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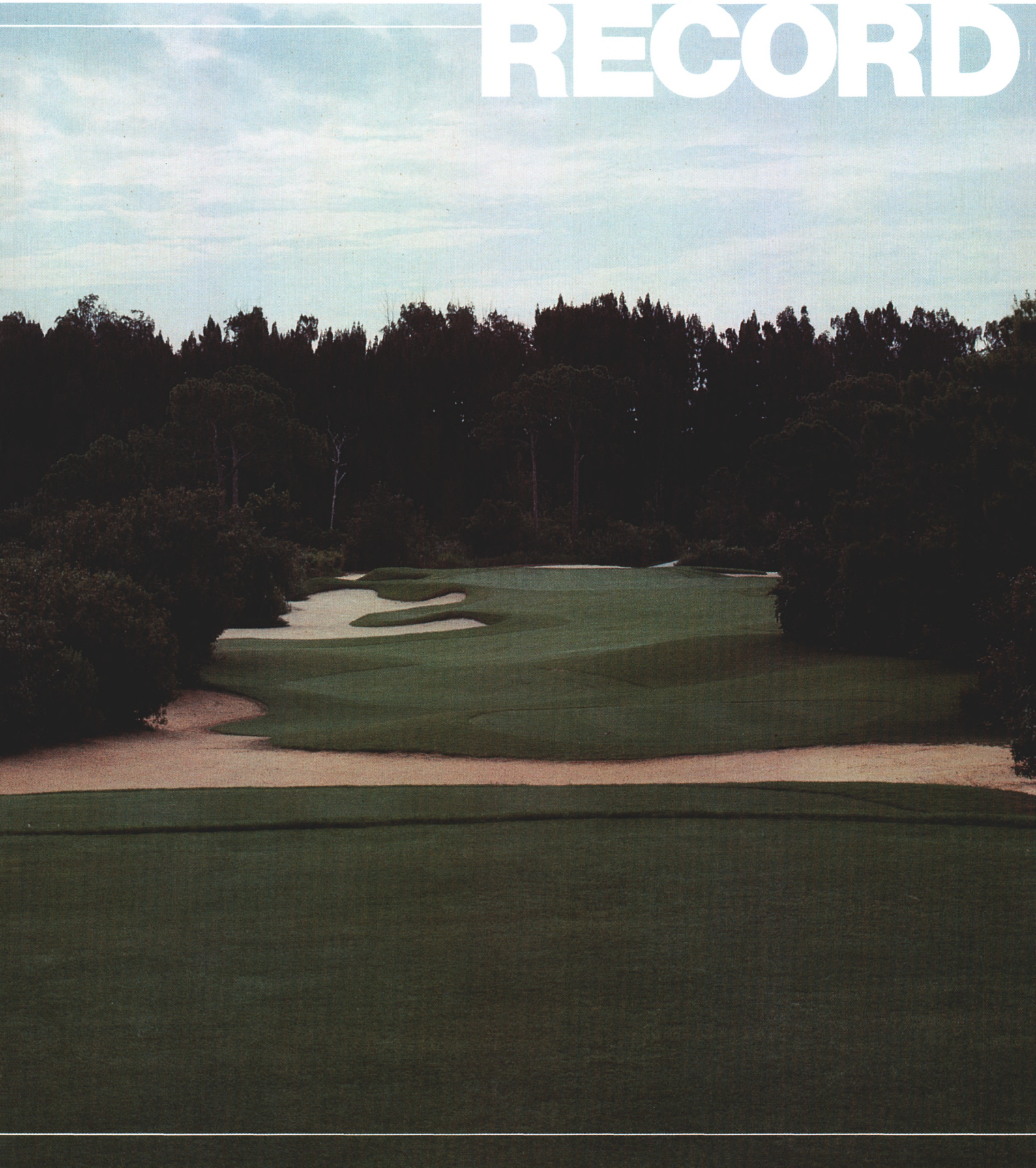

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Cover Photo:
Blending with the environment — John's Island West.

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Hole #13, John's Island West Course.

Golf Courses and the Environment: What's the Future?

by JOHN H. FOY
Agronomist, Southeastern Region, USGA Green Section

FOR THOSE OF US in the turfgrass and golf course industry, the good news is that the game of golf is experiencing a tremendous surge in popularity. The National Golf Foundation estimates that there are 21.7 million golfers in the United States, and by the year 2000, the number of players could easily exceed 30 million. To keep up with both present-day needs and the rapidly increasing number of golfers, it has been suggested that approximately 4,000 to 5,000 courses need to be built over the next 10 years. Thus, if current trends continue, there will be tremendous opportunities for individuals in the turfgrass and golf course maintenance industry.

The bad news is that growing environmental concerns about golf course construction and maintenance practices could cause a restriction on the number of new courses that will be built, and could affect the quality and cost of course maintenance at existing facilities.

During the late 1950s and into the 1960s, golf courses were viewed in a very positive light. Besides being a recreational facility and increasing a community's economic base, golf courses were considered to have a positive impact on the surrounding environment. The health and environmental benefits of a good stand of turf were published by The Lawn Institute, in Pleasant Hill, Tennessee. The list of benefits includes:

- Water purification and conservation
- Erosion control and soil building
- Oxygen generation

- Absorption of pollutants and entrapment of particles (dust)
- Fire retardation
- Temperature modifications
- Allergy control
- Noise and glare reduction

In effect, the establishment and maintenance of golf courses and other "Green Belt" areas within urban communities was promoted and accepted by the public. But today, due to the way environmental and pesticide issues are being reported by the news media, the general public could easily get the impression that golf courses and other highly maintained turf areas are not much safer than an active hazardous waste disposal site.

A classic example of negative reporting occurred in 1982 with the unfortunate death of a navy lieutenant after he had played the Army/Navy Golf Course. Because an application of the commonly used fungicide chlorothalonil (Daconil 2787) had recently been made to the golf course, the ensuing headlines gave the immediate impression that a pesticide was the cause of the lieutenant's death. One golf magazine even hit the newsstands with a "Killer Course" cover. It was later reported that the lieutenant's death was due to a rare, rapidly progressive disease called toxic epidermal necrolysis, which was unrelated to his exposure to the chlorothalonil. Unfortunately, the public's perception of golf course pesticides was affected by the "emotional shock" type of journalism that was practiced.

In Vermont, the construction of a golf course has been blocked by the Vermont Environmental Board because of a perceived damage the course would have on the surrounding environment. Despite an extensive, comprehensive program to protect the surrounding environment, including overwhelming expert testimony that the potential for a negative impact on the surrounding environment is very minimal, construction of the course has not been permitted. Unfortunately, politics and emotional issues have overridden all other aspects of the project. Furthermore, as a result of this case, new state regulations have been proposed in Vermont that would require that an extensive data package be submitted before a pesticide use permit would be granted to any course. It has been estimated that the cost of compliance could be as high as $50,000 per facility, per year.

