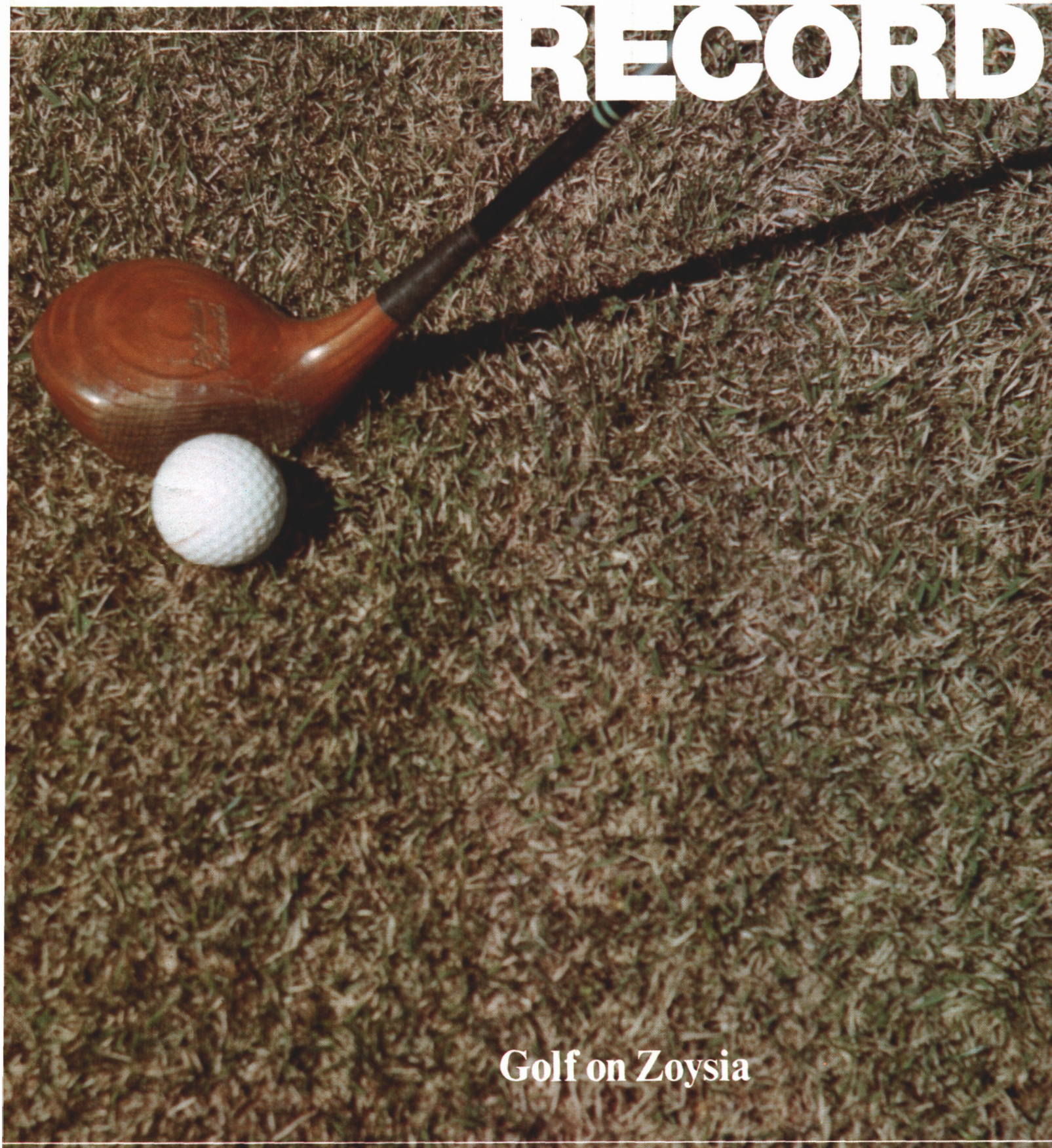
A Publication on
Turf Management by the
United States Golf Association

May/June 1979

USGA Green Section RECORD



Golf on Zoysia

USGA

Green Section RECORD

EDITOR:
Alexander M. Radko
MANAGING EDITOR:
Robert Sommers
ART EDITOR:
Miss Janet Seagle

VOL. 17, No. 3
MAY/JUNE 1979

Cover Photo:
Golf on Zoysia

GREEN SECTION RECORD (ISSN 0041-5502) is published six times a year in January, March, May, July, September and November by the UNITED STATES GOLF ASSOCIATION, Golf House, Far Hills, N.J. 07931. Subscriptions and address changes should be sent to the above address. Articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, Golf House, Far Hills, N.J. 07931. Second class postage paid at Far Hills, N.J., and other locations. Office of Publication, Golf House, Far Hills, N.J. 07931. **Subscriptions $3 a year.**

ZOYSIA: For The Transition Zone

by DR. DOUGLAS T. HAWES
Director, Mid-Continent Region, USGA Green Section

ZOYSIA, a controversial grass of the 1950s, finally seems to be finding its place in golf course management as a fairway turf species in the transition zone.

The transition zone is that region in which the cool season grasses do not stand up well under the heat and disease stresses of summer, and where bermudagrass fails because of inability to cope with occasional severe winters. The Zoysias — *Zoysia japonica, Zoysia tenuifolia* and *Zoysia matrella* are considered one species by many in the turfgrass industry based on research done by Dr. Ian Forbes, who recently retired from the Georgia Coastal Experiment Station. The zoysia mentioned in the context of this article refers primarily to *Zoysia japonica*, variety Meyer, an improved variety researched and released jointly by the Green Section of the USGA and the U.S. Department of Agriculture. Frank N. Meyer, a plant explorer for the United States Department of Agriculture, died while he was on an expedition to China. Meyer zoysia was named to honor his memory. Other zoysia varieties have been used in various turf situations. Presently, however, Meyer zoysia is the only variety being used on golf course fairways to any extent in the transition zone. Zoysia is native to Asia, and it is very widely used on Japanese golf courses for greens, tees and fairways. In Japan, several different zoysias are being used, with fine-textured *Zoysia tenuifolia* used mainly for putting greens.

