Field Performance of Selected Mowed Distichlis Clones Tucson Field Station Report #3

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Abstract

Twenty-one clonal (genotype) accessions of Distichlis are being continually evaluated for field performance as replicated mowed turf plots under desert conditions. The genotype ("treatment") affect was significant for most field variables measured, or assigned to plots using visual rating scales customary for turf evaluations. Genotype differences occurred for percent plot composition color, quality, texture, uniformity and leaf width. Visual stress (prolonged hot weather without irrigation) and leaf hair presence were not significant responses between accessions. Long term mowing stress shows divergent performance amount Distichlis germplasm for growth characters and turf persistence under mowed conditions.

Introduction

This report (#3) includes field data responses of 21 clones of Distichlis which receive regular mowing (2x weekly) at 2.25 inches at the Tucson station. The objectives are and continue to be as follows (1) measure the effectiveness of greenhouse selection techniques through the field performance of Distichlis germplasm (2) identify superior genotypes in long term field trials.

Materials and Methods

Field evaluations for this report cover the time period of November 1999, up to and including June 14, 2000. Typical responses characterizing plot composition (percent plot cover as green foliage, straw foliage, bare ground if any) turfgrass color, quality, texture, leaf width (mm), and the presence or absence of leaf hairs were measured. All values assigned to plots were either on a percent whole plot basis (0-100%), or by using the NTEP 1-9 progressive scale. Leaf widths were measured using a standard fixed mount hand lens which measures to the nearest 0.10mm. Five of the second fully expanded leaves were randomly sampled within the plots, and then averaged for analysis. All data were subjected to analysis of variance using SAS software, with clonal accessions (genotypes) designated as treatments. LSD values were calculated only when the F ratio significance level occurred at a P value of 0.05, or less. A linear orthogonal polynomial contrast tested if responses were different between collector sites (AZ vs CSU). The turf received 0.34 inches of rainfall from November to March, and 0.0 from April until June 14. The turf was flood irrigated on April 25, and on May 11. On April 25, four 50 lb salt blocks of animal feed grade sodium chloride were dissolved in the irrigation plumes to increase salinity and eliminate any surface weeds. The text was fertilized on May 10, 2000, at the rate of 1.2 lbs. of N/M from a 21-7-14 granular product.

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Results and Discussion

November 29, 1999

Percent ground cover, percent plot green, percent plot straw and turfgrass color, texture, and density values were all significant responses between clonal accessions (P=0.001).

Percent ground cover (all foliage) in late November ranged from 47% to 97% (Table 1). Five entries had 90% or more ground cover, such as A40, A86, A55, A137 and A65. Those with less than 70% total ground cover included C10, A119, C66, and C56. Percent plot green turf ranged from 13% to 80%. These values reflect the relative amounts of non-dormant turf, at the end of November 1999. Accessions A137, A86, and A40 had 70%, 75%, and 80% green plot foliage, respectively (Table 1).

Accessions A86 and A137 had a large percentage of their total foliage remaining green, as did A-40. Entries which had less than 40% green ground cover included C12, A48, A53, C56, A119, and C10. Percent plot straw values range from 7% to 55%. Entries C10, A53, A65 and A119 had 45% to 55% plot straw (either dormant or senescent tissue). Entry C66 had 7% plot straw present (but was only 52% total cover with 45% green cover, otherwise). Therefore, percent plot green foliage is the best indicator of fall color maintenance and retention. (Table 1)

December 12, 1999

December 1999 represents a time period essentially 16 months after three plugs were placed into their 4' x 6' field boxes during August 1998. Percent total plot cover values were essentially identical two weeks later. Accessions which in December had the largest amount of green plot cover included A86, C11, and C92. These accessions had 57%, 52%, and 63% green foliage two weeks before Christmas time.

Given the fact the plots were 16 months old, accessions which are to have any commercial value, should have at least 90% plot cover. Entries which met this criteria include A55 (94%), A65 (97%), A86 (93%), and A40 (90%). Distichlis propagates itself from subterminal rhizomes only, and no stolons were discovered in this germplasm pool. Therefore, all shoots arose from rhizomes in this test.

