

Warming Up in the Transition Zone

Golf courses are increasingly choosing warm-season turfgrasses as maintenance budgets continue to be squeezed.

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Cavalier zoysiagrass provides high-quality fairways at the Blessings Golf Club in Fayetteville, Arkansas.

The transition zone is that 200-mile-wide belt between the cooler northern states and warmer southern states that stretches from Kansas to Maryland. Both cool-season and warm-season turfgrasses are present in this area, although few turfgrass species are well adapted to this challenging climate. Transition zone golf courses primarily have cool-season grasses, such as annual bluegrass, creeping bentgrass, Kentucky bluegrass, and perennial ryegrass on the fairways. However, golf course superintendents in this region struggle to maintain cool-season grasses during the summer due to excessive heat, irrigation requirements, disease pressure, and traffic effects. These grasses can decline in the summer, causing poor golfing conditions in spite

of superintendents spending many hours and dollars to maintain acceptable playing surfaces.

Turfgrass breeders continue to make improvements in warm-season grasses, especially bermudagrass and zoysiagrass, and more golf courses in the transition zone are opting for improved varieties of these grasses. Bermudagrass and zoysiagrass both produce excellent fairway turf in the transition zone. During summer months in the transition zone, bermudagrass and zoysiagrass are actively growing, but during the cool periods of the year they enter winter dormancy.

Like nearly all turfgrasses, bermudagrass is not native to the United States. Originating in Africa, bermudagrass is a warm-season turfgrass species that is well suited for golf course greens,

tees, fairways, and roughs. Common bermudagrass and hybrid bermudagrass (a cross between common and African bermudagrasses) are used on golf courses. Establishment of common bermudagrass is by seed, whereas hybrid bermudagrass must be established by sodding or sprigging. Once established, bermudagrass creates an aggressive turf with high shoot densities.

Bermudagrass is best adapted to southern regions of the transition zone, the warm arid zone, and the warm humid zone of the U.S. When bermudagrass is planted in the transition zone, it can be seriously thinned by low-temperature kill during the first year of establishment (8) and again intermittently, depending on the severity of winter. However, newer cold-tolerant

cultivars such as Riviera, Latitude 36, Yukon, Patriot, and NorthBridge, all products from USGA-funded research, are beginning to change this trend.

Zoysiagrass is also an introduced grass species to the United States. Zoysiagrass, named after Austrian botanist Karl Von Zoos, was introduced into the United States in the early 1900s (3). Originating in East Asian coastal areas, zoysiagrass is a warm-season turfgrass species well suited for golf course fairways, tees, and bunker faces. Once established, zoysiagrass creates a dense, high-quality turf (1).

Zoysiagrass performs especially well on golf course fairways and finds its greatest niche in the transition zone. Although it goes off-color, unlike bermudagrass, dormant zoysiagrass fairways remain highly playable for golfers. Zoysiagrass has excellent cold tolerance and is the most cold-tolerant of the warm-season grasses adapted to the transition zone. Many zoysiagrass cultivars can be used in the transition zone (5). In areas north of the transition zone, such as Missouri, Illinois, Kansas, Kentucky, Indiana, Ohio, Virginia, or Maryland, the cultivars Meyer or Zenith should be used.

Cavalier, Emerald, El Toro, Meyer, Zenith, Zeon, or Zorro zoysiagrass should be used in transition zone states such as Oklahoma, Arkansas, Tennessee, and North Carolina. In other states, such as Texas, Louisiana, Alabama, Mississippi, Georgia, South Carolina, and Florida, many cultivars can be used, depending upon the selection criteria. See ([TGIF Record Number 156610](#)) for more information on selecting zoysiagrass cultivars.

ADVANTAGES

Bermudagrass and zoysiagrass are increasingly being used in the transition zone due to difficulty in the management of cool-season turfgrasses. Because bermudagrass and zoysiagrass require fewer inputs than most cool-season fairway turfs, they are less expensive and more environmentally friendly to maintain. The following sections outline the cost of maintenance on a perennial ryegrass/annual bluegrass fairway versus a zoysiagrass or bermudagrass fairway in the transition zone. For a thorough review of the cost comparisons of zoysiagrass versus creeping bentgrass, refer to the publication developed by Dr. Jack Fry and co-authors entitled

“Zoysiagrass: Economic and Environmental Sense in the Transition Zone” (2).

FERTILIZATION

Compared to warm-season grasses, cool-season grasses require more nitrogen fertilizer per year in the transition zone. This increase in fertility is due to a longer growing season of cool-season grasses. Typically, perennial ryegrass requires about 3-4 pounds of nitrogen per 1,000 square feet per year, depending on the intensity of culture in the transition zone. On the other hand, zoysiagrass and bermudagrass in the transition zone require less nitrogen, with bermudagrass requiring about 3 pounds of nitrogen per 1,000 square feet per year and zoysiagrass requiring 1-2 pounds of nitrogen per 1,000 square feet per year.

