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Turfgrass & Landscape Research Field Day

September 11, 2014

University of California Agriculture and Natural Resources

UCR | Turfgrass Science

CA Turfgrass & Landscape Foundation
"Keeping California Green and Growing"

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College of Natural and Agricultural Sciences
UC Division of Agriculture and Natural Resources
Agricultural Experiment Station and Cooperative Extension

Department of Botany and Plant Sciences-072
Riverside, CA 92521-0124

Welcome to Field Day!

On behalf of the entire UCR Turfgrass and Landscape Team, welcome (back) to the 2014 UCR Turfgrass and Landscape Research Field Day. This marks the seventh consecutive year of this event under my watch. We continue to strive to make Field Day one of the pinnacle events of our industry – a place where all come together annually to see old friends, share ideas, and learn about world-class research activities at UCR.

Field Day continues to evolve to meet the interests and needs of our industry. For the third consecutive year, we welcome several of our industry partners under the Exhibitor's Tent. Please take the time to visit them and learn more about new products and services while enjoying complimentary food and beverages. On the research side, you will see several new state-of-the-art research areas designed to study water and salinity management issues on turf and landscapes. Last but not least, while this handout serves to give you a brief synopsis of our current research activities for the research tours, you can read or print our full research reports in their entirety from the Field Day website, **http://ucanr.org/sites/turfgrassfieldday**.

What is the California Turfgrass & Landscape Foundation (CTLF)? The CTLF is a 501(c)(3) organization made up of industry partners and individual stakeholders whose primary mission is to fund and support focused research and educational outreach in the areas of turfgrass, landscape, and related water use for the betterment of the stakeholders, conservation of resources and sustainability of the environment. In today's economic and environmental times, our industry needs statewide cohesiveness not fragmentation and the same is true among researchers and extension specialists. The Foundation is such a vehicle to make that happen. Please stop by the CTLF booth and visit with Bruce Williams, CTLF Executive Director, and learn more about how you can make a difference in making our industry stronger than ever before. Also stay tuned for more information including past and present turfgrass and landscape research findings (including Field Day reports) on the Foundation's website, **www.CAtlf.com**.

As you enjoy today's tours, please take a moment to thank those folks, mostly wearing blue shirts with our Turfgrass Science logo, who assisted with preparation for this event. Special thanks go to my fellow Field Day planning committee members including Peggy Mauk, Sue Lee, Steve Ries, Sherry Cooper, Saundra Wais, and Lauren McNees. Production of this publication, signs, and online reports would not have been possible without assistance from Ms. Magali Lopez (UCR Class of 2010). Staff and students from Agricultural Operations and my lab have worked tirelessly to make this event possible and are deserved of your appreciation. Last but not least, very special thanks to all of our industry partners for their generous donations to our turf and landscape programs throughout the year, and especially for today's delicious food and beverages under the shade of tents!

Enjoy Field Day! And we hope to see you again next year on **Thursday, September 17, 2015.**

Sincerely,

James H. Baird, Ph.D.
Assistant Specialist in Cooperative Extension and Turfgrass Science

Voice: 951-827-4619 · Fax: 951.827-4437 · WWW.PLANTBIOLOGY.UCR.EDU

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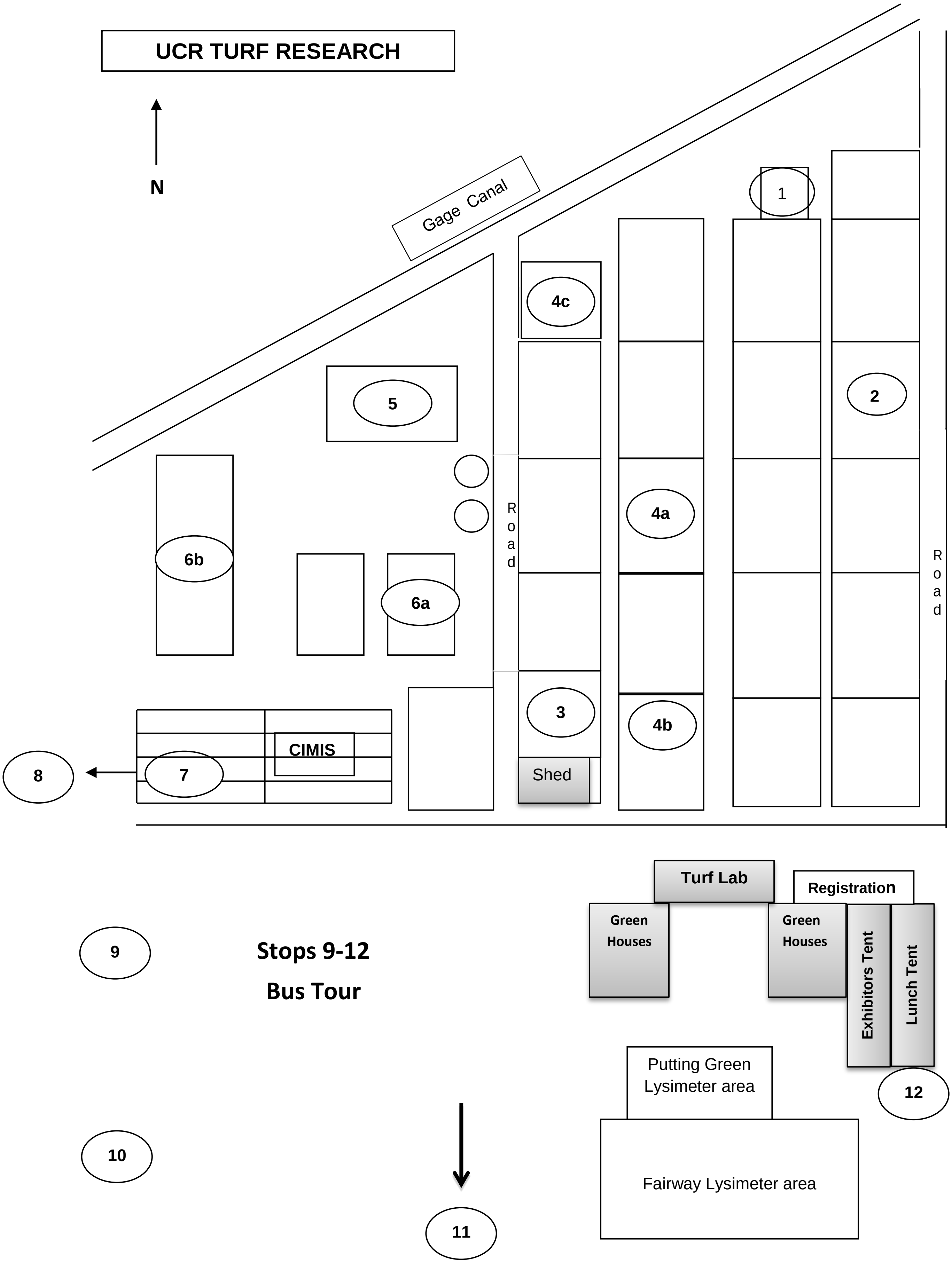
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Turf Lab
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Lunch Tent
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Stops 9-12
Bus Tour
Putting Green Lysimeter area
12
10
Fairway Lysimeter area
11

Turfgrass and Landscape Research Field Day Agenda

7:00 am	**Exhibitor set-up**
7:30-8:30	**Registration and Trade Show**
8:30	**Welcome and Introductions** Peggy Mauk, Mikeal Roose and Jim Baird
8:45 – 10:10	**Field Tour Rotation #1 (20 minutes/station)**
Stop #1 Red Tent:	**Creeping Bentgrass Potpurri: Poa Control with PoaCure; Fungicide and Plant Health; Fairy Ring Control** Andrea Feo, Fayek Negm, Jim Baird
Stop #2 White Tent:	**Evaluation of Natural and Hybrid Turf for Water Conservation** Jon Montgomery
Stop #3 Blue Tent:	**Everything You Always Wanted to Know About Turfgrass Nematodes and Their Control** J. Ole Becker
Stop #4 Black Tent:	**Drought Tolerance of Turfgrass Species and Cultivars/Evaluation of Fertilizer Products Under Deficit Irrigation** Marco Schiavon
10:10 – 10:40	**Break and Trade Show**
10:40 – 12:00	**Field Tour Rotation #2 (20 minutes/station)**
Stop #5 Red Tent:	**Turf and Groundcover Establishment Under Saline Irrigation** Don Merhaut and Matteo Serena
Stop #6 White Tent:	**Evaluation of Products for Alleviation of Salinity and Drought Stress** Marco Schiavon, Toan Khuong, and Andrea Feo
Stop # 7 Blue Tent:	**Pre- and Postemergence Control of Crabgrass in Tall Fescue and Bermudagrass** Jim Baird
Stop #8 Black Tent:	**Evaluation of Fungicides for Control of Anthracnose/The LDS All Star Game** Tyler Mock and Jon Montgomery
12:00 – 1:00 pm	**Barbeque Lunch**
1:00	**Field Bus Tour- 20 minute rotations**
Stop #9 Red Tent:	**UCR Turfgrass Breeding Project** Adam Lukaszewski and Priti Saxena
Stop #10 White Tent:	**Tall Fescue Establishment and Culture using Biochar and Biosolid Soil Amendments** Milt McGiffen and Jon Montgomery
Stop #11 Blue Tent:	**Managing Kikuyugrass Under Deficit Irrigation Using Maxx and Wetting Agents/Herbicides for Control Kikuyugrass** Tyler Mock and Jim Baird
Stop#12:	**Updates on Evapotranspiration Adjustment Factor and Spanish Language Materials for Professional Landscapers Projects** Janet Hartin and Dave Fujino
2:40	**Adjourn**

