mid-July, then decline. This population trend was fairly consistent, despite the geographic location. The genera of nematodes most commonly found in our survey were *Tylenchorhynchus* (stunt), *Hoplolaimus* (lance), *Helicotylenchus* (spiral), *Pratylenchus* (lesion), *Criconemella* (ring), and *Longidorus* (needle). Not all of these genera are equally pathogenic because it takes fewer needle nematodes to cause damage than it does ring nematodes. Just how many nematodes of each genera it takes to cause a problem is a difficult question. Remember the nematodes are merely one stress factor among a whole host of environmental and biological factors that can cause turf decline.

We know that healthy turf can often support a large population of nematodes and show no apparent ill effects. However, turf under heat or moisture stress cannot. It may show damage with lower nematode numbers. Therefore, there is often no relationship between nematode counts and symptoms. High counts in themselves mean little. Before nematodes can be implicated as a problem, you need to show significant population levels, damage symptoms, and no other insect, disease, environmental, or cultural factor as the primary cause. Much more research needs to be done to identify those biotic and abiotic factors that influence nematode populations and their ability to cause turf decline.

IN A PRELIMINARY STUDY, we found that nematodes went deeper than four inches, which was the sampling depth in our 1985 population survey. In 1986 we concentrated on a depth survey to characterize the rise and fall of nematodes in the soil profile. We sampled every two weeks to a depth of 30cm (about 12 inches) and divided each core into five-centimeter (about two-inch) increments. It was interesting to find that certain nematodes (*Longidorus*) were more evenly distributed throughout the depth profile than others.

Other nematode genera had a strong preference for the upper four inches of soil, where active root growth occurs. Overall, most nematodes will be found in this top four-inch zone. *Table 1* shows the distribution of nematodes for three greens, all sample dates combined. The courses were Bald Peak (Moultonboro, New Hampshire), Wentworth (Newcastle, New Hampshire), and Webbhannet (Wells, Maine). Note that the majority of nematodes are in the top four inches (10cm) of soil. The green at Bald Peak had fewer nematodes at 0-5cm than at 5-10cm, because this green received no irrigation, and the top 5cm were extremely dry.

Since most nematodes are found in the upper four inches of soil, we do not recommend sampling any deeper. When sampling for nematodes, take at least 12 cores (one inch) in the area showing symptoms. You need to take some samples in healthy turf, in turf just beginning to show decline, and in the damaged area. If the samples are just pulled from the worst area, the nematode counts may be low because the grass is in poor condition. Since nematodes are obligate parasites, their populations decline when the grass dies.

Place the samples in a plastic bag, place vital information on an outside label (name, location, pesticide history, etc.), and send it as fast as possible to a recognized nematode diagnostic laboratory. It's usually best to mail samples early in the week to avoid samples sitting in a post office for the weekend. If you can't mail the samples immediately, store them out of the sun, in a cool

**Figure 2**

Concord, New Hampshire, 1985

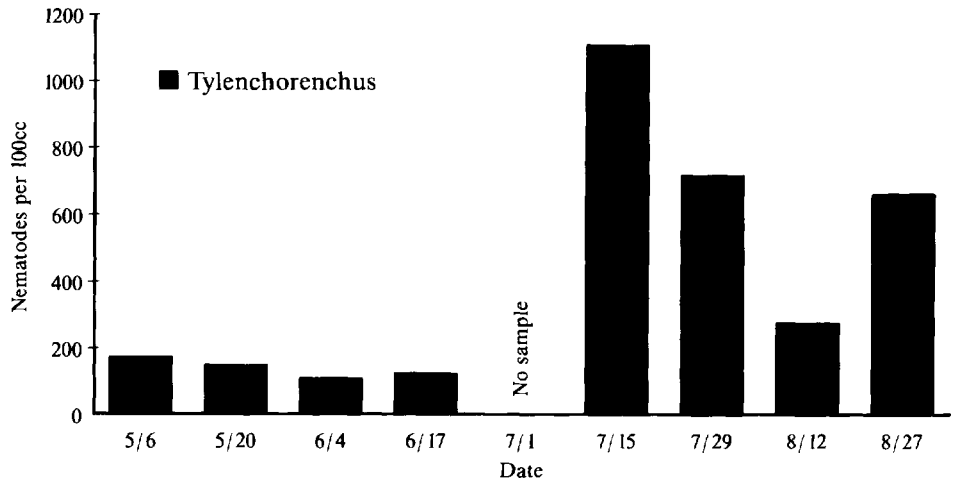
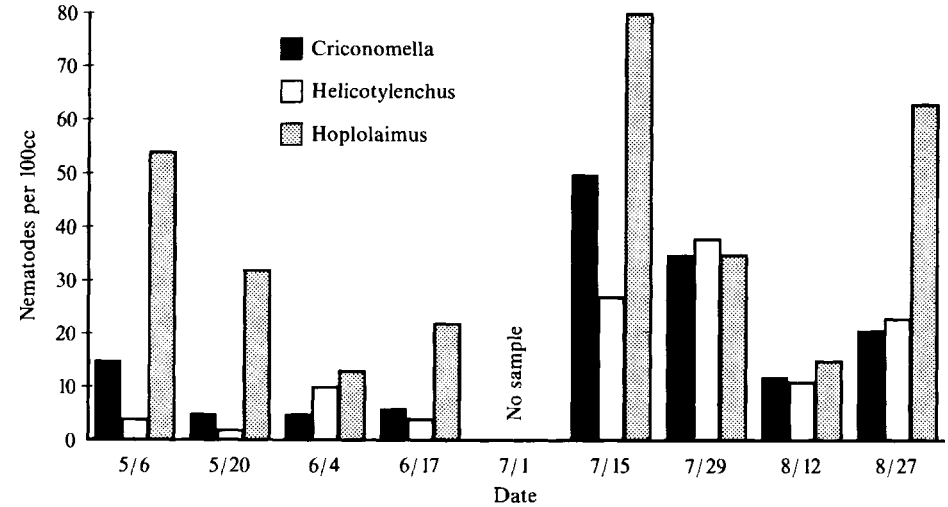