Today, not a day passes that doesn't include reports by the news media on the negative aspects of pesticide use and the declining quality of our environment. Thus, if the golf course maintenance industry is to thrive and meet future demands, those of us in the industry must take an active role in promoting the benefits of golf courses, researching environmental issues, continuing to practice sound environmental stewardship, and educating the general public on the real facts of these issues.

Dr. Thomas Watschke's recently published research (GREEN SECTION RECORD, May/June 1989) reported the benefits of a high-quality turfgrass stand in reducing surface runoff and keeping nutrient and pesticide concentrations in leachate water to an absolute minimum. This work is an excellent beginning, but much more work must be initiated and completed in order to cover the entire range of environmental issues before us.

Sequence of John's Island West site. Before: Sand pine.

During: Selective clearing to enhance native vegetation.

AT THE June, 1989, meeting of the USGA Turfgrass Research Committee, a proposal was made to conduct an exhaustive review of the current research literature on this project. After the review has been completed, the Committee will develop guidelines for future research needs, along the same line as the current 10-year research effort to significantly reduce water usage and maintenance costs of golf courses. Golf course owners, developers, and club managers, the PGA, golf course superintendents, golf course architects, and even individual golfers, must actively support turfgrass research for this worthwhile goal.

Across the country there are golf courses where environmental stewardship is an integral part of basic course management. Mr. Tim Hiers, Golf Course Manager, and his staff at the John's Island Club in Vero Beach, Florida, have successfully integrated sensitive environmental situations and routine course management into an effective, total management strategy. When Mr. Hiers first came to John's Island, a project was initiated to correct shade and poor air circulation problems that had limited turfgrass growth in a number of areas through the 36-hole existing facility. A selective pruning and vegetation removal project is now in the final stages, and turfgrass growing conditions and the health and quality of the native vegetation have been greatly improved. One of the primary components of the native tree population on this course is the cabbage palm, where pileated woodpeckers commonly nest. To make sure that the woodpeckers' habitat was not compromised, great care was taken in selecting the cabbage palms to be removed.

Mr. Hiers has also had the responsibility of supervising construction and maintenance of the new John's Island West Course, located a few miles inland from the beach courses. The Tom Fazio designed course is located in a "sand pine scrub" habitat, which is one of Florida's rarest and oldest ecological communities. Throughout the design and construction phases, as well as with ongoing course maintenance, priority has been given to preserving the environmental balance of the entire site. After a review of the West Course, Mr. John Fitzpatrick, Executive Director of the Archbold Biological Station, a privately funded research facility in Lake Placid, Florida, commented: "The course acts as a refuge for at least 10 of Florida's most endangered plants and animals (such as the Florida Scrubjay). It can serve as a landmark course, protecting an endangered ecological community while maintaining the highest possible aesthetic and golfing standards."

The John's Island Course is a shining example of how a new course can be built and maintained in a sensitive environmental situation so that positive environmental stewardship reigns. But what about the thousands of courses across the country where environmental stewardship was not really taken into consideration during the design and construction and the development of the original management programs? Can current standards and future demands be met? With the help of today's technology and the information from tomorrow's research, the answer to this question should be a definite yes. It is absolutely essential, however, that a conscientious effort be put forward to consistently utilize management programs and practices that favor a balanced environmental situation.

After: Picture of third hole at John's Island Club, the finished project.

WITH the 1990s rapidly approaching, it would be appropriate for every golf course to conduct an in-house review of its impact on the surrounding environment. Basic issues such as pesticide and fertilization use and irrigation practices should be considered, along with the composition and quality of the total plant and fauna community, area hydrological characteristics and the public's perception of the impact of the course on the community.

Presently, there are about 10,000 pages of federal regulations related to the various facets of golf course maintenance. Compliance with all of these regulations is a monumental undertaking for an individual club. The advent of regulatory compliance assistance programs, then, must be viewed as a positive and essential aspect of our golf course operations in the future. Taking advantage of one or more of these programs would seem to be a sound approach to minimizing the potential for repercussions due to a negative environmental situation.

Finally, it behooves all of us in the industry to actively pursue educating the general public on the facts of pesticide usage. There are "environmentalist" groups that have purposely misconstrued information on pesticide

(Top left) Protecting groundwater supplies by installing new fuel tanks with liners and monitoring wells.

(Bottom left) Wildlife enjoying the golf course.

usage and its impacts in order to scare the public and create a totally negative attitude towards all pesticides. A recent example of this was the Public Citizens Congress Watch report, dated April 18, 1989, which reviewed the effects of the pesticides most commonly used by the lawn care industry. Several prominent members of the scientific community have reviewed this report and have stated that, in their opinion, the claims it makes are not supported by scientific data.

It has been said many times that the risk of exposure to hazardous materials is much greater inside the home than it is in conjunction with agricultural pesticide use. Nevertheless, considering the high visibility of pesticide usage on golf courses, it is essential to make sure that every precaution is taken to handle, apply, store, and dispose of all pesticide materials in the safest manner.

In some states, it is presently acceptable for an unlicensed individual to apply certain pesticides under the supervision of a certified pesticide applicator, but it is quickly becoming standard policy that only licensed spray technicians are allowed to handle, apply, and dispose of pesticide materials. Practicing and promoting a management philosophy of adhering to or exceeding all state and federal pesticide regulations is a must. Some extra costs might be incurred, but it can easily be justified if due consideration is given to the potential cost of a pesticide-related accident.

In summary, the future looks bright for the game of golf. With a fast-growing number of golf courses and golfers, there is also great promise for an expanding golf course maintenance industry. The pesticide issue, though, is one that could threaten the growth of the game by robbing golf course superintendents of some of the tools they need to maintain decent quality golf courses. Therefore, if the industry is to keep up with current demands, let alone meet future needs, then active support of turfgrass research, sound environmental stewardship, and a continuing educational effort will all be essential.

Maintaining Adequate Phosphorus Levels in Sand Greens

by Dr. Paul E. Rieke
Department of Crop and Soil Sciences, Michigan State University

MOST putting greens built today are constructed with high sand content mixes because of the need for good soil drainage and compaction resistance. The large pore spaces, low surface area, and low cation exchange capacity that are characteristics of sandy mixes, however, result in soils that are quite susceptible to leaching of nutrients, particularly nitrogen and potassium. The addition of soil to the mix, as suggested in USGA specifications, is helpful, but such a mix is still predominantly sand and requires careful management (fertilizer selection and timing, irrigation programming) to protect against leaching. Sand/peat mixes are somewhat more susceptible to leaching than the soil-based mixes.

