Establishment Rates of Zoysiagrass Cultivars - 2005

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Objective

The objective of our research is to identify differences in growth among zoysiagrass cultivars. The ultimate goal of this research is to expand the use of zoysiagrass in the transition zone, thereby creating more sustainable and affordable golf courses.

Rationale

Zoysiagrass (*Zoysia* spp.) is a popular warm-season grass in the transitional and warm climatic regions of the USA including the southern $^{1}/_{3}$ of Indiana. The primary reason for zoysia's popularity is that it provides an excellent golfing surface with minimal inputs and costs. Zoysiagrass could be a key component in making transition zone golf courses more environmentally friendly and sustainable.

Zoysia japonica Steud. and *Z. matrella* (L.) Merr. are the most common Zoysia species used for turf within the United States and are both often referred to as zoysiagrass. Zoysiagrass is established by sod, sprigs, plugs, or seed. Vegetative establishment by sod, sprigs and plugs is more expensive than seeding. Recent work at Purdue University and other universities has refined methods for establishing newly-available seeded zoysiagrass cultivars.

The main roadblock to widespread zoysiagrass use is its slow establishment and growth rate. Researchers have unsuccessfully searched for methods to hasten establishment including fertilization and plant growth regulators. Although researchers have found no method for expediting establishment, there are documented differences in the establishment rate of zoysiagrass cultivars. For instance, 'El Toro' establishes more quickly than 'Meyer' among the cultivars commonly used. However, there is little information comparing the establishment of the more than 40 commercially and experimentally available zoysiagrass cultivars. Identifying faster-growing cultivars will immediately lead to new cultivar recommendations, which golf course superintendents can use to minimize time for renovation or grow-in, inconvenience, and cost.

How it was done

Plant material of commercially available and experimental cultivars (Table 1) of zoysiagrass was collected in the fall of 2003 and propagated in the greenhouse until the initiation of the experiment. Field plots were prepared by fumigating soil with methyl bromide prior to establishment to minimize weed competition. One zoysiagrass plug (8 by 8 by 8 cm) was transplanted into the center of each plot on 7 June 2005 and irrigated four times daily for the first month to encourage establishment and then irrigated as needed (Figure 1). Plots received 49 kg ha^{-1} N from urea (46-0-0) on 1 July and 1 August.

Digital pictures were taken weekly with a camera mounted on a monopod to insure shooting from a consistent height. Coverage of zoysiagrass was determined using digital image analysis (DIA) (SigmaScan Pro). To selectively identify green leaves in the images, hue range was set from 47 to 107 and the saturation was set from 0 to 100. Images were calibrated and the data was transformed from selected green pixels to zoysiagrass coverage (cm^2). Using a sod staple, stolons and rhizomes reaching the plot border were angled back into the plot to prevent encroachment into adjacent plots and to ensure that all growth from the plug was measured using DIA. Stolon measurements were collected on all stolons forty-three days after planting. Additionally, stolon growth was measured over a seven day interval by marking the growing tip of three stolons in each plot with toothpicks (Figure 2) and measuring the growth of the stolon with a Vernier caliper seven days later. Stolon growth rate was determined for 12 stolons of each cultivar on two separate occasions in August. This is the second year of this study.

Figure 1. One zoysiagrass plug (8 by 8 by 8 cm) was transplanted into the center of

Results - 2005

We observed significant differences among establishment rate of 35 different zoysiagrass cultivars in 2005 (Table 2).

- *Z. japonica* cultivars produced more cover than *Z. matrella* cultivars (Table 3)
- Seeded cultivars produced similar cover to vegetative cultivars (Table 4)
- Seeded cultivars of *Z. japonica* produced similar cover to vegetative cultivars of *Z. japonica* (Table 5)
- *Z. matrella* vegetative cultivars produce less cover than both types of *Z. japonica* cultivars (Table 5)
- Experimental cultivars are being tested that establish as quickly as El Toro

Figure 2. Stolon growth was measured over a seven day interval by marking the growing tip of three stolons in each plot with toothpicks

The experimental cultivar 6186 established the quickest of all cultivars in 2005 (Figs. 3 and 4). El Toro growth was not as vigorous in 2005 compared to 2004, but it was not known why. El Toro zoysiagrass remained among the *Z. japonica* cultivars that established quickest and Meyer and was among the slowest (Figs. 3 and 4). 'Zorro' was among the fastest *Z. matrella* cultivars and 'Diamond' was the slowest (Figs. 3 and 4). Among the *Z. japonica* cultivars 6186 coverage was 3-times that of Meyer and *Z. matrella* cultivar Zorro achieved 4-times more coverage than Diamond.

