USGA® GREEN SECTION

# Record

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## The Best and The Worst of Bermudagrass

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*Cover Photo: Bermudagrass "off-types" in putting surfaces affect aesthetics as well as ball roll and management practices.*

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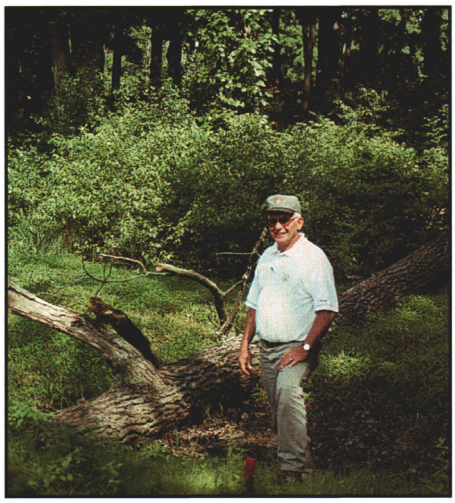

*Superintendent Steve Humphreys, Dutchess Country Club, Poughkeepsie, N.Y., understands the value of downed wood in the forest community. In out-of-play areas, downed trees are left where they lie to provide habitat, serve as nurse logs for new trees, cycle nutrients, and help hold moisture in humus and soil layers. See page 7.*

*Areas that were once mowed as rough are now left natural to provide valuable wildlife habitat and save man-hours for maintenance. See page 16.*

*Following a renovation project, three or four bermudagrasses could be found through the fairways and roughs. Especially in cool weather, providing a consistent character was not possible.*

# The Hybrid Bermudagrass Scene

*"It was the best of times, it was the worst of times."*
— Charles Dickens, *A Tale of Two Cities*

**by JOHN H. FOY**

THIS OPENING LINE to a classic novel well describes the current situation concerning bermudagrasses on golf courses across the southern portion of the United States. With the management tools available today, it is possible to provide an excellent quality bermudagrass golf course. However, the standard cultivars used for many years are now being pushed to their limits, and other problems have arisen. The following pages discuss these issues and update the efforts being taken to address them.

### Origin of the Species

Before discussing the current problems, some background information on the bermudagrasses would be appropriate. The bermudagrasses (*Cynodon* L. C. Rich) have become one of the most important and widely distributed warm-season turfgrasses, but they are not native to the United States. It is believed that the center of origin of this species is Eastern Africa to the East Indies (Beard, 1973).

As to when bermudagrasses were introduced to the United States, no records exist to document this event. However, by the mid- to late 1700s, common bermudagrass (*C. dactylon*) had been found in several locations along the East Coast from Baltimore to St. Augustine, Florida. It probably was brought into the U.S. in soil and rock ballast of sailing ships, which were dumped in several port locations, or in the soil of fruit and ornamental trees brought to the colonies by early settlers. There is evidence that the name "bermudagrass" originated in the vicinity of Sunbury, Georgia, in the early 1800s, rather than the Bermuda Islands.

*Cynodon transvaalensis*, which has been given the common name *African bermudagrass*, is also an important species. Selections of this species were collected in Africa, and the earliest recorded introduction into the United States is 1952. Although it is a very fine-textured plant, it has not been used extensively as a turf cover. Its importance is due to the natural and artificial crosses with *C. dactylon*, which resulted in several improved turfgrass hybrids. 'Sunturf' (Magennis), 'Everglades,' and 'Bayshore' are considered natural crosses of common and African bermudagrasses (Taliaferro, 1992).

A few common bermudagrasses (*C. dactylon*) with improved turfgrass characteristics such as 'U-3,'

'Ormond,' and 'Texturf-10' were selected and used to some extent. However, until the release of Tifgreen (328) in 1956, a true putting green quality bermudagrass had not been available for warm-season golf courses. The introduction of Tifgreen, which was an artificial cross of *C. dactylon* and *C. transvaalensis*, was a major milestone for the industry. The hybrids Tifgreen and Tifway (419), which was released in 1960, were from the breeding programs of Dr. Glenn Burton of the USDA-ARS at the University of Georgia Coastal Plain Experiment Station, Tifton, Georgia. Dr. Burton's turf research program began in 1946 with a $500 USGA Green Section grant to supplement his forage grass breeding research program. Green Section funding continued for 51 years, through 1996.

In 1965, Tifdwarf bermudagrass was officially released. It is also a sterile triploid hybrid, but it was *discovered* as a mutated clone by USGA Green Section agronomist James B. Moncrief in a Tifgreen putting green at the Florence (South Carolina) Country Club (Burton). Since their introduction, the Tif-series hybrids have become well established as the standard turfgrasses for warm-season golf courses across the southern United States and around the world.

### Keeping Up With the Joneses

Unfortunately, right or wrong, many golfers' expectations of putting green conditioning are based on what they see on televised professional events. Most of these events are played on bentgrass putting surfaces, and many golfers have the opinion that bermudagrass greens are inferior. But regardless of the base turf, trying to maintain championship conditioning and very fast putting speeds for daily play is a recipe for turfgrass failure. On the other hand, a smooth, true ball roll and medium to fast putting speed are reasonable to expect.

Years ago, when putting surfaces were routinely mowed at ¼ inch for daily play and 5/16 inch for tournaments, Tifgreen performed satisfactorily. As the demands for faster putting speeds have increased over the years, however, the lowering of cutting heights has essentially exceeded the limits of adaptation of Tifgreen bermudagrass. Regretfully, the trend toward lower cutting heights is a fact of life today.

During Florida's summer rainy season, when high humidity and temperatures are as constant as the reduced sunlight caused by overcast conditions, additional stress is exerted on all bermudagrasses. During this time, Tifgreen bermudagrass greens decline quickly at a height of cut of 5/16 inch or less. As it is with most organisms, prolonged stress can lead to other, more severe problems. It is believed that the high incidence of the Bermudagrass Decline Disease complex experienced on many Florida golf courses several years ago was a result of Tifgreen being pushed beyond its limits.

As its name implies, Tifdwarf bermudagrass has finer-textured leaf blades, greater density, and lower growth habit relative to Tifgreen. Shortly after its release and establishment on several courses in the Southeast, it was being favorably compared to, and even mistaken for, bentgrass putting surfaces (Moncrief, 1967). Tifdwarf can tolerate a height of cut in the range of 5/16 to 5/32 inch most of the time, and can be mowed even lower for short periods of time.

Unlike bentgrass, Tifdwarf bermudagrass thrives in the summertime. However, its fast growth and stiff leaf blades result in greater resistance to ball roll. Thus, green speed and surface smoothness are reduced on Tifdwarf greens compared to bentgrass greens mowed at the same height. Intensive grooming programs, including frequent and light topdressing, verticutting, double cutting, and rolling, are a must to provide acceptable quality putting surfaces. And, while several improved bentgrass varieties have been introduced over the past years, Southern golf courses must rely on grasses that now are more than 30 years old. Imagine trying to compete at the Indy with a vintage 1965 car!

Fortunately, the situation on fairways is not quite so bleak. Since its release, Tifway (419) has become the standard for fairways across the South and in other areas where a fine-textured, dark green, dense, weed-free turf is desired. Most golfers agree that Tifway 419 provides one of the very best playing surfaces in golf. The trend for fairways and tees, however, is to be mowed lower and more frequently. This treatment, combined with increased play and more extensive winter overseeding, has caused increased stress on Tifway 419. After substantial stand losses due to winterkill in recent years, there is a great need for improved fairway bermudagrasses with improved cold hardiness for the mid- to upper South.