**Figure 3**

Concord, New Hampshire, 1985



place. It's good to keep them refrigerated, but don't let them freeze.

Before you chemically treat for a suspected nematode problem, be sure to get competent advice from your appropriate university researcher or extension specialist. You need to be sure that nematodes are to blame for your turf ills.

Since we need to treat nematodes in New England occasionally, I began some efficacy trials. The only registered material for bentgrass is Nemacur (fenamiphos) from Mobay Chemical Company. The 3EC formulation of Nemacur is not registered in New England, so my trials only included the 10G formulation. I wanted to determine the effectiveness of the low rate. If efficacious, the low rate would help reduce the pesticide load in the environment. *Table 2* shows the results of a trial at the Cocheco Country Club, in Dover, New Hampshire. The plots consisted of bentgrass greens; the treatments were replicated nine times. Treatment date was July 17, 1985. Plots were irrigated with ½ inch of water after application. The low rate performed as well as the high rate in controlling the three major genera of nematodes. However, *Helicotylenchus* and *Tylenchorhynchus* were more effectively controlled than *Criconemella*. Since overall control was 87 percent for both the low and high rate, there is no need to use the high rate in this area.

Nematicides are highly toxic pesticides. Their use dictates caution. They should not be used unless absolutely necessary, since we are concerned with possible harmful non-target effects associated with overuse. It is extremely important that you use the necessary safety aids such as a respirator, gloves, and glasses while mixing, loading, and applying nematicides. We also continually stress proper calibration of application equipment. I feel the application should be made about two weeks before the summer stress period (July). However, some superintendents have opted to apply nematicides before the busy golfing season, in May or early June, and have had good success.

We recommend closing the course for the day to allow safer application. If you cannot close the course for the day, try closing for two hours early in the evening, which still gives you enough time to treat 18 greens. One advantage of an evening application is that usually fewer birds will be feeding. Irrigation is necessary to increase the effectiveness of the nematicide and reduce the toxicity of granules remaining on the surface. Immediately irrigate the treatment with ½ inch of water, being sure not to allow puddling. Birds bathing or drinking from a puddle will be exposed to the nematicide. If these precautions are not followed and misuse occurs, our pesticide regulatory agencies will probably eliminate the use of nematicides on golf courses.

**Table 1**

DEPTH PROFILE (All Dates Combined)

| Depth (cm) | Percent of Nematodes | | |
|---|---|---|---|
| | Bald Peak | Wentworth | Webbhannet |
| 0-5 | 23.1 | 37.6 | 68.9 |
| 5-10 | 28.9 | 22.3 | 18.9 |
| 10-15 | 19.9 | 14.4 | 4.0 |
| 15-20 | 15.8 | 11.8 | 3.4 |
| 20-25 | 6.6 | 9.0 | 3.0 |
| 25-30 | 5.7 | 4.8 | 1.9 |

IN CONCLUSION, nematodes are a greater problem in New England putting greens than previously thought. However, they are not a problem on every course. Relatively few courses in our area will need chemical control. Nematodes are mostly a problem when the turf is under other biotic and abiotic stresses. Possibly, we are seeing more nematode stress today due to the trend toward lower mowing heights and sand topdressing. Lowering mower heights adds stress to the grass, and nematode populations tend to be greater in sand soils. Proper diagnosis by a qualified professional is necessary before nematodes can be implicated as the cause of turf decline.