Dr. Fred V. Grau examining the dye used on the zoysia nursery at Pine Valley Golf Club.

After a severely cold winter, zoysia (left) survived while bermudagrass (right) died.

Zoysia was introduced into the United States in 1905, but it was not until the 1950s that it became widely used. Unfortunately, it was used in many situations where it was not best adapted; it was not maintained as it should have been, and it fell into disfavor by the end of the 1950s, particularly on the East Coast. Zoysia is a very persistent slow-growing turf species that has survived winters well in the transition zone. Under low management regimes, when the bermudagrass or bluegrass in competition with it weakens or dies, zoysia replaces it. After observing it slowly dominate companion grasses, turf managers in the transition zone have decided that it has a use. Typically, this use has been in areas where its ability to withstand a low height of cut under a low level of maintenance makes it a very desirable turf species.

This ability to withstand low mowing with minimal maintenance makes it ideal for fairways. Putting greens established to Meyer zoysia on the Naval Ordinance Laboratory Golf Course, in White Oaks, Maryland, testify to this grass's adaptability. These putting greens, mowed at approximately ¼ inch under relatively minimal maintenance, have survived winters for 20 years. These winters are typically mild, yet some have been very severe, such as the winter of 1976-1977. Over the last 20 years, quite a lot of bermudagrass has died from winter-kill in this area. Meyer zoysia is not recommended for putting greens. I mentioned its tolerance to close mowing only to show its ability to withstand close mowing under minimal maintenance levels.

Once it is established, zoysia requires a minimal amount of nitrogen, providing a very satisfactory turf with one to two pounds of nitrogen per 1,000 square feet per growing season. Even these low rates result in a solid, excellent upright turf which provides a very good lie for wood and iron shots when the grass is close-cut. The zoysias have been known to persist for years with no fertilizer at all.

THE ZOYSIAS need far less frequent watering than the cool season grasses, and, since it is almost as drought tolerant as bermudagrass, it resists scalping because of its upright habit of growth, thus providing a uniformly smooth surface after mowing. Bermudagrass, on the other hand, with decumbent growth has a tendency to scalp if it is mowed only infrequently.

Zoysia is quite tolerant of most turf herbicides. Weed control is relatively easy during establishment and often not necessary after the grass has been established. Zoysia is very tolerant of air pollution and heat; thus, it grows well in urban areas. It is quite tolerant of most soil conditions; however, if the pH becomes more acid than 5.5 or more alkaline than 7.5, it will have problems. Zoysia's slow growth makes it a better choice than bermudagrass where encroachment into bunkers is a problem. Zoysia is also more tolerant to shade than bermudagrass.

Although Meyer zoysia is a very desirable grass for fairways in the transition zone, it is not without problems. First, it establishes and grows very slowly. Because of its slow growth rate, the vegetative material required to establish it is costly. Establishment with stolons (sprigs) has a very critical phase. It is critically important that stolons be kept moist for the first 10 to 14 days. When zoysia stolons are allowed to dry, they often fail to establish; there-

fore, plugs are frequently used. Establishment by sprigging can be successful if it is done carefully. Zoysia sprigging requires less man-hours than zoysia plugging and is therefore less costly. Another problem in establishment of zoysia by sprigs is that some leaf material must show above ground; otherwise the sprigs die. Unlike bermudagrass, zoysia will not grow from sprigs if the entire plant is buried under the soil surface.

Although slow establishment has been a primary reason why zoysia hasn't been widely accepted, it has other problems. Mowing is difficult; sharp, heavy-duty reel mowers must be used for best results. The reason for this is that zoysia has more fiber material in the leaf blade than any of the other turf species, and, therefore, it is very difficult to cut with an ordinary mower. Clippings also decompose very slowly. The height of cut must be kept low so that excessive thatch buildup of the accumulated stem and leaf material does not occur. To prevent thatch buildup, nitrogen must not be used in excess. If excessive growth is allowed to accumulate and the turf becomes thatchy, then unstable footing results. It is tiring to walk on zoysia under excessive thatchy conditions, because its surface is similar to a stiff brush where a firm footing is not possible. To avoid this problem, frequent mowing with heavy reel type mowers is desirable. It has been typically found that three mowings a week during the growing season (June, July and August) are required to provide a satisfactory playing surface.

BILLBUG AND nematode problems can't be ignored. Although nematodes don't seem to be a serious problem in most of the transition zone, they are a problem in California, Florida, and Georgia. Both pests are difficult to identify, and they usually cause quite a lot of damage if correct diagnosis is not quickly made. Excessive thatch accumulation appears to encourage billbugs, chinch bugs and other insects. More research is needed on these problems.

Many golfers dislike the tan winter color common to zoysia and bermudagrass, but even when zoysia is tan and dormant, it still provides a very desirable playing surface. However, dormant zoysia will not withstand heavy traffic, and so it should not be used for winter tees. It is more difficult to establish a good overseeding in zoysia than in bermuda. When it is sprayed green for winter color, it retains the dye as well, if not better than dormant bermuda.

Limited research has been done on the possibility of growing a combination Kentucky bluegrass and zoysia turf. Presently, only a few courses in the transition zone use this combination. More research needs to be done on the management of zoysia-bluegrass combination turf. Also, a more open-growing variety other than Meyer might prove to be a more satisfactory warm season companion.

