



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 $\frac{1}{4}$ inch for daily play and $\frac{3}{16}$ 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 tempera-

tures 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 $\frac{3}{16}$ 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 $\frac{3}{16}$ to $\frac{5}{32}$ 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

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



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.

more than 50 percent of the bermudagrass was not Tifway.

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

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,

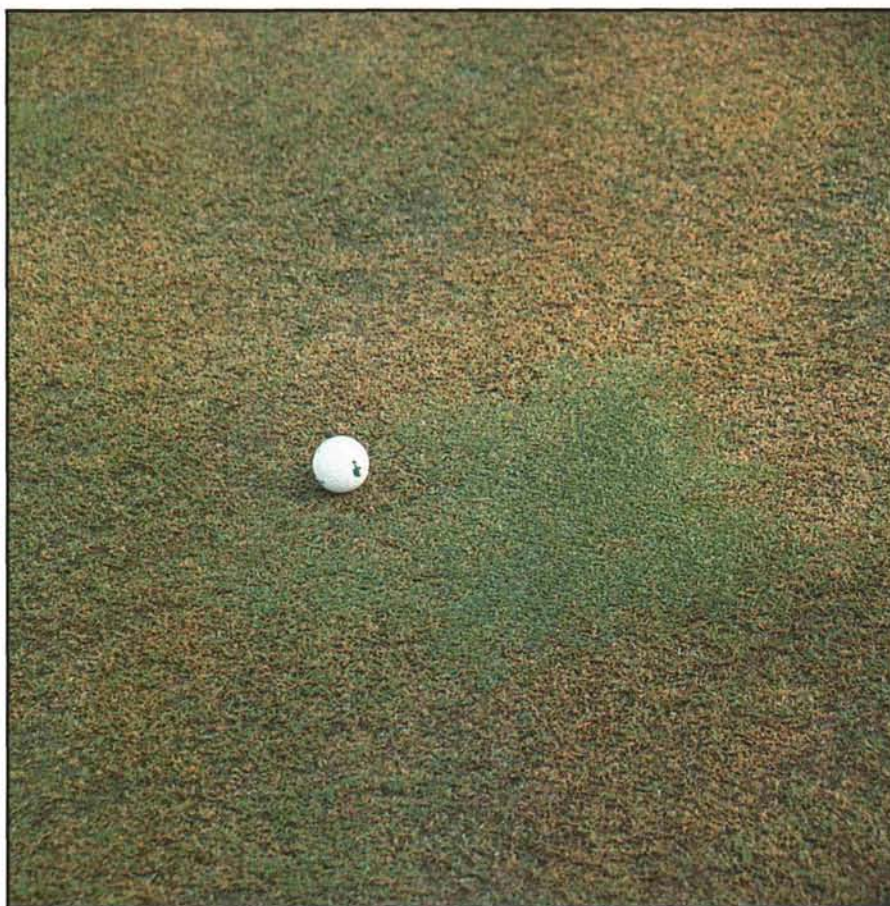
many Southern golf course superintendents have observed off-type areas in their greens that exhibited better growth and performance characteristics relative to the base bermudagrass. Selections and propagation of these grasses have provided another source of improved turf. 'Champion,' 'Floradwarf,' and '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 $\frac{1}{8}$ 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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