**Table 2**

Mean Number Nematodes per 100cc Soil, 8 Weeks Post-Treatment*

| Formulation and pounds ai/acre | Total Nematodes | | Helicotylenchus | | Tylenchorhynchus | | Criconemella | |
|---|---|---|---|---|---|---|---|---|
| | mean no. | % control | mean no. | % control | mean no. | % control | mean no. | % control |
| Nemacur 10G 10 ..... | 212 a | 87 | 61 a | 92 | 80 a | 88 | 75 a | 62 |
| Nemacur 10G 20 ..... | 210 a | 87 | 103 a | 86 | 57 a | 91 | 108 a | 45 |
| Check ..... | 1624 b | | 747 b | | 662 b | | 195 b | |

*Means followed by the same letter are not significantly different (p = .05, DNMRT)

# Gee, I Thought It Ran Forever!

## Equipment Purchasing & Inventory: Part I

by GARY A. WATSCHKE
Agronomist, Northeastern Region, USGA Green Section


THINK BACK for a moment. For some of you it may seem like years, and for others it may be as close as yesterday. As you think, visualize this: A truckster rattling across the fairway with its tailgate held in place with baling wire; or was it a chain guard, engine shrouding, or perhaps a headlight held in place on some other piece of machinery? Maybe it is the duct tape used as a battery tie-down, or used to fix the cracks and tears in the mower's seat. Maybe you see the welding job done to hold a wheel hub to its axle because there are no more threads left for the trust nut, or is it the numerous times the reel blades have been re-welded to the spiders?

Be honest, look around the maintenance center and all will probably find at least one example similar to the imagery given above, if for no other reason than the fact that the mechanic simply has not reached that part of the day's agenda.

Sadly, when it comes to handling the huge monetary resources required to operate the grounds maintenance programs at their clubs, few memberships realize the financial responsibility they have. Oh sure, they can tell you how many hundreds of thousands of dollars they spend each year and how they generate those revenues. But ask how the club goes about replacing the enormously expensive equipment inventory, and they are likely to say, "Gee, I thought that stuff lasted forever!"

Well, forever is a long time, but in this case not long enough. Turf maintenance equipment needs to be replaced, and should be replaced on a regular basis.

Assuming that The Camel Golf Club has finally passed over the hump and is through dealing with money-gobbling peripheral projects (remodeling the clubhouse, refurbishing the pool, and adding paddle tennis courts), the superintendent finds, once again, he has a chance to have his golf course equipment inventory reviewed. The last time this happened is likely to be beyond recall. What are his options and how

can he develop an inventory of equipment that is reliable and will allow him to produce the best golf playing conditions possible?

There are three basic premises from which to work. They are (1) short-term rentals, (2) long-term leases, (3) direct purchasing. A well-informed decision on which premise to work from can only be made if a thorough system of record keeping has been used. A review of these records can readily show which pieces of equipment are used with the greatest frequency and which are not. Seldom-used machines, such as chippers, stump cutters, and trenchers are obvious candidates to be acquired through renting. A search of the records would probably show many other specialized pieces of equipment that are used only from time to time through the year. Purchasing specialized but seldom used pieces of equipment can tie-up thousands of dollars in inventory. Valuable storage space is also consumed, making usually tight maintenance centers more crowded than need be. The number of clear-cut cases where renting is the right and proper thing to do may surprise you.

What about the heart of the equipment inventory, the primary mowing machines, utility trucksters, sprayers, tractors and such? Many golf courses can simply rebuild this equipment during the off season and by doing so often keep the equipment in service well beyond the good sense of economics. There eventually comes a point at which time repairing a machine is no longer monetarily feasible. The superintendent and club must evaluate the cost of anticipated repairs, the cost of replacement with new equipment, trade-in value, if any, and the depreciation value of the present equipment. One standard rule of thumb often used is to replace the machine when the total repair cost, including parts and labor, equals 50 percent of the initial purchase price. Another says to do so when the cost of all repairs since the purchase date exceeds 30-40 percent of the new purchase price.

One method of acquiring these more permanent types of equipment is through leasing. Leasing is most appealing to municipalities or to those clubs that are profit-oriented organizations. Private clubs generally have a better cash flow, or at least it can be created through assessments. However, leasing could be important to them as well, if the budget is tight and the cost of borrowing money is high.

Leasing offers many advantages, not the least of which is flexibility. The terms and conditions of many lease agreements can be set to specific terms for each piece of equipment. They may also be tailored to coincide with the peaks and valleys of club income by setting payment schedules to match the income-producing months and allowing non-payment during the few months when income is negligible.

The most obvious advantage is that few leases require any cash down payment. The monthly payments are paid with today's dollars, which allows use of the machinery during payment and eliminates cash disposal before use. This conserves working capital and creates a situation where monies can be invested in interest-bearing accounts, or used to finance other needed projects. Then, too, established credit lines will remain open and enhanced, enabling the club to increase its borrowing base.

Leasing may also act as a hedge against inflation. Most of the payments made will be with tomorrow's dollars and in an inflationary period those future dollars' value would be deflated.