If zoysia is going to be used for fairway turf, one must first consider what method of introduction should be used. Zoysia is basically a vegetative species, although seeds of *Zoysia japonica* can be used to establish a turf. Seeds of zoysia have a hard coat, germinate poorly and the seedlings are very slow to establish. Therefore sprigs, plugs or sod of improved zoysia varieties are preferred to establish fairways. Whether zoysia competes well with existing turf depends somewhat on management practices. Zoysia competes best with

Kentucky bluegrass or creeping bentgrass under low fertility, careful summer fertilization practices and close mowing. Zoysia established from plugs or from sod strips at spaced intervals tends to provide an uneven surface for several years until full zoysia coverage is obtained. Continuous close mowing after establishment will help reduce this problem.

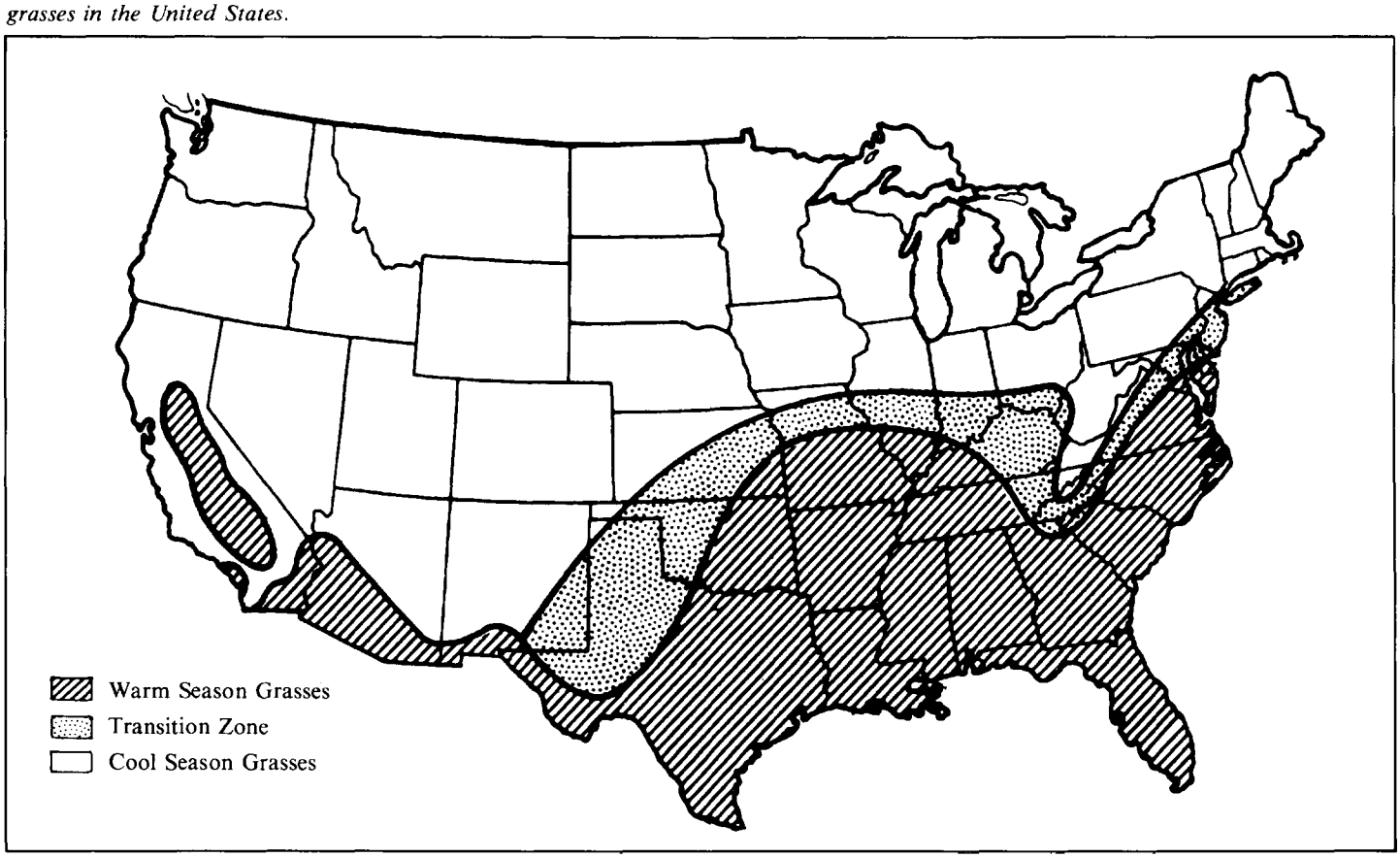
Zoysia established from sprigs spread on a prepared seedbed provides the most satisfactory coverage in the quickest period of time if the sprigging rate is high enough and if properly maintained during the establishment period. Sodding is usually too expensive for most budgets. The need for constant watering of zoysia sprigs during the first two weeks cannot be overemphasized. Sprig preparation is very critical also. The sod from which the sprigs are taken must remain moist as the sprigs are prepared, and the sprigs should be used as soon as they are prepared, and they must be kept moist as they are being spread.

