

Evaluation of Nineteen Zoysiagrass Turfgrass Cultivars on the Texas High Plains

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ABSTRACT

The development of turfgrass quality zoysiagrasses (*Zoysia spp.* Willd.) is dependent upon texture, density, length of growing season, and overall turfgrass quality. Nineteen zoysiagrass cultivars were evaluated for their potential as a high quality turfgrass at Texas Tech University in Lubbock, TX, due to the relatively high elevation (1000m) and latitude (34°N), this area represents one of the most severe environments in which zoysiagrasses have previously exhibited marginal adaptation. Based on turfgrass quality ratings over four-years (1997-2000) the highest rated cultivars were El Toro, Emerald, HT-210, JaMar and Miyako all of which were vegetatively propagated. The highest rated seed propagated cultivars were J-37, Chinese Common, Zenith, Zen-400 and J-36.

KEYWORDS: *Zoysia spp.*, cultivar evaluation, turfgrass quality

Zoysiagrasses (*Zoysia spp.* Willd.) are perennial warm season grasses with stolons and rhizomes that form a uniform, dense, low growing, high quality turf with a slow rate of growth (Beard 1973). There are three species of zoysiagrass used in the turfgrass industry. These species are Japanese (Korean) lawngrass (*Zoysia japonica*), manilagrass (*Zoysia matrella*), and mascarenegrass (*Zoysia tenuifolia*) (Turgeon 2002). Each species is differentiated by leaf texture, vigor and cold hardiness (Duble 1996). All three species are native to tropical, eastern Asia. *Zoysia japonica* has the greatest cold tolerance of the three species, but also has the coarsest leaf texture (Duble 1996). *Zoysia matrella* has a finer leaf texture than *Z. japonica* and grows well in moderate shade (Duble 1996). *Zoysia tenuifolia* has the finest leaf texture, but is intolerant of cold temperatures (Duble 1996).

Zoysiagrasses can make an ideal lawn for use on golf courses, parks, sport fields, commercial lawns, and residential lawns. Zoysiagrasses are adapted across a wide range of environmental conditions found in the Southwestern U.S. However, selection of the appropriate cultivar is relevant to the success of zoysiagrass as a turfgrass

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in this report. Zoysiagrass is intermediate to highly drought resistant depending on cultivar when compared with other C₄ turfgrasses (Huang et al. 1997, White et al. 2001). Numerous studies have shown zoysiagrass cultivars have a wide range of salinity tolerance (Qian et al. 2000, Marcum et al. 1998).

Studies have shown zoysiagrass cultivars also demonstrate differential levels of host resistance to numerous turfgrass pathogens and insects (Brahan and Duncan 2000, Reinert et al. 1992). Previous research has shown that some zoysiagrass cultivars can be maintained in shaded conditions for extended periods of time (Morton et al. 1991, Qian and Engelke 1997).

Zoysiagrass use has been limited because historically turfgrass cultivars had to be vegetatively propagated. *Zoysia japonica* is the only species that can be propagated by seed but has the coarsest leaf texture (Duble 1996). In the tropics, zoysiagrass will remain green year round. However, following extended periods of drought or hard frosts zoysiagrasses turn brown similar to other C₄ grasses

The drought, salinity, shade and pest tolerance of many selected zoysiagrass cultivars make them an important component of the turfgrass industry areas of the southwestern United States. The objective of this study was to evaluate nineteen zoysiagrass cultivars for their potential use as a high quality turfgrass on the Texas High Plains.

MATERIALS AND METHODS

Nineteen zoysiagrass cultivars were planted July 1996 at the Texas Tech University Erskine Research Farm in Lubbock, Texas (Table 1). Two seeded check cultivars, Chinese and Korean common, and three vegetative check cultivars, El Toro, Emerald and Meyer, were included for comparison to fourteen new cultivars. The soil at the test site was an Amarillo fine sandy soil (fine-loamy, mixed thermic, Aridic Paleustalfs). Treatments were arranged as a randomized block design with three replicates. Each cultivar was grown in a 6 ft. x 6 ft. area with a 2 ft. border on all sides. Plots were irrigated with sprinklers during establishment and flood irrigated thereafter. Eight cultivars were established from seed at a rate of 1 lb/1000 ft² and the remaining 11 cultivars were established vegetatively with twenty-four plugs per plot (Table 1). Plots were fertilized at a rate of 4-5 lbs. of N/1000ft²/year, mowed at a height of 2 inches every 7 to 10 days and irrigated weekly to prevent stress during the growing season.

