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NOTE

Preliminary Report on the Performance of Southern Turfgrasses, Texas A&I/A&M Turfgrass Demonstration Plots

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Abstract. **Fifteen cultivars (cvs) representing 5 lawn grass species were set out in wooden frames of 6 plots. Eighteen plots were planted in July 1990 and 6 more in May 1991. Space limitations allowed only 9 cultivars to be replicated twice. The grasses were: bermudagrass, cvs. Santa Ana, NuMex Sahara, Texturf 10, Tif 419, Tifdwarf, and Tifgreen; buffalograss; dichondra (a broadleaf groundcover); St. Augustinegrass cvs. Floratam, Floratine, Raleigh, and Seville and zoysiagrass cvs. Cashmere, El Toro and Meyer. Composted manure was mixed with soil and then weeds mechanically removed for 6 weeks prior to planting the grass plugs. Rate of coverage or spread was estimated over 13 months. Differential N fertilization, 2, 4-D weed control and height growth of grass were also studied. Initial coverage rates for buffalograss and the bermuda- and St. Augustinegrass cvs. was more rapid than the zoysiagrasses and dichondra. However, because of the variation among cultivars within species no differences were observed in mean coverage rates over the 13 months. 'Tifdwarf' and 'Tifgreen' bermudagrass, buffalograss, dichondra and 'Meyer' zoysiagrass did not compete well against weeds. All the bermudagrasses except 'Texturf 10' showed slight injury from 2, 4-D but recovered quickly. Responses in vigor and color to N fertilization were minimal. Continued and expanded testing is needed before any conclusive recommendations can be made on the suitability of these grasses for the Valley.**

Abstracto. **Quince variedades (vars) representando 5 especies de zacate de césped se pusieron en marcos de madera de 6 parcelas. Dieciocho parcelas se sembraron en Julio 1990 y 6 mas en May 1991. Limitaciones de espacio permitieron que solo 9 variedadaes se repitieran dos veces. Los zacates eran: zacate bermudas, vars. Santa Ana, NuMex Sahara, Texturf 10, Tif 419, Tifdwarf, y Tifgreen; zacate búfalo; dichondra (un cubierto de suelo de hoja ancha); zacate san agustín vars. Floratam, Floratine, Raleigh, y Seville y zacate zoysia vars. Cashmere, El Toro y Meyer. Abono compuesto se mezclo con la tierra y después las hierbas se quitaron mecánicamente por 6 semanas antes de plantar los zacates. El índice de cobertura o desplazamiento se estimo por 13 meses. Diferencias en fertilización N, control de hierba 2, 4-D y el crecimiento de altura del zacate también se estudio. El índice de cobertura inicial del zacate búfalo y del bermudas y san agustín vars. fue mas rápido que el del zacate zoysia y dichondra. Sin embargo, por la variación entre variedades dentro de especies no se observaron diferencias en el índice de cobertura promedio sobre los 13 meses. Los zacates bermudas 'Tifdwarf' y 'Tifgreen', zacate búfalo, dichondra y 'Meyer' zacate zoysia no compitieron bien contra las hierbas. Todos los zacates bermudas excepto 'Texturf 10' demostraron ligeros daños por 2, 4-D pero se recuperaron rápidamente. Las respuestas en vigor y color al fertilizante N fueron mínimas. Continuación y desarrollo de la prueba es necesario antes de que alguna recomendación en conclusa se pueda hacer en cuanto a lo apropiado de estos zacates para el Valle.**