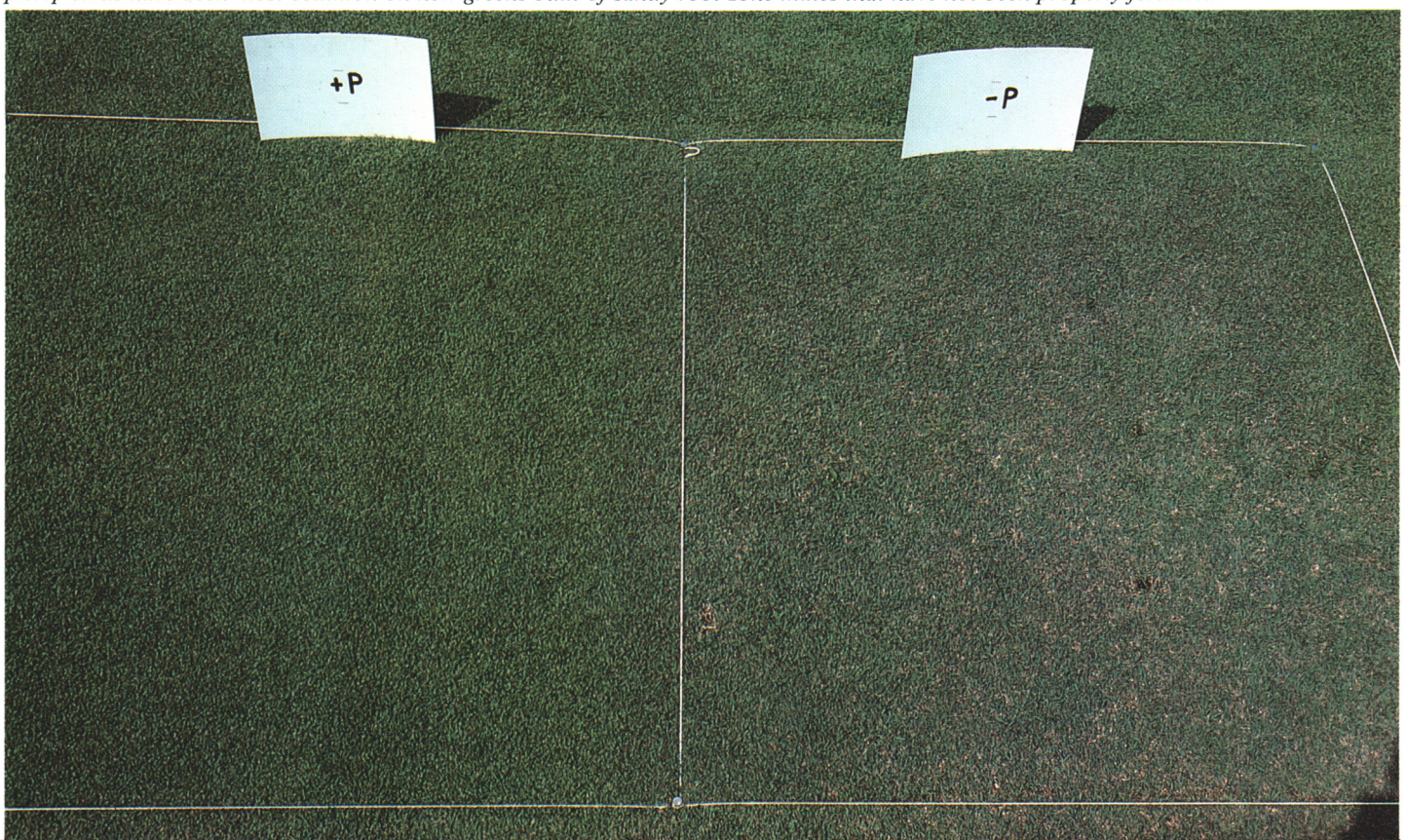
With ever-increasing concerns for protection of water quality, more and more emphasis will be placed on careful management of nutrients on golf courses in the future. There have been several instances recently in which golf course developments have been significantly delayed or restricted because of the concern for pollution of ground and surface waters with nitrates and phosphates. While some of this concern is based on a lack of understanding of turf and soil conditions, managers must be aware of the potential for nutrient pollution of surface and ground waters. Appropriate fertilization and irrigation programs can then be implemented to prevent a pollution problem from developing.

While the potential for leaching of nitrates and potassium are generally understood by most golf course superintendents, the fate of phosphorus in soils is not as well understood.

The chemistry of phosphorus in soils is very complex. Phosphorus has a much lower solubility in the soil than nitrates or potassium, but it is, nevertheless, somewhat soluble in water. While there are several reasons for the relatively low solubility of phosphorus, one is related to surface area of the soil. Soils with greater amounts of silt and clay have very high surface areas, and phosphates are sorbed on these surfaces by way of a mechanism that has little to do with cation exchange capacity. Conversely, sands have a much lower capacity to sorb phosphorus because of their low surface areas. Despite what you might think, the addition of peat to sands for green construction adds very little phosphorus sorption capacity.

Most soils on greens which have been in use for years test very high for available phosphorus. Consequently, most fertilizer programs for greens have incorporated very low levels of P_2O_5 annually. On new greens established on sandy mixes, though, these low-phosphorus programs have often not been adequate. How much phosphorus is needed to establish and maintain healthy putting green turf while protecting against the leaching of phosphorus? There is some evidence from

Phosphorus deficiency (on the right) is characterized by very slow growth, low turf density and a purplish green turf color. Deficiencies of phosphorus have been most common on new greens built of sandy root zone mixes that have not been properly fertilized.



the literature, but more research is needed to answer this question.

Textbooks point out the need for phosphorus in both establishment and maintenance of turf, but of particular note is the need for phosphorus during the establishment period. Since phosphorus has a relatively low solubility, the roots of young turf seedlings must grow to where the nutrient is. The application of extra phosphorus to the seedbed, then, is essential for best establishment success. A recent article reported the response of creeping bentgrass to light, frequent applications of phosphorus to a sand green. Turf response to the first increment of phosphorus was dramatic, but a good-quality turf was subsequently maintained at very low available soil phosphorus levels.

Studies at Michigan State University on the response of Penncross creeping bentgrass putting green turf to phosphorus applications were initiated on three types of soils in 1983. The soils were dune sand, coarse sand mixed with 20% peat by volume, and fine sandy loam. Annual applications of P_2O_5 were made with finely ground 0-46-0 at the rates shown in the tables. Clippings were routinely removed from the site, and irrigation was applied to prevent wilt. Three applications of each treatment were made. Soil samples were taken in the fall of 1983 and the fall of 1988 before applications of P_2O_5 were made.

It is clear that the dune sand holds very little phosphorus (Table 1). When high rates were applied, there was movement noted into the 2- to 4-inch depth in the 1988 tests. Within about one year, traditional phosphorus deficiency symptoms began to appear, characterized by lack of growth, loss of turf density, and the typical dark, purplish green color. Even weeds did not grow in such a phosphorus-deficient growing medium. With the first application of phosphorus, the deficiency symptoms disappeared. Turf quality remained very good even with extremely low soil phosphorus tests (11 pounds per acre in 1988).