Turfgrass evaluations consisted of leaf texture (1 = coarse to 9 = fine), color (1 = light green to 9 = dark green), density (1 = bare to 9 = maximum density) and percent living ground cover. Turfgrass quality ratings were taken monthly from May through August 1997, April through October 1998, and March through October in both 1999 and 2000. Turfgrass quality ratings are based on a scale of 1 = dead or dormant to 9 = ideal turfgrass. All evaluations were based on standards used by the National Turfgrass Evaluation Program (NTEP). Data were analyzed by analyses of variance and means separated with Fisher's Protected Least Significant Difference Test at the 0.05 level of probability using SAS (SAS 1989).

Table 1. Cultivar, propagation method and sponsor of 19 zoysiagrass cultivars evaluated at Lubbock, TX from 1996 to 2000.

Cultivar	Propagation method	Sponsor
Chinese (Common)	Seeded	Standard Entry
DeAnza	Vegetative	Thomas Bros. Grass Co.
El Toro	Vegetative	Standard Entry
Emerald	Vegetative	Standard Entry
HT-210	Vegetative	Horizon Turfgrass
J-14	Vegetative	Jacklin Seed Company
J-36	Seeded	Jacklin Seed Company
J-37	Seeded	Jacklin Seed Company
JaMar	Vegetative	Bladerunner Farms
Korean (Common)	Seeded	Standard Entry
Meyer	Vegetative	Standard Entry
Miyako	Vegetative	Japan Turfgrass
Victoria	Vegetative	Thomas Bros. Grass Co.
Z-18	Seeded	International Sees, Inc.
Zen-400	Seeded	Finelawn/Turf Merchants
Zen-500	Seeded	Finelawn/Turf Merchants
Zenith	Seeded	Patten Seed Company
Zeon	Vegetative	Bladerunner Farms
Zorro	Vegetative	Texas A&M University

RESULTS AND DISCUSSION

The nineteen cultivars in this experiment were evaluated over a four-year period for leaf texture, color, density, percent ground cover and overall turfgrass quality for growth under high altitudes (3300 ft) and northern latitudes (34°N). Leaf texture was taken in the first year after planting in April 1997 (Table 2). There was a wide range in leaf texture between cultivars with the HT-210 having the finest leaf texture followed by Emerald, J-36, Z-18, Zen-400, Zen-500, Zenith Zeon and Zorro. In national test, Zorro had the finest leaf texture, however the HT-210 likewise had the finest texture at a second Northern test site in Arkansas (Morris 2001). This would indicate that leaf texture may be sensitive to production sites. It is interesting to note that many of the seeded cultivars had finer leaf texture than vegetative propagated cultivars (Table 2).

Turfgrass color is a personal preference with a darker green color preferred by most individuals (Beard 1973). The cultivars that had the darkest green color were Chinese Common, Korean Common, J-37 and Zen-500 all of which are seeded cultivars (Table 2). In contrast, Meyer, Zenith and Emerald had the darkest green color in national test (Morris 2001). Turfgrass color is influenced by fertility, irrigation, disease incidence and mowing (Turgeon 2002). Since the sites in the national test received different cultural practices this could have influenced turfgrass color and impacted the results between the Lubbock site and others across the country.

Turfgrass density data was taken in 1998-99 (Table 2). There were no significant differences in turfgrass density between cultivars in either 1998 or 1999 (Table 2). Percent living ground cover was taken in the fall of 1998 and 1999 (Table 2). In 1998, all cultivars had living ground cover ratings higher than 90%. Only the Zen-400, Korean Common and Z-18 had significantly lower living ground cover ratings of less than 90%. In 1999, Emerald, HT-210, El Toro, Miyako, Victoria, JaMar, Zeon Zorro,

Chinese Common, J-37, and Zen-500 had living ground cover ratings of greater than 90%. Zen-400, Meyer and Z-18 had significantly lower living ground cover ratings of 65, 63 and 15%, respectively. The remaining cultivars ranged from 75 to 90% living ground cover.