Different growth patterns have been observed among these 21 clones. Some plots may be very dense, but slow to fill in the entire plot area (A138). Others provide a uniform cover, but are not dense, and have a large amount of bare ground cover showing [e.g. C92= 78% plot cover on November 29, 26% bare ground on December 12.] (Table 1).

Spring Green Up, March – April 2000:

Green up of the clones started occurring by March. Accessions which had the greatest amount of green cover of the entire plot surface included C8 (55%), A138 (50%), A77 (52%), and A86 (48%). C92 which held its color late into the fall was much slower to green up in the spring. It had 4% mean percent plot green up in March. Others that were essentially fully or highly dormant included A55 (4%), A65 (8%), A119 (7%), C66 (0%), A48 (0%), C10 (40%), and A53 (10%). (Table 2)

Two weeks later (March 29, 2000), percent plot green up doubled (averaged across all accessions). A86 was 82% green, followed by A138, A55, and C-8, which averaged 57% to 58% green up. (Table 2)

Warm weather and dry conditions prevailed, starting in early March, and continued into early June. By the third week in April, percent plot green values had increased for some entries, while it decreased for others. For example, entries such as C10, A41, A86, A77, and C8 which demonstrated early green up, were now showing lower values in April than in March. Note that no fertilization had been added, and the natural rainfall from November to March was 1.27 inches. The Reference ET was 29 inches for the period. Other entries progressed more slowly towards green-up. Accessions such as A72, A65, A137, and C-12 produced low, but steady green-up rates, now residing at 35% - 40% green-up. (Table 2)

On April 26, most entries had about twice as much "bare ground" over the plots as there was in December. Surface degredation of senescent shoots, along with a warm and dry spring (devoid of irrigation, normal rainfall, and any fertilizer) led to the decrease in total vegetative growth by the end of April.

On May 11, the test was flood irrigated which also incorporated 1.2 lbs. N/M from a 21-7-14 fertilizer. The fertilization, plus irrigation decreased the bare ground components by 2 to 10 times as was noted in April (Table 2). Accessions which had almost no bare ground on June 14 visible included A55 (5%), A138 (4%), A65 (4%), A51 (6%) and A40 (7%) (Table 3). Plots with the most green cover were A55 (91%), A138(87%), A40 (83%), A65 (82%). These plots also had the lowest amounts of bare ground (4-6%) and the lowest amounts of percent plots straw (4-10%) of the plot surface. (Table 3).

Standard Turf Performance

Turfgrass color, texture, density scores were assigned to plots on November 29 as late fall ratings (using NTEP visual scoring criteria). Mean texture scores ranged from wide leaf width accessions such as C66 (mean =3.0), to accessions with narrow leaves like A65 (mean = 7.0). Accessions with the finest textures were A55 (6.7), A138 (6.7), A51 (6.3) A40 (6.3) and A61 (5.7). (Table 4)

Mean color scores ranged from 3.0 to 6.3 at the end of November. Those with the darkest color turfs were A138 (6.0), C66 (6.3), C92 (5.7), A86 (5.7) and A77 (5.7). (Table 4). The mean of all entries for color was 4.7 on November 29. Turfgrass density scores for November 29 ranged from (low) 3.3, to (high) 7.3. The denser entries were those of A55 (7.7), A65 (7.3), A40 (6.7), A137 (6.0). Accessions with the lowest visual densities were A119 (3.3), and C56 (3.3). (Table 4)

Leaf widths were measured on May 18 and show acceptable widths, but not much variation between entries. Mean leaf widths ranged from 1.9 to 2.9 mm. Most entries had mean leaf widths of 2.1 to 2.4 mm. (Table 4)

The presence or absence of leaf hairs was recorded on May 18 also, using a scale of 0= no hairs, 1= hairs present on the lamina. Only accession C92 proved to be without hairs. Those entries with easily seen lamina hair included A61, A55, C11, A72, A86, A137, A41, C12, C10, A40 and A53. (Table 4)

Spring Evaluations:

Turfgrass color, quality, texture and density scores were assigned to plots on May 24 (2 weeks after a flood irrigation). Turfgrass quality and visual leaf stress scores were assigned to plots on June 10, one month after irrigation at the end of a period of high ET demand and scorching temperatures. The soil between plots was severely cracked, with no moisture visible in the top six inches.

