Better Bermudagrasses to Meet Golf's Demands

by GLENN W. BURTON and JERREL B. POWELL

"Cowpasture pool," a name frequently given to golf 50 years ago, was not chosen by accident. Many golf courses were located in cow pastures and the grass was what was there. Sand greens frequently offered a better putting surface than the mixture of weeds and grasses that covered the greens. Even today several grass species and weeds like yarrow occupy the greens on some of the world's oldest courses.

Golf can be played in a cow pasture, but few golfers in 1971 are willing to do so. One prominent golf course was recently criticized because in the off-season several different strains of bermudagrass could be outlined on the same green. Someone has facetiously observed: "Golf greens today must be as smooth and fast as a billiard table. They must be covered with one grass and not a single weed will be tolerated."

Certainly the grass is one of the most important components of the living green carpet that we call "turf." The other two components that determine turf quality are the environment and management. The grass variety interacts with an environment that is generally altered by management to make turf. For top quality turf, the grass, environment and management must be compatible.

If we are to develop better grasses for golf, we must know the demands of the game. Here they are as we see them:

Golf Demands

For top-quality golf greens, a grass must be able to withstand daily defoliation to a height of 3/16 inch and maintain a smooth, uniform surface that will keep the ball on a true course. Its leaves must be fine, soft, and closely spaced to meet this requirement. It must also have a uniform dark green color. For tees, a variety must be tough to stand the punishment doled out by the golfer and his clubs. It must have dense, stiff leaves to hold the ball well above the soil, and it must heal rapidly to fill in divot holes left by the players. For fairways, a variety must make an attractive, uniform carpet, dense enough to give a good lie to the ball. It must be able to heal divots rapidly and must tolerate considerable traffic. It must do all of this over a great variety of microenvironments with less water and care than greens and tees.

In addition to these specific demands, there are a number of general characteristics that we would like to incorporate into new golf course varieties for the South. First and most important is dependability. These varieties (except for overseeded winter grasses) should be perennial regardless of the weather. They should maintain a green color throughout their growing period (hopefully to be extended by increasing frost resistance). Low maintenance costs and, of lesser importance, low establishment costs should receive major attention in the development of every new variety. Wear resistance, shade tolerance and low weed potential are other important traits that should be added.

Figure 1. Potted plants of Tifgreen on the left and a very small dwarf mutant induced by exposing dormant sprigs of Tifgreen to gamma rays.

Figure 2. Close up of stolons of the two grasses shown in Figure 1.

Last year, $7,750,000 was spent in Georgia on maintaining golf courses. We can lower maintenance costs materially as we add resistance to drought, disease, insects, nematodes and weeds. Adding dark green color and dense growth habit, as we have done in Tifway bermudagrass, can reduce fertilizer needs but it may increase thatch problems, particularly if fertilizer applications are not reduced to match the needs of such new varieties. The dense growth required to give a good lie to the ball adds wear resistance and materially reduces weed problems. Sod density can be increased genetically or by adding more fertilizer. It is much cheaper to do it genetically, but management must match the variety. Too much fertilizer, as it makes too much grass, will increase mowing costs, disease and insect-control problems, and will add to the difficult job of removing thatch. Finally, developing small or dwarf varieties that rarely produce seedheads can reduce mowing frequency and lower maintenance costs. Such savings may be offset, in part, by expenditures for herbicides to control the weeds that are usually more prevalent in areas planted to these less-vigorous grasses.

Having outlined the requirements for these new varieties, we have only to find or create them, prove their worth, learn how to manage them, and put them to work. To do this sounds easy, but it will require a much greater investment in time and money than has been made to date.

Bermudagrass is the species that best satisfies the demands of golf in the South. Since it is a highly variable species, one might expect to find superior types on old golf courses. Such was the history of U-3. Discovered on a Georgia golf course and tested at Beltsville, Md., U-3 bermudagrass was released by the USGA Green Section and the Crops Research Division, ARS, USDA in 1947.