CDPR Credits: 2.0 Hours - Please go on-line and fill out the evaluation form at **http://ucanr.edu/turfgrasseval**

CIMIS Data Sep. 2013- Aug. 2014

Los Angeles Basin-U.C. Riverside - #44

Month Year	Tot ETo (in)	Tot Precip (in)	Avg Sol Rad (Ly/Day)	Avg Vap Pres (mBars)	Avg Max Air Tmp (F)	Avg Min Air Tmp (F)	Avg Air Tmp (F)	Avg Max Rel Hum (%)	Avg Min Rel Hum (%)	Avg Rel Hum (%)	Avg Dew Point (F)	Avg Wind Speed (mph)	Avg Soil Temp (F)
Sep 2013	6.14	0.00	523 K	12.6 K	89.4	62.2 K	74.5	66	24	44 K	49.6 K	3.8 K	71.9
Oct 2013	4.27 K	0.51	407 K	9.1 K	78.1 K	51.7	63.9 K	71 K	26 K	47 K	40.7 K	3.7 K	62.8
Nov 2013	4.27	1.20	270	7.7	72.1 K	49.7	60.0	66	31	46	36.6	3.7	57.8
Dec 2013	2.80	0.39	261	5.1	67.9 K	43.7 K	55.3	55	22	37	26.0	3.9	51.1
Jan 2014	3.27	0.00	280	5.2 K	73.8 K	47.3 K	59.7	49 K	18 K	32	25.7	3.8	51.5
Feb 2014	3.03	1.15	345 K	8.1 K	70.4 K	47.3	57.7	72	31	51 K	34.8 K	3.4	55.7
Mar 2014	4.95	0.50	469 K	8.8	73.3	50.0	60.9	74	30	50	40.1	4.2	59.1
Apr 2014	6.52 K	0.72 K	595 K	8.5 K	77.3	51.3 K	63.6	69	26	45 K	39.3 K	4.9 K	62.3
May 2014	7.65 K	0.00	656 K	9.7 K	82.9 K	56.9 K	69.4	65	26	48 L	45.6 L	4.8 K	66.0
Jun 2014	7.62	0.00 K	716 L	13.3 K	85.9 K	58.4 L	70.9 L	78 K	29 K	51 L	51.6 L	4.4 K	71.0 K
Jul 2014	7.76 K	0.00 L	630 L	14.8 L	91.2 L	65.5 L	77.8 L	71 L	28 L	47 L	54.8 L	4.3 L	74.6 L
Aug 2014	7.29 K	0.28 K	605 K	14.9	91.0	63.6 L	76.1	75	27	49	54.9	4.1 K	73.4
Totals/Avgs	64.06	4.75	480	9.8	79.4	54.0	65.8	68	27	46	41.9	4.1	63.1

M - All Daily Values Missing	K - One or More Daily Values Flagged
J - One or More Daily Values Missing	L - Missing and Flagged Daily Values

W/sq.m = Ly/day/2.065	inches * 25.4 = mm	C = 5/9 * (F - 32)

m/s = mph * 0.447	kPa = mBars * 0.1

Stop #1: Management Practices For Bentgrass Greens

Andrea Feo, Jim Baird, Marco Schiavon, and Fayek Negm

Objectives:

These studies were conducted to determine: 1) the effect of fungicides and fungicide programs on bentgrass putting green health during summer stress; 2) fungicides and programs for managing fairy rings; and 3) effects of PoaCure (methiozolin) herbicide on bentgrass health and rooting.

Materials and Methods

The studies were conducted on a creeping bentgrass ‘Pure Distinction’ putting green maintained at 0.125 inches, 0.125 lbs N/M/month, and 100% ETo irrigation. As the study progressed, irrigation was reduced to encourage drought stress. Fungicide treatments were initially applied on 18 June 2014. The fairy ring study received treatments from June 18 to July 16 and again from August 26 to September 24. The summer stress treatments will continue to be applied through the remainder of summer and early fall. Visual assessments of turf quality (1-9 scale; 1=worst, 9=best), color, density, localized dry spot and fairy ring cover were taken weekly; TDR (% volumetric water content) and Clegg Impact Tester (firmness) were taken bi-weekly. PoaCure treatments were applied on 14 and 28 August and 11 Sep 2014. Soil samples were taken before treatment application at 0, 14, and 28 days to monitor herbicide effects on rooting.

Results:

Fairy Ring

- ✓ Differences in fairy ring pressure were not detected during the first run. During the second run, Xzemplar + Revolution was the most effective treatment in controlling fairy rings on September 5, with only 3.75% presence of fairy rings on the plots.
- ✓ Xzemplar + Revolution also showed the highest quality (6.0); Velista + Revolution also increased bentgrass quality in comparison to control (5.75).

