More Transition Zone Blues

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THERE IS NOTHING more frustrating than losing large stands of turfgrass due to climatic conditions that cannot be controlled. In the transition zone, though, this is a fact of life. Each year, in some location, golf course turf is lost simply because it is just too hot or too cold. This was the situation facing golf courses in the spring of 1989 throughout northeastern Oklahoma — another verse of the "transition zone blues."

This year it was bermudagrass tees and fairways that suffered from abnormal climatic events during the five-month period from December through April. Winterkill varied from the loss of entire fairways to isolated injury in areas that experienced additional stress due to excessive shade, traffic, and soil moisture, or exposure to cold, dry winds.

The abnormal weather began in December, when temperatures averaged 1 to 3.5 degrees below normal. January temperatures, on the other hand, averaged 4.8 to 7.2 degrees above normal. In fact, January ranked as the tenth warmest since records have been kept. Day and night temperatures for mid-January varied by as much as 45 degrees due to clear skies, a dry air mass, and minimal wind activity.

The unusually warm winter weather brought out golfers in record number, putting additional rounds on dormant bermudagrass tees and fairways. The effects of compaction and stress on the bermudagrass cannot be fully measured, but it certainly did not help. Moreover, the warm weather, with temperatures reaching 69 degrees to 76 degrees on several occasions, may have induced some initial metabolic changes that occur when turf begins to break dormancy.

February brought a completely different set of weather conditions when one of the coldest arctic air masses on record entered the state on February 1. The thermometer plunged 15 to 25 degrees in a few hours during the middle of the day, and record-breaking low temperatures were recorded for several days. The entire month remained abnormally cold and was recorded as the sixth coldest February in the last 98 years.

March did not provide much relief. Widely undulating temperatures produced a monthly temperature average that was only slightly above normal, but it included periods of harsh cold, heavy snowfall, temperature highs in the 90s, and many daily periods of freezing and thawing. The daily and weekly swings

Heavy shade cast by large trees reduces the ability of bermudagrass to survive cold winters.

(Top) Traffic around greens and tees and on popular departure points from cart paths caused bermudagrass turf to be systematically killed this winter.

(Above) Steep, north-facing slopes on fairways experienced the most winter damage due to their increased exposure to cold, dry winds.

between cold and warm temperature extremes must have been a continuing source of stress to bermudagrass tees and fairways.

April is when life usually flows back into Oklahoma, when the trees begin to bud and the bermudagrass breaks dormancy. This was the case in 1989 as bermudagrass tees and fairways began to green up and resume normal spring growth. Unfortunately, the second week of April proved to be the crushing blow to many golf courses, particularly in the northeastern part of the state. Subfreezing temperatures for four consecutive days froze the young green shoots that were rapidly expanding from the bermudagrass crowns. Also, April turned out to be the driest in the last 98 years. Energy reserves for turfgrass plants growing under marginal conditions (*e.g.*, shade, traffic, poor drainage) throughout the affected courses were depleted, and only a few crowns in any of the affected areas were able to recover.

THE WEATHER for the five-month period from December 1988 to April 1989 was very abnormal and contributed greatly to the subsequent loss of turf on many courses. It was not just the weather, though, that caused the winter damage. Several other stress factors, including shade, compaction, excessive soil moisture, low mowing heights, and exposure contributed significantly to the classic winterkill patterns seen this year.

Shade — Excessive shade was one of the most obvious factors contributing to winterkill problems on several golf courses. The most noticeable patterns occurred along the north sides of mature trees, fences, and buildings which effectively shade bermudagrass areas throughout the spring and summer growing seasons. With a reduced amount of light during the growing season, the turf was unable to build sufficient reserves of carbohydrates to overcome the particularly stressful conditions encountered during the winter and spring of 1989.

Compaction — Soil compaction is always a problem, and by itself can severely thin bermudagrass tees and fairways during the growing season. When compaction effects are combined with the stress of cold temperatures, though, the pattern of winterkill can be quite dramatic. Cart traffic areas around tees and the popular departure points from cart paths were systematically killed this winter. The compaction that occurred during the growing season was only part of the story, for it was the winter play in December and January that was particularly tough on the more heavily played golf courses. Entire tees, particularly those opened for winter play, were completely devastated by winterkill. Due to the lack of drying weather conditions during the winter, wet soil is always most susceptible to compaction at that time. During the spring, when green-up should have occurred, the lack of oxygen in the soil and decreased energy reserves prevented the bermudagrass from recovering in these areas.

Soil Moisture — Bermudagrass turf on poorly drained areas of fairways was found to be more susceptible to winterkill. Whether it was the lack of proper soil aeration, the effects of increased freezing and thawing, greater compaction, or a combination of all three cannot clearly be determined. On poorly drained areas, however, the bermudagrass simply did not green up.