When the plots were first established, in 1981, some phosphorus had apparently been applied. This was evident from the soil test results in the sand/peat mix in 1984 (Table 2), where the check plot had a test result of 47 pounds per acre. However, with continued clipping removal, phosphorus deficiency developed in 1988 and became very evident in 1989.

The fine sandy loam soil had a very high phosphorus level at the time of establishment and, while phosphorus levels had increased somewhat, at higher rates it is clear that essentially none had moved into the 2- to 4-inch depth by 1988. Obviously, fine-textured soils have a high-phosphorus sorption capacity.

Managing phosphorus fertilization on sandy greens requires a different approach than on soil-based greens, and golf course superintendents should use soil tests regularly to determine phosphorus needs. If the turf is healthy, dense, and vigorous, application of P_2O_5 may not be necessary even if soil tests suggest it should be applied. The turf should be watched carefully, though, to be sure deficiency does not occur. The approach is particularly appropriate in areas where there are lakes or streams nearby or where a shallow water table exists.

All turf managers should use every tool available to protect the environment while providing a good-quality, stress-tolerant turf. Careful planning of the fertilization program is one important aspect of accomplishing these goals.

TABLE 1
Phosphorus treatment effects on Bray P1 soil tests of a putting green growing on dune sand

Treatment	Bray P1 soil tests, lbs./acre		
P_2O_5 lbs./1,000 sq. ft.	1984	1988	
	0-3 inches	0-2 inches	2-4 inches
0	11 c*	7 c	8 c
1	14 c	11 c	9 c
2	21 b	29 b	28 b
4	34 a	63 a	43 a

*Means in columns followed by the same letter are not significantly different from each other at the 5% level of significance using Duncan's Multiple Range Test.

TABLE 2
Phosphorus treatment effects on Bray P1 soil tests of a putting green growing on a mixture of sand and peat

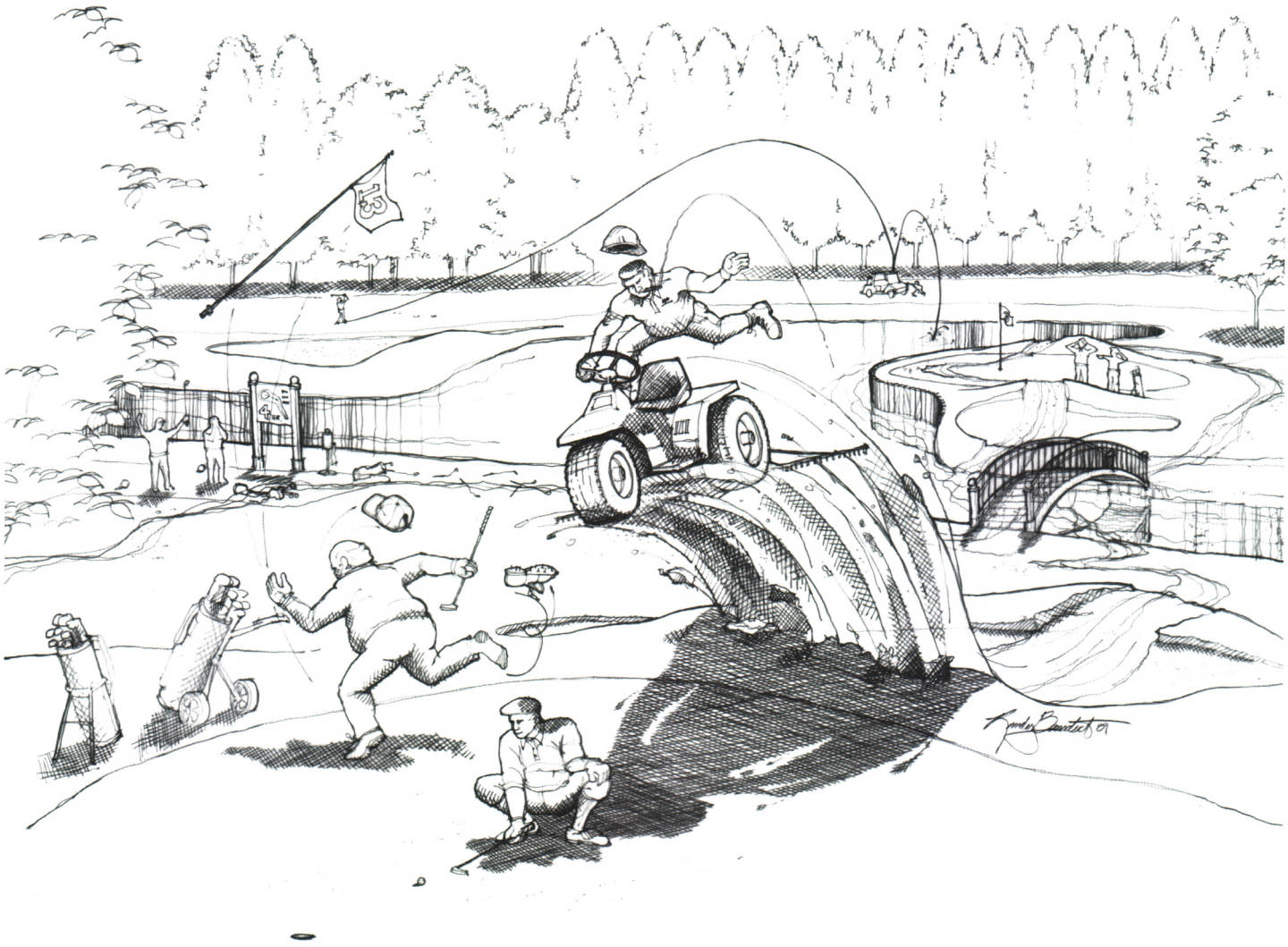
Treatment	Bray P1 soil tests, lbs./acre		
P_2O_5 lbs./1,000 sq. ft.	1984	1988	
	0-3 inches	0-2 inches	2-4 inches
0	47 d*	11 d	5 d
0.5	94 c	50 c	16 c
1.0	161 b	97 b	31 b
2.0	247 a	215 a	82 a

*Means in columns followed by the same letter are not significantly different from each other at the 5% level of significance using Duncan's Multiple Range Test.

TABLE 3
Phosphorus treatment effects on Bray P1 soil tests of a putting green growing on a fine sandy loam soil

Treatment	Bray P1 soil tests, lbs./acre		
P_2O_5 lbs./1,000 sq. ft.	1984	1988	
	0-3 inches	0-2 inches	2-4 inches
0	126 b*	141 b	157 b
0.5	132 b	159 b	153 b
1.0	189 ab	213 b	163 b
2.0	275 a	375 a	149 a

*Means in columns followed by the same letter are not significantly different from each other at the 5% level of significance using Duncan's Multiple Range Test.



TAKING A LOOK AT THE WHOLE PICTURE

by JAMES CONNOLLY
Agronomist, Northeastern Region, USGA Green Section

EACH DAY, golf course superintendents work hard to dress, groom, and manicure their courses to provide what they hope will please most of the club's golfers. Too often, though, they fail to consider the total picture.