### Off-Type Bermudas

A significant problem of Southern golf courses today is the occurrence of off-type turf areas in existing stands of bermudagrass putting greens. Typically, within 5 to 7 years after establishment, it is possible to find patches of what appear to be different bermudagrasses that range in size from a few inches to a couple of feet. Over time, a progressive increase in the size and number of off-type areas occurs. As time goes by, the off-types are spread throughout the green by the changing of holes. This is particularly severe during the winter months on overseeded greens, where overseeded species completely hide the off-types.

This is not a new problem with hybrid bermudagrass greens. More than 20 years ago, USGA Green Section agronomist Monty Moncrief and others began to write and talk about this phenomenon. Off-type areas were occurring in both Tifgreen and Tifdwarf. In the mid-1970s, the problem was so pronounced with Tifdwarf that its use drastically declined for a number of years (Moncrief, 1975).

While debate continues today, it generally is agreed that the primary causes of off-types are:

(1) Contamination of planting stock.

(2) Introduction of off-type seed or vegetative parts into established putting greens.

(3) Genetic mutations.

At first it was believed that spontaneous mutations were a rare occurrence, but there is growing evidence that the triploid hybrids, Tifgreen and Tifdwarf, lack genetic stability. This lack of stability is no doubt accentuated when these grasses are subjected to intense environmental and/or mechanical stress factors, such as being maintained at extremely low heights of cut for prolonged periods of time.

Regardless of the cause, off-type areas are a problem because they differ in growth habits and the ability to tolerate routine management practices. Close monitoring of the putting surfaces and removal of the off-type areas as soon as they are found has been recommended repeatedly. Unfortunately, even with the most diligent contamination control program, a point is reached where the amount of off-type area exceeds what is feasible to remove on a spot treatment basis. When 30 to 40 percent of the putting surface area consists of off-types, management programs cannot be adjusted adequately

to provide consistent playing quality and appearance.

Due to the problems associated with off-types, regrassing of the putting surfaces every 10 to 15 years has become an accepted necessity at courses where top-quality putting greens are demanded. The cost of regrassing 18 or 19 greens typically costs in the range of $75,000 to $120,000. The course also must be closed for 4 to 6 months during the summertime for the regrassing work. Having to regrass putting surfaces is a major disruption to any facility.

### Planting Stock

Another problem for warm-season golf courses today is the difficulty in obtaining genetically pure planting stock. The triploid hybrids are sterile and do not produce viable pollen or seed. Thus, vegetative establishment by sprigs or sod is required. It has been wrongly assumed that the use of vegetative planting stock ensures genetic purity. Unfortunately, it is not possible to prevent a certain amount of common bermudagrass seed or vegetative material in adjacent areas from getting into production fields. In sod production fields, contaminants tend to be more apparent and can be selectively removed, but the bermudagrass in sprig production fields typically is maintained at an elevated height, which masks the presence of contaminants, even to the trained eyes of the growers and certification inspectors. Contaminants can be spread quickly throughout a field by normal sprig harvesting procedures. Furthermore, it recently has been determined that off-type mutations occur in production fields as well as on putting greens.

In some states, matters have been complicated further by the absence of turfgrass certification programs and/or adequate certification standards. In Florida, for example, the state-administered turfgrass certification program was discontinued in 1985 as part of a cost-cutting campaign. To make matters worse, some bermudagrass producers have taken shortcuts in their production programs for the sake of increasing profits, though most producers strive to provide top-quality material.

Corners frequently are cut on the consumer side of things as well. The plant material cost both for new course construction and renovation projects is a very small percentage of the total budget, yet for many years decisions were based strictly on who had the least-expensive grass.

Naturally, the quality of the planting material for the putting surfaces is extremely important. As it turns out, more attention should have been given to the bermudagrass being used on tees and throughout the fairway and rough areas. The names Tifway and 419 have been misused to the point that they have become the generic descriptions for all bermudagrass being produced and sold to golf courses, as well as the significantly larger residential and commercial lawn industry. In 1996, a survey of certified and non-certified Tifway 419 production fields and of golf course fairways believed to have been planted to Tifway 419 revealed that more than 50 percent of the bermudagrass was not Tifway.

*Removal of "off-type" areas and encroachment of fairway/rough bermudagrasses can help extend the life expectancy of putting surfaces. However, a point is typically reached where this is no longer practical.*

### Problem Solving and the Future

During the past five to seven years, bermudagrass problems have reached the boiling point. All too often, golf course superintendents have been blamed for turf problems over which they had no control. Good superintendents have lost their jobs because they could not maintain old, heavily contaminated Tifgreen bermudagrass as effectively as the new Tifdwarf greens down the street or the bentgrass greens the golfers saw on television the previous weekend. Failures also have occurred when something other than the specified grass was unsuspectingly planted. These are difficult situations for golfers and course officials to understand. Unfortunately, some of these cases are ending up in litigation.

After a slow start, steps now are underway to address the problems that have been plaguing the bermudagrass industry. In addition to review and upgrading of turfgrass certification standards by agencies such as the Georgia Crop Improvement Association, programs have been reinstituted in other Southern states. In Alabama and Florida, for example, the Southern Seed Certification Association, Inc., is performing turf certification. Certification alone cannot guarantee 100 percent genetic purity, though, and the same standards currently are not being used by all of the agencies. Still, specifying and purchasing certified planting stock is most strongly recommended and presents the best available assurance that the desired cultivar and top-quality material will be supplied.

The off-type bermudagrass problem is also being researched, and tools such as DNA fingerprinting are being developed and should be of assistance in cultivar identification and breeding.

What is most exciting today is that new bermudagrass cultivars are becoming available. These new cultivars are coming out of traditional breeding programs and from private development efforts. As it turns out, not all of the off-type bermudagrasses that show up in greens are bad. Over the years,

many Southern golf course superintendents have observed off-type areas in their greens that exhibited better growth and performance characteristics relative to the base bermudagrass. Selections and propagation of these grasses have provided another source of improved turf. 'Champion,' 'Floradwarf,' and 'MS-Express' are new cultivars that are now commercially available for putting green use. Champion was a selection made in 1987 by Morris Brown of Coastal Turf, Inc., of Bay City, Texas. Floradwarf was released in January 1995 by the Florida Agricultural Experiment Station. It was a selection made in 1988 by Dr. A. E. Dudeck while on a collection trip in Hawaii. MS-Express was selected by Dr. J. V. Krans and released last year by the Mississippi Agricultural and Forestry Experiment Station.

The buzzwords being used with these selections are *super, ultra,* or *vertical* dwarfs. They have all shown good tolerance to very low heights of cut. These grasses have been characterized as having vigorous horizontal growth and vertical dwarf habit (Beard, 1996). While the term "vertical" dwarf may be more accurate, "ultra" dwarf is establishing a strong foothold around the industry.

TifEagle (TW-72) is a dwarf cultivar scheduled for release during the summer of 1997 by the Agricultural Research Service, United States Dept. of Agriculture, and the Georgia Agricultural Experiment Station, coastal Plain Experiment Station. TifEagle was bred and developed by Dr. Wayne Hanna, geneticist, USDA/ARS. TifEagle was one of 65 mutants produced after exposing Tifway 2 to 7000 rads of gamma radiation. Thus, its genetic character is different from the super dwarf selections. In addition to having a good tolerance to a height of cut of ⅛ inch, in regional testing TifEagle has exhibited improved cool-temperature color retention and growth, relative to Tifdwarf. An interesting characteristic of TifEagle that is still being examined is a non-preference by mole crickets.

New bermudagrasses for fairways are also making their way to the market. "GN-1," "Tift 94," and "MS-Pride" are new cultivars that have exhibited desirable performance characteristics.