Table 2. Mean leaf texture, color, density ratings as well as percent living ground cover of 19 zoysiagrass cultivars evaluated at Lubbock, TX from 1996 to 2000.

Cultivar	Texture rating ^y	Color rating ^x	Density		Living ground cover	
			1998	1999	1998	1999
			-----rating ^w -----		-----%-----	
Chinese	6.3bc ^z	8.3a ^z	7.7 ^z	7.3 ^z	94.7a ^z	91.3a ^z
DeAnza	6.0cd	5.3fg	7.3	7.0	94.7a	85.0ab
El Toro	4.7ef	6.7c-e	8.0	8.3	97.7a	99.0a
Emerald	7.0ab	7.0b-d	9.0	9.0	94.7a	99.0a
HT-210	7.3a	6.7c-e	9.0	9.0	97.7a	99.0a
J-14	6.3bc	6.3d-f	8.0	6.7	94.7a	78.3ab
J-36	7.0ab	5.3fg	8.0	7.0	96.0a	80.0ab
J-37	6.7a-c	7.7a-c	8.0	7.7	97.7a	91.3a
JaMar	4.7ef	6.3d-f	8.0	8.7	99.0a	96.0a
Korean	6.7a-c	8.0ab	6.7	7.3	58.3b	75.0ab
Meyer	5.3de	7.0b-d	7.0	7.3	96.3a	63.3a
Miyako	4.3f	5.0g	8.3	8.0	99.0a	99.0a
Victoria	6.0cd	5.7e-g	8.7	8.3	97.7a	97.7a
Z-18	7.0ab	5.3fg	6.0	6.3	5.0c	15.0c
Zen-400	7.0ab	7.7a-c	5.3	5.7	64.7b	64.7b
Zen-500	7.0ab	5.7e-g	8.0	7.7	91.3a	91.3a
Zenith	7.0ab	5.0g	8.0	6.7	92.7a	78.3ab
Zeon	7.0ab	7.0b-d	8.7	9.0	97.7a	96.0a
Zorro	7.0ab	7.0b-d	8.3	8.3	97.7a	92.7a
LSD (0.05)	0.8	1.3	NS	NS	25.6	25.8
C.V.	7.3%	11.7%	21.5%	20.7%	17.7%	18.6%

^z Means within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^y Texture rating; 1 = coarse to 9 = very fine.

^x Genetic color rating; 1 = light green to 9 = dark green.

^w Density rating; 1 = bare to 9 = maximum density.

NS = Non-significant

Turfgrass quality ratings were collected from May through August in 1997 (Table 3). The highest rated cultivars in 1997 were Miyako, El Toro and JaMar with average quality ratings significantly higher than other cultivars. Quality ratings in the first year may be of minimal value as the cultivars were still being established. The Miyako, El Toro and JaMar received the highest quality ratings in the first year. This is an indication of their vigor as compared to other vegetative cultivars.

Table 3. Turfgrass quality ratings of 19 cultivars of zoysiagrass evaluated at Lubbock, TX in 1997.

Cultivar	Turfgrass quality ratings ^Y				
	May	Jun	Jul	Aug	Avg
Chinese	7.0a-d ^Z	8.0ab ^Z	8.0a-d ^Z	8.7b-d ^Z	7.9bc ^Z
DeAnza	6.0de	6.7cd	7.0de	7.0f	6.7ef
El Toro	8.0a	9.0a	8.3a-c	9.7a	8.8a
Emerald	7.7ab	7.7bc	7.3c-e	8.0ed	7.7cd
HT-210	6.7b-d	7.0b-d	8.0a-d	8.3c-e	7.5cd
J-14	7.0a-d	7.0b-d	7.3c-e	8.0ed	7.3c-e
J-36	7.3a-c	8.0ab	7.7b-e	8.0ed	7.7cd
J-37	6.3c-e	7.7bc	8.0a-d	8.0ed	7.5cd
JaMar	8.0a	9.0a	8.7ab	9.0a-c	8.7ab
Korean	5.3e	6.0d	6.7e	7.0f	6.3f
Meyer	6.7b-d	7.0b-d	7.3c-e	7.0f	7.0d-f
Miyako	8.0a	9.0a	9.0a	9.3ab	8.8a
Victoria	6.0de	7.3bc	7.7b-e	8.0ed	7.3c-e
Z-18	NA	NA	NA	NA	NA
Zen-400	7.0a-d	8.0ab	8.0a-d	8.0ed	7.7cd
Zen-500	7.0a-d	8.0ab	8.0a-d	8.7b-d	7.9bc
Zenith	7.0a-d	8.0ab	8.0a-d	8.3c-e	7.8c
Zeon	6.7b-d	7.0b-d	7.3c-e	7.7ef	7.2c-e
Zorro	6.7b-d	7.3bc	7.7b-e	8.0ed	7.4c-e
LSD (0.05)	1.09	1.06	1.05	0.94	0.82
C.V.	9.5%	8.4%	8.1%	6.9%	6.5%