Everything we do sends a message to everyone who has contact with us and with our activities. In a golf course setting, this could mean that hundreds of eyes are on the superintendent and the product of his work each day. They include the members and golfers, who pay his salary, and his employees, who look to him for leadership.

Surveys indicate that 55% of what people think we are saying is conveyed in our facial expressions, 37 in our tone of voice, and only 7% in our words. Possibly, what we think we are saying is not actually what they are hearing. The truth is that "deed is greater than word."

Today's golf course superintendent is far more than just the "keeper of the green." The golf course, including every square inch within the property boundary, is an important statement about him and his attitudes. Each day, people in hope of peaceful escape pour through the gates, leaving the race to the rats, and tee it up. Their expectations increase proportionately from the $5 per round pitch-n-putt to the $200 per round Maui-Luna-Exotica, but, of course, there are those who expect far more than they are willing to pay for. Regardless of the situation, though, the superintendent should make sure that his 150-acre advertisement says something positive.

There are three ways of communicating — verbal, written, and nonverbal. Many people make a conscious effort to improve their verbal and written skills, but the most frequently neglected type,

RANDY BENEDICT created the illustration above. He is a dedicated golfer (rain or shine) and an architect with the firm of Wyatt Stapper Architects in Seattle.

the nonverbal message, could be shouting all kinds of obscenities! Don't despair, though, for it is possible to control the nonverbal messages being sent out. Following are several areas that play an important part in how golf course superintendents are viewed by their employees and by the people who play their courses.

The maintenance facility is a sore spot for many superintendents. Club officials seldom come begging with plans for building a new state-of-the-art maintenance facility. In many cases, the term "barn" is an understatement. Keep in mind, though, that what you do with what you have is more important than what you have. In other words, an ancient building and fossilized equipment that are kept tidy and in good working order will lure respect and sympathy, and may result in a new facility. Don't allow your building to look like a ruin.

We've all heard the saying "clothes make the man." The following story helps to illustrate the importance of this statement.

> A successful businessman was interviewing prospective partners for a venture he was undertaking. After several minutes of introductions, he crawled beneath the table. Emerging several seconds later he shook the hand of an astonished prospect and said, "Welcome to my company. You've got the job!" Later, the new partner asked how he came to be selected without an in-depth interview. The sapient businessman said, "My father always said you can judge a man by the shine of his shoes, and you had the best-polished shoes."

Dress codes for you and your crew show that you are a team, working together in a common effort to provide a service to those who play the course. Uniforms can take the form of golf shirts and work pants, T-shirts with logos, hats, etc. The staff usually appreciates the supply of clothing; it saves them money. Some clubs supply the crew with five sets of shirts and pants, for which they are responsible.

Equipment is a very visible part of every maintenance program. Is it painted? Do the mufflers work? How fast can it go? Perhaps it goes too fast, and the golfers catch a fleeting glimpse of Mario Andretti on a mower. How the equipment is operated sends a message about the degree of competence of the superintendent and the crew. Operators need to be trained to recognize a mower that is out of adjustment, and how to check for a good-quality cut.

Training should include the placement of tee markers, cutting new holes in the greens, raking bunkers, and many other operations, and employees should be taught to judge their work by *your* standards, not their own. Machinery operators should turn off equipment when golfers are within range. Try to arrange mowing and other routine practices so that the same groups of golfers are not regularly disturbed.

Mowing patterns can have a dramatic effect on even the most inexperienced golfer. Like the view of a Midwest farm from an airplane, a straight-lined, symmetrical mowing pattern on a golf course has a pleasing effect. Crooked and wavy lines can lead golfers to suspect the sobriety of the operator and the interests of the superintendent. On the other hand, golfers often comment on a beautiful fairway solely on the basis of a nice mowing pattern. Take the time to show the operator examples of what the finished product should look like. This is an easy method to create a positive visual impression.

How coarse is this course?

Employees are a superintendent's most valuable asset, and they look to him for guidance and leadership. How do they view him? Is his office area neat? If it is not, they may become sloppy in their own work habits. People learn best by example. If a superintendent can't do it, or won't do it, the crew may lose motivation and develop a lack of trust in his ability. Key employees should be sent to educational seminars. It makes them feel important, and gives them a feeling of greater self-worth. It also improves productivity, and makes the superintendent look better in the eyes of the golfers.

Don't belly up to the bar with the membership. Alcohol and job security don't mix, so be cautious about socializing at your place of business.

A short quiz will help summarize some key points about nonverbal communications on the golf course. Score yourself on the following basis: 1 = worst (no), 10 = best (yes).

1. How would I rank the appearance of the maintenance facility?
2. Do I pick up trash and debris as I drive around the grounds?
3. Do I provide comfortable quarters for employee breaks?
4. Do I have a set of clean dress clothes in my office?
5. Does my club have a committee for beautification?
6. Does my budget include a section for uniforms?
7. How would I rate the appearance of the equipment?
8. Do I hold at least two seminars a year for the maintenance staff on proper work etiquette?
9. Do I have posted, written policies on proper employee behavior?

To score yourself: A total score of 80 - 90 = TOPS; 60 - 80 points = Room for improvement; 40 - 60 = Needs more work; less than 40 points = Get going before it's too late!

Finally, don't lose sight of the fact that we all serve the people we work for. The "us versus them" attitude makes for ulcers, unhappiness, and low job security. It is the little things that people notice, including fixing ball marks, replacing divots, and picking up candy wrappers. Attention to these details shows that you care.

When you take the time to evaluate the whole picture, those whom you have worked so hard to please will be appreciative. After all, isn't that our greatest reward?

Encroachment of Bermudagrass into Bentgrass Greens

by Dr. B. J. Johnson
and Dr. R. N. Carrow
Department of Agronomy,
University of Georgia, Griffin Station

Figure 1. Encroachment of bermudagrass into bentgrass green.

Figure 2. Tifway bermudagrass planted into Paraquat-treated bentgrass.