*A good off-type can be seen to the right of the golf ball. Some of these improved types eventually find their way to the marketplace.*

## Conclusion

The development and introduction of new bermudagrass cultivars holds great promise for warm-season golf courses. However, some patience needs to be exercised. The new bermudagrasses have not been thoroughly evaluated in replicated putting green and fairway trials. A number of questions still need to be answered regarding the stress and pest tolerances of these grasses over a wide range of locations. Furthermore, some of the new putting green bermudagrass cultivars exhibit a faster rate of thatch production. As with the high-density bentgrasses, changes or adjustments in routine bermudagrass putting green management practices will be required.

Since it is difficult to subject putting green turfgrasses to "real world" conditions in university research trials, the USGA, in cooperation with the National Turfgrass Evaluation Program (NTEP) and the GCSAA, is sponsoring the on-site testing of more than 25 new and existing bentgrass and bermudagrass cultivars on 16 golf courses across the country. These tests will be extremely beneficial for accurately evaluating putting green grasses under a wide range of environmental conditions.

For golf courses across the southern United States, there have been good times, but also some troubled times. Hopefully, the best of times is yet to come.

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JOHN FOY *is director of the Green Section's Florida Region. He has worked with warm-season turfgrass golf courses across the U.S., the Caribbean, and in South America.*

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# Establishing An Intern Program

*A valuable activity that can benefit the student and your course.*

**by GEORGE HAMILTON**

THE ROLE of the golf course superintendent has changed dramatically over the past 30 years. Not only has turfgrass management evolved into a very technical discipline, but the superintendent's role has expanded to include many responsibilities far removed from turf-related topics. These changes have created a seasonal demand for experienced workers within the golf course industry.

Turfgrass management students are helping to meet this demand. Many colleges and universities offering a turfgrass science curriculum make internships a requirement or elective for their programs. Internships can vary from being project-specific to an on-the-job training or apprenticeship. For project-specific internships, the students develop a plan of action for a particular project with the help of their academic advisor and the golf course superintendent for whom they will be working. The student completes a report upon returning to campus and is given academic credit for the experience.

The on-the-job training internships may or may not be for credit. Although there is no particular project to complete, the students usually have general guidelines to follow and certain goals to achieve.

Internships in either form can be of great benefit to both the student and the internship provider. Some graduates return to their internship golf course to gain additional experience or to fill vacant supervisory positions. This hiring practice is usually successful because the graduate is familiar with the people and the operation, and vice versa.

*Internships can vary from being project specific to an on-the-job training or apprenticeship. The golf course superintendent helps guide the student through the program.*

### Important Accommodations and Considerations for an Internship Program

The most important accommodation of an internship program is housing. The housing can be on- or off-site, although on-site housing is much more convenient and efficient. If housing is not provided, the intern must locate and secure housing before the employment begins and then must consider a lease, furniture, and other necessities. Most students don't have the time during school to take care of all of these arrangements, especially if the golf course is a great distance from school. It's much easier for students to show up at the internship site with a trunk load of dirty laundry.

Other accommodations that courses can provide are meals, golfing privileges, limited or unlimited overtime, and a competitive wage. The hourly wage is always an item for consideration, but most interns do not make it the most important factor of their decision. They do, and rightfully so, contemplate the type and quality of experience that they are going to receive.

The superintendent can attract potential students by defining and developing an intern position within the management hierarchy. It is very important that management characterizes the intern position as one very different from a regular crew position. **If management does not utilize turf students differently from other seasonal employees, then the turf students are really *just* seasonal employees.** Superintendents need to structure internships so that the students not only gain new knowledge and experience, but also contribute to the operation with their knowledge and experience.

Internship positions should have some level of responsibility associated with them. After all, most interns should only be a year or so from being in a position of responsibility. They should be put in a position that requires long hours and an *on-call* status. The interns should realize they will be the ones who will be expected to come in early, stay late, or work weekends in order to get tasks completed. Too many students have gravitated into assistant and superintendent positions believing the work week consists of 40 hours during the week and three hours on Saturday morning! When interns experience true-to-life working conditions, they have fewer surprises early in their careers.

Interns also should be involved in chemical and fertilizer applications to some extent. They should be far enough along in their education that they have a good understanding of equipment calibration and pesticide handling. Students also should be exposed to irrigation system operation and repair, and water management philosophies and techniques. Interns also could spend a couple of days with a mechanic and in the shop to gain mechanical experience. All of the golf course management staff can provide educational opportunities for interns.

One thing that most interns are interested in is spending time with the golf course superintendent. They like to have the opportunity to discuss *why* things are being done or *how* things are being done. Students appreciate the opportunity to have good lines of communication between themselves and the upper-level management. It allows them to learn more and makes them feel like they are part of the *team.*

Interns can learn and benefit by being a part of another team as well. Many times golf courses rely on volunteers or crew members from surrounding courses for tournament preparation. Allowing interns to work at local, regional, or national tournaments broadens their experience and gives them an opportunity to meet and work with other people in the industry.

### Tips on Recruiting Interns

First, management should develop a true internship program with some of the aforementioned components. Students have more interest in internship programs that are well developed and organized. Some schools have abundant requests for interns. For example, at Penn State University, we had more than 150 requests last year. Our students were seeking internships that were well-established and had a reputation for providing good experience.

Students have different internship objectives and requirements. However, most interns are seeking a **mentor**. Interns want someone who will take interest in the needs of a developing professional. They want to work for someone who will go out of their way to teach and train them. This point sounds good and seems easy enough to do, but it is very difficult to implement in the hectic world of golf course maintenance. The company line can quickly become "we don't have time for that now; we'll do it later on in the season." But the season is never long enough to have those learning opportunities happen, and the intern ends up dissatisfied. The golf course may have difficulty getting interns in the future if it establishes that type of reputation.

Golf courses can seek interns by communicating with academic institutions that offer a turfgrass management curriculum. Some schools place their interns, and others provide their students with internship opportunities and allow the students to select for themselves. Also, some schools have active student turf clubs that have booths at state and national trade shows. Many times the turf clubs will have a binder of student résumés of those who are looking for employment.

The Golf Course Superintendents Association of America is offering an internship referral service for members who are seeking interns. The World Wide Web is another resource that can be used to locate students looking for internship opportunities. TurfNet (www.turfnet.com) is one of the turfgrass-related sites that posts employment opportunities.

Developing a quality internship program takes time and dedication. It doesn't happen in a year or two. It takes planning and aggressive recruiting to get started. Once your program has been viewed as successful, word-of-mouth will send students to you. However, the competition for interns is on the rise and even the best programs will not get all of the interns they need every year. An internship program is a valuable activity that benefits both the student and the golf course.

*Interns should also be involved in pest identification and chemical and fertilizer applications to some extent.*

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GEORGE HAMILTON *is a Senior Lecturer of Turfgrass Science and a Technical Advisor to the Golf Course Turfgrass Management Program at Penn State University. In his capacity at Penn State, George also administers the Intern Program.*

# Natural Areas

*Establishing natural areas on the golf course.*

**by MATT NELSON**

MANY articles have expounded the merits of golf courses in the overall scheme of environmental quality. Some of the environmental benefits provided by golf courses include wildlife habitat, water purification, noise reduction, temperature modification, atmospheric processes, and preservation of green space.[1] Adversaries of golf courses cite rampant development, often in environmentally sensitive locations, potential pollution by pesticides and fertilizers, unwarranted use of potable water, and other threats posed to the environment by golf courses. Regardless of the exact ecological significance of golf courses, the fact remains that the approximately 15,000 golf courses in the United States constitute a sizeable acreage, particularly in urban and suburban areas. Opportunities to naturalize exist within many golf courses, and these will become increasingly significant in landscape conservation. This article discusses establishment and maintenance of three general types of natural areas commonly found on golf courses: (1) grasslands, including wildflower areas; (2) riparian areas, including streams, shorelines, and wetlands; and (3) forested areas.