This study will immediately improve our ability to recommend zoysiagrass cultivars, and could dramatically reduce time, inconvenience, and cost of establishing zoysiagrass fairways.

Table 1. Zoysiagrass cultivar and experimental names, species, type of plant material commercially/experimentally available and source of plant material.

Cultivar	Experimental Name	Species	Type	Source
6136	6136	*Zoysia japonica* Steud.	Vegetative	Bladerunner Farms, Inc.
6186	6186	*Zoysia japonica* Steud.	Vegetative	Bladerunner Farms, Inc.
BMZ 230	BMZ 230	*Zoysia japonica* Steud.	Vegetative	Turfgrass America
Cavalier	DALZ8507	*Zoysia matrella* (L.) Merr.	Vegetative	M.C. Engelke, Texas A&M Univ.
Chinese Common		*Zoysia japonica* Steud.	Seed	Natl. Turfgrass Evaluation Program
Companion	ZMB-2	*Zoysia japonica* Steud.	Seed	Seed Research of Oregon, Inc.
DALZ0101	DALZ 0101	*Zoysia matrella* (L.) Merr.	Vegetative	Turfgrass America
DALZ0102	DALZ 0102	*Zoysia japonica* Steud.	Vegetative	Turfgrass America
DALZ0104	DALZ 0104	*Zoysia matrella* (L.) Merr.	Vegetative	Turfgrass America
DALZ0105	DALZ 0105	*Zoysia matrella* (L.) Merr.	Vegetative	Turfgrass America
DeAnza	Z88-8	*Zoysia japonica* Steud.	Vegetative	West Coast Turf
Diamond	DALZ 8502	*Zoysia matrella* (L.) Merr.	Vegetative	M.C. Engelke, Texas A&M Univ.
El Toro	UCR#1	*Zoysia japonica* Steud.	Vegetative	Seedland, Inc.
Emerald	34-35	*Z. japonica x. Z. pacifica* Goudsw.	Vegetative	Natl. Turfgrass Evaluation Program
Empire	SS-500	*Zoysia japonica* Steud.	Vegetative	Sod Solutions
Empress	SS-300	*Zoysia japonica* Steud.	Vegetative	Sod Solutions
GNZ	ZT-11	*Zoysia japonica* Steud.	Vegetative	Greg Norman Turf
Himeno		*Zoysia japonica* Steud.	Vegetative	Zoysian Japan Co.
J-14	J-14	*Zoysia sinica* Hance	Seed	Jacklin Seed Division J.R. Simplot
J-36	J-36	*Zoysia japonica* Steud.	Seed	Jacklin Seed Division J.R. Simplot
J-37	J-37	*Zoysia japonica* Steud.	Seed	Jacklin Seed Division J.R. Simplot
Meyer	Z-52	*Zoysia japonica* Steud.	Vegetative	Natl. Turfgrass Evaluation Program
PST-R7LT	PST-R7LT	*Zoysia japonica* Steud.	Seed	Pure-Seed Testing, Inc.
PST-R7MA	PST-R7MA	*Zoysia japonica* Steud.	Seed	Pure-Seed Testing, Inc.
PST-R7TH	PST-R7TH	*Zoysia japonica* Steud.	Seed	Pure-Seed Testing, Inc.
PST-R7ZM	PST-R7ZM	*Zoysia japonica* Steud.	Seed	Pure-Seed Testing, Inc.
PZA 32	PZA 32	*Zoysia japonica* Steud.	Seed	Patten Seed Co.
PZB 33	PZB 33	*Zoysia japonica* Steud.	Seed	Patten Seed Co.
Palisades	DALZ 8514	*Zoysia japonica* Steud.	Vegetative	M.C. Engelke, Texas A&M Univ.
Royal	DALZ 9006	*Zoysia matrella* (L.) Merr.	Vegetative	M.C. Engelke, Texas A&M Univ.
VJ		*Zoysia japonica* Steud.	Vegetative	Bladerunner Farms, Inc.
Victoria	Z88-14	*Zoysia japonica* Steud.	Vegetative	West Coast Turf
Zenith	ZNW-1	*Zoysia japonica* Steud.	Seed	Patten Seed Co.
Zeon		*Zoysia matrella* (L.) Merr.	Vegetative	Bladerunner Farms, Inc.
Zorro	DALZ 9601	*Zoysia matrella* (L.) Merr.	Vegetative	Natl. Turfgrass Evaluation Program

Table 2. 2005 Zoysiagrass mean stolon length, total stolon length, stolon growth rate and coverage by cultivar.