From a tax perspective, since rental payments may be charged directly as business operating expense, leasing may offer another advantage. However, most leases are established based on the economic life of the machine as opposed to the tax-depreciable life. Confusing this issue further will be the Tax Reform Act of 1986. Leasing companies will lose the advantage of investment tax credits and will incur longer depreciation schedules. This still does not diminish most of the arguments for leasing, such as conserving credit, shifting unusable depreciation, and easing cash flow requirements. A thorough check with an accountant would be in order, however.

The continuation of lease programs protects against obsolescence. This ensures that new and more sophisticated equipment will always be at the club's disposal. Downtime and costly repairs can be nearly eliminated while the club enjoys the benefit of the latest technology used in the creation of superior playing conditions.

Like any piece of tape, leasing too has its sticky side. Where there is plenty of cash available, leasing would be an uneconomical choice. Any club would be better off employing its working capital to the fullest extent. Leasing will invariably cost more than purchasing the equipment (the lessor needs to make a living, too). Just as if the machine was purchased, the maintenance, unwarranted repairs and insurance will be the lessee's responsibility.

There are different opportunities available when the lease expires. Some lease agreements offer no trade-in value at the expiration of the term, resulting in a loss. Others offer a residual value for the equipment, and you have the option of buying it for that price or turning it back to the lessor. And still other contracts may require you to purchase the equipment at a predetermined price, leaving you responsible for selling it. This can lead to an awkward situation, especially if the pre-set residual value was overstated to create lower, more convenient lease payments. Situations that set residual value at the end of the lease force you to pay that price for the option to keep or sell the machine. This scenario may work out well, or it may not. Obviously there are some risks to leasing.

The third and perhaps most popular method of adding to or replacing equipment inventory is that of direct purchase. The most compelling reason is simply that buying generally results in lower overall costs. But how do most clubs go about making such purchases? Unfortunately the majority wait until they have to and this places an unexpected (and equally unpleasant) strain on the club's cash flow or forces the club into borrowing the needed capital. Either way, a bruised and battered budget is the precipitated result of poor planning when it is announced that "We need a $40,000 machine . . . NOW!"

Fast-learning memberships will endure this unnerving situation only once, after which they embark on some sort of a planned equipment replacement program.

One popular way of financing such a program is to develop a capital equipment purchasing fund. This typically amounts to allocating a dollar amount equivalent to 10 percent of the current year's operating budget. This practice can work quite effectively when applied to those pieces of equipment that may cost less than $10,000 to $15,000. However, even if a club has an operating budget of $350,000, 10 percent would equal only $35,000. It quickly becomes evident that it is difficult to replace a fleet of triplexes or a pair of hydraulic five-gangs used to mow fairways. The 10 percent concept is better than nothing, but it can have serious limitations.

Many of the country's more exclusive clubs and certain government facilities


*(Above) Cooperative efforts produce positive results. Green Chairman Tom Craighead and Superintendent Alton Moore shown with recently purchased tractor.*

*(Left) Moving into the modern world.*

operate on equipment replacement programs, which take into consideration depreciation schedules and anticipated equipment replacement dates. Accountants and equipment distributors can help set up depreciation schedules that are based upon the tax-depreciable life of the equipment and correlate it to the useful life of the machine.

The club can then pay itself the monthly depreciation earnings and deposit them in an interest-bearing escrow account, the funds of which are reserved for capital equipment purchasing. Then, as a particular piece of equipment comes due for replacement, sufficient funds will be readily available. The new machine is purchased, a new depreciation schedule developed, a replacement date is set and the scheduled payments to the escrow account start all over again.

Club leadership needs to realize that operating a golf course is a business proposition, and with it comes the responsibility of handling the club's financial resources intelligently. Assuming a well-conceived equipment replacement program, utilizing depreciation schedules and replacement dates can eliminate sharp peaks in the club's operating budget and stave off financially troubling times without sacrificing turf quality or playing conditions.

The Waccabuc Country Club, in Waccabuc, New York, where Alton Moore and Tom Craighead are Superintendent and Green Committee Chairman, respectively, recently adopted this type of equipment purchasing program. As it is at many clubs, Al and his crew did an excellent job of maintaining their equipment. In fact, too good of a job, since many pieces of equipment had been in daily use since the 1940s. With the mechanic retiring, and many parts no longer available, it became apparent the club had to replace the old with new.

An inventory was taken, and a wish list was compiled when it became time to catch up with modern technology. With facts and figures in hand and lots of persuasive conversation, the chairman and the club agreed to a five-year program. During this time the most pressing equipment needs were addressed first, and by the end of five years nearly all of the old equipment will be replaced. Beginning in year six, those machines purchased during the first year that have a five-year service life will be replaced with funds derived from the depreciation payments made to the escrow account.