*Clearly delineated wetlands at the South Course, Whitefish Lake Golf Club, Whitefish, Montana.*

## Grasslands

The value of natural areas on the golf course is generally acknowledged, but little has been published concerning the implementation of natural area plantings on golf courses. The use of native grasses to establish attractive, environmentally beneficial, low-maintenance areas is one of the most commonly desired types of natural areas. Stands of native grasses can result in water savings, reduced fuel use and labor, and improved aesthetics. Images of these areas conjure visions of some of the world's greatest courses — the Old Course at St. Andrews, Prairie Dunes, Shinnecock Hills, and National Golf Links. Unfortunately, not all sites are blessed with the soils, climate, and existing vegetation to make the establishment and maintenance of these areas as easy as the great courses make it seem. Most course officials do not understand the establishment process required for native grasses, and accordingly lack the patience to see the implementation of these areas through to fruition. Even more common is the failure to employ proper establishment techniques, which often translates into the development of an unsightly stand of weeds that receives strong criticism from the golfers.

## Establishment

When establishing native grasses from seed, minimum or no tillage is recommended when preparing the seedbed. This technique discourages the germination of weed seed present in the soil. Drill seeding is preferred, and seeding rates should be kept low to avoid establishing an excessively thick stand that reduces the quality of wildlife habitat and slows the pace of play.

A rate of 25 lbs. of seed per acre is a common recommendation for sowing seeds of native grasses.[7] Grasses such as fescues or annual ryegrass used as a cover crop can dominate the stand and hinder native grass establishment, so cover crops usually are not recommended and, if used, should be kept to a very low seeding rate. Fertilizer is not recommended except for extremely poor soils and, if used at all, should consist of low analysis natural organic material. Fertility generally enhances weed growth over the native grass stand. The use of a non-selective herbicide prior to planting reduces competition with existing vegetation for nutrients, water, and light. An early fall planting date takes advantage of favorable soil temperatures and decreased weed pressure in most areas. Since most of these areas will be non-irrigated, seeding dates should be timed to take advantage of climatic patterns and expected precipitation. Early spring seeding and dormant seeding also can be effective in many areas.[5]

During the first year or two of establishment, native grasses typically allocate around 70% of fixed carbohydrates to root development.[7] This explains why it may take up to three years to notice significant foliar development in native grass stands. The phrase "sleep, creep, and leap" is often used to describe the first three years of native grass development. Therefore, it is important to convey to the golfing clientele what to expect when establishing grasslands with native species.

Native grasses also can be established vegetatively. Many nurseries today stock native plants, including grasses. Some golf courses have established on-site nurseries today of native grasses where plant material can be expanded and relocated to desired areas on the golf course. Vegetative establishment is an effective way to speed stand establishment, and may be especially desirable on steep slopes that are prone to erosion.

*Milkweed provides invaluable habitat for monarch butterflies.*

## Weed Control

Controlling weeds during establishment is an important facet of a planting program and can involve mowing, hand rouging, spot or wick application of selective herbicides, and open field burning. Mowing establishing grassland areas reduces weed pressure by inhibiting photosynthesis of broadleaf species. Mow twice per year during the first few years of establishment.[7] Pulling weeds manually is one of the most effective methods of weed control, but obviously is labor intensive. Spot applications of a selective herbicide also are possible, as is wick application early in the year when broadleaf weeds have grown above the canopy of the grasses.

However, weed control should be carefully considered. Many plants deemed weeds are in fact valuable herbs and forbes within the community. For instance, milkweed might be considered undesirable by some for aesthetic reasons, but this plant is critical for the reproduction cycle of monarch butterflies. The best approach is to have all plants in the stand identified and their relative significance and abundance evaluated by someone familiar with local ecology. Species identification can determine where and when weed control efforts are warranted.

Open field burning is a very effective means of reducing weed pressure since it destroys weed seed. Burning also reduces disease and insect pests and improves vigor of desirable grasses.[3] Burning grasslands is one of the oldest agricultural practices, and its benefits were well known by native peoples of this continent who employed burning of grasslands for millennia. If allowed, burning should commence on an annual basis after the third year of establishment. Burning before this time could cause injury to juvenile grass plants. Burn in early spring, and it may be helpful to swath the area ahead of time to lay senesced tissue down for fuel.[16] Be sure to obtain all necessary permits before proceeding to burn natural areas.

Among the most popular native grasses used on the golf course are big and little bluestem, switchgrass, indiangrass, blue grama, side-oats grama, buffalograss, reed canary grass, wheatgrasses, and sheep fescue. These grasses vary in their climatic adaptation, so

check references to determine appropriate native grasses for your particular site.[7]

Wildflowers often are a popular component of grass stands and are sometimes established alone. Much of the same advice applies for establishment: minimize tillage and fertility, prepare the site in advance, and seed when germination is favored. Wildflowers usually do not perform well in shaded or trafficked areas, or under very poor soil conditions. Look for sunny, well-drained, out-of-the-way sites for wildflowers. As with grasses, choose a mix of wildflowers that is adapted to your region, and choose a desired blend of annual and perennial flowers. Wildflower areas may require annual or biennial seeding to prevent one perennial species from dominating the stand. Weed control requires preplant herbicide applications and hand pulling of weeds. Spot applications of herbicides can be made, but no selective herbicides are available for broadleaf weed control in wildflower stands.[8]

### Wildlife

Wildlife habitat can be significantly enhanced with the establishment of grasslands. Birds and mammals utilize prairie plant communities for nesting, foraging, and cover. Stands that are too thick actually reduce habitat quality by impeding overland travel; therefore, maintain open, bunch-type stands of grasses and flowers.[4] Creating cells, or zoned patches, of habitat with shrubs or trees enhances the wildlife value of the area by mimicking natural plant succession. Isolated patches of shrubs provide thermal and protective cover for wildlife, thereby reducing isolation and vulnerability to predators.

A stand of native plants also helps preserve populations of native insect pollinators. Many ecologists have considered the loss of native pollinators a significant threat to many native plant species. The relationship between plant and insect can be very specific, and golf courses offer an opportunity to preserve native plant species within the ecosystem.[13]

Another important consideration with regard to wildlife habitat is the presence of ecotones, which are the transition areas between habitat types. For instance, edges of forests and riparian areas could be considered ecotones. The most desirable approach when considering ecotones is to avoid stark transitions like straight lines. Transition areas should approximate the natural landscape and include irregular borders and a diverse vegetative composition. Ecotones are important components of the ecosystem as they represent areas of community interaction and varied wildlife habitat components.[14, 15]

When naturalizing the golf course with native grasses and wildflowers, be sure to start with a small area to evaluate establishment methods and the adaptability of the chosen plants. Also, be sure that the selected areas are appropriately located so as not to adversely affect the speed of play. Excessively thick stands of secondary rough often are located too close to in-play features and can be overly penal. The caliber of play at the golf course should be evaluated to determine where forced carries and other natural areas come into play. The number of available teeing areas per hole also could impact where natural areas are appropriate. From an aesthetic standpoint, determine what type of natural areas are suitable to your site. Not all sites are suited to prairie or meadow-type natural areas, and they may look out of place when forced into the wrong location.

### Riparian Areas

Riparian areas on the golf course include the shorelines of lakes and ponds, stream corridors, and wetlands. Natural vegetation in these areas serves the dual purpose of improving aesthetics and providing a functional component of ecosystem enhancement. Buffer strips along lakes, ponds, and streams reduce soil erosion, filter runoff, provide a barrier between nutrient-rich grass clippings and the water feature, create wildlife habitat, utilize nutrients that have entered the water feature, and help prevent thermal pollution of our waterways.[2, 11] Establishing buffers also saves valuable labor hours by reducing or eliminating time-consuming string trimming and walk mowing. Vegetative buffers also may deter geese from occupying critical play areas such as greens, tees, and fairways. Geese often are reluctant to venture through thick vegetation when exiting a water source for fear of predators on the terrestrial side.