Accessions with the finer texture appearance in May included A55 (7.0), A86 (6.7), A51 (6.3), A65 (6.3), A40 (6.3), and A61 (6.0). Those accessions with the darkest turfgrass color of the foliage were A138 (8.3), C8 (7.3), A72 (7.3), A86 (7.3), A40 (7.3), A77 (7.0), and A119 (7.0). Those with the lightest color turf included A48 (5.3), C66 (5.3). (Table 5).

Accessions with the highest numerical scores for overall turfgrass quality in May (non stressed) included A86 (7.7), A55 (7.3), A51 (6.7), A40 (6.7), and A138 (6.3). (Table 5). One month after irrigation, turfgrass overall quality scores ranged from 4.3 to 7.0, as plants were showing some slight stress from lack of irrigation. The same 5 top entries produced the better looking turfs (under both stressed and unstressed conditions). While under stress, the quality scores (June 14) were as follows: A55 (7.0), A86 (7.0), A51 (6.7), A138 (6.3), and A40 (6.3). (Table 5).

These same entries had the more denser turfs, as a note on the May 24 evaluation date for turfgrass density. (Table 5). Accessions A55, A138, A86, had density scores of 7.0, or greater. A51 and A40 both had mean density scores of 6.0. (Table 5). A65 had a high shoot density mean score of (7.3), with somewhat slightly lower identical quality scores in May and June (6.0), respectively. (Table 5).

Visual stress scores were assigned to plots on June 14 (35 days after the last flood irrigation, and with no rain). The Reference ET (Modified Penman) from the on-site weather station was 7.42 inches for this 35 day span. Turf stress was scored on a scale of 1-6, whereby 1 = no stress, 4 = moderate stress, and 6 = severe stress. Visual water stress for Distichlis took the form of leaves exhibiting a lack of sheen on the leaves. There was only a trace amount of wilting on very few leaves within plots. Rather, the stress appeared to cause the leaves to become dull on the surface. Mid-day ratings on June 14 revealed mean stress ratings from 2.3 (slight stress) to 5.0 (moderate to severe stress). (Table 5). The mean of all 21 entries for stress was 3.8 (slight-to-moderate visible stress). C56 had the least visible stress (2.3), while C10 was the most stressed (5.0). Others that were noticeably stressed were A51 (4.7), A41 (4.7), A137 (4.7), C12 (4.3), A48 (4.3), C8 (4.0) and A55 (4.0). Note that the “treatment” variable was not significant for the “stress” response.

Conclusions

1. Clonal accessions (genotypes) continue to show divergent responses for turf-type adaptation under mowing stress in the field.

2. The treatment affect was significant for all measured and visual plot attribute assignments on all dates, with the exception of the presence/absence of lamina hairs, and visual stress ratings when water was withheld.

3. Distichlis clones varied for Fall 1999 color retention. Accessions with the greatest percent plot green foliage in late November included A40 (80%), A86 (75%), A137 (70%), A138 (65%), and C92 (65%). At the end of November, turfgrass color was greatest for accessions C66 (6.3), A138 (6.0) and A77, A86, and C92 (all with mean color values of 5.7, respectively).

   By mid-December 1999, accessions with the greatest amount of percent plot green foliage were C92 (63%), A86 (57%), C11 (52%), A40 (53%), and C12 (50%).

4. Entries with the greatest amount of turfgrass cover, at the close of 1999 (16 months after initial field transplanting) were A65 (97%), A55 (93%), A86 (93%), and A40 (90%). Accessions decreased with lesser amounts of total foliage plot cover, down to 43% for C56.

5. Early spring green-up (mid-March 2000), ranged from 0% to 55% green plot surface between accessions, while having been devoid of any meaningful rainfall or any irrigation.

6. C8 (55%), A77 (52%), and A138 (50%), exhibited early green-up characteristics in mid-March, in terms of percent plot green foliage.

7. By late March, A86 exhibited 82% plot green-up, followed by C8 (58%), A55 (57%), A138 (57%), and A77 (53%).

8. Without irrigation and no rainfall (from January 1 to April 26), percent plot green values dropped for the early green-up accession, while other accessions stagnated, or slowly increased in their respective rates of late spring green-up. Plots were flood irrigated on April 25 and May 11.