As Al and Tom will admit, this five-year transition into modern times represents a sizable piece of change to the membership. This was justified by comparing initiation fees, member dues and budgeted capital equipment expenses with comparable clubs in the area. All were found to be low. Initiation fees were raised $3,000 and member dues a modest $300. These increased funds were the source used for the initial purchases being made. The plan calls for spending a little more than $50,000 for each of the five years, for a total of more than $250,000. However, remember that the machines are being depreciated out 100 percent and the club is also making these payments to the escrow account. Even though they are experiencing certain tax advantages, the five-year program is costing in excess of $500,000.

The good part is that the light is on at the end of the five-year tunnel. At that time, all the equipment will be replaced, and a sufficient cash reserve in the escrow account will have accumulated, so that all future equipment replacement can be done on time with the comforting knowledge that the money is available. The situation at the Waccabuc Country Club was quite immense, but the solution to the problem is one that could easily be mimicked by any other club currently without an effective equipment replacement program.

While there are no clear-cut ways to solve the equipment replacement problem, it is good to know we have choices available. The keys are to match the right equipment for the job, prepare a replacement schedule, develop a financially responsible attitude to the problem, and remember, it *doesn't* last forever.

# Food for Thought — Regarding Fast Greens

**by MICHAEL ZEDRECK**
Superintendent, Butler Country Club, Butler, Pennsylvania

*Editor's Note: The procedures outlined in this article are proving successful at Butler Country Club. However, they may not be practical or feasible for every golf course or for every reader of the* GREEN SECTION RECORD. *Nevertheless, the idea of achieving and maintaining smooth, fast greens with the best in cutting unit maintenance and moderate levels of fertility is an interesting concept that may interest all readers.*

PRODUCING fast greens has always been associated with reduced nitrogen levels. I for one have tried this approach, but I find that with increased mowing frequency, along with other management practices, nitrogen levels can be increased to a moderate level without adversely affecting putting green speeds.

Last year, our fertility level for greens was increased twofold compared to previous years, resulting in denser, healthier turf without sacrificing green speed. At Butler Country Club, we seem to be achieving the best of both fast greens and healthy grass, grass that is better able to handle the wear and tear our small, old-style greens receive.

Our members feel comfortable with daily green speeds of 11.5 feet as measured by the Stimpmeter. Peak speeds of 12.5 feet are our goal for tournaments and special events. These speeds are not easily accomplished, but they are possible because of the small amount of undulations in our greens. Following is a description of the management practices we have developed to achieve these goals:

### Fertility versus Mowing Frequency

Low fertility is the common standard for producing fast greens. However, at Butler Country Club fast greens are being maintained with increased fertility along with increased mowing frequency. Nitrogen applications ranging from .25 to 1 pound per 1,000 square feet begin in late May and continue into the fall. Fertilizer applications are made bi-directionally with a total of 5 to 10 pounds nitrogen per 1,000 square feet annually. Consequently, more grass is being grown, but by mowing more frequently (and increasing other management practices discussed later), fast greens are achieved.

The greens are mowed seven days a week. We found skipping one day of mowing results in a loss of green speed that cannot be regained in the next day's mowing. Greens are double-cut a minimum of six days a week, while on special event days, they are triple- or quadruple-cut. Daily double-mowing is done using 21-inch walking mowers, but when cutting more often, triplex mowers are also used. The bottom line is a dense stand of turf and a smooth putting surface.

### Cutting Units

This becomes a specialized area in itself, which requires more than simply height and cutting adjustments. The most expensive mowers are worthless if they're not set up properly and adjusted, and the closer you cut, the more precise these adjustments must become. If not, the cutting unit itself scuffs the grass for extra and unwanted abrasion. This is not good for the grass or the appearance or playability of the greens.