*A wonderful example of a stream in natural condition. Thermal protection from trees, vegetated stream banks for erosion control and habitat, and spillways oxygenating the water all contribute to a healthy stream. Springdale Golf Club, Princeton, New Jersey.*

### Lakes, Ponds, and Streams

Vegetated shorelines and streambanks can be established simply by allowing existing vegetation to grow unmaintained, or native riparian plant species can be established by seed or transplanting. Emergent vegetation such as juncus and iris can be transplanted and provide a wonderful aesthetic enhancement, especially where water levels fluctuate. Cattail

seed can be collected by hand and spread along shorelines to establish this extremely productive plant. Cattails utilize many nutrients which otherwise might be available for algal growth. These are a few examples of various techniques used to reclaim shoreline vegetation.

Maintaining vegetation along streams, especially trees in out-of-play areas, provides thermal protection and helps maintain adequate supplies of dissolved oxygen for floral and faunal aquatic species by reducing biological oxygen demand. Vegetated streambanks and shorelines also anchor soils and reduce erosion. Another important consideration for streams is to leave a certain amount of downed wood and rocks in the stream channel to create spillways and eddies for oxygenation and wildlife habitat. This is a lesson the U.S. Forest Service learned after decades of logging and stream clearing when salmon habitat declined severely. Dredging and clearing stream channels eliminates wildlife habitat, reduces natural water purification, and promotes accelerated erosion.

Water quality in streams, ponds, and lakes should be monitored regularly to document change and establish baseline values for evaluation of maintenance practices. A testing laboratory can perform water quality testing, and stream health can be gauged by sampling macroinvertebrate aquatic species.[9]

Vegetated shorelines and streambanks should be at least 10 to 15 feet deep from the edge, and should be clearly marked for hazard delineation on the maintained edge. Protection of our waterways should be given a high priority by golf courses, as protection of water resources is at the forefront of environmental concern in this country. Also, maintenance hours spent string trimming and hand mowing shorelines and streambanks can be put to better use on other areas of the golf course more critical to play.

### Wetlands

Wetland areas should be clearly delineated, and players and employees should be kept out. Use caution with fertilizer, pesticides, clippings, and irrigation near wetlands. In some cases, it may be appropriate to designate wetlands as environmentally sensitive areas by an appropriate authority. Wetland areas are among the most productive and dynamic ecosystems on the face of the earth, and they are host to numerous foraging and nesting wildlife species. Wetlands should be monitored yearly for water level fluctuations, water quality, and species changes. Water should be tested and numerous photographs should be taken at regular intervals throughout the year.[10,12] Documentation of wetland parameters enables the establishment of a database, which can be used to evaluate management practices and correlate to climate variations.

### Forests

Trees can be both an environmental asset and liability on golf courses. The key is to know where forest habitat is appropriate and where it is not. From an environmental standpoint, it generally is believed that a diverse mix of both tree species and ages is the best for wildlife and plants. A stand consisting of a well-developed structure provides the greatest amount of habitat niches for the most diverse amount of wildlife. Thus, canopy, secondary growth, and understory all are important functional components of the forest community. It has been well documented that snags and dead or decaying trees provide excellent roosting habitat for many raptors and nesting habitat for cavity-nesting bird species such as the spotted owl. Equally important, but often overlooked, is downed wood on the forest floor. Downed wood provides habitat for many terrestrial species, serves as nurse logs for new trees, is important for nutrient cycling, and helps hold moisture in humus and soil layers. Leaving downed wood in forest areas is just as important as leaving snags.

In many climates across the United States, however, there are areas of the golf course where natural forest areas are not appropriate. Where summer humidity and disease pressure are problems, a well-structured forest in close proximity to turfgrass can create severe problems, especially for greens and tees. This is the case where trees can actually create an environmental liability. Shading and restricted air circulation limit growth and recovery of turfgrasses, and enhance disease pressure. To keep grass alive, increased pesticide use often is necessary, which increases employee and golfer exposure, volatile losses to the atmosphere, and the threat of groundwater or surface water pollution. Although proper management and application can minimize these risks, modification of the growing environment can reduce the amount of needed chemical inputs. Shade and poor air circulation are among the biggest problems for turf management in the United States, reflecting people's poor understanding of the effects of trees on turfgrass. Forested areas can provide tremendous environmental enhancement, but they need to be properly located and also properly balanced with the rest of the management program.

Rarely do tree plantings approximate the natural condition. Trees planted on golf courses should be selected for a number of management and playability factors, and species that are part of native, local forest communities should be selected. Never plant trees to the immediate southeast of greens and tees, as they eventually restrict morning sunlight penetration. Morning sun is thought to be the most important of the day. Also, avoid introduced species. The Norway maple is an example of an introduced tree species commonly used on golf courses. It severely restricts grass growth and has become a problem in natural forest communities. Norway maples develop leaves much earlier in the season than most native trees, and they hold their leaves much later into the fall. The result is that many forest species and turfgrass are effectively shaded out of establishment. This weed can be considered one of the greatest threats to native plant communities in many parts of the country.

Using forested natural areas as corridors between larger natural areas is a progressive means of enhancing wildlife habitat and managing within the larger ecosystem. Linking fragments of habitat preserves genetic diversity among populations and provides thermal and protective cover for diurnal and seasonal movement of wildlife.[10] Golf courses often serve as *links* between surrounding habitats and natural features. This point should always be given consideration during new development.

Forested natural areas can be an excellent benefit to wildlife and the environment, but be sure they are properly located far enough away from critical play areas. Allowing forest plants to develop through natural succession is perhaps the best way to manage these areas. Leave snags and downed wood, and allow the forest to manage itself. Walking paths with signs identifying different species and components are a wonderful way to share the benefits of natural areas with golfers.

The implementation of plans for natural areas on the golf course can be a rewarding experience for humans and nature. Every golf course has something different to offer, and collectively golf courses can play a tremendous role in landscape conservation across this country. The game of golf is here to stay, as is continued population growth and development. The focus now should be retrofitting the nearly 15,000 golf courses nationwide to maximize their environmental contribution, and laying the groundwork for sustainable golf course development and management in the future. Golf has long shared a close connection with our environment, and the game now has an increasingly important role in conservation. It is time to step up and contribute at your course. After all, it isn't called the greatest game for nothing.

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MATT NELSON *visits golf courses throughout the Northeast as an agronomist for the USGA Green Section. He finds natural areas to be some of the greatest assets of golf courses.*

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*Wildflowers can provide an attractive and functional feature on golf courses. Niagara Falls Country Club, Lewiston, New York.*

*Winterkill can have a devastating effect on spring course conditions.*

# Exploring the Use of Plant Growth Regulators to Reduce Winter Injury on Annual Bluegrass (*Poa annua* L.)

*Increasing energy reserves will reduce winterkill and enhance plant health.*

**by FRANK S. ROSSI, Ph.D., and EMILY J. BUELOW**

EACH YEAR, golf turf managers in the northern United States are faced with the possibility of widespread turf loss as a result of winter injury. Winter injury, or winterkill, as defined in Beard (1973) is a nonspecific term commonly used to represent any injury that occurs to turf during the winter period. Stresses leading to injury that could be included in this discussion are a result of desiccation, low-temperature pathogens, traffic, chilling, suffocation from ice encasement, and freezing stress. Furthermore, because winters vary from year to year, each stress could be imposed individually or collectively and result in turf loss. The myriad of stress and growing environments leaves a golf course superintendent wondering how to maximize turf health before winter or how to recover dead turf the following spring.