Cultivar	Species†	Type	46DAP‡ Mean stolon length	46DAP Total stolon length	Stolon growth rate§	29 DAP coverage	63 DAP coverage	91 DAP coverage
			cm	cm	mm day^{-1}	cm^2	cm^2	cm^2
6186	j	Vegetative	34.0	346	8.6	190	1711	3729
6136	j	Vegetative	21.9	213	6.5	54	1416	3164
DALZ0102	j	Vegetative	25.0	202	6.3	194	1259	3036
Chinese Common	j	Seeded	30.5	382	9.5	196	1339	2925
Palisades	j	Vegetative	11.8	82	5.5	137	836	2153
El Toro	j	Vegetative	11.9	71	4.5	168	877	2052
J-37	j	Seeded	14.0	155	5.0	142	960	1992
Zorro	m	Vegetative	11.4	171	5.0	163	835	1949
DALZ0104	m	Vegetative	13.8	128	3.7	132	802	1940
PZB 33	j	Seeded	18.0	288	4.7	223	1169	1917
PST-R7LT	j	Seeded	16.5	166	4.1	167	1066	1890
DeAnza	j	Vegetative	14.9	164	4.8	137	863	1757
BMZ 230	j	Vegetative	18.8	221	3.4	179	1008	1754
Companion	j	Seeded	16.2	251	5.8	235	1116	1721
Zenith	j	Seeded	13.9	218	4.1	220	1125	1668
GNZ	j	Vegetative	14.4	147	2.9	151	821	1642
J-36	j	Seeded	14.1	152	6.4	124	939	1619
PST-R7ZM	j	Seeded	12.0	167	3.8	167	865	1575
Cavalier	m	Vegetative	8.6	86	4.7	130	615	1535
Emerald	jp	Vegetative	12.2	144	3.7	153	720	1532
VJ	j	Vegetative	10.2	54	6.9	130	671	1491
PST-R7MA	j	Seeded	10.6	112	4.2	147	770	1469
DALZ0101	m	Vegetative	12.1	121	3.5	117	684	1409
Victoria	j	Vegetative	10.4	68	4.8	127	593	1262
J-14	s	Seeded	13.1	100	5.3	137	590	1254
Meyer	j	Vegetative	10.6	64	4.9	147	708	1209
PZA 32	j	Seeded	10.1	78	3.7	132	619	992
Empress	j	Vegetative	10.1	77	1.5	119	510	925
PST-R7TH	j	Seeded	9.5	58	4.5	107	435	909
Zeon	m	Vegetative	6.8	41	4.3	115	358	877
Royal	m	Vegetative	9.2	81	4.0	93	363	747
Himeno	j	Vegetative	12.1	123	6.4	111	359	691
DALZ0105	m	Vegetative	4.9	25	1.6	116	311	548
Empire	j	Vegetative	3.8	15	2.3	71	259	489
Diamond	m	Vegetative	3.4	12	1.7	122	263	482
Mean			13.4	137	4.6	147	795	1609
$LSD_{0.05}$			4.7	75	2.6	38	330	694

† j = *Zoysia japonica*, m = *Zoysia matrella*, s = *Zoysia sinica*, jp = *Z. japonica x. Z. pacifica*

‡ Days after plugging (DAP)

§ Stolon growth rate was determined by dividing the growth (length) from 57 DAP to 64 DAP and 64 DAP to 71 DAP of each stolon by 7 d.

¶ Mean of 24 stolons (three samples per plot with four replications on two sampling intervals).

Table 3. Differences in zoysiagrass coverage 91 days after planting by species for the 2005 growing season.

Species	n	Mean	Std. Dev.
		cm^2	
Z. japonica	104	1742	903
Z. matrella	36	1224	633

t-test

Method	Variances	df	t Value	Pr > |t|
Pooled	Unequal	87	3.76	0.0003

Table 4. Differences in zoysiagrass coverage 91 days after planting for the 2005 growing season by type of plant material commercially/ experimentally available.

Type	N	Mean	Std. Dev.
		cm^2	
Seeded	48	1661	709
Vegetative	92	1581	946

t-test

Method	Variances	df	t Value	Pr > |t|
Pooled	Unequal	121	-0.56	0.58

Table 5. Differences in zoysiagrass coverage 91 days after planting for each species based upon type of plant material available.