On a daily basis, the cutting units are inspected and adjusted, along with

**Figure 1**

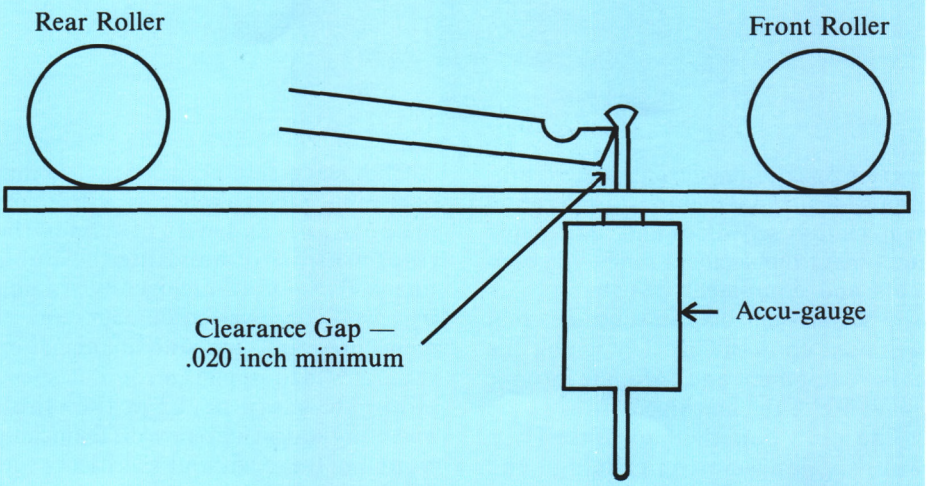



**Figure 2**

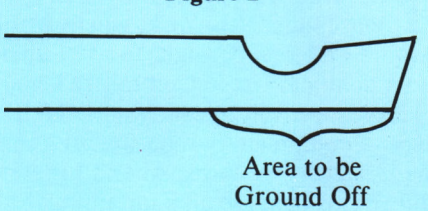
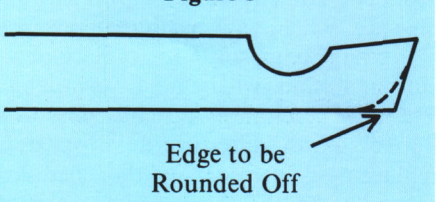



**Figure 3**



periodic inspections in the field by the mechanic. All inspection checks play a vital role in producing a precision cutting unit as well as a precise quality of cut on the putting surface. They include:

1. Reelbearing endplay and drag.
2. Roller bearing endplay and drag.
3. Mower squareness.
4. Quality of cut.
5. Tightness of all bolts and screws.
6. Clearance between bottom of bedknife and height of cut gauge.
7. Height of cut.

All of these inspection items are important for both bedknife-to-reel or reel-to-bedknife adjusted units. Although both types of units can be set up to achieve the same quality of cut, each requires some specific adjustments.

The one item I feel is commonly overlooked is the clearance gap between the bottom of the bedknife and the height of adjustment gauge (*Figure 1*). This gap becomes more important the closer the greens are mowed. Obviously, the smaller the gap the more stress the grass is subjected to from the bedknife dragging across the surface of the greens.

Two mowing units set at the same height will mow and cut differently because of the variations in this gap. When our mechanic initially sets up a cutting unit with a new bedknife, a minimum gap of .020 inch is achieved by grinding the bottom of the bedknife with a bedknife grinder (*Figure 2*).

This .020-inch gap is the minimum clearance that we use for a cutting height of .080 inch to .090 inch. Also, an Accu-gauge that measures in thousandths of an inch is used to set the height of cut. For the 1987 season, we plan to try a higher mowing height, just under .100 inch.

Working with a bedknife-to-reel adjusting mower unit, such as on a Toro GM-300, reel diameter is an important factor with closely mowed greens. As the reel diameter is reduced, the bedknife relief angle is also reduced. This results in the front roller not being able to be set low enough while moving the rear roller to obtain proper bedknife relief angle. We find that four years is the maximum life of a reel used in this type of cutting unit for greens.

On cutting units with stationary bedknives, such as the Toro Greenmaster 21-inch walking mower, the relief angle for the bedknife remains constant. Reel diameter has no influence on mower adjustment, making it easier to replace the bedknives during mid-season.

*Light and frequent topdressing.*

One item of importance when changing a bedknife on any unit for closely mowed greens involves the bottom front edge of the bedknife (*Figure 3*). This sharp edge needs to be rounded off using a flat file. Otherwise, it will result in scuffing the turf until this edge naturally wears round.

Mower squareness on cutting units with adjustable rear rollers is also commonly overlooked. This is done by using a bench plate to adjust the rear roller so that it is parallel with the reel while achieving the proper relief angle for the bedknife. Only when this is done can the height of cut be set. Doing this will eliminate the cutting unit from rocking across the putting surface. I have seen putting green surfaces that were wavy because of mower units not being square.

Many man-hours are used to maintain the cutting units, but without precisely adjusted mowers, all other management practices could be worthless. It is all of these fine adjustments that lead to a truer putting surface while reducing mower stress on the turf. By reducing mechanical damage to closely mowed putting greens, you can have faster, smoother greens that are easier to keep healthy.

**Topdressing**

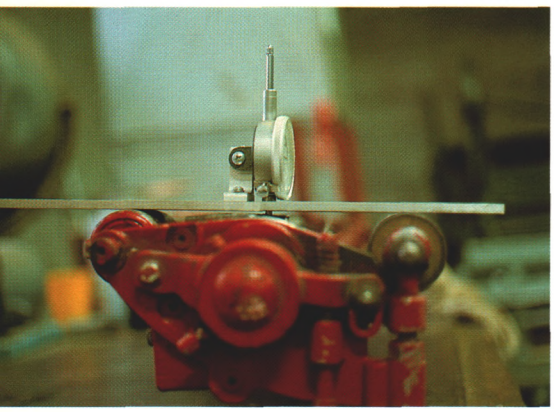
When increasing the fertility level on putting greens, other management practices, such as topdressing, need to follow suit. Topdressing rates of .10 to .25 cubic yards per 1,000 square feet at three- to five-week intervals are applied using a commercially prepared topdressing mix of eight parts sand, one part soil, and one part organic matter, according to USGA specifications. The greens are mowed in the morning to help dry them off. Once they are completely dry, the topdressing is applied using a Lely rotary spreader. The greens are then dragged twice using a dragmat and mowed once again to clean up any debris. At these light rates, very little sand is picked up to damage the cutting units, although enough abrasion does occur to require maintenance.