The lower Rio Grande Valley ranks in the top 100 metropolitan areas in the U.S. and the 5th most populous in Texas (Valley Chamber of Commerce, 1990). Expanding urbanization together with the economic importance of tourism, and expecially its "winter Texan" population, equate to a growing interest in and market for lawns and turf management. Unfortunately, much information on warm-season grasses published in national and even Texas publications do not apply to the Valley (Beard, 1973; Knoop, 1986). For example, Ortho's "All About Lawns" (Mace, 1985), puts the semi-arid Valley with average precipitation ca. 25 inches (64 cm), in tropical Zone 8 where annual rainfall often exceeds 70 inches (178 cm). Since environment is the major determinant of turfgrass adaptability, the performance of turfgrasses under the Valley's unique set of climatic, soil and water conditions should differ considerably from that reported for southern Texas (Webster, 1980). Turfgrass demonstration plots were established at Texas A&I Citrus Center to study some of these differences. Although 5-6 years are needed to draw definite conclusions from turfgrass tests, these preliminary results are offered in hope of stimulating more interest in and studies of turfgrasses for the lower Rio Grande Valley (Sifers, et al. 1990; Menn and Beard, 1991).

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Materials and Methods

Turfgrasses.

The specific cultivars and their source are shown in Table 1. All were received as plugs except for the NuMex Sahara which was propagated from seed in a wooden flat. The turfgrasses were grown in a greenhouse from 1 to 3 months while the outside plots were prepared for planting.

Plots, Planting and Care. Four 4 × 24 foot (1.2 × 7.3 m) frames of 1 × 6 inch treated lumber were divided into six 4 × 4 ft (1.22 × 1.22 m) subplots and placed into trenches excavated with a front-end loader. The frames were flush with the ground and their long axes oriented north and south. The soil at the test site was Hidalgo sandy clay loam which may

have been somewhat disturbed during construction of a drain ditch 75 feet (68.5 m) to the north. The site had been maintained as a mixed St. Augustine-bermudagrass sod for over 30 years. Frames 1, 2 and 3 were installed in July 1990 while frame 4 was installed in Feb. 1991.

The frames were refilled with original soil from which most existing sod, weeds and plant debris had been removed. Approximately 10 lbs. (4.54 kg) of composted cow manure was spaded into each 4 × 4 plot and then the plots were watered. The plots were alternately watered and hoed free of weeds for 4 weeks prior to planting the turf plugs.

From 2 to 6 turf and dichondra plugs of 3-6 inch (7.6-15.2 cm) diameter were randomly assigned to and planted 10-12 inches (25-30 cm) apart in the plots of frames 1, 2 and 3 on July 31, 1990. The plots were immediately watered by hand with approximately half an inch (1.3 cm) of cistern-stored river water which probably had less sediment, weed seeds and other debris than unstored irrigation water. Subsequent waterings were made weekly through December, biweekly until late March, then weekly again unless obviated by rainfall.

Frame 4 was installed, the soil amended and replaced as described above. The plots were occasionally watered and maintained weed-free until May 21st when the turf plugs were planted. Space constraints limited planting 2 replications of each turf cultivar to those shown in Table 1.

Tests and Procedures. The test imposed and data taken on the turfplots were:

1. Rate of coverage or spread: The initial soil surface area covered by the grass plugs and their subsequent spreading was visually estimated over 4 time periods roughly equivalent to early fall (Aug. 15-Oct. 18, 1990), winter (Oct. 19-Feb. 12, 1991), spring (Feb. 13-May 20, 1991) and summer (May 21-Sep. 30, 1991). Percent coverage for each plot in frames 1, 2 and 3 was estimated for all 4 periods, while estimates for frame 4 plots were made only for the summer period. Rate of coverage was calculated by multiplying percent coverage by plot size and dividing by the length of the period in weeks.

2. Nitrogen fertilization. In mid-February 1991, the plots in frames 1, 2 and 3 were divided and each half fertilized with either 1/2 or 1 lb N/1000 ft^2 (0.23 or 0.46 kg/9.3 × 10^3 ha) as NH_4NO_3.

