Tifgreen Bermudagrass: Past, Present, and Future

How a trip to Taylor´s Creek Golf Course in Georgia offered an agronomic history lesson while simultaneously providing a glimpse into the future.

BY PATRICK O´BRIEN

Photo 1. An aggressive ultradwarf mutation from Tifgreen bermudagrass was able to completely overtake green number 10. Could this ultradwarf someday become the putting green variety of choice in the future?

Tifgreen bermudagrass, also commonly known as 328, isn't talked about much these days. It is not even commercially available on a wide scale as it once was. But to say that Tifgreen bermudagrass is not continuing to make a major contribution to the turfgrass industry simply could not be further from the truth. A recent trip to Taylor's Creek Golf Course at Ft. Stewart, Ga., revealed that Tifgreen bermudagrass may have one final encore remaining before it is literally — and figuratively — put out to pasture.

This article is a story about the past meeting the future. Tifgreen bermudagrass is the central character, and in the coming pages a tribute is made to one of the great turfgrass varieties of the past and details are offered on how it may forever influence the development of bermudagrass putting greens in the future.

AN INVITATION TO TAYLOR´S CREEK

In March 2012, I received a call from Taylor's Creek superintendent Robert Greer seeking assistance with an upcoming putting green regrassing project. Taylor's Creek was built in 1961 by the U.S. Army Corps of Engineers, and the putting greens had not been renovated since they were first planted to the original Tifgreen bermudagrass. I must say that upon my arrival at Taylor's Creek I was stunned by the appearance of the putting greens. They looked like a patchwork quilt. The number and variety of mutations was extraordinary. All but two greens were covered with patches — some large, some small — with differences in colors and textures, tolerance to nematodes and shade, and even competitive relationships among themselves. I had a hunch that these putting greens might hold some historical value and could be of interest to turfgrass breeders. Before continuing with the story, however, it is impor-

Green Section Record Vol. 50 (22)
October 19, 2012
TGIF Record Number 212126

Photo 2. Purple mutations on green number 18 demonstrate the dynamic and changing nature of Tifgreen bermudagrass over the past 51 years at Taylor's Creek Golf Course in Ft. Stewart, Georgia.

tant to first provide some background information on Tifgreen bermudagrass

WHAT IS TIFGREEN BERMUDAGRASS AND WHERE DID IT COME FROM?

Tifgreen bermudagrass was a game changer for golf in the South beginning with its release in 1956. Prior to this, the surfaces of putting greens on southern U.S. courses were either sand, seeded common types of bermudagrass, or ryegrass in the cooler months. Each type of surface had unique problems, and there was a need for something better. These needs were affirmed by then USGA Green Section director Fred Grau and U.S. Department of Agriculture scientist O. S. Amondt. Beginning in 1946, the United States Golf Association began giving Dr. Glenn Burton $500 in annual grants. His first goal was to find a better bermudagrass for use on putting greens.[1]

Traditional plant breeding is a slow process that requires dedication and patience over many years. Research that began in 1946 in Tifton, Ga., led to the cross pollination of *Cynodon transvaalensis* (African bermudagrass) and *Cynodon dactylon* (common bermudagrass). African bermudagrass is a very fine-textured diploid bermudagrass with low stress tolerance and 18 chromosomes. Conversely, common bermudagrass is a coarse-textured tetraploid bermudagrass with 36 chromosomes and high tolerance to stress and pests. When crossed, they produce triploid hybrids that contain 27 chromosomes with excellent stress tolerance and good pest resistance. Triploid hybrids are sterile, meaning that even though they produce seed, it is not viable, according to Dr. Wayne Hanna, former research scientist with the U.S. Department of Agriculture and longtime plant breeder and professor at the University of Georgia's research center in Tifton, Ga. Therefore, all propagation must be done vegetatively through sprigging, plugging, or sodding. The breeding work at Tifton produced many sterile triploid hybrids with a variety of physical characteristics. These were evaluated in numerous field trials and studies. Ultimately, a hybrid known as Tifton 328 showed the most promise, and it was released commercially as Tifgreen bermudagrass in 1956.[1] The label 328 stuck with Tifgreen the same way 419 stayed associated with Tifway. However, and just to be clear, the correct variety name is Tifgreen, not 328.