While cool-season turfs must be fertilized with slow-release fertilizers at certain times during the year because of agronomic reasons and potential for fertilizer burn, quick-release fertilizers can be used more safely on the warm-season grasses since fertilizer burn is less of a problem. Since quick-release fertilizers are cheaper than slow-release fertilizers, the cost of fertilization can potentially drop when used on warm-season grasses. However, superintendents may choose to use a slow-release fertilizer on their warm-season fairways in the transition zone in order to provide a slow feed and reduce the potential for fertilizer burn at the interface with a cool-season rough. Regardless of strategy, warm-season grasses require less annual fertility in the transition zone (Table 1).

FUNGICIDES

Currently, the only major diseases that affect bermudagrass in the transition zone are spring dead spot and dollar spot, while zoysiagrass suffers primarily from *Rhizoctonia* large patch disease. Conversely, cool-season grasses can be affected by numerous diseases, including brown patch, dollar spot, gray leaf spot, *Pythium* blight, and summer patch. Disease susceptibility increases maintenance costs and reduces environmental soundness of cool-season grasses.

Table 1

Approximate annual maintenance costs for three grass types in the transition zone. Irrigation costs are not included as they vary by golf course location and water source.

Annual Maintenance	Annual Blue/ Perennial Rye (cost/A)	Bermuda (cost/A)	Zoysia (cost/A)
Fertilizer	\$300	\$250	\$150
Mowing*	\$350	\$250	\$250
Cultivation*	\$20	\$40	\$20
Fungicides	\$1,750	\$200	\$400
Insecticides	\$175	--	\$50
Herbicides	\$105	\$50	\$90
Total annual maintenance cost/A	\$2,700	\$790	\$960

*Adapted from Fry et al. (2)

Table 2

Comparison of cool-season vs. warm-season turfs for the transition zone

	Annual Blue/ Perennial Rye	Creeping Bentgrass	Bermuda	Zoysia
Nitrogen needs	👎	👎	👍	👍
Disease susceptibility	👎	👎	👍	👍
Insect control	👎	👎	👍	👍
Weed control	👎	👎	👍	👍
Irrigation needs	👎	👎	👍	👍
Summer play	👎	👍	👍	👍
Winter survival	👍	👍	👎	👍
Winter play	👍	👍	👎	👍
Thatch control	👍	👎	👎	👎
Establishment cost/time	👍	👍	👍	👎
Annual maintenance cost	👎	👎	👍	👍
	👍 More desirable	👎 Less desirable		

INSECTICIDES

Bermudagrass and zoysiagrass in the transition zone are less susceptible to insect pests compared to cool-season turfgrasses. Most of the insect pests that affect bermudagrass and zoysiagrass are located in the warm-arid regions of the country, south of the transition zone. The armyworm (bermudagrass) and the hunting billbug (zoysiagrass) are capable of causing damage (9), however few reports of damage to warm-season turf are reported in the transition zone. Unlike cool-season turfs, which are often damaged by white grubs and other insect pests, bermudagrass and zoysiagrass suffer little visible damage from these pests in the transition zone.

HERBICIDES

Whether growing cool-season or warm-season turf, every golf course has occasional weed problems. Most superintendents in the transition zone use pre-emergence herbicides for the control of annual grassy weeds on both cool-season and warm-season fairways. The dense cover of zoysiagrass and bermudagrass helps reduce weed populations, and, in general, the weed control budget of a warm-season turf in the transition zone will be slightly

less than a cool-season stand. Perennial and winter-annual weeds can be controlled on dormant bermudagrass or zoysiagrass with a single application of a non-selective herbicide in the winter. Some weeds like annual bluegrass and sedges can be controlled more easily in warm-season turf than cool-season turf due to difference in herbicide tolerance. Additionally, several new effective herbicides are available for weed control that can only be used on warm-season turf.

IRRIGATION

Bermudagrass and zoysiagrass have excellent heat and drought tolerance compared to cool-season grasses and are thus better adapted to the hot, humid summers in the transition zone than cool-season turfs. Using either bermudagrass or zoysiagrass on golf course fairways in the transition zone will reduce irrigation requirements compared to cool-season turf, resulting in lower irrigation costs (1, 2).

MOWING

Mowing fairways takes a considerable amount of time, which varies by turfgrass species. Time spent mowing fairways from greatest to least are annual bluegrass/perennial ryegrass,

bermudagrass, and zoysiagrass. Annual bluegrass/perennial ryegrass fairways usually require more total mowing because they actively grow from March to November. Bermudagrass requires a great deal of mowing during the summer months, but will only grow from May to October in the transition zone. Zoysiagrass is the slowest-growing grass and may only need mowing two to three times per week from May to October.

WEAR TOLERANCE

Another benefit of bermudagrass and zoysiagrass use in the transition zone is wear tolerance. Since bermudagrass and zoysiagrass are warm-season turfgrasses, they are actively growing during the greatest period of golfer activity and offer better wear tolerance than cool-season species (10). In fact, most courses with bermudagrass or zoysiagrass fairways instruct golfers to keep golf carts in the fairways and out of cool-season roughs during the summers.