^ZMeans within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^YTurfgrass rating; 1 = dead or dormant to 9 = ideal turfgrass.

In 1998, quality data was taken from April through October (Table 4). The highest rated cultivars were HT-210, JaMar and Miyako. These cultivars had the highest overall average for the entire growing season.

Table 4. Turfgrass quality ratings of 19 cultivars of zoysiagrass evaluated at Lubbock, TX in 1998.

Cultivar	Turfgrass quality ratings ^Y							
	Apr	May	Jun	Jul	Aug	Sep	Oct	Avg
Chinese	8.0a ^Z	8.3ab ^Z	7.7a-c ^Z	6.7bc ^Z	6.0c-e ^Z	6.3b-d ^Z	3.0bc ^Z	6.6a-c ^Z
Dalz9601	5.7ef	6.7c-e	8.0a-c	8.0ab	7.0a-d	7.7a-c	4.3ab	6.8a-c
DeAnza	5.3f	5.3e	7.0b-d	7.3ab	7.0a-d	7.0a-c	5.0a	6.3a-c
El Toro	7.0a-d	9.0a	7.7a-c	8.3ab	8.0a-c	8.3ab	3.7a-c	7.4ab
Emerald	6.3c-f	7.3bc	8.3a-c	8.0ab	8.0a-c	8.0ab	4.3ab	7.2ab
HT-210	6.0d-f	5.0a-c	9.0a	8.7a	9.0a	8.0ab	4.3ab	7.6a
J-14	7.7ab	7.0b-d	7.3a-d	7.0a-c	6.7b-d	6.7b-d	3.0bc	6.5a-c
J-36	7.3a-c	7.0b-d	7.0b-d	7.0a-c	6.3b-e	7.0a-c	3.0bc	6.4a-c
J-37	7.3a-c	8.0a-c	7.7a-c	7.0a-c	7.7a-d	7.3a-c	4.3ab	7.1a-c
JaMar	8.0a	8.3ab	8.7ab	8.7a	8.0a-c	8.3ab	3.0bc	7.6a
Korean	7.0a-d	6.7c-e	6.7cd	6.7bc	6.7b-d	7.0a-c	3.7a-c	6.3a-c
Meyer	5.7ef	5.7de	6.7cd	6.7bc	7.0a-d	7.0a-c	3.0bc	6.0bc

Table 4. (Cont'd.)

Cultivar	Turfgrass quality ratings ^Y							
	Apr	May	Jun	Jul	Aug	Sep	Oct	Avg
Miyako	6.3c-f	5.0a-c	8.0a-c	8.3ab	7.7a-d	9.0a	5.0a	7.5a
Victoria	6.7b-e	7.3bc	8.3a-c	8.0ab	8.3ab	8.0ab	5.0a	7.4ab
Z-18	3.3g	3.7f	4.0e	3.7d	4.3e	4.7d	3.7a-c	3.9d
Zen-400	7.7ab	7.3bc	5.7de	5.3cd	5.7de	5.7cd	2.3c	5.7c
Zen-500	7.3 a-c	7.7 a-c	7.7 a-c	7.0 a-c	7.0 a-d	7.0 a-c	3.0 bc	6.7 a-c
Zenith	7.3 a-c	7.3 bc	7.3 a-d	6.7 bc	6.7 b-d	6.3 b-d	3.7 a-c	6.5 a-c
Zeon	6.3 c-f	7.0 b-d	8.7 ab	7.7 ab	7.7 a-d	7.3 a-c	3.7 a-c	6.9 a-c
LSD (0.05)	1.20	1.48	1.90	1.93	2.25	2.11	1.62	1.47
C.V.	10.9%	12.5%	15.5%	16.2%	19.1%	17.7%	26.1%	13.4%

^ZMeans within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^YTurfgrass rating; 1 = dead or dormant to 9 = ideal turfgrass.