ROLE OF TIFGREEN

Upon its release, Tifgreen was used primarily on putting greens, but several golf facilities used it throughout the entire course — putting greens, tees, fairways, and rough. Although Tifgreen raised the bar for turf performance and set a new standard for golf, a major weakness began to surface. Tifgreen possessed a prolific ability to genetically mutate and create different plants that have widely varied physical characteristics. Dr. Elsner, retired executive director of the Georgia Seed Development Commission, says that no

Photo 3. Several mutations of Tifgreen bermudagrass were surviving areas infested with nematodes on green number 3.

morphological characteristic used to identify triploid bermudagrass cultivars, including texture, color, seed heads, growth rate, rooting, and rhizomes, was exempt from this mutation phenomenon. As one might imagine, these off-types, or contaminants, were highly undesirable in a putting green or production field.

led to several other major breakthroughs for golf in the Southeast:

- **Mutation Breeding** — Dr. Burton said it best in 1986, "The occurrence of the natural mutant Tifdwarf in Tifgreen and the finding of other probable mutants indicated to us that we might speed up this natural mutation process by treatment with mutagenic agents."[1]

Photo 4. Among the Tifgreen bermudagrass population changes were several mutations that had adapted well to shade on green number 15.

Ironically, Tifgreen's weakness became its legacy. A case in point is Tifdwarf, which is a naturally occurring mutant of Tifgreen, originally identified by James B. "Monty" Moncrief, then director of the USGA Green Section's Southeast Region, in the early 1960s at Florence Country Club in Florence, S.C., Mr. Moncrief collected the Florence ecotype along with one from Sea Island and encouraged Dr. Burton to evaluate them with Tifgreen, as the two ecotypes were a darker green color and could tolerate lower mowing heights than Tifgreen. Early speculation was that the two mutants occurred in experimental sprigs at Tifton and were transferred to Florence and Sea Island when those greens were planted.[3] However, following the release of Tifdwarf in 1965, it became apparent that the mutations continued to occur on golf greens wherever Tifgreen was planted, and we know now that the phenomena are present in all ecotypes of Tifgreen parentage.

In addition to the discovery of Tifdwarf, Tifgreen's propensity to mutate This method has since been used extensively by bermudagrass breeders.[2] In fact, Dr. Wayne Hanna used this technique to develop TifEagle bermudagrass.

- **Natural Selection of Ultradwarfs** — Two prominent modern ultradwarf bermudagrass varieties — Champion and Miniverde — are selections from naturally occurring mutations in Tifdwarf. Metaphorically speaking, these grasses are grandchildren of Tifgreen bermudagrass.

COLLECTING SAMPLES

Upon returning from my first trip to Taylor's Creek, I contacted Dr. Earl Elsner and Dr. Brian Schwartz, a turfgrass breeder at the University of Georgia, Tifton Experiment Station. I told them that 50 years of low maintenance on a genetically unstable grass, Tifgreen, had me wondering if the next bermudagrass might be lurking somewhere on the course. They were both intrigued by the opportunity and agreed to make a collection trip to Taylor's Creek.

Dr. Elsner, Dr. Schwartz, and I returned to Taylor's Creek on April 13, 2012, with everything we needed to collect samples. Turfgrass breeders seek genetic diversity on collection trips and therefore we tried to select plants that had both desirable and undesirable physical characteristics. Generally, we tried to take at least four sets of samples per green using a two-inch plugger. All samples were labeled and taken back to Dr. Schwartz's facility in Tifton, Ga.

Below are a few of the more interesting mutants collected:

- Green No. 10 and a practice putting green had fine-textured ultradwarf types present. One ultradwarf was so aggressive it had taken over the entire surface of the 10th green (Photo 1). On the practice green another ultradwarf type had taken over about 40 percent of the green, yet it was distinct from the one on the 10th green. Dr. Schwartz plans to observe these closely in the future.
- Two putting greens contained off-types that had purple leaves (Photo 2). A secondary mutation was battling with the purple-colored mutations and a mixture of the two colors was present. This showed us the dynamic and changing nature of mutated populations.
- Green No. 3 had been well documented with nematode issues over the years, and it had several mutations of Tifgreen that were surviving well. Photo 3 highlights some of the mutations being unaffected by high nematode populations in the soil.
- Greens Nos. 13 and 15 had shade issues, but a few mutations were performing well under lower light intensities (Photo 4).