3. Weed Control. In the first week of April half (randomly selected) of each plot except dichondra in frames 1, 2 and 3 were sprayed with 2, 4-D. The herbicide solution [.031 oz. (879 mg) of 38% ai 2, 4-D (butyl ether ester) + .06 oz. (2 ml) non-ionic wetting agent] was applied with a backpack sprayer to equal a rate of 1 lb. 2, 4-D per acre (.454 kg/.4 ha). Weed density and species were evaluated before and after spraying. Weed kill and turfgrass phytotoxicity were evaluated 3 weeks post-treatment.

4. Height Growth of Grass. Grass growth in height was measured from Aug. 22 to September 24, 1991 by cutting the grass at 1 1/2 inches (3.8 cm) within a circular frame of 0.98 ft^2 (908 cm^2). Two samples per plot were cut, one from each half representing the 1 or 1/2 lb./1000 ft^2 nitrogen fertilizer applications. The cut grass sample was collected and weighed to evaluate growth per unit area for the 34 day period (Fig. 1).

5. Color. Color which included aspects of vigor and condition was rated on a scale of 1 (poor) to 5 (excellent) by visual evaluation at the same time that coverage was estimated.

6. Shade. To assess the effect of sun and shade on turfgrass responses, the shade/sun line on the test site was determined at 2 hour intervals from 8:00 AM to 6:00 PM as near as possible to 21 Dec. (1990) Mar., June, and Sep. (1991). From the position of this line the average hours of shade each plot received a day by quarter was calculated.

Where valid and appropriate, standard statistical analyses were performed to help interpret results of the characteristics observed or measured (SAS Institute, 1990).

Results

Rate of Coverage. Because the climatic conditions and grass growth stage for Period 4 was similar to Period 1, the coverage rates for the turfgrass samples planted in Period 4 were combined with those for Period 1.

Averaged over the 4 periods which totaled 13 months, there was little difference between the grasses' rate of coverage (Table 2). However, the rates varied considerably within periods. Although the rates were statistically different only in Period 2, the rank order of coverage rates for Period 2 and 3 were almost completely inverted. For Period 2, the bermudas, except for 'Tifdwarf' and 'Texturf,' spread most rapidly, the zoysias were slowest and the St. Augustines intermediate. For Period 3, the zoysias' rates of coverage were highest, the bermudas' slowest with the St. Augustines', except 'Floratine,' again intermediate.

While as a group the species appeared to have distinct coverage rates, the variability between cultivars especially for the bermudagrass and zoysia cvs. precluded detecting statistical differences between species means. To check this, we analysed the coverage rates for the 5 species of grasses by pooling all cultivars within species and found no differences within or over the periods (data not shown). If resources had permitted more replication or larger plots, differences in coverage rates as great as those measured would likely be significant.

In contrast to general experience, (Morton et al., 1991; Fry and Dernoeden, 1986) the zoysia cvs. spread quite rapidly after the initial period with all plots being 70-90% covered by 20 May 1991. At this time, all the other grasses had achieved 90-100% coverage except dichondra and 'Texturf' bermuda, which had 60 and 65% coverage, respectively.

Grass Height. The amount of grass growing above a standard height provides an estimate of mowing requirements albeit somewhat confounded by blade density. The obvious ground-hugging characteristic of 'Tifdwarf' bermuda and dichondra is documented by our test (Table 3). While there were no significant differences between the other bermudagrass cvs., they appeared less uniform in growth than the St. Augustinegrass cvs. Although their blades were somewhat finer-textured, the zoysias as a group still seemed to be slightly shorter than the other grasses.

Table 1. Species, cultivars and sources of turfgrasses in Texas A&I / A&M demonstration planting.

