

Identification of Drought Resistant Turfgrass Cultivars for Water Conservation

Progress Report to:

Canadian Turfgrass Research Foundation

**Progress Report from:
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Summary

As the last report was completed in February 2015 significant progress in the establishment of both trials has been made here at the PTRC. After a long delay in receiving the fine fescue seed from the TWCA group due to seed availability shortages the fine fescue trial has been planted. Two rain-out shelters were purchased and installed at the plots. An acute (short-term) drought period was performed on the August 2014 established Kentucky bluegrass trial during the late summer - early fall time period of 2015.

Research Initiated Since Last Report

1. Kentucky bluegrass trial: The Kentucky bluegrass plots continued their grow-in phase during the spring and early summer of 2015. Plots were deemed 'established' on Aug. 1st, 2015. The first round of drought was initiated August 5th, 2015 (Fig.1) and completed Sept. 23rd. This provided a total of 7 weeks of data to examine.
2. Fine fescue trial: The fine fescue trial was planted after the construction of the two rain-out shelters on Aug. 31st, 2015. The trial was originally planted on Aug. 14th, 2015, however a large rainstorm washed seed from one plot to the next, so the soil had to be removed and collected to prevent seed contamination in the new plots. There was enough seed to replant the trial, however now there is no extra seed to overseed in spring 2016 if there is a lot of winter kill. The trial should be ready to run an acute drought period in Aug. 2016, with a full season of data collection in 2017.

Progress to Date

In July 2014, construction was undertaken by Goodwin Golf Ltd. and plots were contoured and drainage swales were constructed. Two raised platforms were constructed out of the native soil that had a 1% slope from north to south. Drainage swales were constructed on each side of the raised platforms to take away excess water from the trial platforms that are currently planted into the Kentucky bluegrass trial and the fine fescue trial. Thirty-six entries of Kentucky bluegrass seed was received on August 2014, and seeding took place on August 19, 2014. Plot sizes were 1 x 1 m and were replicated four times. All plots were considered established by Aug. 5th, 2015. A late summer/ early fall drought period was initiated from Aug. 5th – Sept. 23rd, 2015.

Seed for the fine leaf fescue portion of the study was received in July 2015 and due to weather and construction of the rainout shelter the seed was not seeded until Aug. 31st, 2015. Twenty-five entries of various species of fine fescue seed was planted in 1 x 1 m individual plots replicated four times. The delay in planting of this trial will result in a delay in data collection for the fine fescue trial, which is now anticipated to commence in the late spring of 2017. An acute drought trial is planned for Aug. 1st, 2016, if the plots are considered established.



Fig. 1 – Picture of Kentucky bluegrass drought trial under the rainout shelter. August 5th, 2015.

Results

Kentucky Bluegrass Drought Trial:

Digital pictures using a lightbox, Normalized Difference Vegetative Index (NDVI), soil volumetric moisture content at 1.5” and 3” were taken weekly starting on Aug. 5th, 2015. Statistical comparisons were performed using the Each Pair Student’s T multiple means comparison in JMP 11 for the moisture and NDVI data. NDVI data did not differ statistically for most sampling dates when an ANOVA was run. This suggests that the difference in chlorophyll content did not differ enough between cultivars to be detected on each sampling date. Further investigations into the statistical analysis of the NDVI data and the lightbox data will be run during the Nov. – Feb. timeframe to determine if there will be a correlation between the % green pixel data and the NDVI data.

The data collected at ten days after the drought was initiated, is summarized in Table One. Mallard, a TWCA approved Kentucky bluegrass cultivar, is highlighted in Tables One and Two, to represent a drought resistant KBG cultivar that is considered an industry standard. The data shown in Table One displays that there are more than one strategies being implemented by the various entries. Bedazzled has one of the highest quality at 10 days into drought, and has the highest moisture levels at the 1.5” depth. This suggests that the water use rate of Bedazzled may be lower than Mallard. At 30 days into the drought period, Bedazzled has maintained the highest

moisture level reading (Table Two), while Mallard has used significantly more moisture in the upper rhizosphere. It is important to note that the data collection time period for this round of the trial was during the months of August and September, which in Olds, AB tend to have cool nights and warm days, so heat stress would not be a factor in the trial.

Table One: Summary of 3" moisture depth, 1.5" moisture depth, NDVI, and Quality of entries after 10 days of drought