Drs. Elsner and Schwartz made many interesting observations during the trip. First, they affirmed that they had never seen anything like this in their careers. They believed that given the advanced age of the putting greens combined with Tifgreen's propensity to mutate, there may not be any of the original Tifgreen remaining. Additionally, they confirmed that the low level of maintenance intensity at Taylor's Creek contributed significantly to the current population of mutations. Had

maintenance been more intense, there likely would have been completely different populations. They also felt that in another 50 years the population dynamics and makeup of these greens would be even more different because mutations would not stop. They believed changes in population dynamics would continue to occur even if the existing population of mutants was allowed to remain and regardless of whether or not management conditions were kept the same for all greens or varied.

WHAT IS NEXT?

This is an excellent question. The discovery of these mutations at Taylor's Creek opens up a wide variety of possibilities. First, Dr. Schwartz will plant the off-types in containers in a greenhouse to increase their population. Eventually, they will be planted in a nursery at the Tifton Station. Observations of agronomic traits such as establishment rate, density, color, leaf width, etc., will be recorded and compared with industry standards. Will another ultradwarf be discovered that offers the next level of performance? We must wait and see.

Although the Tifgreen at Taylor's Creek has now been sprayed with glyphosate and removed, Dr. Schwartz intends to keep its legacy going. He plans to establish a nursery green with all the mutants and see how they battle it out, just as they have done for the last 51 years.

Finally, an opportunity exists for a research scientist or graduate student to identify why Tifgreen bermudagrass is so genetically unstable. Unraveling this mystery could lead to further breakthroughs in turfgrass breeding.

CONCLUSION

What began as a $500 investment by the USGA in a turfgrass breeding program combined with keen observations by a USGA agronomist has led turfgrass scientists and golf course superintendents down a path no one could have predicted. More important, the game of golf has been the winner as Tifgreen and its progeny, in this case a family of mutations, has been the surface of choice for golf courses that span the globe. It is safe to assume that millions upon millions of rounds of golf have been played on surfaces that were established with Tifgreen or a product of Tifgreen. Just as turfgrass grows, matures, and evolves each season, plant breeding continues to advance. The story at Taylor's Creek turned out to be an unexpected history lesson, and it just might provide a glimpse of what's ahead in the future.

ACKNOWLEDGEMENTS

Special thanks to Dr. Earl Elsner, retired executive director, Georgia Seed Development Commission; Dr. Brian Schwartz, turfgrass breeder, University of Georgia, Tifton, Ga.; Robert Greer, golf course superintendent, Taylor's Creek Golf Course, Ft. Stewart, Ga.; and Jarrod Nemitz, assistant superintendent, The Ford Plantation, Richmond Hill, Ga.

REFERENCES

1 Burton, Glenn W. 1986. Annual Turfgrass Research Report [USGA/GCSAA]. December. p. 2-3. (TGIF Record 9230)

2 Burton, Glenn W.; Powell, Jerrel B. 1971. USGA Green Section Record. November. 9(6): p. 9-11. (TGIF Record 17390)

3 Elsner, Earl. 1966. M.S. Thesis. A New Bermudagrass for Golf Greens.

PATRICK O'BRIEN *is the USGA Green Section's Southeast Region director located in Griffin, Ga., not far from what has become known as the bermudagrass breeding capital of the world in Tifton, Ga.*

Photo 5. The plant collection team at Taylor's Creek Golf Course included Dr. Brian Schwartz, Dr. Earl Elsner, Jarred Nemitz, and Patrick O'Brien.

Photo 6. The collected samples of bermudagrass off-types are now planted in containers in a greenhouse at the Tifton Station. Soon they will be taken to a nursery and planted for further observations and studies.