Field Performance of Selected Mowed Distichlis Clones: Tucson Station, Report #4.

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Abstract

Clonal accessions (genotype selections) of Distichlis continue to show divergent responses for turf-type growth habit and general turf-type adaptation under field mowing stress. The treatment (clonal accession) affect was significant for all field response variables from mid July to mid August (data collections for Report #4, except for "percent plot straw" on October 12. In July 2000, mean percent plot green cover ranged from 47% to 96% among clonal accessions. Turfgrass quality in July was best among the entries A138, A86, A137, A48, A51, and A40. These entries had the greatest percent plot cover, moderately fine leaf texture, and high shoot density, compared to other entries.

In the calendar year 2000, (includes weather conditions in Report #3), the test site was exposed to atmospheric conditions which included a reference ET. of 3.59" (January); 4.42" (February); 6.23" (March); 8.96" (April); 11.32" (May); 9.08" (June); 9.31" (July); 7.53" (August); 7.37" (September); 3.55" (October). The test was subjected to severe drought conditions throughout the test, starting April 2000. Rainfall from January too, and including April was 1.28 inches. There was no rain from May 1 to June 15. Four rains from July 17 to July 30 added 2.94 inches of rainfall, with two thirds of this occurring from one storm on July 29. No irrigation was added from July 1, until September 15. During that time period, 3.26 inches of rain fell in July. In August, 2.47" of rainfall occurred. From June 1 to September 15, the accumulated reference ET. was 29.68 inches. Total rainfall was 5.81" (no irrigation practiced).

Most (but not all) Distichlis accessions maintained adequate turf color and percent plot green, up to late August. Visual stress ratings in early August showed differences in visual stress ratings and leaf canopy temperatures measured with a hand held IRT device. Entries A48, A51, A40, A138, A61, and C10 exhibited the least amount of visible drought stress in early August. Accessions that had the highest overall quality ratings in July were A138, A86, A137, A48, A51, and A40. Accessions that exhibited acceptable (highest) turf quality prior to and during the drought period included A138, A40, and A51.

Drought induced dormancy finally occurred at the beginning of September, as most accessions drastically decreased the amount of green plot foliage after a prolonged period without irrigation. After flood irrigation and fertilizer applications on September 15 and September 29, plots recovered by mid October. The recovery was not full, as the greatest amount of green percent plot cover ranged from 23% to 83% among entries. Entries with the greatest amount of green cover after the post dormancy period included, A65, A138, A137, A77, and A72. All entries did exhibit reduced quality in comparison to July ratings. Based on these results, Distichlis should be irrigated once/month in a desert condition to avoid drought induced dormancy.

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During the calendar year 2000, accessions which had notable performance included: Early Spring Green Up: C8, A77, A138, A86; Early Summer Quality (non-water stress in May, and water stressed in June): A55, A86, A51, and A40, A138; Mid Summer Quality: A48, A86, A137, A51, A138; During Drought Quality: A138, A40, A51; Post Dormancy Quality: A65, A138, A137, A77, A72.

Introduction

This report (#4) includes field data responses of the 21 clonal accessions of Distichlis at the Tucson Station. The objectives in progress are to (1) measure the effectiveness of greenhouse techniques through assessment of field performance and (2) identify superior genotypes under long-term field trials. The yearly responses of turf performance for the calendar year 2000 resides in both report #3 (November 1999 to June 14, 2000), and in (this) report #4 (July 7 to October 12, 2000).

Materials and Methods

Distichlis plots were mowed 2x or 3x weekly at 2.0 inches with a 22" rotary mower and clippings were removed. Plots were rated in July for turfgrass color, quality, density and texture using NTEP scales. Percent plot composition scores were assigned in July using 0-100% cover scale for percent green plot cover, percent straw plot cover, percent total plot cover (% green + % straw), and % bare ground visible. The test site was deprived of water as much as possible in 1999 and 2000. As previously mentioned in Report 3, the site received 0.34 inches of rain from November 1999 to March 2000, and 0.0 inches from April until June 14. The turf was flood irrigated on April 25 and on May 11. Accession data on Report #3 ended on the 14 June collection date, which coincided with the end of the spring – early summer drought, which was substantial.

The report includes data from the time period after June 29, in which the plots were flooded from a 1.8 inch rainstorm beginning as part of the first monsoon. The plots were submerged for 48 hours from an estimated 4.0 inch head of water. At that time, the test site was pumped to remove excess water, leaving approximately ¼" of water remaining.