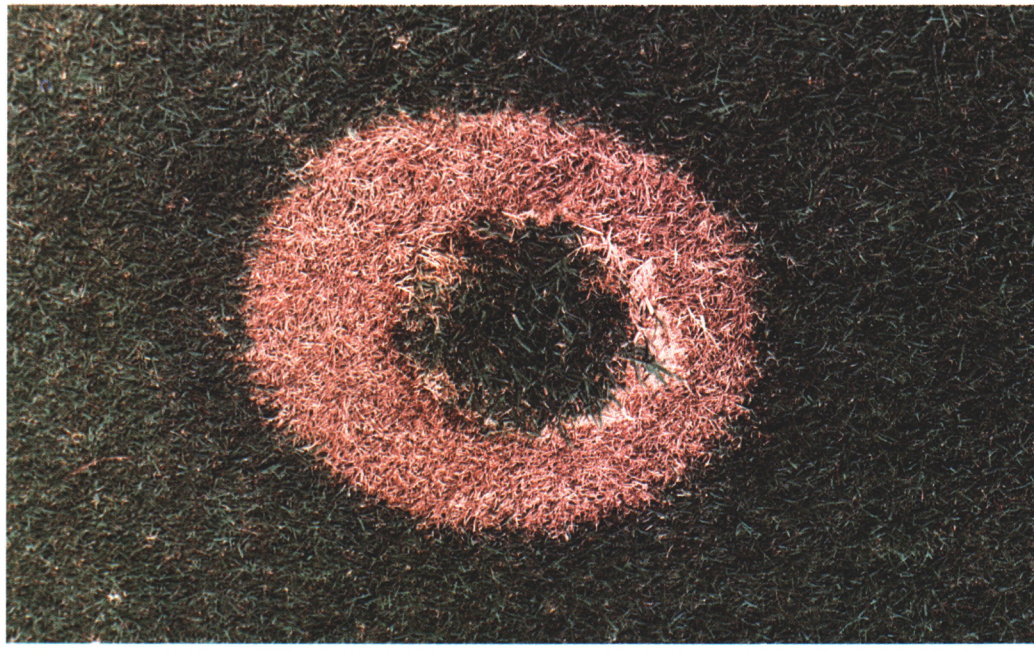


Figure 3. Moderate bentgrass injury from Prograss & Cutless applied April 19. Left, Prograss & Cutless at full rate (1.5 & 0.75 pounds per acre); right, untreated. Picture was made April 29.

THE DEMAND FOR smoother, faster putting surfaces on golf course greens in the South has led to a significant increase in the use of bentgrass. Bentgrass greens are usually surrounded by bermudagrass collars and aprons, however, and encroachment of bermudagrass into the bentgrass can create a severe contamination problem that results in a poor putting surface and lower turf quality (Figure 1). Therefore, effective control of bermudagrass without concurrent bentgrass injury is a goal that has long been sought.

Several researchers have investigated bermudagrass control using Tupersan, and the results have varied from zero to 100% control. A researcher in Australia found that Tupersan at 40 pounds per acre (all chemical rates are reported as active ingredient per acre) in each of two applications 12 weeks apart in late summer controlled bermudagrass completely. Work in Texas produced similar results when the chemical was applied at 18 pounds per acre in two applications at 4- to 6-week intervals. However, additional applications may be required to prevent future bermudagrass encroachment. Others have reported a variety of effects with Tupersan, including suppressed bermudagrass growth, reduced stolon length into the treated area, or no effect at all on growth or control.

To identify the chemicals that prevent encroachment of bermudagrass into bentgrass greens, experiments were conducted with several chemicals to determine the tolerance of bentgrass to the materials, the effects of application

TABLE 1
Dates and frequency of chemical treatments applied in fall-spring 1986-1988. Experiment I.

Treatments	Applied	
	Sept. 30	April 15
	pounds active ingredient per acre	
Tupersan	48	48
	—	48
Cutless	1.25	1.25
	—	1.25
Tupersan & Cutless	48 + 0.75	48 + 0.75
	—	48 + 0.75
Prograss & Cutless	1.5 + 0.75	1.5 + 0.75
	—	1.5 + 0.75

TABLE 2
Dates and frequency of chemical treatments applied in spring and summer 1987-1988. Experiment II.

Treatments	Applied		
	April 15	June 1	July 15
	pounds active ingredient per acre		
Cutless	1.25	—	—
	1.25	1.25	—
	1.25	0.63	—
	1.25	0.63	0.63
Tupersan & Cutless	48 + 0.75	—	—
	48 + 0.75	48 + 0.75	—
	48 + 0.75	24 + 0.38	—
	48 + 0.75	24 + 0.38	24 + 0.38
Prograss & Cutless	1.5 + 0.75	—	—
	1.5 + 0.75	1.5 + 0.75	—
	1.5 + 0.75	0.75 + 0.38	—
	1.5 + 0.75	0.75 + 0.38	0.75 + 0.38

dates and frequencies, and the effectiveness of the chemicals in controlling the encroachment of three bermudagrass cultivars (Tifway, Tifgreen, and common).

Procedures

Chemicals were applied alone or in combined treatments in three separate experiments at Griffin, Georgia, from 1986 to the present. The rates and frequency of application are presented in Table 1 for Experiment I, Table 2 for Experiment II, and Table 3 for Experiment III. Experiment I has been completed, but the results from the other experiments are preliminary.

Plugs of Tifway, Tifgreen, and common bermudagrasses were planted (4 inches in diameter at a 4-inch depth) into a mature Penncross creeping bentgrass golf green. Prior to transplanting, the bermudagrasses were grown on the same USGA green mix as the bentgrass and at the same mowing height (5/32-inch). During the summer prior to the fall or spring-summer treatments, each grass plug was transplanted to the center of an 8-inch diameter area previously treated with paraquat (Figure 2). All lateral stolons from each bermudagrass plug were removed back to the original size at treatment time.

Bentgrass Injury

Injury to bentgrass from chemical treatments of more than 30% would not be acceptable on most golf courses.

Tupersan. When Tupersan was applied in September, it injured the bentgrass more (28%) than when it was applied in April (16%). This occurred whether bentgrass was treated with Tupersan both in September and April, or only in April. However, when bentgrass was treated with Tupersan at 48 pounds per acre in either March or April and at monthly intervals through June at the same rate, the chemical caused moderate turfgrass discoloration and the injury was undesirable for two weeks.

Cutless. Cutless severely injured bentgrass (50%) when it was applied in September, and the injury was unacceptable for 6 weeks. However, bentgrass tolerated Cutless when the application was delayed until April (maximum injury 30%). Cutless applied in April at the full rate (1.25 pounds per acre) and repeated at one-half rate June 1, did not cause unacceptable injury any time during the spring and summer. However, bentgrass did not tolerate Cutless when applied at a full rate in April and again in June, or when one-half rates were applied June 1 and July 15 to plots treated at full rate in April.

Tupersan and Cutless. Bentgrass injury was unacceptable for 1 to 4 weeks when Tupersan and Cutless were applied in September or from multiple applications during spring and summer. Turf injury was slight when treated only in April.