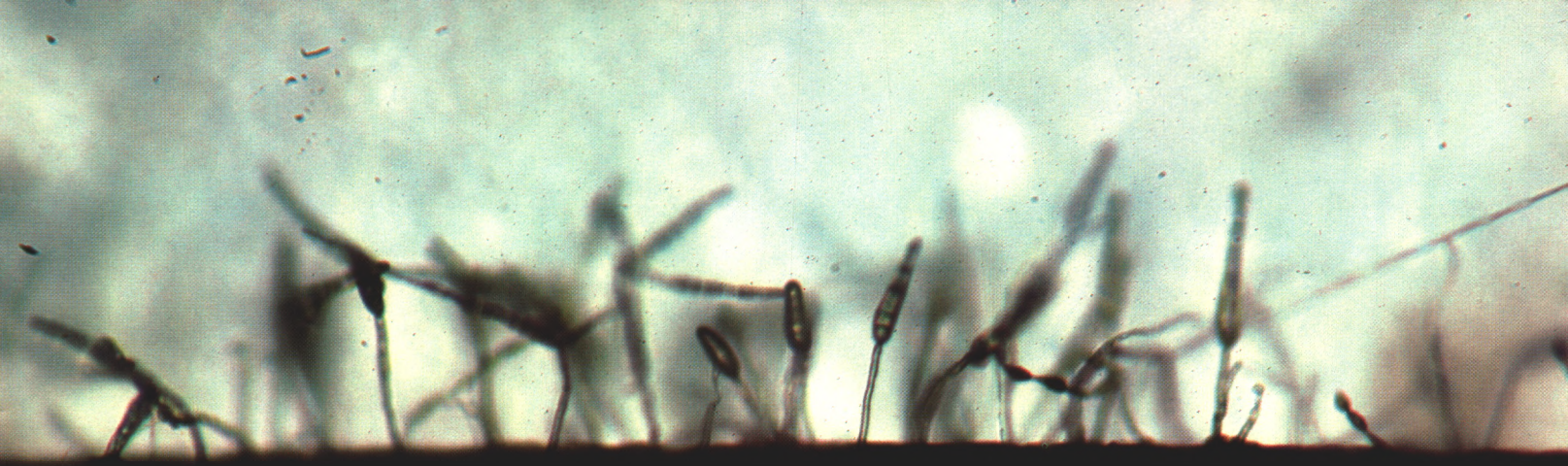
WEED CONTROL can be obtained by the use of methyl arsenates and 2,4-D materials as commonly done for post-emergent crabgrass and broadleaf weed control. These herbicides can be used on plugs or sod immediately after planting. With sprigs, one should wait until the initial two- to three-week period of critical watering has ended to be sure rooting has occurred before attempting any herbicide treatment.

Once complete coverage has been obtained, nitrogen applications should be dropped from the one to two pounds per 1,000 square feet recommended per month during June, July and August to one or two pounds per season, preferably applied in late May, June or July. Excessive nitrogen must be avoided because of the rapid buildup of thatch on an established stand of zoysia. Mowing should be done as follows: the height of cut should begin in the spring at somewhere between 1/3 to 1/2 inch; this should be gradually raised at approximately 1/8 to 1/16 of an inch every month from early June through the end of August. This practice of increasing the height of cut during the growing season will allow the turf to go into the winter a little long. Reducing the height of cut in the spring to a low level should be followed by sweeping to remove debris or blowing the debris off into the rough to prevent thatch accumulation. Unlike most grasses, zoysia clippings do not decompose rapidly. The early close mowing of zoysia should be conducted before greenup in late March in most of the transition zone. This early close mowing promotes faster greenup. If the practice of lowering the height of cut in the spring and removing debris does not keep thatch under control, then a dethatching program will have to be initiated. Dethatching should be carried out in the actively growing period of July and early August. Thatching late in the year is to be avoided.

In summary, zoysia's ability to handle the heat, humidity, air pollution, and close mowing with minimal weed problems and with more winter hardiness than bermuda makes Meyer zoysia and other *japonica* varieties worthy of consideration for fairway turf in the transition zone. It should be emphasized again that zoysia is slow to establish. It does have pest problems, but they do not seem to be any worse than for any other turf species. Properly maintained zoysia provides an excellent playing surface.

Adaptation of warm and cool season grasses in the United States.





Leaf Blight and Crown Rot of Toronto Creeping Bentgrass

by Dr. PHILIP O. LARSEN

Photo courtesy DR. BOBBY JOYNER

Drechslera catenaria sporulation on leaf tissue.

IN THE PAST few years there have been a number of reports from golf courses in the midwest concerning a disease problem on Toronto bentgrass putting greens. The disease has been diagnosed as red leaf spot, which is caused by the fungus *Drechslera erythrospila* (formerly referred to as *Helminthosporium erythrospilum*). Symptoms first appear in early spring as tip dieback and as reddish lesions on leaf blades. As the weather becomes warmer, entire leaves become necrotic, and eventually the whole plant is blighted down to the crown. Usually, several small groups of adjacent plants will be infected, forming reddish-brown, sunken areas approximately one inch in diameter composed of blighted plants. As disease symptoms progress, these infected areas will coalesce so that areas several yards in diameter may be affected. From a distance, the entire diseased area will take on a reddish-brown color. The disease symptoms continue to develop throughout the summer.

Fungicidal control of the disease has been difficult and expensive. In 1975, Meyer and Turgeon reported effective disease control of red leaf spot on Toronto creeping bentgrass with weekly fungicide applications of 6 oz/1,000 sq ft Daconil 2787 or 6 oz/1,000 sq ft of Daconil and 6 oz/1,000 sq ft of Dyrene applied on alternate weeks. These weekly treatments were applied from May through October. Disease control was improved slightly through the application of one to two pounds of nitrogen every eight weeks during the treatment period.

In summer, 1977, turf samples were taken from Toronto bentgrass greens in Ohio that were diagnosed as having red leaf spot. A fungus was isolated from the diseased leaf tissue that did not resemble *Drechslera erythrospila*, the red leaf spot fungus. Instead, a fungus identified as *Drechslera catenaria* was observed. When greenhouse grown Toronto bentgrass plants were inoculated with spore suspensions of the fungus, symptoms similar to those described on diseased plants from golf course greens were observed. The fungus was re-isolated from the diseased plant tissue and again identified as *D. catenaria*. From these studies it was concluded that *D. catenaria* is the causal organism associated with the disease described on Toronto bentgrass. This fungus has since been isolated from additional Toronto bentgrass greens that had previously been diagnosed as having red leaf spot. Discussions with plant pathologists and golf course superintendents familiar with the symptoms of this disease on Toronto indicate that symptoms they

PHILIP O. LARSEN is associate professor of plant pathology at Ohio State University, in Columbus, Ohio.

observed are similar to those associated with *D. catenaria* infected turf.