Turfgrass	Cultivar	Rep	Source	Date Planted[z]
Bermudagrass (*Cynodon dactylon*)	Santa Ana	1	Texas A&M Univ.	July 30, 1990
		2		May 21, 1991
	NuMex Sahara	1	"	May 21, 1991
	Texturf 10	1	"	July 30, 1990
	Tif 419	1	"	"
		2		May21, 1991
	Tifdwarf	1	"	July 30, 1990
		2		May 21, 1991
	Tifgreen	1	"	July 30, 1990
		2		May 21, 1991
Buffalograss (*Buchloe dactyloides*)	Common	1, 2	Conlee Seed Co. Waco, TX	July 30, 1990
Dichondra (*Dichondra micrantha*)	Native	1	Texas A&I Citrus	July 30, 1990
		2	Center	May 21, 1991
St. Augustinegrass (*Stenotaphrum secundatum*)	Floratam	1	Pursley Turf Farms Bradenton, FL	July 30, 1990
	Floratine	1	"	"
	Raleigh	1, 2	"	"
	Seville	1, 2	"	"
Zoysiagrass (*Zoysia spp.*)	Cashmere	1, 2	Pursley Turf Farms	July 30, 1990
	El Toro	1	Texas A&M Univ.	July 30, 1990
	Meyer	1	"	"

z - Dates respective replications were planted

Fig. 1. Collecting grass samples for growth in height determination showing frames, plot layout and site characteristics of the turfgrass demonstration planting.

Table 2. Rates of coverage ($ft^2\ wk^{-1}$) of 15 turfgrass cultivars during 4 seasonal periods[z].

Grass	Period 1	Period 2	Period 3	Period 4	Mean for Grasses
Bermuda cvs.					
Santa Ana	393	489	162	0	353
NuMex Sahara	368				368
Texturf 10	156	111	431	78	194
Tif 419	583	356	108	39	434
Tifdwarf	738	44	108	39	329
Tifgreen	613	334	-54	39	328
Buffalo	760	89	377	20	311
Dichondra	308	267	0	-78	209
St. Augustine cvs.					
Floratam	719	178	269	23	297
Floratine	320	200	538	0	265
Raleigh	729	178	296	0	301
Seville	487	167	269	78	250
Zoysia cvs.					
Cashmere	85	131	646	110	243
El Toro	52	76	808	39	244
Meyer	56	9	689	78	206
MSD[y]	n.s.	176	n.s.	n.s.	n.s.
(p level)	-	(.03)	-	-	-
MEAN FOR PERIOD (MSD = 175)	348	167	110	90	

[z]-Seasonal periods: 1 = Aug. 15 - Oct. 18, 1990; 2 = Oct. 19 - Feb. 12, 1991; 3 = Feb. 13 - May 20, 1991; 4 = May 21 - Sep. 30, 1991.
[y]-MSD's (Minimum Significant Differences) within columns and for period means by Waller-Duncan k-ratio, k = 100
n.s. = not significant
[x]-$Ft^2wk^{-1} = (10.8 \times 10^{-4})\ cm^2\ wk^{-1}$

Color. Only during the establishment period did any significant differences in grass color occur. (Table 3). During this period buffalograss and the St. Augustine cvs. generally had poorer color and appeared less lush than the other cultivars. There was little discernable variation for the other periods which was reflected in the lack of significant differences in color averaged over the 13 months of the test.

Weed Competition and Control.

The 'Tifgreen' and 'Tifdwarf' bermudas, 'Meyer' zoysia and dichondra did not compete as well against weeds as the other grasses (Table 3). Presumably, 'Tifdwarf' and dichondra's low-growth habit precluded shading or smothering weeds and the slow spread of 'Meyer' zoysia permitted weed germination and growth. Why 'Tifgreen' had more weeds is not readily explainable. The number and kinds of weeds present in each plot, indicated no differences among the grasses in supressing any particular weed species.

None of the grasses reduced the effectiveness of 2, 4-D in eliminating the assortment of broadleaved weeds which had invaded the plots (Table 3). Buffalograss and all the bermudagrass cvs. except 'Texturf' were somewhat intolerant to the herbicide as evidenced by tipburn and slight yellowing; however, all had achieved 70-85% recovery within 3 weeks.