### Freezing Stress

DiPaola and Beard (1992) summarized the forms of winter injury that can occur in cool-season turfgrass systems due to mechanical and dehydration stresses. These stresses are related to the movement of water out of the cell during slow cooling (1-2°C per hour) of the plant tissue as ice forms between the cells. Ice formation within plant cells is thought to be rare because of the historically slow rate of temperature drop and the ability of the cell to supercool, i.e. dehydrate and concentrate the cell sap so that the freezing point is lowered.

Ice develops in the larger vessels between the plant cells because water

between the cells has a lower solute concentration than the water within the cells. Ice formation in plant tissue usually occurs by the time temperatures drop to between -1 to -3°C. Living cells in the plant are surrounded by the plasma membrane, which prevents the growth of ice crystals in the cell. Therefore, ice formation is confined to the space between the cells and is absent within the cell.

Extracellular freezing cannot directly produce freezing injury since there is no direct contact between the ice and the interior of the cell. Water moves from the inside to the outside of the cell to support the growing ice crystal, resulting in cellular dehydration. Physiologically, cellular water lost to the growth of extracellular ice can result in severe dehydration and death as a result of mechanical stress due to the collapse of the cell walls.

The primary area of concern for survival of turfgrasses is the meristematic region, or the crown of the plant. Freezing stress injury is directly related to how and where ice forms in the cells of the turfgrass crown. Within the crown tissue itself, there are different levels of cold hardiness. The lower part of the crown, the region that initiates root development, is less hardy than the upper part of the crown. This is especially true in annual bluegrass (Beard and Olien, 1963). Therefore, in the spring, it is possible for plants to appear healthy, only to become necrotic in the absence of functional roots associated with lower crown damage.

Many changes occur in the plant cell during the induction of freezing, such as changes in membrane lipids, proteins, and non-structural carbohydrates. Davis and Gilbert (1970) demonstrated that starch and total non-structural carbohydrate content of turfgrasses increase during fall hardening, and showed a strong association between these reserves and freezing stress tolerance. However, the contribution of each of these changes toward increased freezing tolerance is not well understood.

Carbohydrates in the cells are thought to interfere with ice crystal growth, thereby reducing mechanical injury to the cell during freezing. For example, trehalose, a disaccharide, functionally replaces free water bound to membranes and proteins, and thus confers structural stability during desiccation. It could be hypothesized that if carbohydrate levels were increased through alternate management practices, freezing stress tolerance could be enhanced as a result of many cryoprotective mechanisms operating concurrently.

## Plant Growth Regulators?

Plant growth regulators (PGRs) were introduced more than 40 years ago for application to utility turfs to reduce mowing requirements by inhibiting turfgrass shoot growth. With improved technology and the introduction of newer materials, the effectiveness and potential utility in turfgrass management have increased. Today, plant growth regulators are used to improve turf color, reduce clippings, suppress seedheads, and improve green speed.

A field study of fall-applied PGRs resulted in an increase in the average survival of winter cereals (Gusta et al., 1988). These effects, however, were not consistent from year to year, suggesting the problem is a complex one. Winter cereals, especially the less-hardy genotypes, are known to have reduced freezing stress tolerance from January to March, even though they are constantly exposed to sub-zero temperatures. It is possible that the regulation of the acclimation and deacclimation process through the use of PGRs may involve a component of a complicated stress response. Still, the interaction of freezing stress and PGRs might provide insight to solving the previously uncontrollable problem.

Certain classes of PGRs increase cold hardiness or winter survival by reducing the production of gibberellic acid (GA) and/or could increase the photosynthate partitioning in the crown of the plant (Hanson and Branham, 1987). Spak et al. (1993) indicated that a post growth-inhibition period six to eight weeks following a PGR application results in a resurgence of growth and a concomitant decrease in total carbohydrate levels. This resurgence of growth would need to be minimized by the timing and rate of applications.

Trinexapac-ethyl is a class-A plant growth regulator labeled for use in turfgrass management for reducing shoot growth without causing significant injury. Trinexapac-ethyl inhibits the gibberellin biosynthesis process late in the pathway. This inhibition results in an increase in abscissic acid (ABA) levels that decrease shoot growth and increase carbohydrate storage, which may improve freezing stress tolerance.

Triazole plant growth regulators such as paclobutrazol are class-B PGRs that act much earlier in the gibberellin biosynthetic pathway. ABA levels are thought to increase in plants grown under triazole regulation, and it has been suggested that the lowered gibberellic acid and increased ABA levels increase stress tolerance during chilling or freezing (Gusta et al., 1996).

Theoretically, late fall applications of a plant growth regulator could improve

*A cold room at the University of Wisconsin - Madison Biotron, where cold hardiness is studied.*

the winter hardiness of plants by altering their carbohydrate status during acclimation, when energy is being produced and used for storage rather than for top growth. This treatment could coincide with the gradual cessation of shoot growth, the initiation of the hardening process, membrane alteration, and accumulation of photosynthate. This application could lead to a plant with enhanced cryoprotective features and an increased energy source, allowing it to withstand the incipient freeze-thaw periods.

The objectives of our research project are: (1) to determine if commonly used plant growth regulators affect the winter hardiness and turf quality of annual bluegrass throughout the fall and spring; (2) to determine the relative freezing tolerance of annual bluegrass during fall and winter acclimation while under growth regulation; and (3) to determine if trinexapac-ethyl increases carbohydrate concentrations and thereby improves winter hardiness under controlled environment conditions.

### Controlled Environment Studies

Plant growth regulator effects on winter injury of annual bluegrass were studied in a growth room at the University of Wisconsin – Madison. Preliminary studies indicated that, in general, lower rates of PGRs enhanced winter survival while higher rates had a detrimental effect. It also was evident that wet conditions during acclimation made the plants more susceptible to injury. Subsequent experiments simulated fall and winter acclimation as well as the late winter/early spring deacclimation process on plants maintained in relatively saturated soil.

Seven-centimeter plugs of annual bluegrass were extracted from the same fairway where a field study was being conducted to ensure consistency in biotype population between the field and controlled environment studies. The plants were then maintained in a greenhouse with a 12-hour day length for a month, simulating summer conditions. The plants were hand watered to prevent moisture stress and mowed with clippers approximately every other day.

Pots were then treated with trinexapac-ethyl and permitted to acclimate. Temperatures were reduced two degrees per hour to 5°C day temperature and 2°C nighttime temperature. This 5°/2°C daily regime was maintained for three weeks.

Secondary acclimation was attained by lowering the temperature of the room one degree per hour to 0°C, where it was maintained as both the daytime and nighttime temperature for three weeks. Secondary acclimation conditions were then followed by a 48-hour warm-up to 8°C daytime temperature and 5°C nighttime temperature, permitting deacclimation.

Freezing tolerance of plants was estimated by an experimental technique that utilizes a circulating glycol bath. Specifically, plants were removed from the Biotron after 1 and 3 weeks of primary hardening, 1 and 3 weeks of secondary hardening, and after the 48-hour deacclimation. A variety of freezing temperatures were imposed to determine the tolerance of the plants untreated and treated with trinexapac. Simultaneously, plants were being harvested to determine carbohydrate content to correlate with changes in freezing stress tolerance.

Results from the controlled environment experiments indicate that freezing stress tolerance can be enhanced with ultra-low rates of trinexapac. The amount of enhancement initially appears to be slight and not well correlated with observed increases in carbohydrate content. Plants treated with trinexapac appear to deacclimate more rapidly when exposed to warming temperatures than untreated plants. However, at the lowest rate, the treated plants had a greater relative freezing tolerance than untreated plants.

The variability we observed with the carbohydrate concentration was consistent with results observed by Eagles and Williams (1992). Further experimentation will be needed in controlled environments to specifically quantify the physiological state of the plant prior to PGR application.