Drechslera catenaria has not previously been reported as a disease organism on creeping bentgrass (*Agrostis palustris*), but it has been reported on red top (*A. alba*) and colonial bentgrass (*A. tenuis*), which are related plant species. It is proposed that this disease be called leaf blight and crown rot of creeping bentgrass in view of the symptoms that develop in diseased plants. Preliminary greenhouse incubation experiments indicate *D. catenaria* is also pathogenic on Penncross creeping bentgrass. Research is now in progress to determine the relative susceptibility of other commonly used bentgrasses to this fungus. Also, little is known about how the fungus is spread under natural golf course green conditions and how specific weather conditions affect disease development. Field and greenhouse studies have been initiated in an attempt to obtain this information.

IN 1977, FUNGICIDE trials were initiated on diseased Toronto bentgrass greens on a golf course in northern Ohio in an attempt to find an effective control measure. Fungicides that were shown to be effective against red leaf spot were included, as well as RP26019, an experimental fungicide that had shown great promise against other turf diseases. Daconil 2787, Dyrene, Tersan SP and RP26019 fungicides were applied May 16, May 26 and June 7, 1977. No differences in control among treatments were observed throughout May and June. On September 1, however, RP26019 at 2 oz/

(Top) Control of leaf blight and crown rot of Toronto (C-15) bentgrass using fungicide RP 26019 (treatment labeled 5). Note disease severity on adjacent test plots.

(Above) Close-up view of localized infection centers associated with leaf blight and crown rot of Toronto (C-15) creeping bentgrass.

(Opposite page) Symptoms of leaf blight and crown rot of Toronto creeping bentgrass, May 1977. Note reddish cast.

1,000 sq ft was observed to have provided excellent disease control. Observations by the golf course superintendent a few weeks earlier indicated that the Daconil 2787 treatment had provided a moderate degree of control, but the effect was not observable on the September 1 rating.

During the fall of 1977 and spring of 1978, another fungicide trial was undertaken to evaluate more closely the efficacy of RP26019 in control of leaf blight and crown rot. Daconil 2787 at 8.0 oz/1,000 sq ft and RP26019 at 1.0, 2.0 and 4.0 oz/1,000 sq ft were applied as fall/spring and spring-only applications. Fall/spring applications were made on October 7, 1977, and April 12 and April 24, 1978. The October 7, 1977, application was excluded for the spring-only applications. Daconil 2787 performed poorly under these conditions and was not significantly different from the unsprayed control plots, regardless of when the fungicide was applied. RP26019 proved to be an excellent fungicide for control of leaf blight and crown rot. The 2.0 oz/1,000 sq ft spring-only treatment was not as effective as either of the four ounce rates, however. When RP26019 was applied at the one ounce rate, it offered only mediocre control and was not acceptable for a putting green. There appeared to be no significant difference between the fall/spring and spring-only application times for either fungicide at each rate tested.

In conclusion, two applications of RP26019 applied at the 4 oz/1,000 sq ft rate in April will provide excellent control of leaf blight and crown rot on Toronto creeping bentgrass throughout an entire growing season. A fall application of RP26019, however, may be advised for a continued preventive control program. RP26019 has recently been registered and should be available now under the trade name of Chipco 26019.

It is my opinion, based on research data, personal observations and discussions with individuals familiar with this disease problem on Toronto creeping bentgrass, that the disease frequently diagnosed as red leaf spot on Toronto is probably not red leaf spot but a disease named leaf blight and crown rot caused by the fungus *Drechslera catenaria*, a new fungal pathogen on creeping bentgrass. The importance and occurrence of red leaf spot on bentgrasses needs to be evaluated further to eliminate any further confusion between that disease and leaf blight and crown rot.

Conference Proceedings Available

In November 1978, a significant conference took place in Arlington Heights, Illinois. It was the first conference jointly sponsored by four national golfing organizations. It was also the first national conference which addressed itself solely to the topic of wastewater for recreational use, a topic of vital importance to golf course management. Because of the increasing demand on present water supply and possible future restriction in recreational use, it is important to investigate sources of supply other than potable water. Wastewater potentially has great value for irrigating turf. Speakers from throughout the nation assembled to lend their research and experience in the use of wastewater on land treatment. Proceedings covering this two-day conference are now available. It is over 200 pages . . . cost $10.00 per copy and should prove to be an important part of every golf course turfgrass management library. Place your order with any of the following organizations.

American Society of
Golf Course Architects
221 North LaSalle Street
Chicago, IL 60601

Golf Course Superintendents
Association of America
1617 St. Andrews Drive
Lawrence, KS 66044

National Golf Foundation
200 North Castlewood Drive
North Palm Beach, FL 33408

United States Golf Association
Golf House
Far Hills, NJ 07931

Green Section Anniversary Marked for Inverness

Inverness Club, in Toledo, Ohio, was the birthplace of the Green Section of the United States Golf Association in 1920. Coincidently, it was also the year of the Open Championship played at Inverness. A Green Section exhibit will commemorate the Green Section's 59th anniversary at Inverness Club, June 11-17, during the 79th United States Open Championship.

Traction bar is bent and welded across front of hopper.

We Built a Truckster-Mounted Topdresser

by VIC CEDRONE

PINEHURST Country Club, with its five 18-hole golf courses, is a superintendent's delight. Sometimes, though, it also can be a headache. During the height of our season (six months of the year), we receive an average of 280 to 320 rounds of golf daily on each of our five courses. At that time of year, every piece of machinery must be in top running condition. We cannot afford breakdowns in equipment because it is most important that all operations stay ahead of play. Once caught by golfers, production for the rest of the day is minimal. For example, a man can mow 15 fairways without interruption in four hours and then spend four tortuous hours cutting the remaining three fairways in traffic. It's frustrating to the superintendent, annoying to golfers and indeed has significant impact upon the budget. It was at a time like this last year when we decided to improve our topdressing method.