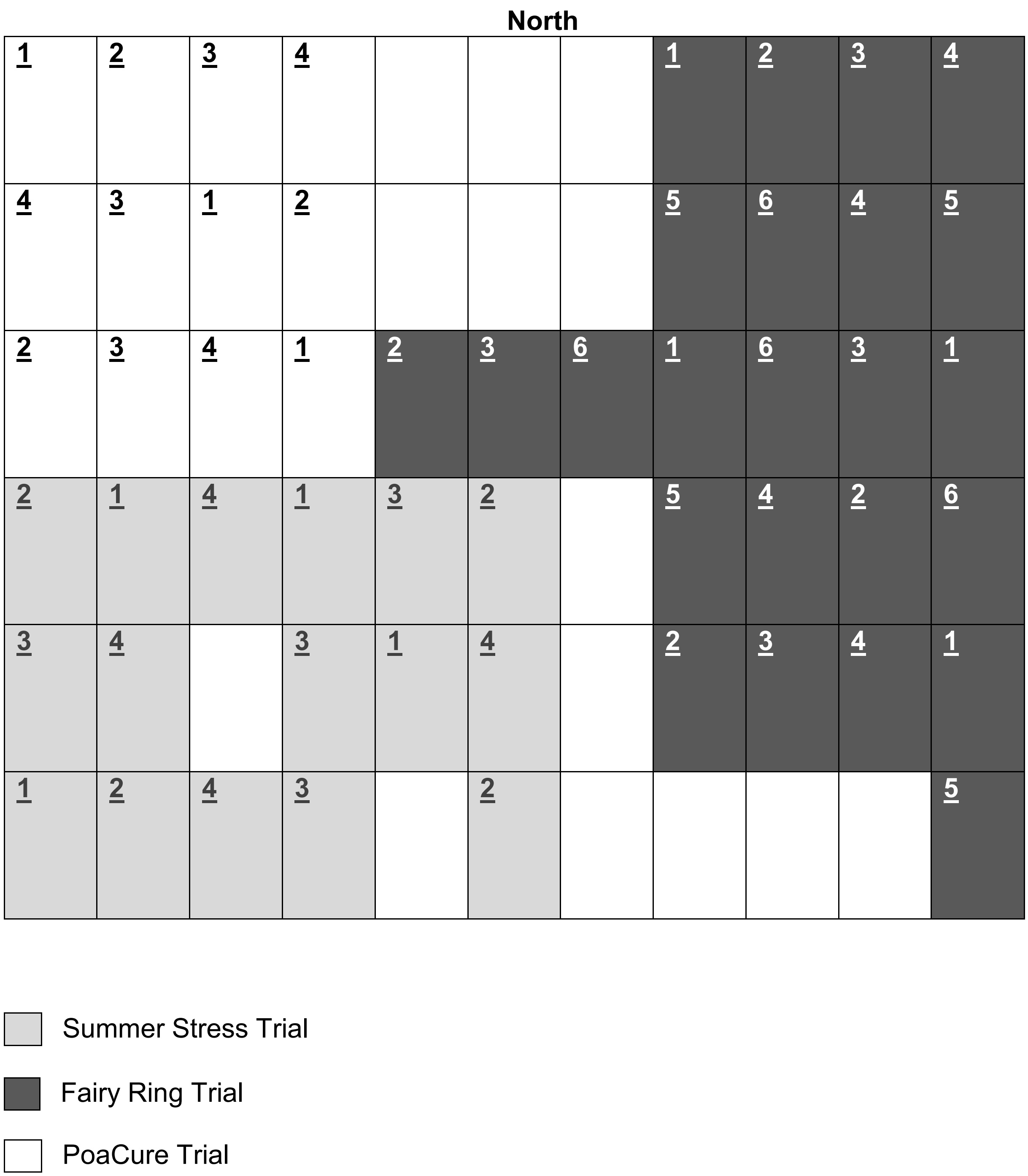
Summer Stress

- ✓ Fungicides increased turf quality in comparison to control only on August 8; regardless, quality of fungicide-treated plots was abundantly below an acceptable quality level of 6 due to presence of LDS and fairy ring.
- ✓ Differences in dry spots among treatments were detected on August 22 only; BASF programs had a positive effect in reducing percent dry spots in comparison to control. It is likely that the LDS was caused by fairy ring and that the fungicides in the BASF programs were more efficacious against these fungi.

PoaCure

- ✓ Despite two applications of PoaCure at 2x and 4x rates for putting greens, both made at the wrong time of year for bentgrass safety and effective Poa control (i.e., daytime temperatures >90F), coupled with the added stress of solid-tine aeration and sand topdressing implemented shortly after the second herbicide application, there have been no aboveground visual signs of turf phytotoxicity as a result. Analyses of roots are pending. These results corroborate previous unpublished field research by the authors that identified ‘Pure Distinction’ as one of the most tolerant creeping bentgrass cultivars to this herbicide.

Plot plan for the study area



Treatment list for fairy ring trial

Treatment	Product	Rate	Frequency
1	Control		
2	Velista+Revolution	0.5 oz/M+6 oz/M	28 days
3	Lexicon Intrinsic	0.47 fl oz/M	28 days
4	Lexicon Intrinsic+Revolution	0.47 floz/M+6 fl oz/M	28 days
5	Xzemplar	0.26 fl oz/M	28 days
6	Xzemplar+Revolution	0.26 fl oz/M	28 days

Treatment list for summer stress trial

Treatment	Product	Rate	Frequency
1	Control		
2	BASF program* (Lexicon Intrinsic	0.34 fl oz/M	14 days
3	BASF program** (Lexicon Intrinsic	0.47 fl oz/M	14 days
4	Daconil Action+Velista	3.5 fl oz/M+0.3 oz/M	14 days

*Includes one application of Tourney 50 WG (0.37 oz/M), one application of Lexicon Intrinsic, one application of Chipco Signature+Fore Rainshield (4 oz/M+6 oz/M), two applications of Lexicon Intrinsic+ Daconil Ultrex (3.2 oz/M), one application of Segway+26GT+Fore Rainshield (0.9 fl oz/M+4 fl oz/M+6 oz/M), one application of Chipco+Xzemplar (4 oz/M+0.21 fl oz/M), and one application of Lexicon Intrinsic+ Fore Rainshield (6 fl oz/M).

** Includes one application of Tourney 50 WG (0.37 oz/M), one application of Lexicon Intrinsic, one application of Chipco Signature+Daconil Ultrex (4 oz/M+3.2 oz/M), two applications of Lexicon Intrinsic+Fore Rainshield (6 oz/M), one application of Segway+Tourney 50WG (0.9 fl oz/M+0.37 oz/M), one application of Xzemplar (0.26 fl oz/M), one application of Chipco Signature+26GT+Daconil Ultrex (4 oz/M+4 fl oz/M+ 3.2 oz/M), one application of Segway+26GT+Fore Rainshield (0.9 fl oz/M+4 fl oz/M+6 oz/M) and one application of Lexicon Intrinsic+Daconil Ultrex (3.2 oz/M).

Treatment list for PoaCure trial

Treatment	Product	Rate	Frequency
1	Control		
2	PoaCure	0.6 oz/M	14 days
3	PoaCure	1.2 oz/M	14 days
4	PoaCure	2.4 oz/M	14 days

Table 1. Bentgrass quality and fairy ring cover assessed on 5 Sep 2014

Treatment	Quality	Fairy ring (% cover)
Control	4.8 C	18.8 A
Velista+Revolution	5.8 AB	6.2 B
Lexicon Intrinsic	5.0 BC	7.5 B
Lexicon Intrinsic+Revolution	5.5 ABC	5.0 B
Xzemplar	4.8 C	12.5 AB
Xzemplar+Revolution	6.0 A	3.8 B

Table 2. Bentgrass quality on 8 August 2014 and localized dry spot cover on 22 August 2014 in response to fungicide programs.

Treatment	Quality	Dry spot (%)
Control	3.5 B	28.8 A
BASF (Lexicon Intrinsic Low Rate)	4.8 A	8.8 B
BASF (Lexicon Intrinsic High Rate)	4.5 A	10.2 B
Daconil Action + Velista	4.8 A	21.5 AB

Evaluation of Natural and Hybrid Turf for Water Conservation

Jon Montgomery and Jim Baird

Project Overview

This study was designed to evaluate CoverLawn hybrid turf for potential water savings and other turf quality characteristics such as winter color retention. CoverLawn is produced by EZ Hybrid Turf, and consists of a netted polyester and latex material with a polyethylene artificial turf pile. This design allows natural turf to grow up through spaces in the material, blending with the synthetic turf. Coverlawn avoids the use of infill material, which is often involved in synthetic turf use. Additionally, runoff can be avoided as water infiltrates the soil and follows the natural water cycle. Here we also evaluate different installation strategies and material types.

Study Design

This study will evaluate the use of CoverLawn with both tall fescue (New Millennia) and bermudagrass (Princess 77) turf, and their performance at a reduced level of irrigation. In order to evaluate establishment and reclamation with the product, turf was either scalped or completely removed and seeded before installation. Tall fescue was seeded at a rate of 5 lbs/M, while bermudagrass was seeded at 1 lb/M. Tall fescue will be maintained at 2.5 inches, while bermudagrass will be maintained at 0.5 inches. One or two materials were evaluated for each grass type, and each treatment consists of a 6’ x 60’ strip of fabric overlain on turf or bare soil. Installation was completed on 3 September 2014. Full integration of turf with the material is expected after 5 weeks.

Beginning in April 2014, each lane will be split into 3 sections and subjected to varying degrees of ETo replacement representing minimal irrigation and reductions of 20 and 40% ET_o to evaluate performance under extreme water deficit. Measurements will be taken bi-weekly or monthly throughout the study including: rate of turfgrass establishment; cover; surface canopy temperature; drought stress; color (visual/digital image analysis/NDVI); winter color retention; and spring green-up. In addition, effects on the carbon fixation rate of turf will be estimated for each treatment. It is expected that the reduced density of living turf resulting from Coverlawn presence will reduce irrigation requirements to maintain acceptable turf quality.