After that, no flood irrigation was practiced until September 15, and again on September 29 (2 weeks later). On both flood dates, 100 lbs. of 21-7-14 fertilizer was applied (equal to 2.0 lbs./N/M on each application date). With only minimal total inches of rain from June 16 to September 14, the Distichlis finally and suddenly lost much of its green tissue. This was assumed to be a latent response from drought induced dormancy. This condition lasted from approximately September 15 to the first week in October. Plots then began to green-up, and plots were rated on October 12.

During the severe summer drought stress period, plots were evaluated for visual stress on September 4, 2000 using a progressive visual scale of 1-6; 1=no stress, 3= lite/moderate, 4= moderate, 6=severe. Infrared canopy temperatures were taken as 3 subsamples/plot using a hand-held Everest IRT sensor. Temperatures were taken on portions of the plots that had the highest degree of canopy cover to minimize bare soil exposure inclusion.

On October 12, percent plot composition and overall color and quality were assigned to all plots as well.

Surflan AS was applied at quarts (2.0 lbs. AI/A) along with isoxaben (1.0 lb AI/A) on September 14, for pre-emergence control for fall and winter annual weeds.

All data were subjected to the analysis of variance technique. Least significant difference values were calculated to separate accession mean performance only when the F ratio for the "treatment" (accession) effect was significant at P=0.05, or less. A single orthogonal polynomial contrast was used to measure the "collector" site of origin (AZ vs CO).

In the calendar year 2000, (includes weather conditions in Report #3), the test site was exposed to atmospheric conditions which included a reference ET. of 3.59" (January); 4.42" (February); 6.23" (March); 8.96" (April); 11.32" (May); 9.08" (June); 9.31" (July); 7.53" (August); 7.37" (September); 3.55" (October).

The test was subjected to severe drought conditions throughout the test, starting April 2000. Rainfall from January to, and including April was 1.28 inches. There was no rain from May 1 to June 15. Four rains from July 17 to July 30 added 2.94 inches of rainfall, with two thirds of this occurring from one storm on July 29. No irrigation was added from July 1, until September 15. During that time period, 3.26 inches of rain fell in July. In August, 2.47 inches of rainfall occurred.

Results and Discussion

The accession (treatment) effect was significant a P=0.05, for all variables, except for percent plot straw on October 12, (post dormancy green up).

July 26, 2000

Percent plot composition percentages and turfgrass color, quality and density were assigned to plots on July 26 (no drought stress) Entries with the greatest amount of percent plot green cover included A40 (96%), A138 (95%), A48 (94%), A137 (94%), and A51 (94%), (Table 1). Accessions A40 and A48 had less than 3% straw plot cover, and not more than 1% bare ground showing. Accessions with the least percentage plot green included C66 (20%), C92 (47%), C56 (55%), C11 (57%) and C10 (62%). Many of these same entries had a large percent plot straw values, which ranged from one third to one half of the total plot cover, (Table 1).

Overall, turfgrass quality scores on July 26, 2000 ranged from 3.0 [C66] to 8.3 [A51], (Table 2). The mean of all treatments was 6.2. Entries A51, A137, A138 and A40 had quality scores of 8.0, or greater. These accessions had the highest percent plot green scores, and highest shoot densities, (Tables 1, 2). Entries A48, A86 had mean quality scores of 7.7, while A65 and A53 were next, both with scores of 7.0. Entries C10, C56, C11, C92 and C66 had overall quality scores of 4.3, or less, (Table 2). The contrast for AZ vs CO was not significant.

Mean visual density scores ranged from 4.0 to 7.7. Accessions A53, A86, A40 and A138 all had mean density scores of 7.5 or greater. Entries A137, A61 and A48 had mean density scores of 7.3. Entries with low shoot density estimates included C66, C11, C10, and C565, of all which had mean density scores of 4.7, or less, (Table 2). The contrast between CO vs. AZ was not significant.

Mean turfgrass color scores ranged from 3.3 to 8.0. Entries A138 and A40 had mean color scores of 8.0 and 7.7, respectively, (Table 2). Three additional entries had mean color scores of 7.0 (A119, A61, and A72). Entries A137 and C8 were next in rank, with mean color scores of 6.7. Seven other entries had mean color scores within the 6.0 and 6.3 range, (Table 2). The contrast between collection sites was not significant.

