A Bermudagrass Primer and the Tifton Bermudagrass

by **WAYNE W. HANNA,** Research Geneticist, USDA-ARS,
Coastal Plain Experiment Station, Tifton, Georgia

BECAUSE bermudagrasses, *Cynodon* spp., are well adapted to a wide range of environmental conditions, they have adapted to areas from the tropics to well into the temperate zones and have been widely used in the United States for turf on golf courses, athletic fields, lawns, recreational areas, and for landscaping. The bermudagrasses are high temperature- and drought-tolerant, adapted to a wide soil pH range, tolerant to frequent close mowing, and adapted to most well-drained soils. However, they require frequent mowing, are not tolerant of heavy shade, and they become brown and dormant in the winter (except in frost-free areas where they remain green year-around).

There are two basic types of bermudagrass: (1) common and (2) the improved triploid hybrids.

Most common bermudagrass is of the *Cynodon dactylon* type. It produces seed and sheds pollen (which can cause allergy problems for some people). Common types can be seeded or vegetatively propagated, they usually have coarser leaves than triploid hybrids, and they produce good turf if they are fertilized and mowed regularly. The seeds and stolons of common types can become a weed problem, and common types established from seed can produce an uneven or mosaic-appearing turf from lack of plant uniformity. Vamont bermudagrass is an example of a more winter-hardy common selection released by Virginia Polytechnic Institute and State University.

Another type of bermudagrass is *Cynodon transvaalensis.* It is a very fine-textured, usually low-growing species. It can make a good quality turf early in the season, but this quality usually declines rapidly. It also sheds pollen and produces seed. Usually it is not as wear tolerant or pest resistant as the improved triploid hybrids. One of the major research and breeding objectives at the Tifton Experiment Station is to find more cold hardy *C. transvaalensis* plants to cross with common *C. dactylon* to produce triploid hybrids with more cold hardiness. Readers are encouraged to contact the author if they have, or are aware of the location of *C. transvaalensis* accessions.

THE IMPROVED triploid hybrids are made by crossing *C. transvaalensis* with *C. dactylon,* two common types. The hybrids combine the fine texture of *C. tranvaalensis* with the pest resistance, wear tolerance, and cold tolerance of *C. dactylon.* The hybrids are sterile and produce no seed or pollen. The reason for this is that *C. transvaalensis* has 18 chromosomes (small genetic or biochemical units in each cell that control the plant characteristics) and *C. dactylon* has 36 chromosomes. The hybrids get half the chromosomes from each parent, or a total of 27 chromosomes (one set of nine chromosomes from *C. transvaalensis* and two sets of 9, or a total of 18 chromosomes from *C. dactylon* to give three sets, which is referred to as a triploid). Since the base number of chromosomes for bermudagrass is x = 9; by dividing 18, 36, and 27 by 9 we get 2, 4, and 3 sets of chromosomes for *C. transvaalensis*, *C. dactylon*, and the hybrids, respectively.

Even numbered sets of chromosomes result in seed and pollen production while odd numbered sets result in sterility (no seed or pollen production).

The production of pollen on common types, or lack of pollen production on the hybrids, is one of the easiest ways to distinguish between the two. Pollen production can be determined by thumping a head currently exerting anthers (brownish sacs on a white stem in each small flower) at 7 or 8 a.m. against a black piece of paper. Pollen will be seen as a powdery substance on the paper *(Figure 2.).* Pollen production can also be determined at any time during the day

Old common bermudagrass fairway with significant mutations.

Head on, left — common bermudagrass. Head on, right — triploid hybrid bermudagrass.

by observing a seed head in flower, as in *Figure 1.*, with a small 10x pocket magnifier. Sterile triploids will have spongy anthers that have not opened on the sides, while anthers from common types will split on two sides of the anther to shed pollen *(Figure 1.)*.

The triploid hybrid bermudagrasses compared to common bermudagrass produce higher quality turf, are more pest resistant, make a denser turf, have fewer seedheads, are finer textured, produce no seed or pollen, and produce a more uniform turf because they are vegetatively propagated. The breeding and selection process insures survival of only the best plants. The Tif hybrids tolerate frequent close mowing. They may be more expensive to establish.