In 1999, turfgrass quality ratings were taken from March through October (Table 5). The top rated cultivar was Emerald followed by El Toro, HT-210, JaMar, Miyako, Zeon and Victoria.

Table 5. Turfgrass quality ratings of 19 cultivars of zoysiagrass evaluated at Lubbock, TX in 1999.

Cultivar	Turfgrass quality ratings ^Y								
	Mar	Apr	May	Jun.	Jul	Aug	Sep	Oct.	Avg
Chinese	1.7ab ^Z	2.7de ^Z	5.0b-d ^Z	7.0a ^Z	7.0ab ^Z	6.7a-d ^Z	3.7ab ^Z	1.7bc ^Z	4.4a-c ^Z
DeAnza	1.7ab	3.0c-e	6.3a-c	7.0a	7.7a	3.7e	3.3b	1.7bc	4.3a-c
El Toro	2.0ab	4.3ab	6.7ab	8.0a	8.3a	7.3ab	5.3ab	2.0a-c	5.5ab
Emerald	2.3a	4.0a-c	6.7ab	8.0a	8.3a	7.3ab	5.0ab	3.3a	5.6a
HT-210	2.0ab	4.0a-c	6.0a-c	8.0a	8.0a	7.3ab	5.3ab	3.3a	5.5ab
J-14	2.0ab	3.0c-e	5.7a-d	7.0a	7.0ab	5.7a-e	3.3b	1.7bc	4.4a-c
J-36	2.0ab	3.0c-e	4.7cd	7.0a	7.0ab	6.3a-d	3.7ab	1.7bc	4.4a-c
J-37	2.0ab	3.0c-e	6.3a-c	7.3a	7.0ab	6.0a-e	3.7ab	2.0a-c	4.7a-c
JaMar	2.0ab	5.0a	7.0a	8.0a	8.7a	7.3ab	4.7ab	1.7bc	5.5ab
Korean	2.3a	3.0c-e	5.7a-d	6.7ab	7.0ab	5.0b-e	4.0ab	1.7bc	4.4a-c
Meyer	2.0ab	2.7de	4.0de	7.0a	7.0ab	6.3a-d	3.7ab	1.3c	4.3a-c
Miyako	2.0ab	3.7b-d	5.7a-d	7.0a	8.3a	8.0a	5.7a	3.3a	5.5ab
Victoria	1.7ab	3.0c-e	6.3a-c	8.0a	8.0a	7.0a-c	4.7ab	3.0ab	5.2ab
Z-18	1.3b	2.0e	2.3e	4.7c	5.3b	4.7c-e	3.7ab	3.0ab	3.4c
Zen-400	1.7ab	3.0c-e	5.0b-d	5.0bc	5.3b	4.3de	3.3b	1.3c	3.6c
Zen-500	2.0ab	3.0c-e	6.0a-c	7.0a	7.0ab	6.0a-e	4.0ab	1.7bc	4.6a-c
Zenith	1.3b	2.3e	4.0de	6.3a-c	7.0 ab	6.0 a-e	3.7ab	2.7 a-c	4.2 bc
Zorro	1.7ab	2.7de	6.0a-c	7.7a	8.3 a	5.0 b-e	3.7ab	2.0 a-c	4.6 a-c
Zeon	1.7ab	3.7b-d	6.0a-c	8.0a	8.7 a	7.0 a-c	5.0ab	2.7 a-c	5.3 ab
LSD (0.05)	0.69	1.30	1.98	1.87	2.23	2.52	2.06	1.46	1.41
C.V.	22.7%	24.5%	21.6%	15.9%	18.1%	24.7%	29.7%	40.2%	18.1%

^ZMeans within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^YTurfgrass rating; 1 = dead or dormant to 9 = ideal turfgrass.