**Verticutting**

Verticutting is practiced as necessary, occasionally followed with topdressing. Depending on what the greens appear to need, double verticutting is done every two to four weeks. The verticut heads are adjusted on a steel plate so the blades are just touching the surface.

*(Below) Establishing the mower clearance gap.*

*(Right) For uniform distribution, apply fertilizer at one-half rate in two directions.*



**Brushing or Dragmatting**

These two management practices are used in place of verticutting. We usually use these during periods of hot weather to achieve basically the same results as verticutting with a lesser degree of stress on the turf. Double-mowing follows the process and leaves no evidence that the surface of the green has been groomed.

**Combs or Brushes on Cutting Units**

Personally, I have not used these on a routine basis. I feel using combs or brushes can continually change the surface, resulting in less than true putting quality. I put emphasis on specific management practices to achieve specific goals.

**Turf Groomers**

The recent development of turf groomers has captured my attention. This could be another fine tool to help produce a truer putting surface. The increased number of blades along with their smaller diameter will definitely do a much finer job as compared to conventional vertical mowers used today. Turf groomers can be an important key to producing fast greens that putt truer without the need to cut them so short. Time will tell.

**New Ideas for 1987**

This year we are trying two new ideas with our cutting units. First, in order to increase the frequency of cut with the Toro 21-inch walking mower, a 20-tooth chain sprocket was machined to replace the 16-tooth sprocket, which runs off the universal shaft. Secondly, on the Toro GM-300s, 11-bladed reels have been installed.

Our goal for this season is to produce a denser, smoother, healthier putting surface without cutting as short as in previous years. More precise mowing equipment and careful fertility practices may make this goal possible for all of us.

# Managing Anaerobic Soils

**by DR. ROY L. GOSS**
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*Editor's Note: In the following article, Dr. Roy L. Goss discusses the much-publicized black layer issue in a clear and forthright manner and from a position of experience and fundamental/basic agronomics. His original article appeared in the April, 1987,* Northwest Turfgrass Topics.

AN ARTICLE entitled "The Black Plague" appeared in the November 1986 edition of *Golf Course Management*, and a similar article entitled "An Update on the Black Layer" appeared in the February 1987 edition of *Golf Course Management*. Unless I am badly mistaken and being misled from what I read, we all should be embarrassed to admit to the world that we have forgotten the fundamental concepts of managing soil and grasses. Isn't this problem of black layer or black plague simply one of an anaerobic condition developed through neglect of one or several management practices?

Soils in the coastal areas of northern California, Oregon, Washington, and British Columbia commonly develop anaerobic conditions between October and April of each year, unless they are properly managed. This time frame is characterized by heavy winter precipitation, low evaporation, low light intensity, and continued use of turfgrass facilities throughout the winter.

When soils become compacted, particularly under saturated or near-saturated conditions, the oxygen diffusion rate into these soils is near zero. Organic materials, which have accumulated in the surface few inches of these soils, may break down anaerobically, and many of their components are not oxidized, but are reduced. There have been comments from some writers alluding to the fact that sulfur applications are part of the problem. It should be common knowledge to these people that most of the soil's sulfur is held in reserve in organic matter. Regardless of whether we apply the material as elemental sulfur or if the plant gets it from breakdown of organic matter is irrelevant from the standpoint of oxidation and reduction. Under anaerobic conditions, sulfide ions are formed instead of sulfate ions, and one of the end products is hydrogen sulfide, which is a very foul-smelling substance. Usually, the resulting color is also black.

There isn't much question that under this total neglect of soil drainage and aeration, additional sulfur will cause problems. However, hydrogen sulfide can be produced without the addition of any elemental or extraneous sulfur applications. Sulfide ions can also interact with iron and other micronutrients to form insoluble sulfides. It is also common knowledge that most of these insoluble metal sulfides are usually black.

The reports from areas of the country affected by black plague indicate the soils are somewhat compacted, whether they be sands or heavier textured soils, wet, no roots on the turfgrass, and eventual death of both *Poa annua* and bentgrass on putting greens. It is generally conceded that *Poa annua* dies first, followed by bentgrass. It was also alluded to by some of these people that the condition was significantly improved following intensive aerification. I think now we are getting down to the real root of the problem.