Tall Fescue Plot (Northern) Plan and Treatment List

(North)

Trt	ET Replacement		
1	60% ET_o	80% ET_o	100% ET_o
2			
3			
4			
5			
4	80% ET_o	60% ET_o	100% ET_o
2			
1			
3			
5			
4	100% ET_o	80% ET_o	60% ET_o
1			
2			
3			
5			

1	Coverlawn CL6003 Bareground
2	Coverlawn CL2003 Bareground
3	Coverlawn CL6003 Renovation
4	Coverlawn CL2003 Renovation
5	Tall fescue Control

Bermudagrass Plot Plan and Treatment List

(North)

Trt	ET Replacement		
1	40% ET_o	60% ET_o	80% ET_o
2			
3			
4			
5			
4	60% ET_o	80% ET_o	40% ET_o
2			
1			
3			
5			
4	80% ET_o	40% ET_o	60% ET_o
1			
2			
3			
5			

1	Coverlawn CM2003 Bareground
2	Coverlawn CM2003 Renovation
3	Bermudagrass Bareground
4	Bermudagrass Renovation
5	Bermudagrass Control

Stop #3: The Proof of the Pudding is in the Eating

Jim Baird[1] and J. Ole Becker[2]
[1]Department of Botany and Plant Sciences; [2]Department of Nematology,
University of California, Riverside, CA 92521

The Pacific shoot-gall nematode *Anguina pacificae* is a serious pathogen on annual bluegrass (*Poa annua*) on golf courses along the Northern California coast (McClure et al., 2008). The disease symptoms manifest as conspicuous galls at the grass shoot base. The galls may contain all development stages of the nematode such as eggs, juveniles and adults. Infected plants may die or branch into several shoots that often become infected and stunted. Putting greens become patchy and bumpy under severe disease pressure.

Considerable effort has been devoted to the development of effective management strategies against *A. pacificae* (Westerdahl et al., 2005). More recently, 29 products were screened in a bioassay for efficacy against the nematode (McClure and Schmitt, 2012). Of those, 8 products showed some degree of control but only 4 were registered for use on golf course greens. Two botanical products tested were Neem-based with the active ingredient azadirachtin, a triterpenoid with known activity against certain insects. The authors suggested that the products should be applied every 14 days throughout the season (March to October). Several golf courses with severe *A. pacificae* problems have been following that recommendation. The objective of our trial was to evaluate the efficacy of biweekly Neemix 4.5 treatments by monthly monitoring of three different plant parasitic nematode populations and visual turf vigor ratings compared to the non-treated control. In addition, after 4 months Anguina shoot-gall symptoms and *P. annua* plant weight were determined.

Materials and Methods

The trial was performed on a nursery putting green at the Pebble Beach Golf Links on the Monterey peninsula. In addition to *A. pacificae*, the green was fairly uniformly infested with *Helicotylenchus* sp. (spiral nematodes) and *Mesocriconema* sp. (ring nematodes). The trial was installed mid-April and will continue until mid-September 2014. The experimental design was a complete randomized block design with 4 replications and 4 x 6 ft plots. Neemix 4.5 was applied at 9 oz/1,000 ft^2 in 14-day intervals. Three turf cores (7/8-inch diameter, 6 inch deep) per replication were collected at the middle of each month, pooled into a plastic bag and analyzed in the lab for nematode population density. At the same time, each plot was evaluated for performance by visual vigor ratings. At the last sampling date, plant weight and number of shoot galls were determined.

Results

Preliminary results indicate that none of the plant parasitic nematode populations differed significantly between the non-treated control and Neemix 4.5 treatment during the 4-month monitoring period. Likewise plant health, indicated by monthly visual turf ratings, fresh weight determination of turf cores and number of shoot galls after 4 months were not significantly affected by the Neemix 4.5 treatment.

Discussion

The results demonstrate that laboratory bioassays do not necessarily reflect efficacy under outdoor conditions. Previous reports about in vivo activity of Neem products against various plant parasitic nematodes have been inconsistent at best (Crow, 2005, Ntalli et al., 2009). Applying any pesticide frequently in short intervals should be considered poor practice as it increases the chance for developing pest resistance and/or accelerated biodegradation of the active ingredient. It should also be noted that Neemix 4.5 has been advertised only as an insect growth inhibitor. The company's web site does not cite activity against nematodes.

The take-home message is that for any pest management treatment it should be standard operating procedure to include non-treated controls. The efficacies of turf treatments against plant parasitic nematodes are difficult to evaluate but become impossible without suitable controls for comparison.

Literature

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Stop #4: Evaluation of Fertilizer Products for Turf Quality and Drought Tolerance

Marco Schiavon, Jon Montgomery and Jim Baird

Objective:

Evaluate the ability of fertilizer products to maintain acceptable turf quality under deficit irrigation.

Methods:

The study was conducted on mature bermudagrass ‘Princess 77’ turf. The 60’ x 90’ field was divided into six 30’ x 30’ plots. Beginning August 11, the plots received either 40% or 70% of previous week ET_0, as determined by an on-site CIMIS station. Fertilizer products (see table below) were randomized inside the ET_0 replacement plots and applied monthly beginning August 9, 2014. Each treatment received an equivalent of 1 lb N/M/month except for AgriPower PALB and HGLF. Prior to application of fertilizer treatments, the entire field received a total of 3 lb N/M in 2014. Every two weeks, plots were evaluated for turf quality, volumetric soil water content, and Digital Image Analysis.

Results:

Thus far, no differences have been detected between irrigation levels for the data collected; however, results indicate that adequately fertilized turf maintains color and quality longer under drought or deficit irrigation. Gro-Power showed the highest turf quality, followed Amidas applied as a granular. Lowest quality was observed on plots treated with HGLF and PALB + HGLF. Similar results were detected for Dark Green Color Index, where HGLF and PALB + HGLF showed the lowest color indices.

Treatments:

No.	Treatment	Company	Analysis/Application Rate	Application Intervals
1	Amidas (Granular)	Yara	40-0-0/1 lb N/M	28 days
2	Amidas (Spray)	Yara	40-0-0/1 lb N/M	28 days
3	Turf Royale	Yara	21-7-14/1 lb N/M	28 days
4	Calcinit	Yara	15.5-0-0/1 lb N/M	28 days
5	PALB + HGLF	AgriPower	½ qt/A + ½ qt/A	28 days
6	HGLF	AgriPower	½ qt/A	28 days
7	Best Super Turf	Simplot	25-5-5/1 lb N/M	28 days
8	Gro-Power	Gro-Power	5-3-1/1 lb N/M	28 days

Plot plan North

*	70% ETo		*	40% ETo		*
	2	6		6	2	
	3	8		5	3	
	7	4		4	7	
	5	1		8	1	
*	40% ETo		*	70% ETo		*
	3	8		7	2	
	4	5		1	6	
	2	1		3	4	
	7	6		8	5	
*	70% ETo		*	40% ETo		*
	4	8		5	2	
	1	6		8	1	
	7	3		6	3	
	5	2		4	7	
*			*			*

Table 1. Quality (1-9; 1=worst, 9=best) and Dark Green Color Index (DGCI) of bermudagrass fertilized monthly at 1 lb N/M under 40% and 70% ETo. Data were pooled over irrigation levels. 2014. Riverside, CA.

Trt. No.	**Fertilizer**	**Quality**			**DGCI**		
		8/11	8/23	9/4	8/11	8/23	9/4
1	Amidas (Granular)	5.3	6.2 AB	5.7 AB	0.379	0.419 A	0.391 A
2	Amidas (Spray)	5.2	6.2 AB	5.2 BC	0.374	0.410 AB	0.392 A
7	Best Super Turf	5.2	5.5 BC	5.7 AB	0.373	0.402 B	0.389 A
4	Calcinit	5.3	5.2 C	4.7 BCD	0.371	0.402 B	0.388 A
8	Gro-Power	5.0	6.8 A	6.3 A	0.375	0.420 A	0.394 A
6	HGLF	5.0	4.0 D	3.2 E	0.370	0.373 C	0.370 B
5	PALB + HGLF	5.2	4.0 D	4 DE	0.373	0.372 C	0.371 B
3	Turf Royale	5.0	5.5 BC	4.3 CD	0.372	0.404 B	0.387 A

STOP #4b: Delta Bluegrass Sod Under Deficit Irrigation

Marco Schiavon and Jim Baird

Objectives

Assessing quality of California native sodded cool-season mixes during the summer under a deficit irrigation regime.

Material and Methods

a. Entries (following pages) were sodded in late October 2013.
b. 2.0 lbs N/M and non-limiting irrigation during establishment.
c. The area is divided in three independent separate studies: native sod, no mow sod, and tall fescue mixes sod.
d. Native sod and tall fescue mixes sod are mowed weekly at 4 inches.
e. On 30 May 2014 irrigation was turned off. Plots were then watered by hand 3X weekly to replace 60% CIMIS ETo.
f. Plots rated every two weeks for quality (1-9 scale, 9 = best) and digital image analysis

Results

Quality ratings dropped below an acceptable level of 6 for all of the native (mowed and unmowed) grasses 14 days after the deficit irrigation was initiated. After six weeks of deficit irrigation, and throughout the remainder of summer, native bentgrass was the sodded species showing the lowest quality ratings. No differences were detected between the other sodded species (Figure 1).
Bolero mix quality was the highest at the beginning of the drought, but decreased significantly after one month of deficit irrigation (Figure 1).