9. After irrigation, percentage green plot cover resumed to 91% (A55), 87% (A138), 83% (A40), 87% (A86), and 82% (A65). The lowest percent green plot cover was 64% (A41), at this time (on 14, June 2000).

10. Leaf widths varied from 1.9 to 2.9 mm between accessions. Leaf width is not a prime variable which is correlated to other turf measurement responses. Leaf width is not correlated to visual estimates of turfgrass plot density in Distichlis.

11. Lamina hair is variable both between and among accessions of Distichlis.

12. Accessions with the best overall turfgrass quality in May (unstressed) and for June (stressed) included A55 (7.3:7.0), A86 (7.7:7.0), A51 (6.7:6.7), and A40 (6.7:6.3). The slow growing dwarf A138 averaged (6.3:6.3).

13. Under prolonged denial of irrigation or rainfall, Distichlis accessions vary in the amount of green foliage they can maintain.

14. After some irrigation or rainfall, Distichlis clones will accelerate regrowth by sending up new shoots from rhizomes, or slowly “shedding” senile tissues and emerging new leaves.

15. The evaluation period for this report (#3) includes November 1 to June 14, 2000. During this period, the reference ET was 35.21 inches. Rainfall was 1.2 inches between this time, and plots were flood irrigated on April 25 and May 11. The turf was mowed a minimum of 2x weekly at 2.25 inches, and was fertilized once on May 10 at 1.2 lbs N/M.

Table 1. Mean percent plot[1] composition values for mowed Distichlis Clones. University of Arizona 2000.

	% plot cover	*% plot green*	*% plot straw*	*%plot straw*	*% plot green*	*% plot cover*	*% bare grnd*
Entry	29-Nov-99	29-Nov-99	29-Nov-99	9-Dec-99	9-Dec-99	9-Dec-99	9-Dec-99
A61	81.7	48.3	33.3	55.0	25.0	80.0	20.0
A55	95.3	51.7	60.0	46.7	46.7	93.3	6.7
C8	78.3	45.0	30.0	41.7	35.0	76.7	23.3
C92	78.3	65.0	13.3	10.0	63.3	73.3	26.7
A138	80.0	65.0	15.0	45.0	33.3	78.3	21.7
A65	97.7	42.5	48.3	86.7	10.3	97.0	3.0
C56	46.7	26.7	20.0	25.0	18.3	43.3	56.7
C11	83.3	63.3	20.0	18.3	51.7	70.0	30.0
A72	71.7	41.7	30.0	48.3	18.3	66.7	33.3
A119	66.7	20.0	46.7	61.7	5.0	66.7	33.3
A86	94.3	75.0	18.3	36.7	56.7	93.3	6.7
A77	75.0	58.3	16.7	50.0	23.3	73.3	26.7
A137	90.0	70.0	20.0	43.3	43.3	86.7	13.3
A41	75.0	40.0	25.0	50.0	21.7	71.7	28.3
C66	51.7	45.0	6.7	8.3	38.3	46.7	53.3
A48	80.0	36.7	43.3	68.3	11.7	80.0	20.0
A51	86.7	48.3	38.3	63.3	20.0	83.3	16.7
C12	71.7	38.3	33.3	15.0	50.0	65.0	35.0
C10	68.3	13.3	55.0	61.7	5.0	66.7	33.3
A40	92.7	80.0	12.5	36.7	53.3	90.0	10.0
A53	85.0	35.0	50.0	75.0	7.5	82.5	17.5
Test[2] mean	**78.6**	**48.1**	**30.3**	**45.1**	**30.4**	**75.5**	**24.5**
LSD[3]	12.3	21.4	23.9	22.7	30.9	16.1	16.0

[1] Percent plot cover 0-100%. Note (% plot green & % cover straw) = % plot cover. Values are the mean of three replications.

[2] Mean of all treatments on each evaluation date.

[3] LSD Value = mean separation statistics. Absolute difference between two entries must be larger than the LSD value for entries to be statistically different from each other.

Table 2. Mean percent plot[1] composition values for mowed Distichlis Clones. University of Arizona 2000.