Mean texture (relative leaf width) scores ranged from 4.0 (coarse) to 7.7 (fine), (Table 2). Entries A48, A41, A51, and A61 had mean texture scores of 7.3 to 7.7. These accessions had the "finest" leaf textures among all accessions. Entries A137, A65 and A40 had mean texture scores of 6.7 to 7.0. These entries still had narrow leaves, compared to most other accessions. Accession A138 (which ranked high in overall turfgrass quality, color and density) had a mean texture score of 6.3. Entries with the widest leaf blade (visual estimates) included A77, C92, C11, C10 and C66. These entries had upright and broad leafs, compared to other entries, (Table 2).

August 4, 2000

The accumulated drought stress that occurred by early August was now evident among entries. At this time, the soil was extremely dry, with no visible moisture present in the soil clods down to six inches in non-turfed alleyways. Leaf stress scores using a scale of 1-6 were assigned to plots were 1 = no stress, 4 = moderate stress, and 6 = severe stress (Table 2). The drought stress appeared as a loss of leaf sheen, along with some slight leaf curling. IRT canopy temperatures were taken on August 4, in degrees Celsius.
Mean canopy temperatures ranged from 40.4°C, to 47.4°C, (Table 2). Accessions with the least amount of visible stress tended to have the lowest leaf temperatures, while the most visible stressed accessions tended to have the highest leaf temperatures.

Accessions with low visible stress/leaf temperatures included A40 (2/40.4°C), A48 (2.0 / 42.2°C), A61 (3.3 / 40.8°C), C8 (2.7 / 42.1°C), A138 (3.3 / 41.4°C), A72 (3.3 / 41.9°C), and A119 (3.0 / 41°C). Entries with high visible stress/temperatures included C92 (5.3 / 47.0°C), C66 (5.7 / 46.9°C) and A53 (4.5 / 47.4°C). The simple Pearsons Product correlation between visual stress and IRT leaf canopy temperatures was r=0.57. Potential

differences in stress reaction (heat vs drought) not measured may have resulted in the modest correlation. The contrast for origin was not significant, (Table 2).

September 14, 2000

At the close of the prolonged summer (drought) period, percent plot composition values were again assigned to plots. Percent plot green turf was now substantially lower, compared to the ratings assigned seven weeks prior. As most entries had 85% or more total cover (green and straw turf), the percent plot green turf now ranged from 15% to 67% green tissue, (Table 1). Entries A119, A65, A138, A48 and C92 had the largest amounts of percent plot green foliage. The amounts ranged from 59% to 67%, although ranking numerically in the largest amounts of green turf present, note that a large amount of the turf was dormant straw, presumably from a drought induced response. Percent plot straw (drought induced) ranged from 18% (A119), 18% (C56), to 72% (A51), (Table 1). Drought induced dormancy occurs in other warm season turfgrasses, notably that of buffalograss (Buchloe dactyloides). Immediately after this rating date, the file was flood irrigated the next day on September 15, 2000.

October 12, 2000

As indicated previously, the test area received supplemental irrigation with the addition of two flood irrigation events on September 15 and September 29. A total of 3.5 inches of irrigation and 4.0 lbs of N/M were added in September in order to "break" the drought induced dormancy.

Percent plot composition values along with turfgrass color and quality were assigned on October 12th.

Most accessions demonstrated a slow return to full growth conditions by mid October. Decreases in temperature, day length and solar angle would also naturally slow overall growth. It is not known as to what extent the drought induced dormancy affected the relatively slow regrowth period, since it was now the fall season. "Percent plot green turf" in October was slightly greater than that in September, (Table 1). Certain accessions had notable increases (C8: 25% / 47%), (C12: 42%/62%), (A86: 52%/72%). Others exhibited an actual decrease in percent plot green turf (C92: 58%/53%), (A119: 67%/45%), and (C66: 40%/25%). The mean percent plot green turf values on both dates were 42% and 52%, respectively (Table 1).

On October 12 accessions with the greatest amounts of percent plot green foliage included A65 (83%), A138 (73%), A86 (72%), A77 (67%), and A137 (65%). It is important to note that these plots maintained between 1% to 10% bare ground, with the remaining plot cover comprised or bare (dormant?) straw colored turf. A65 had the largest percent plot green turf (83%) and acceptable turfgrass quality (6.3) and color (6.3), as noted below, (Tables 1, 2). After two full summers of growth after the establishment year (August 1998), there were still accessions which still show appreciable % plot bare ground. These include the entries C66 (32%), C10 (33%), A53 (38%), and C92 (20%), (Table 1). A low maintenance turf should maintain 90% or more turf cover (on a total potential plot ground cover basis).