Prograss and Cutless. The combination of Prograss and Cutless caused moderate bentgrass injury within 10 days after treatment with the full rate (1.5 and 0.75 pounds per acre) in April. However, the discoloration from the treatment shown in Figure 3 did not last longer than two weeks, and the bentgrass fully recovered. A similar pattern

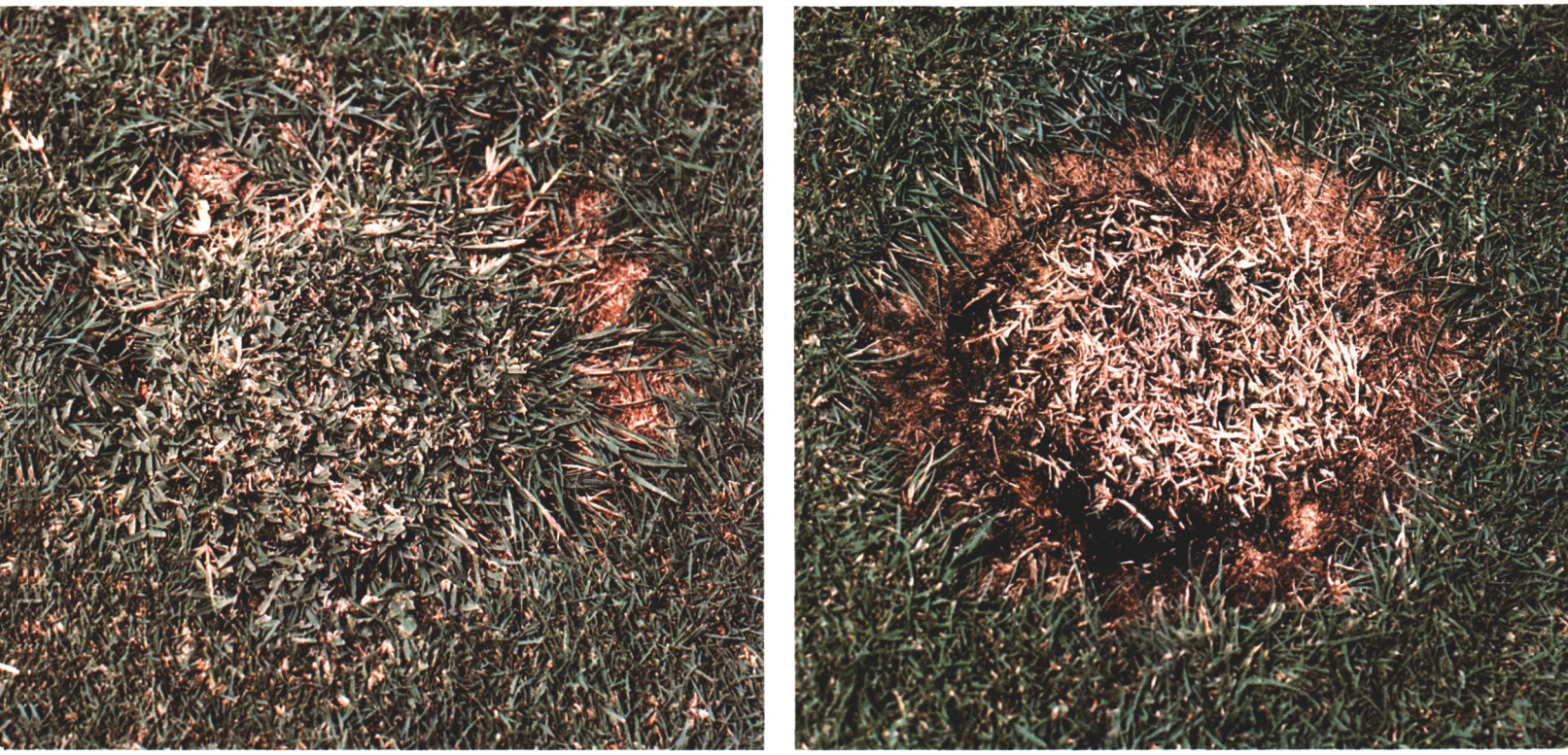


Figure 4. Suppression of Tifway bermudagrass on June 9. Left, untreated; right, Tupersan & Cutless at full rate (48 & 0.75 pounds per acre) in mid-April.

occurred when bentgrass was treated again with the chemicals at one-half rate on June 1. In 1989, bentgrass injury was slightly higher than in previous years when the full rate was applied in March or April (40%), but repeated applications at one-fourth rates discolored bentgrass only slightly.

Bentgrass generally tolerated Prograss and Cutless treatments when applied at the full rate in April and one-half rate or less in June. However, severe bentgrass injury can occur when the chemicals are applied at full rates in the fall or during late spring and summer.

Acclaim. Preliminary results with Acclaim in 1989 indicate that bentgrass was severely injured (73% to 77%) when the chemical was applied in April at either 0.125 or 0.18 pounds per acre. Bentgrass injury was unacceptable for 8 weeks when 0.06 pounds per acre was applied at monthly intervals following either the 0.25 or 0.18 pounds-per-acre rates.

Bermudagrass Suppression

Generally, the suppression of Tifway, Tifgreen, and common bermudagrasses was similar from the chemical treat-

TABLE 3
Dates and frequency of chemical treatments applied in spring-summer 1989. Experiment III.

Treatments	Rate	Date Applied
	pounds active ingredient per acre	
Tupersan	48	March 15/April 15/June 15/July 15/Aug.15
	48	April 15/June 15/July 15/Aug.15
Acclaim	0.18	April 15
	+ 0.06	May 15/June 15/July 15/Aug. 15
	0.125	April 15
	+ 0.06	May 15/June 15/July 15/Aug. 15
Tupersan & Cutless	48 + 0.75	March 15
	+ 12 + 0.19	May 1/May 22/June 14/July 3
	+ 12 + 0.19	May 1/May 22/June 14/July 3/July 24
	48 + 0.75	April 15
	+ 12 + 0.19	June 1/June 22/July 14/Aug. 3
Prograss & Cutless	1.5 + 0.75	March 15
	+ 0.38 + 0.19	May 1/May 22/June 14
	+ 0.38 + 0.19	May 1/May 22/June 14/July 3
	1.5 + 0.75	April 15
	+ 0.38 + 0.19	June 1/June 22
	+ 0.38 + 0.19	June 1/June 22/July 14
	+ 0.38 + 0.19	June 1/June 22/July 14/Aug. 3

ments. The suppression ratings were based on a scale where 1 = dead and 10 = full growth. All chemicals suppressed bermudagrass growth to some degree throughout the spring and summer. However, it was decided that the suppression must be at least 70% or more to be acceptable, and the duration of the suppression should be at least several weeks. Tupersan applied in April provided acceptable suppression of bermudagrass growth until late May. When Tupersan was applied in March and repeated at monthly intervals, suppression was extended to mid-June.

Bermudagrass treated with Tupersan and Cutless in April also effectively suppressed growth until early June (Figure 4). When one-half rate was applied in early June to plots previously treated at full rate in April, the growth was suppressed until late June. Bentgrass was injured too severely in plots treated with two Tupersan and Cutless applications, however, so this treatment should not be used.

Prograss and Cutless effectively suppressed bermudagrass longer than any of the other treatments. A single treatment in April effectively suppressed bermudagrass growth until late May. When it was applied in April at full rate plus June 1 at one-half rate, growth was suppressed until mid-September. The degree of suppression from one and two applications is shown in Figure 5.