In 2000, cultivars that had the highest average quality ratings were Emerald, Miyako, Zenith, El Toro and HT-210 (Table 6). An infestation of white grubs in the fall of 1999 severely damaged many of the plots and influenced individual turfgrass quality ratings in 2000. In 1999 and 2000, visual quality ratings were collected from March through October. In March some cultivars were beginning to green-up and received higher quality ratings compared to other cultivars that were still dormant. Similarly, in October many of the top cultivars were still green when others were already dormant. In some cases, the higher average quality rating was due primarily to an extended growing season rather than a high quality rating during the peak of the growing season.

Table 6. Turfgrass quality ratings of 19 cultivars of zoysiagrass evaluated at Lubbock, TX in 2000.

Cultivar	Turfgrass quality ratings ^Y								
	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Avg.
Chinese	2.0a ^Z	3.0ab ^Z	5.0a ^Z	5.7a ^Z	5.7a-c ^Z	4.7a-d ^Z	4.7a-c ^Z	3.7a-d ^Z	4.3ab ^Z
DeAnza	1.0c	1.7bc	2.3d-f	3.3b-d	3.7b-e	3.7c-e	3.7b-d	3.0cd	2.8b-d
El Toro	1.3bc	2.0a-c	4.3a-c	5.3ab	6.3a	6.0ab	5.7a	5.0a	4.5a
Emerald	1.0c	3.0ab	5.0a	5.7a	6.0ab	6.3a	5.7a	4.3a-c	4.6a
HT-210	1.3bc	2.0a-c	4.0a-d	5.3ab	5.7a-c	6.3a	5.7a	4.7ab	4.4a
J-14	1.7ab	2.0a-c	2.7c-f	3.3b-d	3.3c-e	3.0ed	3.0cd	2.3d	2.7cd
J-36	1.7ab	2.3a-c	3.0b-f	4.3a-c	4.7a-e	4.0b-e	4.0a-d	3.3b-d	3.6a-d
J-37	1.7ab	2.7a-c	3.7a-d	4.7a-c	5.0a-d	4.7a-d	4.3a-c	3.7a-d	3.8a-c
JaMar	1.7ab	2.0a-c	4.7ab	5.3ab	6.0ab	5.3a-c	5.0ab	4.7ab	4.3ab
Korean	1.7ab	2.7a-c	4.3a-c	4.7a-c	4.7a-e	4.0b-e	4.0a-d	3.3b-d	3.7a-c
Meyer	1.0c	1.7bc	1.7ef	2.7cd	3.0ed	4.0b-e	3.7b-d	3.3b-d	2.6cd
Miyako	2.0a	2.3a-c	4.3a-c	5.3ab	6.3a	6.0ab	5.3ab	4.7ab	4.5a
Victoria	1.0c	1.7bc	3.0b-f	4.0a-d	4.3a-e	3.7c-e	3.7b-d	3.3b-d	3.1a-d
Z-18	1.0c	1.3c	1.3f	2.0d	2.3e	2.3e	2.3d	2.3d	1.9d
Zen-400	1.3bc	2.0a-c	3.3a-e	3.7a	4.0a-e	3.7c-e	3.7b-d	3.0cd	3.1a-d
Zen-500	1.3bc	2.3a-c	3.3a-e	3.7a	4.0a-e	4.3a-e	3.7b-d	3.3b-d	3.3a-d
Zenith	2.0a	3.3 a	5.0a	5.7a	6.0ab	5.3a-c	4.7a-c	4.0a-c	4.5a
Zeon	1.0c	2.3a-c	3.7a-d	5.0ab	5.0a-d	4.3a-e	4.3a-c	3.7a-d	3.7a-c
Zorro	1.0c	1.7bc	2.7c-f	3.7a-d	3.3c-e	3.0ed	3.0cd	3.0cd	2.7cd
LSD(0.05)	0.62	1.40	1.97	2.08	2.4	2.12	1.94	1.66	1.06
C.V.	26.9%	38.4%	33.5%	28.8%	30.9%	28.7%	27.8%	27.6%	23.5%

^ZMeans within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^YTurfgrass rating; 1 = dead or dormant to 9 = ideal turfgrass.