Delta Bluegrass Native and No Mow Sod Deficit Irrigation Study

No.	Product/Species/Variety	Company
1	Delta Native Mow Free Mix ➢ *Festuca rubra* Molate 40% - Red Fescue ➢ *Festuca occidentalis* 30% - Western Fescue ➢ *Festuca idahoensis* 30% - Idaho Fescue	Delta Bluegrass Company
2	Delta Native Biofiltration Mix ➢ *Stipa pulchra* - Purple Needlegrass ➢ *Festuca rubra* Molate – Red Fescue ➢ *Hordeum californicum* – California barley ➢ *Hordeum brachyantherum* – Meadow barley	Delta Bluegrass Company
3	Delta Preservation Mix ➢ *Nassella cernua* - Nodding needlegrass ➢ *Nassella pulchra* - Purple needlegrass (California's State Grass) ➢ *Koeleria macrantha* – Junegrass ➢ *Festuca rubra* Molate – Red Fescue	Delta Bluegrass Company
4*	Delta Native Bentgrass ➢ *Agrostis pallens*	Delta Bluegrass Company

*Not included in the no mow study

UCR Delta Sod Tall Fescue Mixes Deficit Irrigation Study

1	Delta Bolero Mix	Delta Bluegrass Company
2	Delta 90/10 Fescue/Blue Mix	Delta Bluegrass Company

UCR Delta Bluegrass Sod Plot Plan

No Mow

101 1	102 3	103 2
201 3	202 1	203 2
301 2	302 3	303 1

Native grasses

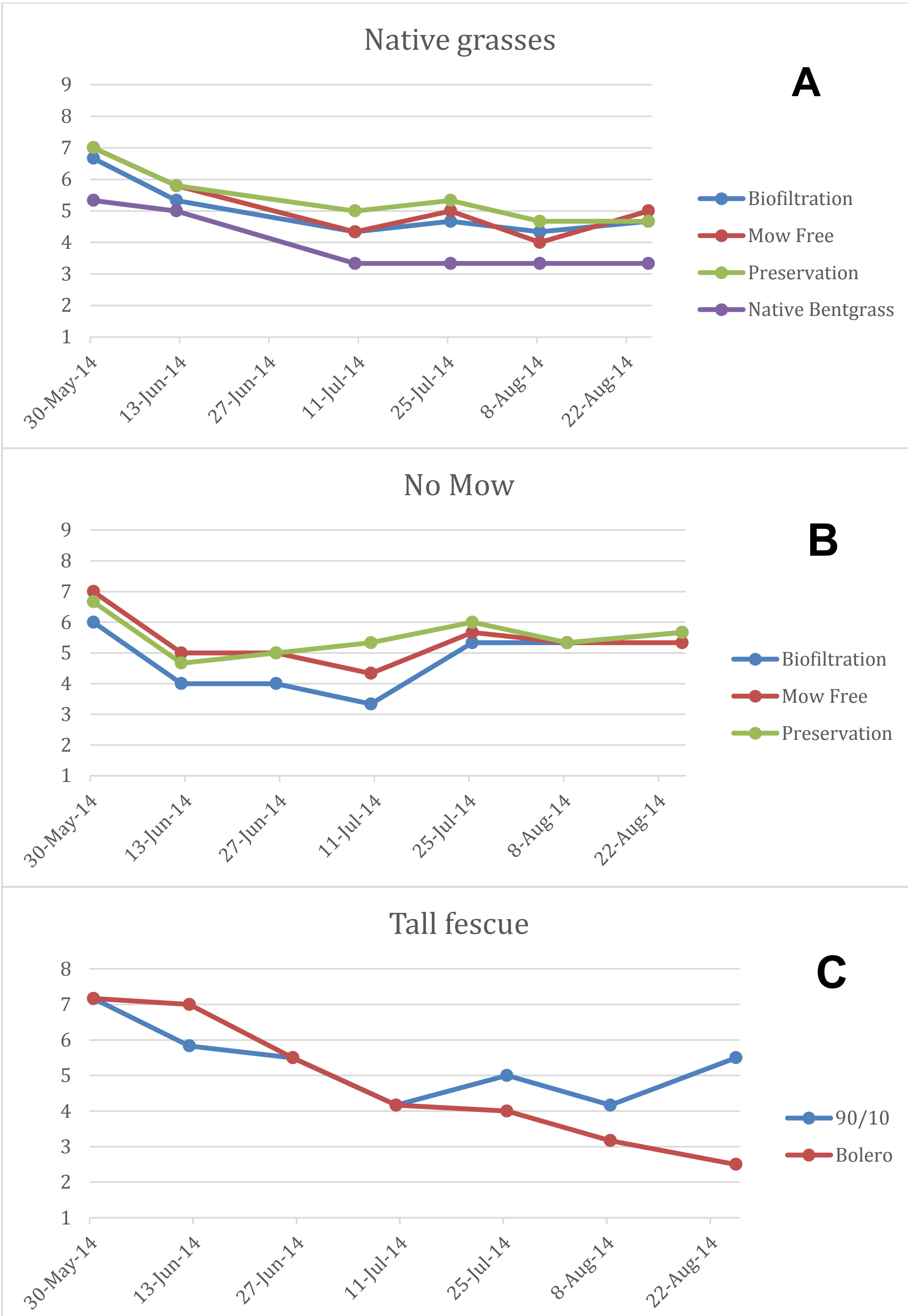
101 3	102 4	103 1	104 2
201 4	202 3	203 2	204 1
301 2	302 1	303 4	304 3

Tall fescue mixes

101 1A	201 1B	301 2A
102 2C	202 2B	302 1C

↑ **North**

Figure 1. Quality of native (A), no mow (B) and tall fescue (C) sod mixes under irrigation replacement at 60% ETo.



STOP #4c: Drought Tolerant Seeded Cool-Season Turfgrasses for Southern California

Marco Schiavon and Jim Baird

Objectives

Identify species/cultivars with improved tolerance to drought/heat stress.This is an important approach toward sustainability of turfgrasses in the California landscape amidst declining water resources and increasing water use restrictions on lawns and landscapes. Seeded turfgrasses provide a cheaper alternative to more expensive sodding.

Material and Methods

a. Entries (following pages) were seeded on 10 May 2013.
b. 4.0 lbs N/M and non-limiting irrigation during establishment.
c. Plots mowed weekly at 2 and 4 inches since July 2013.
d. On August 15 2013 irrigation was turned off. Plots were then watered by hand 3X weekly to replace 50% CIMIS ETo until the end of October. During fall and winter irrigation was restored at 100%. On 30 May 30 2014 irrigation was turned off. Plots were then watered by hand 3X weekly to replace 60% CIMIS ETo.
e. Plots rated every two weeks for drought stress (1-9 scale, 9 = best) and digital image analysis

Results

Higher mowing height caused reduction in turf quality only during the first month of the study. Subsequently no differences in quality were found when grass was mowed at 4 inches.
During the first year, tall fescues PPGTF105, PPGTF142, PPGTF145 and PPGTF156 and Delta Bolero Mix achieved the highest quality and percent green cover. Pearl’s Premium showed the highest Dark Green Color Index (DGCI). Conversely, the lowest ratings were collected on bentgrass plots. On Aug 25, and consistently with the other rating dates, no grasses achieved an acceptable quality of 6. However, PPGTF105 and PPGTF142 tall fescues performed better than the other grasses achieving higher quality and percent green cover. Conversely, both bentgrass plots (Delta Native Bentgrass and Stover Native Bentgrass) had the poorest quality and cover, revealing poor adaptability to inland hot, desert environments such as Riverside (Table 1).