Pinehurst has several topdressing machines, all of which we consider unsatisfactory for one reason or another, i.e., amount of time required to topdress a green, or distribution of topdressing was not consistent. It was our opinion that we could improve upon any topdresser in our equipment inventory, and not only save our time, but also reduce inconvenience to the golfer.

Richard Yow, our equipment manager, is very imaginative and is willing to attempt to fabricate any type of specialty machinery not available commercially. Yow and his crew of

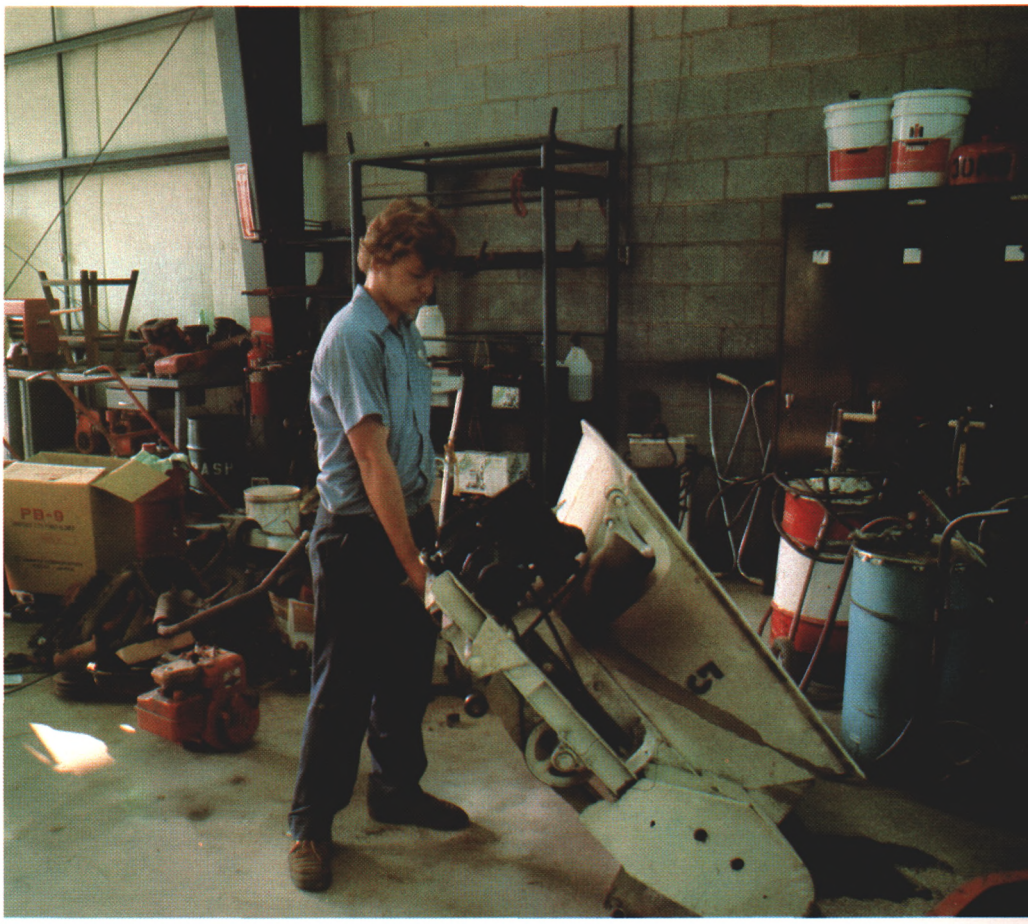
VIC CEDRONE is golf course superintendent, No. 2 Course and No. 4 Course, Pinehurst Country Club, Pinehurst, North Carolina.

mechanics went about the task with abandon. Several ideas were discussed and after thorough study of each, a definite plan evolved to convert our walking topdresser to a mounted, riding model.

The first stage was to cut the front wheel off the topdressing machine. Next, the two sides of the traction frame were heated, pulled together, and welded square across the front of the hopper. The traction and feed shafts were removed. The rear support bar was shortened one and one-half inches, thus allowing the hopper to sit level in the golf cart. The clutch handle was remounted on the left side of the hopper. The feed shaft was cut in half and mounted on the left side of the hopper through the sprocket which pulls the brush. A piece of the old traction frame was cut and welded to the hopper with a pillar block bearing to give support to the chain sprocket and the clutch pulley. The clutch pulley was mounted on the same adjustable part of the frame so that we could still use the standard V belt and chain that comes with the topdresser. Two brackets were then welded to the rear of the topdresser to align it with the rear mounting pins on the truckster's short-dump bed. The gas tank and engine breather were modified so that the engine compartment would not interfere with the truckster seat.

ALL THE PARTS taken from the traction part of the topdresser were re-used; every part on the truckster-mounted topdresser can be ordered from the manufacturer.

We tried it on one green, calibrated it and immediately knew we had a winner. We topdressed 54 greens the first day. We can now topdress an 18-hole golf course in two hours, have the topdressing dragged and watered-in before the golfers catch up. We found the slowest part of the operation was dragging the topdressing soil into the green. We built a drag using 2 x 4's and two steel drag mats and mounted it on a golf cart. Thereafter we moved along very smoothly with little or no interruption to play.



(Top) The remodeled topdresser is now ready for mounting on the truckster.

(Right) The riding topdresser — the finished product. Author Vic Cedrone (left) and builder Richard Yow (right).