	%plot green	*%plot green*	*%plot green*	*%plot bare grnd*	*%plot cover*
Entry	14-Mar-00	29-Mar-00	26-Apr-00	26-Apr-00	26-Apr-00
A61	20.0	38.3	43.3	40.0	60.0
A55	4.0	56.7	48.3	23.3	76.7
C8	55.0	58.3	35.0	46.7	53.3
C92	4.0	28.3	30.0	40.0	60.0
A138	50.0	56.7	51.7	16.7	83.3
A65	8.3	31.7	40.0	8.3	91.7
C56	14.0	23.3	28.3	61.7	38.3
C11	25.0	36.7	35.0	40.0	60.0
A72	12.3	33.3	40.0	50.0	50.0
A119	6.7	21.7	38.3	38.3	61.7
A86	48.3	81.7	50.0	15.0	85.0
A77	51.7	53.3	30.0	50.0	50.0
A137	10.0	30.0	38.3	31.7	68.3
A41	26.7	50.0	25.0	30.0	70.0
C66	0.0	10.0	33.3	60.0	40.0
A48	0.3	15.0	31.7	33.3	66.7
A51	15.0	50.0	51.7	20.0	80.0
C12	13.3	30.0	35.0	51.7	48.3
C10	4.0	41.7	36.7	40.0	60.0
A40	18.3	40.0	36.7	26.7	73.3
A53	10.0	15.0	25.0	37.5	62.5
Test[2] mean	**18.9**	**38.2**	**37.3**	**36.2**	**63.8**
LSD[3]	16.3	21.6	17.7	13.4	17.7

[1] Percent plot cover 0-100%. Note (% plot green & % cover straw) = % plot cover. Values are the mean of three replications.

[2] Mean of all treatments on each evaluation date.

[3] LSD Value = mean separation statistic. Absolute difference between two entries must be larger than the LSD value for entries to be statistically different from each other.

Table 3. Mean percent plot[1] composition values for mowed Distichlis Clones. University of Arizona 2000.

	% bare grnd	*% straw*	*% green cover*
Entry	14-Jun-00	14-Jun-00	14-Jun-00
A61	15.3	6.7	78.0
A55	4.7	4.7	90.7
C8	16.7	18.3	65.0
C92	20.0	11.0	69.0
A138	4.0	8.7	87.3
A65	4.3	14.0	81.7
C56	53.3	6.7	40.0
C11	16.0	6.0	78.0
A72	22.7	10.3	67.0
A119	17.0	10.7	72.3
A86	2.7	15.3	82.0
A77	13.0	5.7	81.3
A137	12.0	23.3	64.7
A41	12.7	23.3	64.0
C66	25.0	11.7	63.3
A48	13.7	13.3	73.0
A51	6.3	14.0	79.7
C12	15.0	10.7	74.3
C10	30.3	20.0	49.7
A40	7.0	10.0	83.0
A53	17.5	20.0	62.5
Test[2] mean	**15.7**	**12.6**	**71.7**
LSD[3]	12.4	N/A	23.9

[1] Percent plot cover 0-100%. Note (% plot green & % cover straw) = % plot cover. Values are the mean of three replications.

[2] Mean of all treatments on each evaluation date.

[3] LSD Value = mean separation statistics. Absolute difference between two entries must be larger than the LSD value for entries to be statistically different from each other.

Table 4. Mean turfgrass performance values, leaf widths and presence of leaf hairs of mowed Distichlis Clones. University of Arizona 2000.