Entry	3"	1.5"	NDVI	Quality
T10-18	33.71 CD*	41.39 ABCDEF	0.712 ABC	6.75 A
K13-143	31.18 D	37.72 DEF	0.697 CDE	6.75 A
K13-140	33.26 CD	44.30 ABCDE	0.698 CDE	6.50 AB
K13-139	31.83 D	38.09 CDEF	0.715 ABC	6.50 AB
K10-111	37.90 BCD	38.40 CDEF	0.674 EF	6.50 AB
Geronimo	34.86 CD	39.30 CDEF	0.691 CDE	6.50 AB
Bedazzled	41.16 ABC	50.90 A	0.710 ABC	6.50 AB
A98-344	31.58 D	36.59 DEF	0.710 ABC	6.50 AB
T10-17	33.62 CD	40.70 BCDEF	0.700 BCDE	6.25 ABC
K9-96	31.84 D	33.22 F	0.679 DEF	6.25 ABC
AKB1765	32.43 D	41.26 ABCDEF	0.709 ABCD	6.25 ABC
K10-110	32.14 D	36.71 DEF	0.732 A	6.00 BCD
AO5-204	36.92 BCD	36.32 EF	0.695 CDE	6.00 BCD
AKB1820	35.60 BCD	37.98 CDEF	0.707 ABCD	6.00 BCD
AKB1812	35.93 BCD	41.94 ABCDEF	0.693 CDE	6.00 BCD
AKB1193	31.26 D	37.79 CDEF	0.694 CDE	6.00 BCD
Snap	31.72 D	34.80 EF	0.652 F	5.75 CDE
AKB24543	35.21 CD	47.21 ABC	0.695 CDE	5.75 CDE
AKB2404	34.62 CD	38.54 CDEF	0.673 EF	5.75 CDE
AKB2094	30.96 D	34.24 F	0.707 ABCD	5.75 CDE
AKB1925	35.98 BCD	42.39 ABCDEF	0.692 CDE	5.75 CDE
AKB1222	43.80 AB	46.27 ABCD	0.685 CDE	5.75 CDE
Diva	32.64 D	37.77 CDEF	0.705 ABCD	5.50 DE
AKB2192	37.39 BCD	42.73 ABCDEF	0.730 AB	5.50 DE
AKB1892	32.56 D	33.91 F	0.703 ABCDE	5.50 DE
Midnight	46.34 A	49.27 ABC	0.692 CDE	5.25 E
Mallard	36.41 BCD	34.62 EF	0.697 CDE	5.25 E

*Levels not connected by same letter and in the same colour are significantly different.

Table Two: Summary of 3" moisture depth, 1.5" moisture depth, NDVI, and Quality of entries after 30 days of drought

Entry	3"		1.5"		NDVI		Quality	
K13-143	32.71	E*	14.54	EFGH	0.708	A	7.00	A
T10-18	40.00	BCDE	17.64	ABCDEF	0.714	A	7.00	A
Bedazzled	47.83	AB	20.59	A	0.722	A	6.75	AB
K9-96	36.57	DE	15.24	DEFGH	0.712	A	6.75	AB
Geronimo	36.74	DE	13.96	GH	0.697	A	6.50	ABC
K10-111	37.40	CDE	17.91	ABCDE	0.712	A	6.50	ABC
K13-139	32.01	E	14.67	DEFGH	0.705	A	6.50	ABC
AKB1765	37.96	CDE	15.69	DEFGH	0.711	A	6.25	ABCD
K13-140	37.02	CDE	17.28	ABCDEFG	0.704	A	6.25	ABCD
T10-17	32.17	E	15.64	DEFGH	0.715	A	6.25	ABCD
A98-344	36.86	CDE	17.07	BCDEFGH	0.714	A	6.00	ABCDE
AKB1222	46.37	ABC	19.57	AB	0.702	A	6.00	ABCDE
AKB1812	37.92	CDE	16.01	CDEFGH	0.722	A	6.00	ABCDE
Snap	31.84	E	14.87	DEFGH	0.678	A	6.00	ABCDE
AKB1193	34.62	DE	16.19	BCDEFGH	0.704	A	5.75	BCDE
AKB1820	36.13	DE	16.73	BCDEFGH	0.715	A	5.75	BCDE
AO5-204	35.98	DE	16.60	BCDEFGH	0.710	A	5.75	BCDE
K10-110	34.11	DE	14.82	DEFGH	0.706	A	5.75	BCDE
Diva	34.61	DE	17.83	ABCDE	0.700	A	5.50	CDEF
Mallard	36.69	DE	14.71	DEFGH	0.716	A	5.50	CDEF
Midnight	50.69	A	17.94	ABCD	0.713	A	5.50	CDEF
AKB1925	37.37	CDE	17.33	ABCDEFG	0.700	A	5.25	DEF
AKB2094	33.43	DE	13.73	H	0.702	A	5.25	DEF
AKB2192	36.58	DE	15.38	DEFGH	0.694	A	5.00	EF
AKB2404	37.36	CDE	14.27	FGH	0.683	A	5.00	EF
AKB24543	42.31	ABC D	19.30	ABC	0.686	A	5.00	EF
AKB1892	36.40	DE	14.32	FGH	0.687	A	4.50	F

*Levels not connected by same letter are significantly different.

Plan for the Next Period

November - February – Complete digital green pixel analysis of KBG 2015 drought pictures using ImageJ

May – Install sump pump at lowest point around the drought research plots. Currently we are using a gas-powered pump, which may be causing a block effect in the KBG drought trial, as water tends to pool just off the west edge of the platform if there is a rainstorm during off hours. Statistical analysis showed a block effect on dates that were close to the few large rain events we had during this time period.

May – August – focus on grow-in of the fine fescue trial

June-August – initiate drought in the KBG trial. The PTRC research team will discuss further with Dr. Lyons on data collection protocols to ensure that our two data sets match.

Changes to the Work Plan

With the re-construction of the plots that occurred in 2014, combined with the delay in receiving the fine fescue seed from the TWCA group the work schedule has been pushed back a full year. Drought tolerance testing of the fine fescue trial will now begin in 2017. There is a small concern around the survivability of the fine fescue trial over this winter due to the seedling stage of the plants (3 leaf stage), however we are currently in discussion with the TWCA group to receive some extra seed of each entry for overseeding purposes.

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