Cutless applied by itself did not suppress bermudagrass growth as effectively as Prograss and Cutless. Bermudagrass growth was only slightly decreased when treated with Acclaim, Prograss, Tupersan and Embark, and Prograss and Embark.

Bermudagrass Stolon Growth

The bermudagrass growth ratings were based on the number of stolons from the outer edge of the 4-inch diameter plug. In most instances there was a direct relationship between bermudagrass suppression and number of bermudagrass stolons, but there were differences between bermudagrass cultivars in stolon growth from some of the chemical treatments. Tupersan applied alone in April suppressed the stolon count until late May, but when applied in March or April and at monthly intervals in 1989, it generally did not suppress the number of stolons in Tifway or Tifgreen when counts were made mid-June. Multiple Tupersan treatments, however, effectively suppressed the number of stolons of common bermudagrass during the same period.

Tupersan and Cutless applied in April suppressed the number of bermudagrass stolons until late May. Based upon the preliminary 1989 results, suppression continued until late June when the plots treated in April were treated again at one-fourth rates on May 30 and June 22. It is not known whether the reduced rates will effectively suppress stolon encroachment throughout the summer.

Prograss and Cutless applied at full rate in mid-April, followed by a one-half rate application on June 1, effectively suppressed stolon encroachment of Tifgreen until late July. Tifway and common bermudagrass were affected a month longer. Although foliar growth of Tifgreen treated with Prograss and Cutless was suppressed until mid-September, the number of stolons for Tifgreen was higher than for either Tifway or common.

From preliminary results in 1989, Acclaim did not effectively suppress stolon encroachment of Tifway or Tifgreen, but it suppressed common bermudagrass when counts were taken in late June.

Summary

Three bermudagrass cultivars growing in a bentgrass green were treated with Tupersan, Tupersan and Cutless, Cutless, Prograss and Cutless, and Acclaim. Prograss and Cutless applied during mid-April at a full rate (1.5 and 0.75 pounds per acre) and repeated at one-half rate June 1 suppressed bermudagrass foliar growth and reduced stolon encroachment throughout the spring and summer without an unacceptable level of injury to bentgrass. In some instances effective bermudagrass retardation was obtained for the same period with other treatments, but the rates and frequency of chemical application caused too much injury to the bentgrass.

Figure 5. Suppression of Tifway bermudagrass on September 12. Left, untreated; center, Prograss & Cutless applied on April 19 at full rate (1.5 & 0.75 pounds per acre); right, Prograss & Cutless applied on April 19 at one-half rate (1.5 & 0.75 pounds per acre) and on June 2 at one-half rate (0.75 & 0.38 pounds per acre).

ALL THINGS CONSIDERED

Those Were The Good Old Days!

by STANLEY ZONTEK
Director, Mid-Atlantic Region, USGA Green Section

REMEMBERING HOW things were back in the "good old days" is a common pastime. Among golfers, a favorite and commonly heard sentiment is, "I remember how fast our greens were back in the good old days. I sure wish they were that fast today. I just don't understand why our superintendent can't get them that fast."

The fact is, putting green speeds were *not* faster years ago. Here's proof.

For one thing, it was not until the 1970s that greensmower bedknives could be purchased that were less than 3/16" thick. Since the thickness of a bedknife determines the minimum cutting height to which a putting green mower can be set, it is clear that a 3/16"-thick bedknife would drag on the ground if the height were set at anything less than 3/16". It was not until about a dozen years ago that thin, "tournament" bedknives became available to allow for cutting heights in the range of 1/8". Also, the practice of grinding or shaving bedknife edges to achieve even faster green speeds has been done only recently.

Times and conditions change, and this is as true with putting greens as with anything else. I am fortunate enough to have been exposed to stories about golf course maintenance from my father, who has been associated with the game of golf and turfgrass management for more than 50 years. I also have had the pleasure to meet and spend time discussing the "good old days" with many golf course superintendents of yesteryear. They remember the way it really was — from a perspective of maintaining fast greens through two or three generations of golfers.

What is their story? Most putting greens 30 years ago were cut at 1/4"; fast greens for the time were shaved down to 3/16", and slow greens were cut at 5/16" (the height at which some fairways are cut today). Not exactly the stuff of which lightning-fast greens are made!

Finally, perhaps the best proof comes from the tool that has stirred much of the controversy about green speeds in recent years. When the Stimpmeter was introduced by the USGA in 1976, the agronomists of the Green Section staff checked the speed of several thousand greens on golf courses throughout the country. The average reading was 6'6" on the Stimpmeter. Such a slow speed is practically unheard of these days, yet there are plenty of golfers who claim that greens were faster in the mid-1970s than they are today.

Our perceptions of conditions in the good old days aren't so easy to reconcile with what we see today, are they?

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

Robert Sommers, Managing Editor

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NOVEMBER/DECEMBER 1989

TURF TWISTERS

HOW MANY TIMES

Question: Some golf courses topdress their greens once per week while others topdress just twice per season. Which is best? (Texas)

Answer: Topdressing frequency and the amount of topdressing applied to greens depends on many factors. Unless a major modification of the upper root zone is being attempted, the key to topdressing is to match the growth rate of the turf. On greens that are kept in a state of rapid growth, frequent and light topdressings will serve to keep the surface smooth while at the same time helping to prevent the accumulation of thatch. Very closely cut or slower growing greens should not be topdressed as frequently. To do so could result in the upper portion of the root zone becoming excessively sandy. A properly adjusted topdressing program will help keep the soil profile free of restrictive layers.

DO WE GET WHAT WE PAY FOR

Question: Our golf course architect says he can save us a couple of thousand dollars per green by building greens to his specifications rather than the USGA's, and he claims that his greens work just as well. Any good reason we shouldn't go with his recommendation? (New York)

Answer: You often get what you pay for, and if it costs 5% to 10% more to build a USGA spec green, we feel it's worth it. Many architects who claim never to have lost a green have not been around five to 10 years later when the club gets so tired of the problems they've had that they rebuild. If you consider the poor-quality turf, the extra work needed to keep the turf in fair condition, the years of aggravation that goes along with maintaining poorly built greens, and the high cost of eventual rebuilding, cheap greens are no bargain. In saving a small percentage of the total cost of a green construction project, the risk of maintenance problems or turf failure goes up significantly. When all is said and done, we can't think of any good reason not to build to USGA specs.

WHEN WE TREAD ON DORMANT TURF

Question: I am a club official from a course in northern Virginia. Please settle an argument. I have every confidence that the USGA will give me an honest answer. Does winter play on greens in this part of the country really increase the amount of *Poa annua* in greens? (Virginia)

Answer: An old adage states that "the best weed control is a dense stand of turf." Thus, any activity that thins the desired stand of grass on the greens, such as winter play, encourages the establishment of *Poa annua* and other weeds. Over the years we have seen a definite link between winter golf on dormant grass and the introduction of *Poa annua* into greens.