Code	n	Species	Type	Mean†
				cm^2
ZJV	56	*Z. japonica*	Vegetative	2705 a
ZJS	48	*Z. japonica*	Seeded	2431 a
ZMV	36	*Z. matrella*	Vegetative	1412 b

† Within columns, means followed by the same letter are not significantly different according to LSD (0.05).

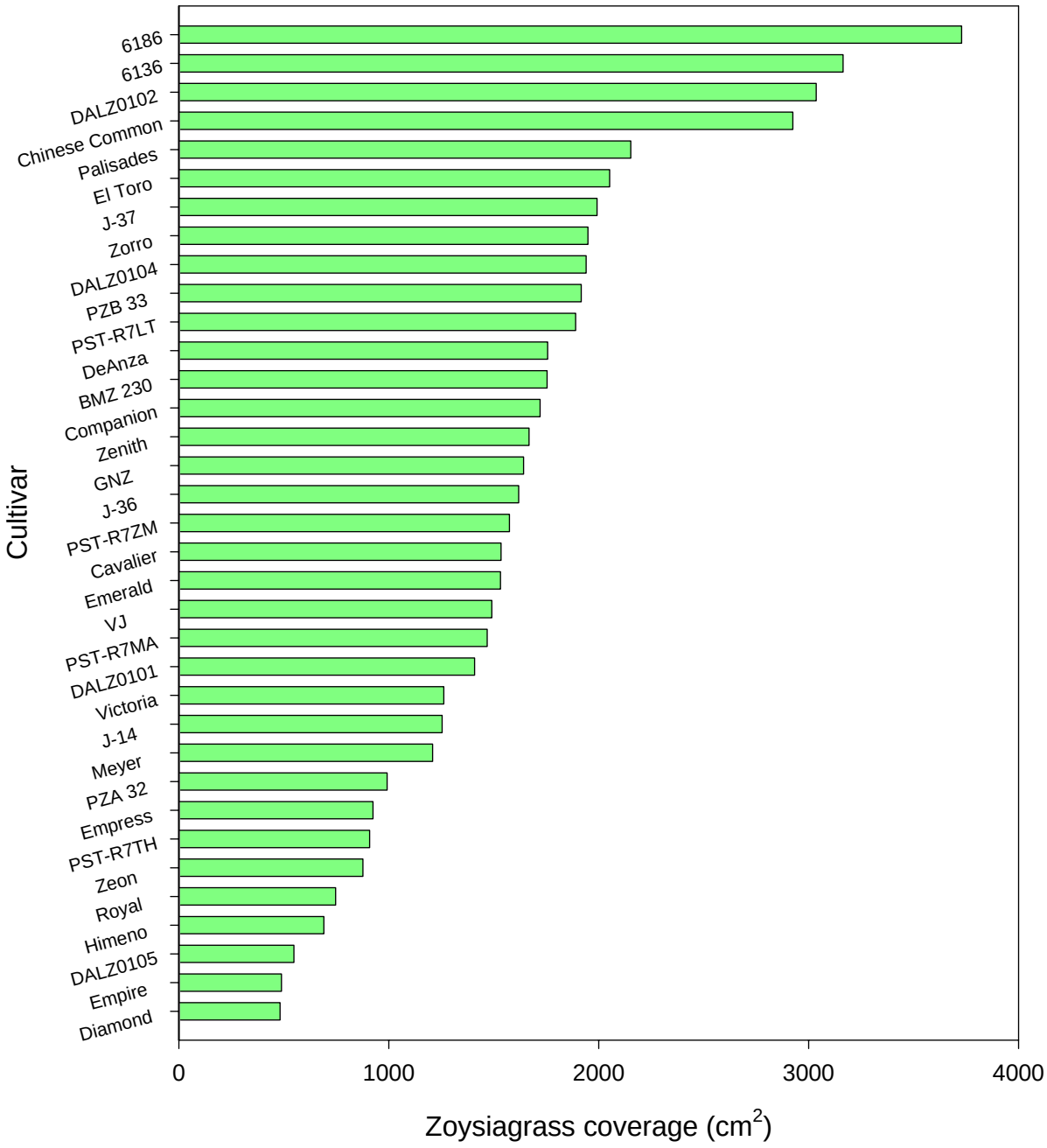

Figure 3. Relative ranking of zoysiagrass coverage 91 days after planting in 2005 with an $LSD_{0.05}$ of 694.