Nitrogen Fertilization. There were no differences in appearance between the half plots which received the two rates of N. Also no differences were measured in the amount of grass cut between the differentially fertilized plot halves as determined in the grass height study in October 1991 (data not shown).

Other Observations. Cold tolerance and spring green-up, which are important turf characteristics farther north, would have considerably less application in the Valley which has only a 60% probability of freezing temperatures in any 2-3 year period (Orton, et al., 1967). As the winter of 1990-91 was

Table 3. Growth, color, weed status and control for 15 turfgrass cultivars.

Grass	Assessment of Height Growth[z] (g)	Color[y] Period 1.	Color[y] Ave.	% Weeds	Weed Species (No.)	% Weeds Killed	Turf Injury
Bermuda cvs.							
Santa Ana	8.2	4.8	4.2	4	5	95	2.0
NuMex Sahara	7.5	3.2	3.2				
Texturf 10	5.1	4.4	4.1	2	5	95	1.0
Tif 419	3.7	4.5	4.0	2	5	100	2.0
Tifdwarf	0	4.2	3.6	10	5	85	3.8
Tifgreen	4.5	4.0	3.8	15	5	95	3.0
Buffalo	5.5	3.8	3.6	9.5	5	98	3.9
Dichondra	0	4.5	4.0	15	5		
St. Augustine cvs.							
Floratam	5.2	4.1	4.1	2	4	95	1
Floratine	4.3	3.9	4.3	2	6	95	1
Raleigh	7.0	3.9	4.1	2.5	3	95	1
Seville	5.0	3.8	4.0	3	4	98	1
Zoysia cvs.							
Cashmere	1.6	4.8	4.5	6.5	5	98	1
El Toro	2.2	4.8	4.5	1	4	100	1
Meyer	3.0	4.8	4.1	10	6	90	1
MSD[w]	4.8	.41	n.s.	10	-	-	.23
(p level)	(.10)	(.10)		(.10)	-	-	(.001)

[z]-weight of grass cut off above (1.5 in.) 29 cm height; oz/ft^2 = .0325 (g/1000 cm^2)
[y]-1 = poor (yellow, faded, unthrifty), 5 = excellent (green, bright, lush). Period 1 = Aug 15-Oct 18, 1990.
[x]-1 = none, 5 = severe
[w]-MSD (Minimum Significant Difference) within columns by Waller-Duncan k-ratio test, k = 100, n.s. = not significant

mild, all the grasses remained green except buffalograss, 'Tifdwarf' and 'Tifgreen' bermuda. These grasses were 50-90% brown from December through January but by Feb. 12, were 85, 90 and 50% regreened, respectively.

From March 21 to Sept. 21 all but plot 6 in all frames were in full sun from 5 to 9 hours per day. Through the fall and winter months a large live oak (*Quercus viginiana*) to the southwest of the plots began shading frame 4 by 1:00 to 2:00 PM and completely shaded all plots by 4:30 PM. To date this shading has not had any marked effect on the performance of the grasses including the bermuda cultivars in frame 4. In contrast, apparently the combined effect of the Valley's high solar radiation and summer temperatures resulted in poor color and growth of dichondra which naturally does quite well when slightly shaded by taller grass or shrubs.

Discussion

While recognizing the need for tests over more years and locations, we feel some comparisons to other reports are in order. Generally, the order of our turfgrasses' coverage rates were fairly typical (Fry and Dernoeden, 1986; Ruemmele and Engelke, 1990; Sifers, Beard and Hall, 1990; Morton, et al., 1991) though the Valley environment caused some modifications. For example, the zoysiagrasses had achieved 90% coverage in 9 months which is much more rapid than generally reported (Mace, 1985; Fry and Dernoeden, 1989; Sifers, et al., 1990). Even though most of the grasses continued spreading during Period 2, 'Tifdwarf' bermuda, 'Meyer' zoysia and buffalograss appeared more sensitive to cooler winter temperatures and/or perhaps lower light intensities since this was the only period in which coverage rates were statistically different.