Fertigation

by SCOTT A. SINCERBEAU

FERTIGATION, the term for applying liquid fertilizers through an irrigation system, is expanding rapidly on golf courses in South Florida where sandy soils have little nutrient-holding capacity and demand for high-quality turf is intense. Royal Palm Yacht & Country Club, in Boca Raton, Florida, installed a fertigation system in 1976 to help improve playing conditions at a reduced cost.

Our irrigation system consists of four pumping sites with a 40-horsepower turbine pump at each site. All water is pumped from wells. There are 744 valve-in-head centrally programmed sprinklers on a looped piping system covering 120 acres. Because sprinklers cycle on and off in different areas of the golf course, one pump may pump different proportions of the total water supply. Therefore, standard constant volume fertilizer injection pumps would have made equal distribution of the fertilizer into four separate pumping sites impossible.

Recent technological advances allow the precise automatic metering of liquid fertilizers, even on golf courses with more than one pumping site. This induction sensing system monitors the flow volume of water from each pump and injects a specified amount of liquid fertilizer into the irrigation water. If one sprinkler is running, therefore, the same rate of fertilizer is being applied as though 10, 20 or 30 sprinklers are running.

Fertilizer requirements are closely related to water requirements. Soils with higher water retention capacity seem to have a greater nutrient-holding capacity; stress areas, or areas where water retention is low, will also require more fertilizer to maintain quality turf. On a given golf course, where both soil extremes exist, we automatically correct this problem by dialing compensating

Calvin Orr, irrigation technician, checking the operation of the pumping system. Daily checks insure proper sprinkler operation and proper fertilizer distribution.

Close-up of the injection pump showing where the liquid fertilizer is injected into the main irrigation line. The black marks on the fertilizer storage tank allow easy determination of how many tons of fertilizer are on hand.

times on the individual clock stations. Regardless of your soil type or geographic location, whether you use large amounts of fertilizer or relatively small amounts, better turf quality can be achieved more economically with fertigation.

Uniform growth is one of the biggest advantages of fertigation. Liquid fertilizer distributed through any reasonably well-designed irrigation system with induction sensing will give very uniform results. Any one night the water pattern may be disturbed by wind, but on an average, amazing results have been achieved. Also, fertigation does away with the peaks and valleys of growth by applying small amounts of fertilizer regularly, supplying what is needed by the plant from day to day, which is what we have been trying to accomplish for years.

SINCE WE installed our fertigation system, the golf course no longer needs to be closed for fertilization, because minute quantities of liquid fertilizer are automatically applied nightly during the regular irrigation cycle.

Superintendents in this area have actually reduced the amount of fertilizer applied by 15 to 40 percent and have been able to maintain turf superior to what they had with dry fertilizer. This has been accomplished by feeding the plant small amounts of fertilizer as it is needed, eliminating the waste. These percentages represent significant savings. Labor saved in fertilizer application and handling can be put to other uses. It is expected that 600 man-hours will be available that were used to fertilize the golf course in previous years.

In Florida, where golf is played the year around, fertigation is also helping in other ways. Uniform levels of nutrients in the plant during short-term cold snaps help keep the turf strong and gently help the plant grow out after the cold has passed.

The Superintendent has always been concerned with "hot" fertilizers that streak, track or burn. With dilution rates ranging from one gallon of liquid fertilizer in 1,000 to 5,000 gallons of water, there is never a burn. Our total range of dilution using 12 percent nitrogen fertilizer is from zero parts per million to 120 parts per million.

Royal Palm Yacht & Country Club is surrounded by private homes, many with large screened-in patios and pools. Dust from dry fertilizer application has always been a problem. Also, players have had to put up with the course being closed, or at best a portion of the course being closed, so that it can be fertilized. With fertigation, this is no longer necessary.

WHENEVER THE subject of fertigation arises, there are always a number of questions that follow. Some of the most common are: What size are the storage tanks? Where are they located and how are they filled?

At Royal Palm Yacht & Country Club our tank capacity is 1,250 gallons, over six tons of fertilizer each. They are above ground at each pump

Superintendent Scott Sincerbeau adjusting the rate of fertilizer to be applied. This adjustment takes only a few seconds and is very accurate.

site, and they are filled by the suppliers' trucks, which are equipped with pumps and hoses.

Do the injection pumps mount near the irrigation pumps? Our injection pumps are relatively small, with a capacity of 18 gallons per hour, and they are mounted in a convenient location at the pump site. They are plummed into the pressure side downstream of the irrigation pumps.

Is this fertilizer a foliar fertilizer? The product applied to golf courses through the induction sensing system is a ground application grade of clear solution fertilizer. Some foliar feeding takes place in both trees and turf, but nutrients are taken up mainly by the root system.

How does liquid fertilizer affect trees? Can you see a difference in their growth? Deciduous trees under fertigation on golf courses get their new leaves up to two weeks earlier than those outside the perimeter of irrigation. They also appear to be more vigorous, hold their leaves longer and seem to grow somewhat faster.

Does the use of liquid fertilizer limit us to certain analyses? No, the liquid fertilizers can be ordered in any complete fertilizer ratio required by particular soil or turf conditions with the micro-nutrients that are regularly supplied in South Florida. Also, nitrogen sources can be changed to assist in pH control. Even with special formulations, prices are comparable to dry fertilizers and decidedly less expensive than slow-release type fertilizers.

How much does the liquid fertilizer cost a gallon? Liquid fertilizer is purchased by the ton. You apply it the same as dry fertilizer, by pounds of nitrogen to the acre.

How does the actual cost per acre compare with conventional fertilizers? I have compared prices of dry inorganic, slow-release and liquid fertilizer to determine which would be most efficient and most economical. Dry inorganic 16-4-8 fertilizer at the rate required by our geographic location and our soil structure would cost about $150.00 per acre per year. Slow-release type fertilizers to give us equal amounts of nutrients would cost from $200.00 to $280.00 per acre per year, depending on the product used. Liquid fertilizer at equal rates costs us less than $130.00 per acre per year.