*Injury observed in November on plots that were treated with PGRs one and two months earlier. Note checkerboard yellowing. Uninjured plots were untreated.*

*The plant on the right was treated with an ultra-low rate of trinexapac the previous fall and exhibited increased tillering the following spring as compared to the untreated plant.*

## Field Studies

Field experiments to evaluate winter injury and spring green-up were conducted on a golf course fairway composed primarily of annual bluegrass. Plant growth regulator applications were made at various rates and times throughout the fall at Nakoma Country Club (Randy Smith, golf course superintendent) in Madison, Wisconsin, from 1994 to 1996. This particular area is a regular site of significant winter injury. Plots were rated for injury related to the application in the fall and subsequently for winter injury and recovery in the spring.

Significant injury occurred in each of the three years we conducted the study. In year one, applications made in September and October at standard use rates caused significant injury, which was evident in November. Consequently, most plots were killed by the spring. In years two and three, the rates were reduced to 6%, 3%, and 1.5% of the use rates, and we observed less injury in the fall; however, the winters were harsh and resulted in a widespread kill that was attributed to severe ice encasement. Interestingly, in year two, plots that survived the winterkill were treated with low rates of PGRs and had produced significantly more tillers that were more robust as compared to untreated plants. Nevertheless, in all three years, plots required more than eight weeks to reach acceptable quality, a situation that would be completely unacceptable to golf course superintendents.

As a result of the lack of field efficacy, we are hesitant to make strong recommendations for this strategy under field conditions. Still, increased tillering evident in the spring on treated plots and results observed under controlled environment studies indicate that some benefits might be available using different application strategies, i.e. timing and rate.

## Conclusions

The logic that motivated this research effort remains sound, i.e. enhancing plant health through increased energy reserves will reduce winter kill. However, as with all exploratory research, we have raised more questions than we have answered. The search for enhanced stress tolerance, be it temperature, moisture, or traffic will be tedious as we realize that there are no singular answers to complex interactive responses. Until researchers find improved methods of quantifying plant health other than visual quality or biomass production, we will be limited in our ability to enhance stress tolerance.

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# Naturalizing: *A Superintendent's Perspective*

*Going natural can be a win-win situation, but it pays to follow good advice and start slowly.*

**by PETER SALINETTI, CGCS, CCM**

OUR CLUB IS LISTED WITH Audubon International as a charter member of the Audubon Cooperative Sanctuary Program for Golf Courses. When we joined, my initial feeing about the program was that it felt like the right thing to do as someone who was concerned about the environment. The first few years we just paid our dues and received the mailings sent out from Audubon's headquarters. Occasionally I would take out my certification packet and look over the resource inventory information and feel somewhat overwhelmed. It's my suspicion that a great number of superintendents feel the same way when they first join the program. One winter, feeling somewhat guilty for having put my certification packet from one desk drawer to another, I finally decided to work on my resource inventory. When that was done, I slowly began to chip away at the six certification categories.

One category I found to be particularly interesting was Wildlife and Habitat Management. This category encompasses the management of non-play areas to provide habitat for wildlife on the golf course. Certification is granted for management practices and habitat enhancement projects that maximize the use of the golf course property to provide the best possible habitat, given the course's location, size, and layout. A description of wildlife food, cover, and water enhancement projects, a list of wildlife species on the property, and a simple map showing habitat areas are required documentation. At the Schuyler Meadows Club we are blessed with about 200 acres of very diverse habitat.

When I received my initial report back from Audubon International summarizing my Resource Inventory Report, I was particularly interested

*Areas like this no longer need the irrigation system to survive.*

in their recommendations regarding naturalizing non-play areas. Their report included the following comments: "We are pleased you have some no-mow areas and wildflower areas on the course. Look for other non-play areas that you currently maintain with mowed grass and target these for naturalization with taller grasses, shrubs, or trees. You may be able to reduce mowing on the 122 out-of-play acres by naturalizing some of these areas. Further naturalization will extend available habitat, add distinctive contrast to the manicured look of in-play areas, and substantially reduce maintenance time spent on mowing. Areas between fairways, under smaller stands of trees, and along wooded edges may be suitable. These areas do not have to be large — you can start small and expand over time, where possible. Initially, you may be able to simply mow once or twice per year to allow taller grasses to grow. We also recommend adding plugs of native grasses and perennial wildflowers to add diversity and beauty over time."

Additional comments included: "At the Schuyler Meadows Club, you have a great potential to provide habitat for wildlife, maintain a high degree of environmental quality, and offer golfers a challenging game. Based on your resource inventory, it looks like you have begun to balance these needs. We commend your current efforts to leave natural vegetative buffers around the creek, allow natural areas around the course, and continue to expand your integrated pest management plan."

We did follow the advice of Audubon International and start naturalizing slowly and in small areas. We had no idea how quickly this concept would gain acceptance with our members. Now, we cannot have a green committee meeting without the subject of additional "no-mow" areas being discussed. Our course is 71 years old and has a tremendous amount of the older types of fescues in the unirrigated parts of the rough. When unmowed, the grasses provide a beautiful contrast to our maintained turf. To quote our Green Chairman, Dan Walsh, "We've always been looking for ways to make our course more interesting and exciting — how do you spell *fescue*?"

So, naturalizing has added a new challenge to our golfers' game, and they're happy. We have much more habitat for our wildlife, and they're happy. We spend a lot less time mowing rough, and I'm very happy. Talk about a win-win situation. Give some serious thought to naturalizing, but follow Audubon's advice — start slowly.

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PETER SALINETTI *serves the Schuyler Meadows Club, Loudonville, N.Y., as both Superintendent and General Manager. In 1995, the Schuyler Meadows Club became the first fully certified Audubon Cooperative Sanctuary golf course in New York State.*

*Contrast and definition are other benefits of naturalizing.*

*Seven generations of green committees put their mark on the golf course with various yardage markers. Not pictured are painted lines on the path, marked sprinkler heads, colored disks in the middle of the fairway, and pop-up markers at the edge of the fairway.*

# INFORMATION OVERLOAD

*How many yardage markers do you really need on the golf course?*

**by PATRICK J. GROSS**

WE LIVE IN AN AGE when information is at our fingertips. Witness the growing popularity of the Internet, where you can have instant access to information on a wide variety of subjects with the click of a button. It seems the need for instant and accurate information is finding its way into our golf game with several gadgets and gizmos for marking yardage. There are red, white, and blue flags; whiffle balls on the flagstick; colored disks in the fairway; painted lines on the cart paths; shrubs or trees at the edge of the fairway; pop-up markers; painted stakes; distances marked on the sprinklers to the front, middle, and back of the green; yardage books; binocular-type range finders; and the ultimate — global positioning system devices for golf carts. With so much information, you would think there is no excuse for a shot missing the green.

Despite such exact measuring devices, the handicap index for the average golfer in the United States remains between 16 and 17. He has trouble enough keeping the ball on the fairway, let alone striking the ball a precise distance to the green. After watching professional golfers for so many years, the average golfer is now conditioned to search for the nearest sprinkler or yardage marker and pace off the distance to his ball. Instead of helping the average golfer, the yardage markers are slowing play and becoming a maintenance headache. The person changing holes now must carry three different sets of colored flags. Mower operators must avoid the many obstacles in their

way, including the cute little shrubs and the posts at the edge of the fairway. More hand labor is necessary to edge, trim, paint, replace, and maintain the variety of markers in the ground. Few people consider that the cute little 150-yard trees planted by the last green committee grow to become big 150-yard trees that need extra pruning and maintenance. Oddly enough, there is always money in the budget to purchase the trees but never any money for pruning and maintenance. Yet, green committees can't avoid the temptation of putting their mark on the golf course with yet another type of more accurate and more visible yardage marker. The results can be confusing.