Exposure — Exposure to cold, dry winds during February and early spring played an important role in the winterkill process. Fairways and tees near roads or large open areas experienced greater winterkill than those in the interior of the course that were protected by trees and other types of windbreaks. Also, steep, north-facing slopes on long fairways had the most winter damage, while south-facing slopes on the same fairways recovered completely during the spring.

Mowing Height — Lower heights of cut on tees (½ inch) and fairways (⅝ to 1 inch) appeared to affect the degree of winterkill. It was especially dramatic on walking paths maintained between the tee and first cut of fairway. Perhaps the difference was attributable to the physiological stress that occurs at lower mowing heights combined with the effects of soil compaction that results from extra foot traffic in these areas.

EVERY GOLF course superintendent is in search of the perfect grass or grasses that meet the demands of his greens, tees, and fairways. In the transition zone, unfortunately, there is simply not a perfect solution. Nevertheless, we do have enough experience to give us some direction. For example, common bermudagrasses are generally more susceptible to winterkill than improved varieties, and hybrid bermudagrasses such as Tifgreen and Tifway are more susceptible to early freezing temperatures in the fall compared to Midiron. We also know that the variability found among the many available strains of U-3 that predominate on fairways and tees on Oklahoma golf courses makes it nearly impossible to predict their winter hardiness level. Even winter-hardy Midiron and U-3 were subject to winterkill under the severe conditions that occurred in 1989.

Many agronomists have supported the use of Meyer zoysiagrass because of its substantially better winter hardiness compared to bermudagrass. However, the disadvantages of slow growth during establishment, poor recuperative potential on heavily used areas, and increased water requirements have limited its widespread use. Other bermudagrasses, such as the seeded varieties Guymon and Sahara, also have problems meeting the demands of the transition zone. Guymon has improved winter hardiness, but lacks the fine texture demanded of golf course fairways and tees. Sahara would be well suited for fairways in Oklahoma because of the significant improvements in texture and turf quality, yet its winter hardiness is doubtful in the colder parts of the bermudagrass growing region.

The bermudagrass breeding program at Oklahoma State University and the cooperative effort between the USDA and University of Georgia are currently receiving funding support from the USGA/GCSAA research effort. Bermudagrass breeding efforts have concentrated on the development of seed-propagated varieties that are superior to Arizona Common and the improvement of existing vegetative varieties such as Tifway and Tifgreen. At Oklahoma State University, Dr. Charles Taliaferro continues to make progress toward increasing the seed production and improving leaf texture and growth habit of a cold-tolerant bermudagrass population. Mean fertility (seed set) was tripled while texture was improved slightly during three cycles of recurrent selection. Plants of very fine textured *C. transvaalensis* having excellent seed production were identified and will be evaluated further for important seed production and turfgrass characteristics. The need for superior cold tolerance, sod density, and extremely fine texture make the development of vegetative and seeded varieties from these parental clones extremely important.

In Georgia, Tifton 10 bermudagrass was recently released by the USDA breeding program under the direction of Dr. Glenn Burton and Dr. Wayne Hanna. This variety originates from a lawn in Shanghai, China, and has a unique bluish-green color that distinguishes it from other bermudagrasses. Under low management, Tifton 10 displayed turf quality similar (but coarser textured) to Tifway and Tifway II and received higher ratings than Midiron at two locations. Tifton 10 has good cold hardiness and is well suited for golf course roughs. Future research plans at Tifton, Georgia, will include the development of more cold-tolerant, fine-textured hybrids, new dwarf hybrids similar to Tifdwarf, and evaluation of breeding lines similar to Tifton 10 with turfgrass potential.

IN SUMMARY, new varieties will be too late to help the golf courses that suffered winterkill in the spring of 1989. Many superintendents have already purchased as much as three acres of sod to quickly repair their damaged areas. Others have sprigged directly into the injured turf, and still others have been unable to do anything because of financial restrictions. The popular bermudagrasses for replacing damaged areas have been U-3 and Midiron. At least one course converted a major portion of its tees to Meyer zoysiagrass. Where time and funding permit, correction of soil drainage and traffic problems will receive extra attention. In roughs where shade has become a problem, tall fescue or Kentucky bluegrass will be established. Many of these courses, however, will need to extend their irrigation systems to maintain adequate moisture for these grasses during the dry, hot summer months.

Despite these heroic efforts, there will be some frustrating years ahead until plant breeding programs develop significantly improved, winter-hardy varieties. With luck, the record-breaking temperatures that were observed this year in Oklahoma during the late winter and early spring will not occur again for several years. Let's hope that the "transition zone blues" does not make it to the top of the charts.