MANY superintendents have been obsessed with developing the fastest greens in town, and the other superintendents have been forced to follow suit because their neighbors' greens were faster than theirs. The usual methods of developing fast greens are to 1) cut the grass as closely and as frequently as possible, including double and triple cutting, 2) verticutting, 3) elimination of aerification.

Reduction in irrigation water will also make the green surfaces firmer and increase ball speed. What do we do, however, when the surfaces are hard and compacted and excessive rainy periods occur? We should all remember that the respiration rate of turfgrass roots increases with increase in temperature. In the summer, when we get higher temperatures and rainfall, added to compacted soils, I think we are spelling doom unless we have extremely good drainage and good gaseous exchange with the soil.

The algae factor has also been mentioned. It is not at all uncommon to see thick algae scums that are slimy and slippery when wet, leathery and hard when dry, and literally impermeable to water or air. Algae usually follows thin turf and bare ground. These algal scums can definitely produce anaerobic conditions if the surface is not properly managed.

There was also comment about sand layering over slower draining, finer textured soils. To my knowledge, this condition has never been observed in the Pacific Northwest, where we probably have as long a history or longer than any other part of the country in sand topdressing putting greens, tees, fairways, sports fields, and other areas.

If you place one to four inches of sand through topdressing programs over slow-draining, fine-textured soils, you will achieve greater surface stability during most of the year, but it may not necessarily always be dry. Wet sand is generally considered to be more stable than wet fine-textured soil, since we can destroy the structure of normal soils containing silt and clay, and sands have no structure, since they are single grained. If anaerobic conditions develop at the interface between sand and heavier textured soil, it is obvious we need to improve our drainage situation. Since it is nearly impossible to drain deep, fine-textured soils on flat grades through artificial drainage techniques of drain tile, it is important that we try to practice subsoiling, deep aerification, or other methods of relieving the saturation, or simply build deeper profiles of sand. I would ask you, how else can it be done on a practical basis?

Tom Lubin wrote an article for *Divot News*, from the Southern California Golf Course Superintendents, a few months ago describing similar conditions in southern California, generally in August of each year. The symptoms on greens are yellow, especially the *Poa*. After a period of time, if not treated, the *Poa* will die, but the bent still has a healthy look. The root system is shortened, and there is a black or dark brown color to the soil, sometimes in bands. The soil samples have the smell of a stagnant pond. The symptoms do not respond to fungicide applications.

He also indicated that in areas of poor water quality or high salt content in the soil, salt levels were found to be high enough to cause severe problems, due to lack of drainage. We all know that good infiltration and permeability and good subsoil drainage are most essential to the reduction of salts to a level where plants can survive. Lubin also points out that good aerification and water management programs can shift the equilibrium to one of oxidation over reduction and create healthy conditions frequently as early as one week.

I hope this will help to clear up questions our readership may have in mind, and I would hope that turf managers remember to practice good management of soil aeration, compaction reduction, and good internal drainage to prevent these problems; there is no mystery here.

USGA GREEN SECTION RECORD
JULY/AUGUST 1987

# TURF TWISTERS

## HOW TO REDUCE TENSION

**Question:** We are having problems with fried-egg lies in our bunker sand. The sand has been tested and is not round in nature, yet the membership is still complaining. Any ideas? (California)

**Answer:** Two ideas come to mind. First, you may wish to consider using steel leaf rakes on your bunker raking machine to reduce the penetration and disruption caused by regular raking. This surface raking has been used successfully on different types of sands that do not pack well. With a non-round sand, it is fluffed following the raking procedure. The sand particles remain in position due to small mineral deposits that act as glue after the water dries following raking. You may wish to use a very small amount of wetting agent in water and apply it to the problem bunkers every two to three weeks. The wetting agent reduces the surface tension and allows the sand particles to pack down after raking, resulting in fewer fried-egg lies.

## WHEN PUTTING ABOVE

**Question:** I feel the slope on several of my greens is too great, since the golfers always complain that it is too difficult to putt when their ball is above the hole. Are there any guidelines for slopes on putting greens? (North Carolina)

**Answer:** The slope of a major portion of a putting green should usually not be greater than 3 percent, although some areas may exceed this for special reasons, such as difficult terrain or dramatic architectural effect. Proper design will allow for a minimum of three areas for hole locations, although more are desirable, especially if over 20,000 rounds are played annually.

## AN OVAL HOLE

**Question:** If a vertical hole is cut on the steep slope of a putting green, will not that hole be of a different shape and larger than the 4¼-inch diameter permitted by the Rules of Golf? (Pennsylvania)

**Answer:** According to Frank W. Thomas, Technical Director for the USGA, such a hole would have very small differences that fall within hole-cutting tolerances. The major axis of the oval shape of a hole in the plane of a green surface having 8½ degrees of slope to the horizontal is approximately .040 inch greater than the minor axis. But more importantly, a hole cut on an 8½-degree slope would *not* be within the tolerance of most golfers.