Averaged over a three-year (1998-2000) or four-year period (1997-2000) El Toro, Emerald, HT-210, JaMar and Miyako had the highest overall quality (Table 7). These five cultivars were all vegetatively propagated (Table 7). In national testing, Zorro was the highest rated over the four years of the study, but was not significantly different than Emerald, Zeon and El Toro (Morris 2001). J-37 was the highest rated seeded cultivar over the period of this study, but was not significantly better than Chinese Common, J-36, Korean Common, Zen-500 and Zenith (Table 7). This is similar to national testing except that Zen-400 had the second highest quality rating of the seeded cultivars, but a low turfgrass quality rating in Lubbock (Morris 2001). Over the four-years of this study none of the new seeded or vegetatively propagated cultivars of zoysiagrass had

significantly better turfgrass quality ratings than the check cultivars Emerald, El Toro (vegetative) and Chinese Common (seeded).

Table 7. Turfgrass quality ratings of 19 cultivars of zoysiagrass evaluated at Lubbock, TX averaged from 1997 to 2000.

Cultivar	Turfgrass quality ratings ^Y					
	1997	1998	1999	2000	1997 to 2000	1998 to 2000
Chinese	7.9bc ^Z	6.6a-c ^Z	4.4a-c ^Z	4.3ab ^Z	5.8a-c ^Z	5.1ab ^Z
DeAnza	6.7ef	6.3a-c	4.3a-c	2.8b-d	5.0c	4.4b
El Toro	8.8a	7.4ab	5.5ab	4.5a	6.5a	5.8a
Emerald	7.7cd	7.2ab	5.6a	4.6a	6.3ab	5.8a
HT-210	7.5cd	7.6a	5.5ab	4.4a	6.2ab	5.8a
J-14	7.3c-e	6.5a-c	4.4a-c	2.7cd	5.2bc	4.5ab
J-36	7.7cd	6.4a-c	4.4a-c	3.6a-d	5.5a-c	4.7ab
J-37	7.5cd	7.1a-c	4.7a-c	3.8a-c	5.8a-c	5.2ab
JaMar	8.7ab	7.6a	5.5ab	4.3ab	6.5a	5.8a
Korean	6.3f	6.3a-c	4.4a-c	3.7a-c	5.2bc	4.8ab
Meyer	7.0d-f	6.0bc	4.3a-c	2.6cd	5.0c	4.3bc
Miyako	8.8a	7.5a	5.5ab	4.5a	6.6a	5.8a
Victoria	7.3c-e	7.4ab	5.2ab	3.1a-d	5.7a-c	5.2ab
Z-18	NA	3.9d	3.4c	1.9d	3.1d	3.1c
Zen-400	7.7cd	5.7c	3.6c	3.1a-d	5.0c	4.1bc
Zen-500	7.9bc	6.7a-c	4.6a-c	3.3a-d	5.6a-c	4.8ab
Zenith	7.8 c	6.5 a-c	4.2 bc	4.5 a	5.7 a-c	5.0 ab
Zeon	7.2 c-e	6.9 a-c	5.3 ab	3.7 a-c	5.8 a-c	5.3 ab
Zorro	7.4 c-e	6.8 a-c	4.6 a-c	2.7 cd	5.4 bc	4.7 ab
LSD (0.05)	0.82	1.47	1.41	1.06	1.12	1.32
C.V.	6.5%	13.4%	18.1%	23.5%	12.1%	16.1%

^ZMeans within column not followed by the same letter differ at the 0.05 level of probability by Fisher's Least Significant Difference Test.

^YTurfgrass rating = 1=dead or dormant to 9=maximum turfgrass.

Due to the aggressive growth habit of zoysiagrass many of the cultivars in this study developed extensive thatch layers over the four-years of this study. Dethatching of this accumulation may have led to better quality rating for some of the cultivars tested, although none of the new cultivars performed better than the check cultivars in this study. Many of these cultivars have been developed with improved host resistance to insects and diseases, as well as enhanced shade tolerance, which was not tested for at this location.

CONCLUSION

This study indicates that cultivars El Toro, Emerald, HT-210, JaMar and Miyako produced a high quality turfgrass when grown on the Texas High Plains. These cultivars provide a high quality turfgrass suited for use on golf courses, parks, commercial lawns and residential lawns. The highest quality rated zoysiagrasses were all vegetatively propagated. Although the seeded cultivars J-37, Chinese Common, Zenith, Zen-500 and J-36 produced acceptable turfgrasses. These zoysiagrass cultivars appear to be adapted to the High Plains of West Texas where historically cold temperatures have limited adaptation of zoysiagrasses.

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