UCR Lawn/Native Grass Deficit Irrigation Study

No.	Product/Species/Variety	Company	Seeding Rate lbs/1000 ft^2
1	Delta Native Bentgrass ➢ *Agrostis pallens*	Delta Bluegrass Company	1.5
2	Delta Native Mow Free Mix ➢ *Festuca rubra* Molate 40% - Red Fescue ➢ *Festuca occidentalis* 30% - Western Fescue ➢ *Festuca idahoensis* 30% - Idaho Fescue	Delta Bluegrass Company	3.0
3	Delta Native Biofiltration Mix ➢ *Stipa pulchra* - Purple Needlegrass ➢ *Festuca rubra* Molate – Red Fescue ➢ *Hordeum californicum* – California barley ➢ *Hordeum brachyantherum* – Meadow barley	Delta Bluegrass Company	3.0
4	Delta Bolero Plus Mix 90/10	Delta Bluegrass Company	5.0
5	Delta 90/10 Fescue/Blue Mix	Delta Bluegrass Company	5.0
6	MVS Tall Fescue ➢ Spyder LS	Mountain View Seeds	5.0
7	MVS Tall Fescue ➢ PPG-TF105	Mountain View Seeds	5.0
8	MVS Tall Fescue ➢ Titanium LS	Mountain View Seeds	5.0
9	MVS Tall Fescue ➢ PPG-TF142	Mountain View Seeds	3.0
10	MVS Tall Fescue ➢ PPG-TF156	Mountain View Seeds	3.0
11	MVS Tall Fescue ➢ PPG-TF145	Mountain View Seeds	3.0
12	Stover Native All- Purpose Mix ➢ *Bromus carinatus* 20% ➢ *Nassella* (*Stipa*) pulchra 31% ➢ *Festuca rubra* Molate 31% ➢ *Deschampsia cespitosa* var Holciformis 8% ➢ *Agrostis pallens* (*Diegosensis*) 6% ➢ *Koeleria macrantha* 4%	STOVER Seed Company	1.12
13	Stover Native Fine Fescue Mix ➢ *Festuca rubra* Molate 37% ➢ *Festuca occidentalis* 37% ➢ *Koeleria macrantha* 11% ➢ Deschampsia cespitosa var Holciformis 15%	STOVER Seed Company	0.62
14	Stover Native Bentgrass ➢ *Agrostis pallens* (Diegosensis) Siskiyou thingrass	STOVER Seed Company	0.69

No.	Product/Species/Variety	Company	Seeding Rate lbs/1000 ft^2
15	Cutting Edge Sun & Shade Mix ➢ Tall Fescue 19.8% ➢ Chewings Fescue 19.8% ➢ Hard Fescue 19.7% ➢ Kentucky Bluegrass 19.4% ➢ Perennial Ryegrass 19.4%	Cutting Edge	5.0
16	Pearl's Premium Ultra Low Maintenance Lawn Seed - Sunny Mix ➢ 'Dakota' Tall Fescue 19.75% ➢ 'Frontier' P. Rye 19.75% ➢ 'Deepblue' Kentucky Bluegrass 19.65% ➢ 'Harpoon' Hard Fescue 19.65% ➢ 'Carmen' Chewings Fescue 19.65%	Pearl's Premium	5.0
17	New Millennia Dwarf Fescue Blend ➢ '2nd Millennium' Tall Fescue ➢ 'Focus' Tall Fescue ➢ 'Avenger' Tall Fescue	STOVER Seed Company	5.0

17		6		4		14		16	
8		7		5		2		12	
4		7		12		6		7	
6		14		11		12		5	
1		11		3		15		17	
16		16		10		13		10	
9		13		8		3		1	
3		2		1		10		15	
14		15		5		9		8	
2		4		9		11		13	

North →

4-inch mowing height

2-inch mowing height

Table 1. Lawn/Native grasses quality, cover (%) and Dark Green Color Index (DGCI) on Sep 26 2013.

Product/Species/Variety	Quality	Cover (%)	DGCI
Cutting Edge Sun and Shade Mix	4.3 AB	72 ABC	0.3595 ABC
Delta 90/10 Fescue Blue Mix	4.0 BC	73 ABC	0.3480 ABCDE
Delta Bolero Plus Mix 90/10	4.7 AB	81 AB	0.3493 ABCD
Delta Native Bentgrass	3.0 E	58 EF	0.3244 EFG
Delta Native Biofiltration Mix	3.3 CDE	67 CDE	0.3332 DEF
Delta Native Mow Free Mix	3.2 DE	58 DEF	0.3187 FG
NewMilleniaDwarfFescueBlend	4.0 ABCD	71 ABCD	0.3400 CDEF
PPGTF105	4.7 AB	82 A	0.3670 AB
PPGTF142	4.8 A	75 ABC	0.3436 BCDE
PPGTF145	4.8 A	77 ABC	0.3513 ABCD
PPGTF156	4.7 AB	80 AB	0.3500 ABCD
Pearl's Premium	4.0 BC	77 ABC	0.3707 A
Spyder LS	4.3 AB	78 AB	0.3511 ABCD
Stover Native All Purpose Mix	3.2 DE	57 EF	0.3278 DEFG
Stover Native Bentgrass	2.8 E	50 F	0.3072 G
Stover Native Fine Fescue Mix	3.5 CDE	68 CDE	0.3375 CDEF
Titanium LS	4.3 AB	71 BC	0.3398 CDEF

Table 2. Lawn/Native grasses quality, cover (%) and Dark Green Color Index (DGCI) on Aug 25 2014.

Product/Species/Variety	Quality	Cover (%)	DGCI
Cutting Edge Sun and Shade Mix	4.8 ABCD	48 ABC	0.368 ABC
Delta 90/10 Fescue Blue Mix	5.2 ABC	40 ABC	0.3692 ABC
Delta Bolero Plus Mix 90/10	5.0 ABCD	36 ABC	0.3665 ABC
Delta Native Bentgrass	2.3 F	28 BC	0.3708 ABC
Delta Native Biofiltration Mix	3.7 E	29 BC	0.3717 AB
Delta Native Mow Free Mix	4.2 CDE	33 ABC	0.3576 BC
NewMilleniaDwarfFescueBlend	4.7 ABCDE	31 ABC	0.3664 ABC
PPGTF105	5.3 AB	51 A	0.3739 A
PPGTF142	5.5 A	49 AB	0.3731 A
PPGTF145	4.8 ABCD	45 ABC	0.3697 ABC
PPGTF156	5.3 AB	47 ABC	0.3651 ABC
Pearl's Premium	4.8 ABCD	43 ABC	0.3696 ABC
Spyder LS	4.3 BCDE	31 ABC	0.3583 BC
Stover Native All Purpose Mix	4 DE	41 ABC	0.3688 ABC
Stover Native Bentgrass	1.7 F	27 C	0.3657 ABC
Stover Native Fine Fescue Mix	4.5 ABCDE	45 ABC	0.3561 C
Titanium LS	4.5 ABCDE	36 ABC	0.366 ABC

Stop #5: Groundcover Establishment Under Saline Irrigation

Marco Schiavon, and Jim Baird

Objectives:

The objectives of this research were to determine how seven vegetatively propagated groundcover species (Kurapia, plugged buffalograss 'UC Verde', *Rhagodia spinescens, Carex praegracilis, Frankenia salina, Frankenia thymifiola*, and inland saltgrass) are affected by increasing salinity levels in irrigation water during establishment.

Methods:

A line-source gradient experiment was designed to alternate distribution of potable and saline water to establish an irrigation salinity gradient, identifying 5 different Electrical conductivity (EC) levels (2, 3, 4.5, 5.5, and 7 dS/m). Groundcover species were plugged on 2 July 2014. Soil is a Hanford fine sandy loam. Irrigation was set to 100% ETo. Percent ground cover is assessed weekly throughout the experiment using Digital Image Analysis.

Results:

On September 2, 2014, 'UC Verde' buffalograss reached the highest percent ground cover (90%) when irrigated with the lowest EC level. However, buffalograss had the most dramatic drop in ground cover when salinity levels increased, reaching only 1% ground cover when EC of irrigation water was 7 dS/m. Similar drops in percent ground cover with increasing salinity levels in irrigation water were observed in *Rhagodia spinescens, Carex praegracilis* and inland saltgrass. Conversely, Kurapia was a fast establisher when irrigated with 2 and 3 dS/m (81% and 88% respectively), and also was the best performer when irrigated with water EC of 7 dS/m (Table 1).

Plot Plan of The Study Area (North)

6	5	1	3	2	7	4	**Potable Irrigation Line**
6	5	1	3	2	7	4	
6	5	1	3	2	7	4	
6	5	1	3	2	7	4	
6	5	1	3	2	7	4	**Saline Irrigation Line**
5	4	6	1	7	3	2	
5	4	6	1	7	3	2	
5	4	6	1	7	3	2	
5	4	6	1	7	3	2	
5	4	6	1	7	3	2	**Potable Irrigation Line**
3	2	7	5	6	4	1	
3	2	7	5	6	4	1	
3	2	7	5	6	4	1	
3	2	7	5	6	4	1	
3	2	7	5	6	4	1	**Saline Irrigation Line**

1 *Carex praegracilis*

2 *Frankenia salina*

3 *Frankenia thymifiola*

4 Kurapia

5 Inland saltgrass

6 *Rhagodia spinescens*

7 ‘UC Verde’ buffalograss

Table 1. Percent ground cover affected by species and EC levels.