How many times have you played a course and stood on the big white disk indicating 150 yards to the green and noticed the sprinkler next to it that reads 154 yards? Do you put a red flag or a blue flag on that 2,500 sq. ft. green that is only 10 yards deep? These are non-agronomic questions that more and more superintendents are facing because if a golf shot is missed, it's not the fault of the golfer. It's bad information! Dealing with these issues takes time away from the real business of golf course turf management.

What do the Rules of Golf say about yardage markers? Objects that have been placed on the course or marked to indicate yardage are permissible. If these objects are man-made or they interfere with the lie of a player's ball or his stance or area of intended swing, the player is entitled to relief without penalty under the obstruction Rule (Rule 6-24). But if the interfering object is natural, such as a shrub or tree, relief without penalty is not available. Finally, Rule 14-3 strictly prohibits the use of electronic distance-measuring devices, be they the hand-held or cart-mounted variety.

*This 150-yard shrub looks out of place and blocks the shot from the bunker on this dogleg hole.*

I guess gadgets and gizmos are a part of the game. It's the nature of golfers to want whatever advantage they can get to shave one or two strokes off their score. A good case can be made that yardage markers improve safety so that golfers don't hit into the group ahead of them. A simple yardage marker should be sufficient, as well as some common sense and good course etiquette. Traditionally, the game of golf should test the nerves and skill and judgement of the player in executing a proper golf shot. Part of that skill is judging distance. Yardage markers should not become eyesores or maintenance problems. The best advice is to keep it simple. One or two types of marking devices should be plenty. Let's speed up the game and simplify maintenance by eliminating the clutter of different yardage markers on the course. Information overload can be paralyzing for the pace of play as well as for the maintenance of the golf course.

*A graveyard for 150-yard markers that are past their prime.*

PAT GROSS *is an agronomist in the Western Region. He has a 10.5 handicap index and can judge distance just fine, but his golf ball won't follow instructions.*

# NEWS NOTES

## IN MEMORIAM

Dr. C. Richard Skogley, recipient of the 1992 Green Section Award, passed away on September 10, 1997, in Exeter, Rhode Island. Dr. Skogley had been active in turfgrass management programs at the university level for 40 years.

In 1960, he accepted a position at the University of Rhode Island to conduct research and extension activities, and to teach in the field of turfgrass management. As a researcher, Dr. Skogley produced several important turfgrass cultivars, including Providence creeping bentgrass, Jamestown chewings fescue, Kingstown velvet bentgrass, and Exeter colonial bentgrass. He also was involved in developing cultural maintenance practices that have been widely adopted on golf courses throughout New England.

As an educator, he guided, mentored, and taught hundreds of students in the University of Rhode Island turfgrass program, many of whom continued on to prominent positions in the turfgrass industry. Throughout his career, he received awards and honors from many professional and community groups, recognizing his dedicated energy and commitment to raising educational programs to new levels.

A comment from one of the Green Section Award nominations provided insight into Dr. Skogley: "Dr. Skogley is a gentleman, a scholar, and a soft-spoken, compassionate individual who loves the game of golf and the turf on which it is played."

## 1998 TAS FEES

For the third straight year, fees for 1998 Turf Advisory Service (TAS) visits will remain the same for the upcoming season!

Back by popular demand, a $300 discount will again be offered to TAS subscribers paying prior to May 15th. The actual TAS visit can be scheduled anytime throughout the year.

| | Regular Fee | With Pre-May 15 Discount |
|---|---|---|
| Half-Day Visit | $1,200 | $ 900 |
| Full-Day Visit | $1,700 | $1,400 |

For past subscribers, TAS reminders will be mailed to golf courses after the first of the year.

## *GREEN SECTION RECORD* BINDERS


Want to get a head start on that New Year's resolution to straighten up your office for the 1998 season? The USGA Order Department is offering magazine binders to help organize the *Green Section Record* collection in your office library.

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JAMES T. SNOW, Editor

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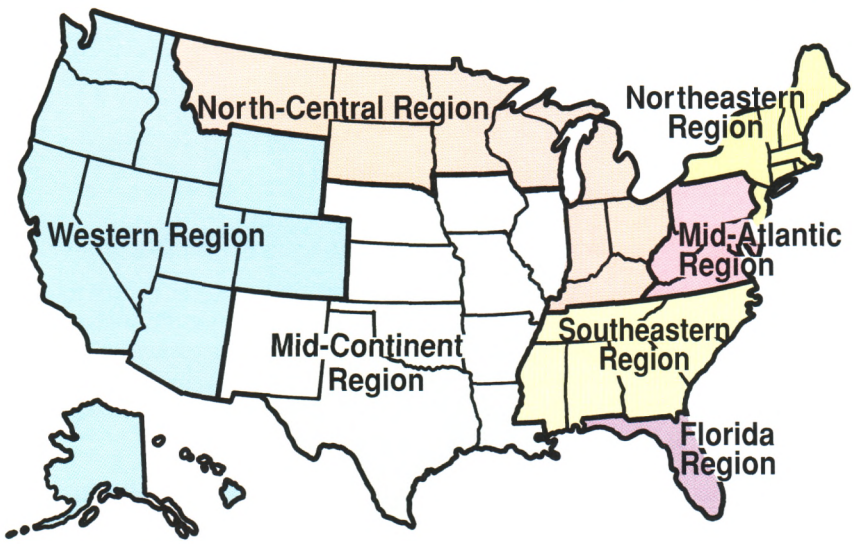


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# TURF TWISTERS

## PLAN ON

**Question:** We are in the process of developing a master plan for our cart paths. During the discussions, a question arose regarding the width. My committee prefers narrow paths that are less visible and have less of an impact on play. What is your opinion? (New York)

**Answer:** The minimum suggested width for cart paths is eight feet. In areas where there is two-way traffic or where maintenance equipment frequently travels, the paths should be wider (12 feet or more) to allow for ease of passage and to minimize the chance of wear occurring off the cart path.

## MONITORING

**Question:** We rebuilt our greens to USGA specifications three years ago and since then the infiltration rate has decreased from 17 inches per hour (when new) to 7 inches per hour. Aerification helps, but within a month infiltration drops again. What's most alarming is the formation of a layer high in clay, silt, and organic matter immediately below the turf surface (within the top inch). What can we do to improve our situation? (Texas)

**Answer:** Check the water source that you are using to irrigate the greens. You may be pumping water high in suspended solids. An easy way to test the water is to fill a graduated cylinder and let it stand undisturbed for three or four days. The suspended solids will settle on the bottom. If you have muddy water, you may be able to correct the situation by installing a floating intake and/or a filter on the pump station. Once the water quality is improved, begin an aggressive core aerification program to slowly reduce the effects of the layering. In severe cases, the best course of action is to remove the surface layer and replant.

## STUDENTS AS AN UNTAPPED RESOURCE

**Question:** We have heard that there are a number of university turf students who look for summer work. In fact, many need this type of employment to complete their curriculum requirements. How can we best tap into this resource to benefit the turf maintenance program at our course? (Maryland)

**Answer:** Begin by contacting universities that offer turfgrass management programs. Provide information to the university about the requirements of your prospective employees. Generally, if there is an opportunity for the students to be involved with a wide array of turfgrass management techniques and practices, they will be eager to come on board. The employee and the employer will gain the most when their job duties are clearly defined.

One of the major stumbling blocks in attracting turf students to an intern program is housing. If there is local housing available, this should be clearly stated when announcements are sent to universities. If you are truly interested in establishing a strong intern program for the future, you may even want to invest in a two- or three-bedroom trailer that can be parked near or on the property.