Hybridization

When we began our turf research at the Georgia Coastal Plain Experiment Station with the help of a USGA Green Section grant in 1946 (support that has been continuous to date), we collected superior bermudagrasses from a number of golf courses in the South. Most of these were superior to bermudagrass established from seed, but none of it was equal to an experimental hybrid that we had made. This hybrid, named Tifton 57 (later Tiflawn), was released in 1952. Experience soon proved that Tiflawn grew too fast for golf. (It is still tops for football fields and similar heavy duty use.)

Hybridization, the technique that gave us Tiflawn, was used to create Tiffine, Tifgreen and Tifway. To produce these varieties, the tetraploid *Cynodon Dactylon* was crossed with the tiny fine leafed diploid *Cynodon transvaalensis* to combine the desired turf qualities of both species. Like their parents, these hybrids were variable and only the best selected

THE AUTHORS

Research Geneticists, Plant Science Research Division, Agricultural Research Service, U.S. Department of Agriculture, and the University of Georgia, College of Agriculture Experiment Stations, Coastal Plain Station, Tifton, Georgia.

after much testing, were named and released. Although these triploids are sterile, vegetative propagation has permitted their widespread use in the South.

A turf bermudagrass with greater winter hardiness than any now available would have a place in the U.S. We hope to develop such a hybrid using as one parent a very winter-hardy bermuda found in Berlin in 1966.

Attempts in recent years to improve the "Tif-" bermudas by making new hybrids have failed. The best of these (that are nearly as good as the "Tifs-") are being kept in our nursery as insurance against a possible disaster, such as the 1970 corn blight disease which greatly reduced corn yields.

Tifdwarf, our latest development, is a natural dwarf mutant that occurred in Tifgreen. As one might expect, Tifdwarf is very much like Tifgreen except that it is smaller. This makes it better able to withstand daily mowing at a height of 3/16 inch and gives it better putting qualities. One of the nation's all-time-great golfers said recently, "These Tifdwarf greens and Tifway fairways and tees are the finest turf I've ever played on." Obviously, they were well managed.

Mutation Breeding

Apparently, Tifdwarf and Tifway are close to the ideal for golf. But small changes in their plant color, pest resistance, herbicide tolerance, size and ease of management could make them better. 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.

Thus in the winter of 1969-70, we began mutation breeding research designed to produce mutants of Tifdwarf and Tifgreen. Dormant stolons, washed free of soil and cut into one or two node sections were selected because their buds contain few cells. Actively growing buds contain many cells and a one-celled mutant occurring in such buds will usually be obscured by the development of the normal cells around it. Thus the ideal bud for mutation breeding would be one cell in size.

When we treated dormant buds of Tifdwarf and Tifgreen with the chemical mutagen EMS (ethyl methane sulfonate) at rates up to levels that killed many buds, noticeable variants failed to appear. When we exposed dormant sprigs to 5 to 12 kR of gamma irradiation from a Cobalt 60 source, however, a number of distinctly different bud mutations occurred. Isolated from normal tissue and grown in two-inch pots in the greenhouse, these 60 mutants differed in leaf size, hairyness, stem diameter, internode length and basic plant color. In a field planting they showed differences in herbicide sensitivity, frost tolerance and rate of spread.

In the winter of 1970-71 we exposed dormant stolons of Tifgreen and Tifway to gamma rays and planted them in flats of sterile soil in the greenhouse. In April we spaceplanted in the field, the tiny plants that grew from the irradiated buds and isolated 62 mutants from Tifgreen and 36 from Tifway. These mutants were similar to those obtained earlier. Tifway, however, gave a lower mutation frequency and failed to produce as much variation in plant color.

These mutants are yet to be evaluated for pest resistance and all of the important characteristics required by golf. Time (at least three years) and much work will be required to test these mutants. Many will fail to pass the tests, but, hopefully, some of them will be better than the best we have today.

Figure 3. Tifgreen plot in foreground. Other plots are gamma ray–induced mutants of Tifgreen or Tifdwarf.