WHAT HAPPENS IF an irrigation pipe breaks and runs all night? There is no burn, as one might think. At 35 ppm nitrogen there may be a lush green spot, but after a blowout and a successful pipe repair, the turf needs a little extra nutrition to help it heal over anyway. Today many courses have automatic low-pressure cutoff switches to eliminate waste of water and fertilizer.

Will the fertilizer deteriorate the pipes or sprinklers? Our natural irrigation water has more soluble salts than is contributed by the liquid fertilizer we use. We don't consider the diluted fertilizer to be a problem. As long as it is handled properly, no unusual pipe or sprinkler deterioration is foreseen.

A much asked question is: What's the catch? Where are the bad points? I can honestly say that I have found no really bad points with this system. Sometimes, during long, rainy periods when the irrigation system is turned off, the turf gets no fertilizer. When the system is turned back on, the fertilizer rate can be increased until required monthly rates are applied. There is great flexibility with the induction sensing system.

The most asked question of all is: How much does it cost to install? The cost depends entirely upon the individual course and the type of pumping system on hand. In general, the storage tank and sensing system for each pumping station approximates the cost of a large dry fertilizer spreader. Royal Palm Yacht & Country Club has the most sophisticated fertigation system on a golf course in Florida and most likely in the world. The system has already paid for itself several times. It has freed building space that was previously used for dry fertilizer storage. Now a proposed $40,000 equipment storage building is no longer needed.

Fertigation is a new tool to help the golf course superintendent produce high-quality turf and control his budget. Some superintendents are presently using this tool as a supplement, some are using it as a basis of all fertilization. Regardless of how it is used, in the end it is going to help create better quality turf at a lower cost with less interrupted play. In the future it will become more and more widely used as people see and experience the improved playing conditions it helps to create.

SCOTT A. SINCERBEAU is the golf course superintendent at the Royal Palm Yacht & Country Club in Boca Raton, Florida.

Questionnaire on Recycled Water

Question 1. Do you presently use recycled water on a turfgrass area?

Answer: 26 indicated that they presently use recycled water. 25 of these responses were from golf courses.

Question 2. Are you considering recycled water as a possibility in the near or distant future?

Answer: 19 indicated that they are considering using recycled water in the near or distant future (7 in the near future, 12 in the distant future). 18 of these responses were from golf courses, the other from a University research area.

Question 3. What is your source of recycled water?

Answer: Primary sources of recycled water —

Municipal	16	Military	2
Housing Development	5	Other	2
Industrial	1		

Question 4. How many acres do you irrigate with recycled water?

Answer: Average for 26 facilities — 100 acres
Answer: Median for 26 facilities — 80 acres
Answer: Range — 12-295 acres (includes 36-hole facilities)

Question 5. What type of facility do you operate?

Answer: Type of Facility (using or considering using recycled water) —

Private	18	Military	3
Municipal	4	Resort	11
Daily Fee	4	Other	3

Question 6. Do you know of any other turfgrass facility using recycled water?

Answer: The questionnaire respondees supplied the names of nine other golf courses or multiple-course facilities which are now using recycled water. They also indicated that two other facilities are in the process of converting to recycled water systems.

Question 7. If you use well, pond or city water for irrigation, how many gallons do you use annually?

Answer: 20 facilities reported the number of gallons of water they use annually. These responses did not come from facilities now using recycled water. Average — 82 million gallons per year for 18 holes; Range — 3.5-200 million. Several courses reported from arid western states where fence-to-fence irrigation is practiced.

Miscellaneous: A total of 62 responses were obtained from the survey. There were 17 responses from golf facilities which are not now using or considering using recycled water. However, many of these responses contained information pertaining to and included in Question 7. A few also listed the names of facilities which are now using recycled water, information which pertains to Question 6.

This Questionnaire was prepared by members of the American Society of Golf Course Architects, the National Golf Foundation and the USGA Green Section. It appeared in *Golf Business* and the September/October, 1978, *USGA Green Section Record.* Analysis by James T. Snow, Northeastern Agronomist, USGA Green Section.

USGA GREEN SECTION RECORD
MAY/JUNE 1979

TURF TWISTERS

DEW

Question: Why is dew removal from greens so important? (Georgia)

Answer: Dew is composed of condensation and internal exudates from the grass plants. These exudates contain carbohydrates, amino acids, nutrients and other materials which are an excellent growth medium for disease spores. Removal of dew can be done by whipping, mowing, or light syringing, which will not only eliminate this favorable medium for disease but will allow for faster drying of turf.

STOP WATERING

Question: We were forced to stop watering our bermudagrass fairways this summer because of a lack of sufficient water. Will this cause them to die? (Oklahoma)

Answer: No! Bermudagrass will survive a summer drought without water. The stand may be a little thinner than normal next spring and additional fertilizer at that time would be desirable. If the stand is thin going into winter, then winter annual weeds may become thick enough to require some control measures. If the drought ends a month before expected frost, 400 pounds of a 10-10-10 fertilizer or 10-5-10 might be desirable. Fertilizer applications should not be made later than this in the fall.

A PERNICIOUS WEED

Question: My golf course is located in Southern California, and we have a tremendous problem in keeping kikuyugrass out of the common bermudagrass tees. Any suggestions? (Southern California)

Answer: Kikuyugrass *(Pennisetum clandestinum)* is a vigorous weed pest along the California Coast. Indeed, many courses are now 100 percent kikuyugrass. This grass is extremely aggressive, and thatch control in fine turf areas becomes very difficult. The most successful control method to date is applications of glyphosate (Roundup) in the late summer or early fall.

Consideration might be given to use of a hybrid bermudagrass, such as Tifgreen or Santa Ana, on tees. These hybrids form a denser turf than common bermudagrass. A denser turf is always a deterrent to weed invasion.