Turf color scores among entries ranged from 5.0 to 8.0 inches in mid October, (Table 2). Accession C12 and A138 had dark green color values of 8.0. While this was usually typical for A138, C12 is typically somewhat lighter green in color and with lower overall turfgrass quality and density, along with lower density ratings. C12 may have produced a dark green color as a post-stress response to the limited irrigation of the summer season. C12 and A138 were noticeably the darkest accessions at this time, followed closely by A86 (7.7), A77 (7.3), and A72 (7.0). Those accessions with the lightest color included C66 and C92 (5.0), (Table 2).

Turfgrass quality mean scores ranged from 3.0 (extremely poor) to 6.3 (acceptable) in mid October. Accessions A77, A65, A137 and A86 produced the largest numerical mean scores (6.0 – 6.3 range). These were followed closely by A138, A72, and A48 (5.7). Quality scores were low at this time due to slow re-growth from the summer drought induced dormancy, and certainly cooler fall temperatures.

Conclusion

1. Clonal accessions (genotype selections) of Distichlis continue to show divergent responses for turf-type growth habit and general turf-type adaptation under field mowing stress.

2. The treatment (clonal accession) affect was significant for all field response variables from mid July to mid August (data collections for Report #4, except for "percent plot straw" on October 17.

3. In July 2000, mean percent plot green cover ranged from 47% to 96% among clonal accessions.

4. Turfgrass quality in July was best among the entries A138, A86, A137, A48, A51, and A40. These entries had the greatest percent plot cover, moderately fine leaf texture, and high shoot density when compared to other entries.

5. In the calendar year 2000, (includes data in Report #3), the test site was exposed to weather conditions which included a reference ET. of 3.59" (January); 4.42" (February); 6.23" (March); 8.96" (April); 11.32" (May); 9.08" (June); 9.31" (July); 7.53" (August); 7.37" (September); 3.55" (October).

6. The test was subjected to severe drought conditions throughout the test, starting in April 2000. Rainfall from January too, and including April was 1.28 inches. There was no rain from May 1 to June 29.

   Four rains from July 17 to July 30 added 2.94 inches of rainfall.

7. No irrigation was added from July 1, until September 15. During that time period, 3.26 inches of rain fell in July. In August, 2.47" of rainfall occurred from four rainfall events.

8. From June 1 to September 15, the cumulated ET. was 29.68 inches. Total rainfall was 5.81" (no irrigation added).

9. Most (but not all) Distichlis accessions maintained adequate turf color and percent plot green, up to late August.

10. Accessions which had the highest overall quality ratings in July were A138, A86, A132, A48, A51, and A40.

11. Visual stress ratings in early August showed differences in visual stress ratings and leaf canopy temperatures measured with a hand held IRT device. Entries A48, A51, A40, A138, A61, and C10 exhibited the least amount of visible drought stress in early August.

12. Accessions that exhibited acceptable (highest) turf quality prior to and during the drought period included A138, A40, and A51.

13. Drought induced dormancy finally occurred at the beginning of September, as most accessions drastically decreased the amount of green plot foliage.

14. After flood irrigation and fertilizer applications on September 15 and September 29, plots recovered by mid October. The recovery was not full, as the greatest amount of green percent plot cover ranges from 23% to 83% among entries.

15. Entries with the greatest amount of green cover after the post dormancy period included, A65, A138, A137, A77, and A72.. All entries did exhibit reduced quality comparison to July ratings.

16. Based on these results, Distichlis should be irrigated once/month in a desert condition to avoid drought induced dormancy.

17. During the calendar year 2000, accessions which had notable performance included:

    a. Early Spring Green Up: C8, A77, A138, A86.

    b. Early Summer Quality (*May / no water stress and, June / Water stress*): A55, A86, A51, and A40, A138.

    c. Mid Summer Quality *(July, no water stress*): A48, A86, A137, A51, A138.

d. Minimal leaf roll and loss of color during prolonged drought *(August)* : A40, A48, followed by A 61, C8, A 138, A 72 A119.

e. Post Dormancy Quality *(October):* A65, A138, A137, A77, C12.

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Table 1. Percent plot composition; Distichlis variety trial autumn 2000, University of Arizona.