DISADVANTAGES

The disadvantages of warm-season species compared to cool-season species in the transition zone are few, but they include winterkill potential, winter color, thatch accumulation, and establishment costs (Table 2).

WINTERKILL POTENTIAL

Winter hardiness is a concern of most superintendents in the transition zone. Choosing a cold-tolerant cultivar is the most important step in reducing this risk. Bermudagrass is less winter hardy than zoysiagrass and can potentially winterkill every few years (8), although significant improvements have been made in cold hardiness of bermudagrass in recent years. Zoysiagrass, although more cold tolerant than bermudagrass, also can winterkill in the transition zone. Increasing potassium (K) fertility may increase winter hardiness if soils are deficient in K (4), as well as removing traffic from fairways during the winter. Despite possible partial loss of some warm-season turfs every four or five years in the northern portions of the transition zone, annual bluegrass/perennial ryegrass fairways

Table 3

Summary of establishment methods and costs for bermudagrass and zoysiagrass. Adapted from Patton et al. (5, 6).

	Establishment Method						
	Sprigging Bermuda	Sprigging Zoysia	Strip-Sodding Zoysia	Solid-Sodding Bermuda	Solid-Sodding Zoysia	Seeding Bermuda	Seeding Zoysia
Establishment cost/A*	\$1,000	\$3,000	\$5,000	\$7,500	\$16,000	\$500-\$3,000	\$1,400
Time until 90 percent coverage	8 weeks	2-3 years	2-3 years	0 days	0 days	4 weeks	10 weeks

*Cost variable by species and cultivar. Labor is not included in establishment cost.

face this risk almost every summer from heat, drought, and devastating diseases such as gray leaf spot and *Pythium* blight.

WINTER COLOR

Another negative aspect of warm-season turf is its tan winter coloring during dormancy. Despite its dormancy, zoysiagrass remains very playable in the winter months, with stiff leaves that produce a great ball lie all year long. However, this is not the case with bermudagrass. Bermudagrass loses much of its canopy during the winter months and is often worn down to bare soil by spring. In order to maintain excellent playing conditions all year, bermudagrass may need to be overseeded with perennial ryegrass. This was a popular practice in southern regions of the United States but has

declined due to the economy or is avoided by most superintendents in the transition zone due its damaging effects on bermudagrass. The dormant color of bermudagrass and zoysiagrass is a major reason that some courses might opt to plant creeping bentgrass instead.

THATCH ACCUMULATION

Due to the stoloniferous and rhizomatous growth habit of bermudagrass and zoysiagrass, these species may accumulate thatch. Each cultivar requires slightly different management, and management varies from course to course. Some superintendents on courses that have zoysiagrass fairways and little traffic have found that minimal aeration is needed to maintain high-quality turf. Courses with more traffic or bermudagrass fairways may find

that more verticutting or aeration is needed to promote healthy turf. More frequent aeration may require new equipment and will increase labor costs in order to reduce thatch and soil compaction.

ESTABLISHMENT

A primary drawback to the warm-season grasses is establishment cost. Bermudagrass is relatively inexpensive to establish, either by sprigging or by seeding, but is more expensive to solid-sod. Zoysiagrass is generally more expensive than bermudagrass to establish. Zoysiagrass can be established by seeding, sprigging, strip sodding, or solid sodding. All methods can be effective in the long-term, but certain methods will be much more advantageous in the short-term (Table 3).



(Above left) Meyer zoysiagrass provides high-quality fairways at the Honors Course in Ooltewah, Tennessee.

(Above right) A perfect golf ball lie in a Meyer zoysiagrass fairway.



Zoysiagrass provides a playable surface in the winter months. If only the distinct color contrast would actually help more golf balls find the fairway! (Photo courtesy David Stone, Honors Course in Ooltewah, Tennessee.)

Many new bermudagrass cultivars developed in part with USGA funding are available with increased cold hardiness and excellent turf quality for use in the transition zone.

Traditionally, warm-season grasses have been established vegetatively, not by seeding. Vegetative establishment is expensive compared to seeding. For instance, sprigging bermudagrass is estimated at approximately \$1,000 per acre, and solid-sodding zoysiagrass may cost \$15,000 per acre, whereas seeding costs for bermudagrass and zoysiagrass are typically less than \$1,500 (6, 7). Bermudagrass and zoysiagrass establishment by seed is not only more cost-effective than vegetative establishment, but it is also less labor intensive.

Even though establishment costs of zoysiagrass or bermudagrass are significant, the reduced pest pressure and lower maintenance costs of new zoysiagrass and bermudagrass cultivars make them increasingly attractive long-term options for transition zone golf courses. Many courses in the transition zone with perennial ryegrass/annual bluegrass fairways are considering whether renovating to a warm-season grass is the right option. Whether a golf course is public or private, everyone can enjoy the long-term cost savings, excellent playability, and environmentally friendliness of bermudagrass or zoysiagrass in the transition zone.

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