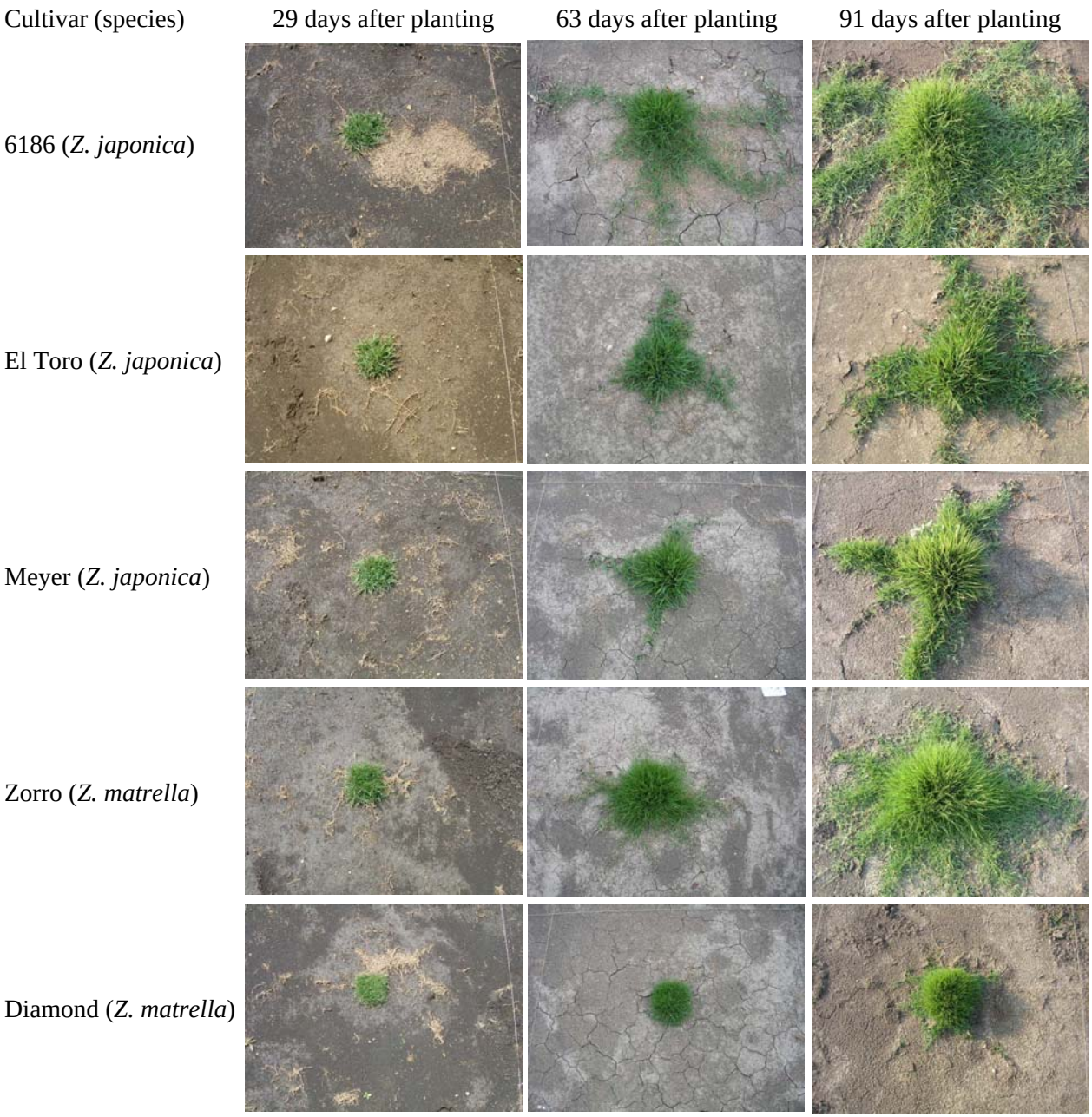

Figure 4. Twenty-nine days after planting (DAP), 63 DAP and 91 DAP images of zoysiagrass (*Zoysia* spp.) cultivars established from plugs on 7 July 2005 in West Lafayette, Ind. '6186' and 'El Toro' are fast-growing *Z. japonica* and 'Meyer' is a slow-growing *Z. japonica*. 'Zorro' is a fast-growing *Z. matrella* and 'Diamond' a slow-growing *Z. matrella*.