MOST OF THE widely used triploid bermudagrass hybrids have been developed and released by Dr. G. W. Burton, at the Coastal Plain Experiment Station, Tifton, Georgia. These include Tifgreen (328), Tifgreen II, Tifway (419), Tifway II, and Tifdwarf.

Tifgreen and Tifgreen II — Both Tifgreen hybrids are used mainly for putting greens but are also used for lawns and in landscaping. They have excellent putting qualities and are tolerant to overseeding. The hybrids have soft, forest green leaves and yellow anthers. They are low growing, disease resistant, spread rapidly and make a dense, weed-resistant turf. Tifgreen II compared to Tifgreen has a lighter green color, makes a denser and more weed-free turf, is more nematode resistant, more frost-tolerant, and has better springtime recovery. However, Tifgreen II may produce more seed heads during the winter (short days) in frost-free areas where the grass does not go dormant.

Tifdwarf — Tifdwarf is a natural vegetative mutant of Tifgreen that is used for putting greens and lawns. Compared to Tifgreen, it tolerates closer mowing (makes a denser turf when mowed at 3/16 inch), has small leaf, stem, and flower parts, takes less fertilizer to give it a comparable green color, has softer leaves, and fewer seed heads, and is more shade tolerant. Tifdwarf putting greens are faster-paced than Tifgreen, and when properly managed are comparable to bentgrass. Tifdwarf is more susceptible to weed competition if not properly managed. It has yellow anthers like Tifgreen.

Tifway (419) and Tifway II — Tifway and Tifway II are used for fairways, tees, athletic fields, lawns, recreational grounds, and industrial landscaping because they are tolerant to traffic. The Tifway hybrids are disease resistant, maintain a naturally darker green color with less nitrogen, make a dense weed resistant turf, and have stiff, upright leaves. Tifway II is a radiation induced mutant of Tifway. Compared to Tifway,

Tifway II makes a denser, more weed-free turf, is more resistant to root-knot, ring and sting nematodes, is more frost tolerant, and it turns green earlier in the spring, establishes faster, and has better quality turf. The Tifway hybrids exceed the Tifgreen hybrids in tolerance to traffic, sod webworm, and mole cricket resistance, and tolerance to 2, 4-D.

IN THE MID-1970s an increased awareness of off-type plants in triploid hybrid turf stimulated questions about their origin. There are three explanations for most of the off-types: (1) contamination — seeds scattered by birds or man, mixtures in planting materials, and/or live seed or stolons in the seedbed at establishment; (2) environmental — a result of fertilizer or chemical spills, soil differences, etc. These effects are usually not permanent. (3) mutations — a mutation is a permanent genetic change that can cause a plant to look different (such as taller or shorter, different color, finer or coarser leaves, etc.) than when it was originally planted. Mutations can occur spontaneously or they can be induced. Spontaneous mutations usually occur very infrequently, but they do occur.

From 1976 to 1980, James B. Moncrief, along with golf course superintendents in the South and Southeast sent to us 61 off type plants from Tifdwarf, Tifgreen, and Tifway turf on golf courses. Nine plants, or 15 percent were common types that resulted from contamination. Fifty-two plants were morphologically different from the variety originally planted, but they were triploid hybrids. These probably originated from a mutation. Finding 52 mutations under natural conditions in these hybrids is not unexpected, considering the billions of cell divisions that had to take place in the growing turf and the close scrutiny of the turf under uniform management.

A single rare offtype plant that is a triploid hybrid in your triploid hybrid turf would most probably be caused by mutation. Many offtype plants in your triploid hybrid turf would most probably be caused by contamination, or possibly the environment.

The Tifton bermudagrasses have made a significant contribution to golf and in all turfgrass areas across the southern United States and many other parts of the world. They are part of the theme "Golf Keeps America Beautiful." Our research on developing new turfgrass is continuing and the Tifton family of grasses will continue to grow.

Tifway fairway with Tifgreen contamination.

Tifway bermudagrass makes excellent tees, fairways, and roughs. Shoal Creek Country Club, Birmingham, Alabama.