Species	EC (dS/m)	Ground Cover (%)
Carex praegracilis	2	22 EFGHI
Carex praegracilis	3	24 EFGHI
Carex praegracilis	4.5	18 FGHI
Carex praegracilis	5.5	23 EFGHI
Carex praegracilis	7	3 HI
Frankenia salina	2	73 ABCD
Frankenia salina	3	43 CDEFGHI
Frankenia salina	4.5	39 CDEFGHI
Frankenia salina	5.5	46 ABCDEFGH
Frankenia salina	7	42 CDEFGHI
Frankenia thymifiola	2	64 ABCDE
Frankenia thymifiola	3	48 ABCDEFG
Frankenia thymifiola	4.5	43 CDEFGHI
Frankenia thymifiola	5.5	52 ABCDEF
Frankenia thymifiola	7	49 ABCDEF
Kurapia	2	81 ABC
Kurapia	3	88 AB
Kurapia	4.5	53 ABCDEF
Kurapia	5.5	44 BCDEFGHI
Kurapia	7	60 ABCDEF
Rhagodia spinescens	2	51 ABCDEF
Rhagodia spinescens	3	46 ABCDEFGH
Rhagodia spinescens	4.5	24 EFGHI
Rhagodia spinescens	5.5	44 BCDEFGHI
Rhagodia spinescens	7	29 DEFGHI
Inland Saltgrass	2	49 ABCDEFG
Inland Saltgrass	3	40 CDEFGHI
Inland Saltgrass	4.5	48 ABCDEFG
Inland Saltgrass	5.5	39 CDEFGHI
Inland Saltgrass	7	28 EFGHI
‘UC Verde’ buffalograss	2	90 A
‘UC Verde’ buffalograss	3	44 BCDEFGHI
‘UC Verde’ buffalograss	4.5	31 DEFGHI
‘UC Verde’ buffalograss	5.5	5 GHI
‘UC Verde’ buffalograss	7	1 I

Means followed by same letter are not significantly different (P = 0.05).

Stop #5 Coating Warm-Season Turfgrass Seeds To Improve Establishment Under Saline Conditions

Marco Schiavon, Jim Baird, and Matteo Serena

Objectives:

The objectives of this research were to determine: 1) if five experimental seed coatings and Zeba coating help the establishment of ‘Princess 77’ bermudagrass and ‘SeaSpray’ seashore paspalum when irrigated with increasing levels of saline water; 2) how irrigation salinity affects establishment of ‘NuMex Sahara’ bermudagrass, ‘Whittet’ kikuyugrass, and ‘Sundancer’ buffalograss.

Methods:

A line-source gradient experiment was designed to alternate distribution of potable and saline water to establish an irrigation salinity gradient, identifying 5 different electrical conductivity (EC) levels (2, 3, 4.5, 5.5, and 7 dS/m). Plots were seeded on 2 July 2014 at the following rates: 2 lb/M (bermudagrass and buffalograss); 1 lb/M (seashore paspalum and kikuyugrass). Irrigation was set to 100% Et_o. Percent ground cover is assessed weekly throughout the experiment using Digital Image Analysis.

Results:

On 2 September 2014, the only seed coating treatment that had a positive effect on bermudagrass establishment was ASET 4000 6%, which increased ground cover in comparison to uncoated seed at 2 dS/m, 5 dS/m and 7 dS/m. In particular, ASET 4000 6% coating on Princess 77 and NuMex Sahara uncoated achieved the highest groundcover when irrigated with saline water at 7 ds/m (53% and 51% respectively). Kikuyugrass was slower to establish in comparison to bermudagrass and seashore paspalum, covering 70% of the ground at 2 dS/m, but only 5% at 7 dS/m revealing poorer adaptability to establish from seed under high salinity levels of irrigation water. The slowest to establish of all grass species was buffalograss (Figure 1).

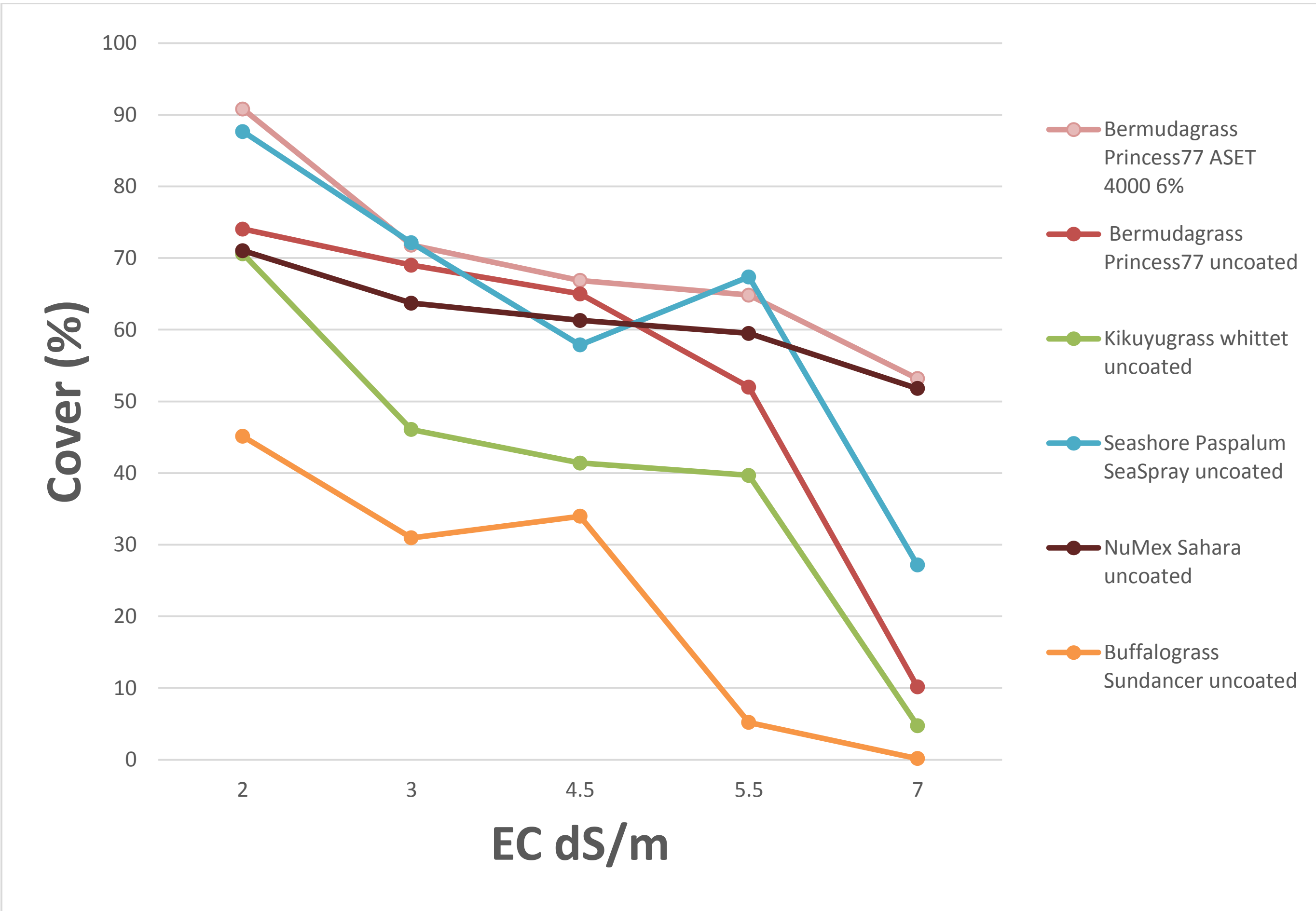
Plot Plan **North**

14	12	1	17	16	5	7	13	9	2	11	4	10	15	3	8	6	**Potable Line**
14	12	1	17	16	5	7	13	9	2	11	4	10	15	3	8	6	
14	12	1	17	16	5	7	13	9	2	11	4	10	15	3	8	6	
14	12	1	17	16	5	7	13	9	2	11	4	10	15	3	8	6	
14	12	1	17	16	5	7	13	9	2	11	4	10	15	3	8	6	**Saline**
17	13	10	14	3	15	16	12	5	7	6	8	9	4	11	1	2	**Line**
17	13	10	14	3	15	16	12	5	7	6	8	9	4	11	1	2	
17	13	10	14	3	15	16	12	5	7	6	8	9	4	11	1	2	
17	13	10	14	3	15	16	12	5	7	6	8	9	4	11	1	2	
17	13	10	14	3	15	16	12	5	7	6	8	9	4	11	1	2	**Potable**
3	8	15	17	14	16	5	1	11	12	13	7	6	2	9	10	4	**Line**
3	8	15	17	14	16	5	1	11	12	13	7	6	2	9	10	4	
3	8	15	17	14	16	5	1	11	12	13	7	6	2	9	10	4	
3	8	15	17	14	16	5	1	11	12	13	7	6	2	9	10	4	**Saline**
3	8	15	17	14	16	5	1	11	12	13	7	6	2	9	10	4	**Line**