Entry	Origin	%-green 26-Jul	%-straw 26-Jul	%-cover 26-Jul	%-bare 26-Jul	%-green 14-Sep	%-straw 14-Sep	%-cover 14-Sep	%-bare 14-Sep	%-green 12-Oct	%-straw 12-Oct	%-cover 12-Oct	%-bare 12-Oct
A61	Arizona	89	4	93	7	35	55	90	10	40	53	93	7
A55	Arizona	86	9	95	5	23	67	90	10	52	41	93	7
C8	Colorado	87	4	92	8	25	57	82	18	47	40	87	13
C92	Colorado	47	33	80	20	58	23	82	18	53	27	80	20
A138	Arizona	95	4	99	1	58	32	90	10	73	23	97	3
A65	Arizona	88	6	94	6	62	27	88	12	83	17	99	1
C56	Colorado	55	25	80	20	47	18	65	35	53	32	85	15
C11	Colorado	57	28	85	15	27	50	77	23	48	37	85	15
A72	Arizona	86	6	92	8	43	37	80	20	55	36	91	9
A119	Arizona	85	6	91	9	67	18	85	15	45	49	94	6
A86	Arizona	91	7	98	2	52	35	87	13	72	22	94	6
A77	Arizona	84	6	90	10	50	40	90	10	67	23	90	10
A137	Arizona	94	2	96	4	50	42	92	8	65	32	97	3
A41	Arizona	88	5	94	6	42	47	88	12	48	48	96	4
C66	Colorado	20	58	78	22	40	22	62	38	25	43	68	32
A48	Arizona	94	2	97	3	58	32	90	10	60	36	96	4
A51	Arizona	94	4	99	1	22	72	93	7	48	54	100	0
C12	Colorado	80	10	90	10	42	35	77	23	62	29	90	10
C10	Colorado	62	20	82	18	15	63	78	22	23	43	67	33
A40	Arizona	96	3	99	1	33	57	90	10	40	54	94	6
A53	Arizona	84	10	62	38	33	55	88	42	35	59	62	38
Test Mean		79	12	90	10	42	42	84	17	52	38	89	11
LSD		13	11	20	20	21	22	7	19	28	27	24	24

Table 2. Visual turf performance ratings and infrared canopy temperatures; distichlis variety trial autumn 2000, University of Arizona.

Entry	Origin	color 26-Jul	quality 26-Jul	density 26-Jul	texture 26-Jul	leaf stress 4-Aug	irt °C 4-Aug	color 12-Oct	quality 12-Oct
A61	Arizona	7.0	5.7	7.3	7.3	3.3	40.8	6.0	4.7
A55	Arizona	5.3	6.3	6.3	5.7	3.7	42.0	5.7	5.3
C8	Colorado	6.7	6.3	6.0	6.3	2.7	42.1	5.7	5.0
C92	Colorado	4.7	3.7	5.7	4.3	5.3	47.0	5.0	5.0
A138	Arizona	8.0	8.0	7.7	6.3	3.3	41.4	8.0	5.7
A65	Arizona	6.3	7.0	6.3	6.7	4.0	44.7	6.3	6.3
C56	Colorado	6.0	4.3	4.0	5.0	5.0	43.4	5.7	4.0
C11	Colorado	5.3	4.3	4.3	4.3	4.7	42.7	5.3	5.0
A72	Arizona	7.0	6.3	6.3	6.0	3.3	41.9	7.0	5.7
A119	Arizona	7.0	6.0	5.7	6.0	3.0	40.7	6.7	4.3
A86	Arizona	6.0	7.7	7.7	6.0	4.0	44.1	7.7	6.0
A77	Arizona	5.3	5.7	5.7	4.7	4.0	43.7	7.3	6.3
A137	Arizona	6.7	8.0	7.3	7.0	3.0	43.2	6.7	6.0
A41	Arizona	6.3	6.7	6.7	7.3	3.3	45.0	6.7	5.3
C66	Colorado	3.3	3.0	4.7	4.0	5.7	46.9	5.0	3.0
A48	Arizona	6.0	7.7	7.3	7.7	2.0	42.2	6.7	5.7
A51	Arizona	6.3	8.3	6.3	7.3	2.7	40.9	6.0	5.0
C12	Colorado	5.0	5.7	5.7	5.0	3.7	42.9	8.0	5.3
C10	Colorado	5.7	4.3	4.3	4.0	4.3	43.7	5.3	3.3
A40	Arizona	7.7	8.0	7.7	6.7	2.0	40.4	6.0	4.7
A53	Arizona	6.0	7.0	7.5	6.5	4.5	47.4	6.5	5.0
Test Mean		6.1	6.2	6.2	5.9	3.7	43.2	6.3	5.1
LSD		1.0	1.4	2.2	1.0	1.4	4.4	0.9	1.3

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