Entry	*Texture* [1] 29-Nov-99	*Color* [1] 29-Nov-99	*Density* [1] 29-Nov-99	*Uniformity* [1] 26-Apr-00	*Leaf wd(mm)* [2] 18-May-00	*Hairs 0=n, 1=y* [3] 18-May-00
A61	5.7	4.3	5.7	4.0	1.9	1.0
A55	6.7	4.7	7.7	6.7	2.1	1.0
C8	4.7	4.3	4.7	3.3	2.3	0.7
C92	3.7	5.7	4.7	3.7	2.5	0.0
A138	6.7	6.0	4.0	5.3	2.4	0.7
A65	7.0	4.7	7.3	6.7	2.0	1.0
C56	4.0	4.3	3.3	1.7	2.1	0.0
C11	4.3	5.3	4.7	3.7	2.4	1.0
A72	5.0	4.3	4.7	3.3	2.1	1.0
A119	5.3	3.0	3.3	2.3	2.0	0.7
A86	6.0	5.7	7.0	6.7	2.2	1.0
A77	5.3	5.7	4.7	3.7	2.5	0.3
A137	6.0	5.0	6.0	4.7	2.3	1.0
A41	5.7	5.0	5.0	4.3	2.1	1.0
C66	3.0	6.3	3.7	2.7	2.9	0.7
A48	5.7	4.0	5.0	4.0	1.9	0.7
A51	6.3	4.7	5.7	6.0	1.9	0.3
C12	5.0	3.7	5.0	3.7	2.1	1.0
C10	4.0	3.3	4.7	4.3	2.1	1.0
A40	6.3	5.0	6.7	5.7	2.3	1.0
A53	5.5	4.0	5.5	4.5	2.2	1.0
Test[4]mean	**5.3**	**4.7**	**5.2**	**4.3**	**2.2**	**0.8**
LSD[5]	1.2	1.3	1.3	1.1	0.4	0.6

[1] Texture, color, density, uniformity = 1-9, 1=dead, 9 = best possible. Values are the mean of three replications.

[2] The width of 2nd fully expanded leaf (mm) at midpont. Values are the mean of 15 observations.

[3] Presence or absence of leaf hairs. 0=no, 1=yes. Values are the average of 15 observations.

[4] Test Mean = Average of all entries on each evaluation date.

[5] LSD Value = mean separation statistics. Absolute difference between two entries must be larger than the LSD value for entries to be statistically different from each other.

Table 5. Mean turfgrass performance values and stress index ratings for mowed Distichlis Clones. University of Arizona 2000.

	Texture [1]	*Color* [1]	*Quality* [1]	*Density* [1]	*Quality* [1]	*Stress* [2]
Entry	24-May-00	24-May-00	24-May-00	24-May-00	14-Jun-00	14-Jun-00
A61	6.0	6.3	5.7	5.0	5.7	3.0
A55	7.0	6.3	7.3	7.0	7.0	4.0
C8	5.7	7.3	6.0	5.3	5.7	4.0
C92	4.3	7.0	5.3	4.7	5.7	3.0
A138	5.3	8.3	6.3	7.0	6.3	3.0
A65	6.3	5.7	6.0	7.3	6.0	3.7
C56	4.3	6.7	3.0	2.7	3.3	2.3
C11	4.7	6.3	5.3	4.7	5.0	3.3
A72	5.3	7.3	4.7	4.0	4.7	3.7
A119	6.0	7.0	5.0	4.3	4.3	3.7
A86	6.7	7.3	7.7	7.3	7.0	4.0
A77	5.0	7.0	6.0	5.3	5.7	3.3
A137	5.7	6.3	5.7	5.0	5.3	4.7
A41	6.7	6.7	5.7	5.3	5.0	4.7
C66	4.0	5.3	4.3	3.7	4.3	3.3
A48	6.0	5.3	5.0	4.7	4.7	4.3
A51	6.3	6.7	6.7	6.0	6.7	4.7
C12	4.7	6.3	5.0	4.3	4.3	4.3
C10	4.0	6.0	5.3	4.0	4.7	5.0
A40	6.3	7.3	6.7	6.0	6.3	3.3
A53	6.0	6.5	5.0	4.5	4.5	4.5
Test[3] mean	**5.5**	**6.6**	**5.6**	**5.2**	**5.3**	**3.8**
LSD[4]	0.8	1.1	0.9	1	1.1	N/A

[1] Texture, color, density, uniformity = 1-9, 1=dead, 9 = best possible. Values are the mean of three replications.

[2] Stress = drought stress after 35 days without irrigation or rain. 1-6; 1=slight; 3=slight/moderate stress 4=moderate stress; 6=severe stress. Values are the mean of three replications.

[3] Test Mean = mean of all entries on each evaluation date.

[4] LSD Value = mean separation statistics. Absolute difference between two entries must be larger than the LSD value for entries to be statistically different from each other.