Improved Zoysia Cultivar Could Have Use in Transition Zone

By Jack Fry, Qi Zhang, David Okeyo, Milt Engelke and Dennis Genovesi

The northern border of the turfgrass transition zone in the United States is roughly Interstate 70 from Maryland through eastern Kansas. The southern boundary is roughly the southern borders of North Carolina, Kentucky and Tennessee (Dunn and Diesburg, 2004). Whether or not a particular warm-season turfgrass species or cultivar will perform well in the transition zone is usually determined by its ability to persist through the coldest of winters. Bermudagrass [*Cynodon dactylon* (L.) Pers.], buffalograss [*Buchloe dactyloides* (Nutt.) Engelm.] and zoysiagrass (*Zoysia* spp.) are used throughout the transition zone and heralded for their heat and drought tolerance. Buffalograss is the most tolerant to cold among the three species with LT50s (the temperature that is lethal to 50 percent of the population) ranging from -14.0 to -21.7 degrees Celsius (Qian et al., 2001), followed by zoysiagrass (-8.4 to -11.5 C) (Patton and Reicher, 2007), and bermudagrass (-7.0 to -11.0 C) (Anderson et al., 1988, 1993).

Zoysiagrass is native to Asia and the South Pacific, along the eastern Pacific Rim to westward of the Indian Ocean (Engelke and Anderson, 2003). David Fairchild, son of George Fairchild, who was Kansas State University President from 1879 to 1897, introduced *Z. japonica* Steud. as Plant Introduction 9299 into the United States in 1902 (Fairchild, 1938). Among the 11 zoysiagrass species identified, three have been grown as turfgrasses in the United States since the 1930s (Halsey, 1956; Engelke and Anderson, 2003). *Zoysia pacifica* (Goudsw.) M. Hotta & Kuroi produces a very attractive turf with the finest leaf texture, but is only used in areas of Florida and Southern California, as it does not tolerate cold weather.

Grasses in the *Z. matrella* (L.) Merr. group form a thick and tough turf that is wear resis-

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PHOTO 1

Zoysiagrass progeny is developed at Texas A&M University-Dallas and evaluated in the field at Manhattan, Kan.

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tant but lack sufficient cold hardiness for use in the transition zone. Those grasses found in the Z. *japonica* group have the best cold hardiness among the three turf-type zoysia species, but most have a coarse leaf texture and inferior turf quality (Halsey, 1956).

Meyer zoysiagrass (*Z. japonica*) is named after Frank N. Meyer who collected zoysia seed in Korea in 1905 (Grau and Radko, 1951). Since the release of Meyer in 1952, it has been the principal commercial cultivar used in the transition zone, primarily because of its excellent freezing tolerance. As good as Meyer is, it does have limitations, including a coarse leaf texture when compared to cultivars of *Z. matrella*. It also has slow establishment and recuperative rates (Fry and Dernoeden, 1987), relatively shallow rooting depth and below-average drought avoidance capability (Marcum et al., 1995), and susceptibility to some pests, including the disease large patch (*Rhizoctonia solani* Kühn) (Green et al., 1993).

Researchers at Texas A&M University and the U.S. Department of Agriculture collected *Zoysia* germplasm in Asia in the 1980s, and some of this material ultimately contributed to the development and release of several vegetatively propagated zoysiagrass cultivars including Cavalier (*Z. matrella*) (Engelke et al., 2002a), Crowne (*Z. japonica*) (Engelke et al., 2002b), Diamond (*Z. matrella*) (Engelke et al., 2002c), and Palisades (*Z. japonica*) (Engelke et al., 2002d). All of these varieties exhibited high turf quality scores in evaluations from Southern states, but lacked the freezing tolerance necessary for long-term survival in the transition zone (NTEP, 2002). In a controlled freezing chamber experiment, Belair (*Z. japonica*), Chinese Common (*Z. japonica*), and Meyer exhibited regrowth from rhizomes exposed to -18 C, but no living tissue regrowth was observed with Cavalier, Crowne, Emerald (*Z. japonica* x *Z. pacifica*) or Palisades after exposure to temperatures below -10 C (Dunn et al., 1999). Winter injury field observations taken on 35 zoysiagrass varieties in Indiana have supported this controlled environment research. There, Diamond had the highest winter injury (98 percent to 100 percent tissue death), followed by Palisades (31 percent to 61 percent) and Cavalier (17 percent to 45 percent); whereas, Meyer and Chinese Common had no injury (Patton and Reicher, 2007).

Recently, researchers at Texas A & M crossed some of the aforementioned high-quality cultivars with cold-hardy *Z. japonica* in an effort to produce a cold-hardy cultivar with better quality and, potentially, a faster spread and recovery rate than Meyer. Some of the *Z. japonica* parental lines included in these crosses were Meyer and two selections of Chinese Common that were seeded at Alvamar Country Club in Lawrence, Kan., in the 1950s (referred to as Anderson No. 1 and No. 2 after Mel Anderson, the golf course superintendent who originally seeded these common *Z. japonica* cultivars).

In 2004 and 2005, more than 600 zoysiagrass progeny (offspring), most originating from crosses of a *Z. japonica* with a *Z. matrella*, were transported to Manhattan, Kan., from Texas A&M-Dallas and planted as single 4-inch-diameter plugs on 3-foot centers in a large nursery (Photo 1, p. 58).

From 2004 to 2007, we evaluated the grasses for cold hardiness, rate of spread and leaf texture. In 2006 to 2007, 31 of the top performing progeny were propagated in the greenhouse for more comprehensive evaluation under golf course fairway maintenance conditions.

The first week of June in 2007, these 31 progeny were planted as 3-inch-diameter plugs on 1-foot centers in 5-by-5 foot field plots with

PHOTO 2

Ph.D. student David Okeyo evaluates new zoysiagrass progeny in the field in Manhattan, Kan.

a total of 25 plugs per plot (Photo 2). Measurement of leaf-blade widths indicated that all but one of the *Z. japonica* x *Z. matrella* progeny had a finer texture than Meyer. By mid-August, Meyer zoysia exhibited 56 percent plot coverage. Three of the zoysia progeny were slower to spread than Meyer, but four had higher levels of coverage than Meyer. Two of the *Z. japonica* x *Z. matrella* experimentals had more than 70 percent coverage by mid-August.

In February, we culled members of the select group of 31 down to a elite group of 10 progeny for more intensive evaluation of cold hardiness. Meyer and Cavalier were included as well. The LT50s were -4.8 C for Cavalier and -16.1 C for Meyer. All 10 of the newly advanced hybrid zoysiagrass progeny demonstrated good cold hardiness, with LT50s ranging from -14.6 C to -16.7 C (Photo 3).

We are encouraged that some of the zoysia progeny evaluated have demonstrated a finer texture and faster rate of lateral spread than Meyer. In addition, 10 of these progeny tolerated temperatures between -14.0 C and -17.0 C in a controlled freezing experiment.

PHOTO 3

Two Z. japonica x Z. matrella progeny pictured on the left tolerated exposure to -14.0 C after a February field sampling. Cavalier (Z. matrella), on the right, did not.

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