Even though the grasses' mean growth rates were similar, the differences between and within periods suggests major differences in the cvs. responses to seasonal climatic features. It would appear that the grasses' rates of spread might be similar but their growth curves have different lag periods (Steward, 1968). Most of the bermudas and St. Augustines, for example, seem to have very short lag phases and reach steady state growth within a few months. In contrast, the zoysia cvs. have a 5-6 month lag before achieving the rapid growth exhibited in Period 3. The fact that most of the grasses in the demonstration attain steady state growth rapidly is evidenced by the sharp drop in the period mean coverage rate after Period 1 followed by a gradual decline in mean rates

through Period 4 (Table 2).

Generally, turfgrass spread is expressed as the percent area covered between 2 dates (Morton, et al., 1991; Ruemmele and Engelke, 1990; Sifers, et al., 1991). To compare such results with ours, we multiplied the reported percent coverage by plot size and divided the product by the number of weeks between evaluation dates. While the lower and medium rates of coverage usually compared to ours, the highest rates reported for St. Augustine-(Morton, et al., 1991), zoysia-(Fry and Dernoeden, 1986) and buffalograss (Ruemmele and Engelke, 1990) were as much as 10 times greater than those we found. If these calculated rates were valid, we assume such rapid coverage is due to improved, better adapted cultivars, higher levels of fertility or both.

Our own and others' data indicate the variability in rates of coverage can be as great within cultivars as between species and that local conditions affect the magnitude and expression of these rates. This is documented in our data by the lack of statistical differences between the pooled species mean rates of coverage either within or over all periods.

By our methods of determining height growth, the cultivars' responses were similar to their coverage performances. Except for the very low-growing 'Tifdwarf' bermudagrass and dichondra, there was considerable variation within species although the zoysias tended to be shorter and the St. Augustines more uniform in height.

Except for buffalograss and 'Tifgreen' bermuda, weeds were a problem only in 'Tifdwarf' bermudagrass, dichondra and the slow-spreading 'Meyer' zoysiagrass. Why the weed percentage was high for the first 2 cultivars was not readily apparent. Generally, all cvs. competed well against weeds and were either not sensitive to or recovered quickly from 2, 4-D sprays. Reactions to other herbicides and perhaps some growth regulators should probably be tested, especially where invasion by weedy grass species must be considered (Hubbell and Dunn, 1985; Johnson, et al., 1990).

While fertilizer requirements for these grasses needs more investigation, the amount of N provided seemed sufficient to provide good color and condition for the 1991 season. On sites with marginal or run-down soils, greater fertilization would likely be beneficial.

Conclusions

1. These preliminary results, indicate the turfgrass evaluations from other areas are not applicable to the Lower Rio Grande Valley. For example, establishment rates, frost tolerance and spring green-up are of less importance while fertilizer, water and weed control requirements will need expanded, long-term investigation.

2. 'Raleigh', 'Seville' and 'Floratine' would appear to be suitable alternatives to 'Floratam' St. Augustinegrass and the 'Santa Ana' or 'Texturf 10' bermudas could be used instead of common bermudagrass.

3. For a fine-textured turf requiring less mowing, 'Cashmere' and 'El Toro' zoysiagrass look very promising. Compared to other areas, the Valley's long growing season could accelerate these grasses' reputed slow coverage rate by 50-100%.

4. In locations having at least 8 hours of full sun, buffalograss would provide rapid coverage, require less mowing and probably less fertilizer and water.

5. For a semi-shaded area, where grass invasion could be controlled dichondra could be a good no-mow substitute for turfgrass provided it got sufficient fertilization and water.

6. To fully evaluate these or other potential turfgrasses for the Valley, continued and extended testing in other locations will be necessary. Additional studies should also included fertilizer and water requirements, responses to growth regulators and other herbicides, wearability and shade tolerance.

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