Entry List

Entry #	Treatment
1	Seashore Paspalum ‘SeaSpray’ uncoated
2	Seashore Paspalum ‘SeaSpray’ ASET 4000 1%
3	Seashore Paspalum ‘SeaSpray’ ASET 4000 6%
4	Seashore Paspalum ‘SeaSpray’ ASET 4000 20%
5	Seashore Paspalum ‘SeaSpray’ ASET 4001 10%
6	Seashore Paspalum ‘SeaSpray’ ASET 4002 10%
7	Bermudagrass ‘Princess 77’ uncoated
8	Bermudagrass ‘Princess 77’ ASET 4000 1%
9	Bermudagrass ‘Princess 77’ ASET 4000 6%
10	Bermudagrass ‘Princess 77’ ASET 4000 20%
11	Bermudagrass ‘Princess 77’ 4001 10%
12	Bermudagrass ‘Princess 77’ ASET 4002 10%
13	Seashore Paspalum ‘SeaSpray’ Zeba
14	Bermudagrass ‘Princess 77’ Zeba
15	Bermudagrass ‘NuMex Sahara’ uncoated
16	Kikuyugrass ‘Whittet’ uncoated
17	Buffalograss ‘Sundancer’ uncoated

Figure 1. Percent groundcover on 2 September 2014 of significant coating treatments, and uncoated bermudagrass, seashore paspalum, buffalograss and kikuyugrass.



Stop 6a: Evaluation of Products to Alleviate Salinity Stress

Marco Schiavon, Toan Khuong, Andrea Feo, and Jim Baird

Objectives:

To evaluate the efficacy of products on turf to reduce stress caused by irrigation with saline water.

Methods:

The plot area was sodded with 'Tifway II' bermudagrass on 6 August 2012 on Hanford fine sandy loam with no pre-existing salinity issues. All treatments were applied initially on 3 April 2014. The turf is mowed three times per week at 0.75 inches. Standard bermudagrass cultural practices are maintained throughout the study, including 3-6 lbs N/M/yr. Plots are irrigated at 75% ET_0 with water that matches the same ion composition of Colorado River See table below. Every two weeks, plots were evaluated for turf quality, leaf firing, and volumetric soil water content. In addition Digital Image Analysis and leachate are collected on the same day. Soil samples will be collected at the end of bermudagrass growing season separately for each combination of chemical treatment and replication to assess salinity accumulation in the root zone.

Chemical properties of saline irrigation water used in this study compared to potable irrigation water used elsewhere at the UCR turfgrass facility.

	Saline Irrigation Water	Potable Irrigation Water
pH	7.57	7.82
Hardness	938.23	215.18
Bicarbonate	209.84	214.72
Carbonate	0.01	0.01
EC (dS/m)	4.43	0.61
Na (ppm)	523.9	53.36
Cl (ppm)	996.27	31.13
Boron (ppm)	0.11	0.08
SAR (meq/L)	18.3	3.24
Nitrate Nitrogen (ppm)	5.11	5.18
Phosphate (ppm)	0.4	0.01
Potassium (ppm)	129.76	4.16
Magnesium (ppm)	151.99	12.24
Calcium (ppm)	126.03	66
Sulfate (ppm)	707.62	78.1
Manganese (ppm)	0.01	0.01
Iron (ppm)	0.11	0.05

Treatments:

Treatments are applied by hand or using a calibrated CO_2 boom sprayer. Treatments are watered in with over 2 cm of water immediately following application. For treatment list see table on next page.

Results

DeSal improved bermudagrass quality consistently through the study. CalPlus (both rates), ACA 3217, MST-1410 (5 oz/M) and Turfcare NPN improved quality in comparison to control in at least one rating date (Figure 1). ACA 2994 had a phytotoxic effect on bermudagrass, and was detrimental to turf quality, but was also the only treatment to constantly decrease EC in the leachate (Figure 2). Cal Plus at 1.5 oz/M also decreased EC of the leachate at two collection dates (Figure 2).

Salinity Alleviation Study Treatment List 2014

No.	Treatment	Company	Rate	Frequency (wks)
1	Untreated Control	--	--	--
2	ACA 2994	Aquatrols	8 oz/M	6
3	ACA 2994	Aquatrols	8 oz/M	2
4	ACA 1849	Aquatrols	3 oz/M	2
5 5	ACA 1849 Gypsum	Aquatrols	3 oz/M 5 lbs/M	2 2
6	ACA 2994	Aquatrols	4 oz/M	6
7 7 7 7	Cal-Vantage Kick Proactin TriCure AD	EarthWorks Earthworks Mitchell Products Mitchell Products	5 oz/M 10 oz/M 1.5 oz/M 4 oz/M	Cal-Vantage and Kick rotated every 2 wks with Proactin and TriCure
8	MC TP	Mitchell Products	2 oz/M	2
9	MC TP3	Mitchell Products	2 oz/M	2
10	Crossover	Numerator Tech.	5 lb/M	4
11	Revert	Numerator Tech.	6 oz/M	4
12	SST 8%CA	Numerator Tech.	8 oz/M	2
13 13	pHAcid Sprayable Crossover	Numerator Tech.	2 oz/M 5 lb/M	2 4
14	Cal Plus 1	Westbridge Agric.	0.75 oz/M	2
15	Cal Plus 2	Westbridge Agric.	1.5 oz/M	2
16 16 16	DeSal StressRx EXP 5-0-1	Ocean Organics Ocean Organics Ocean Organics	0.75 oz/M 6 oz/M 6 oz/M	2 2 2
17	Gypsum	--	5 lb/M	2
18	Gypsum	--	10 lb/M	2
19	ACA 3217	Aquatrols	6 oz/M	2
20	MST-1410*	--	3 oz/M	2
21	MST-1410*	--	5 oz/M	2
22	Turfcare NPN Turfcare NPN Turfcare NPN	Gantec Gantec Gantec	0.1 oz/M 0.1 oz/M 2.3 lb/M	2 (Apr-May) 4 (Jun-Dec) Apr/May/Jul/Sep

*Treatments first applied on 12 June 2014

Plot Plan
Salinity Alleviation Study (Field 12F-4)
North

101 1	201 13	301 8	401 16	501 22	601 9
102 2	202 6	302 5	402 21	502 19	602 4
103 3	203 11	303 18	403 1	503 10	603 10
104 4	204 9	304 7	404 13	504 15	604 22
105 5	205 18	305 14	405 11	505 7	605 13
106 6	206 1	306 4	406 17	506 21	606 5
107 7	207 12	307 19	407 3	507 12	607 11
108 8	208 10	308 16	408 15	508 20	608 18
109 10	209 4	309 21	409 22	509 3	609 19
110 9	210 20	310 2	410 4	510 16	610 15
111 11	211 14	311 1	411 19	511 5	611 7
112 12	212 8	312 17	412 14	512 18	612 17
113 13	213 2	313 11	413 9	513 1	613 20
114 14	214 5	314 3	414 7	514 8	614 3
115 15	215 21	315 6	415 2	515 13	615 2
116 16	216 19	316 12	416 20	516 6	616 14
117 17	217 16	317 15	417 10	517 11	617 21
118 18	218 3	318 9	418 6	518 17	618 8
119 19	219 15	319 22	419 12	519 14	619 1
120 20	220 7	320 13	420 18	520 2	620 12
121 21	221 22	321 10	421 5	521 9	621 16
122 22	222 17	322 20	422 8	522 4	622 6

Figure 1. Quality of treatments that performed better than control in at least one rating date.

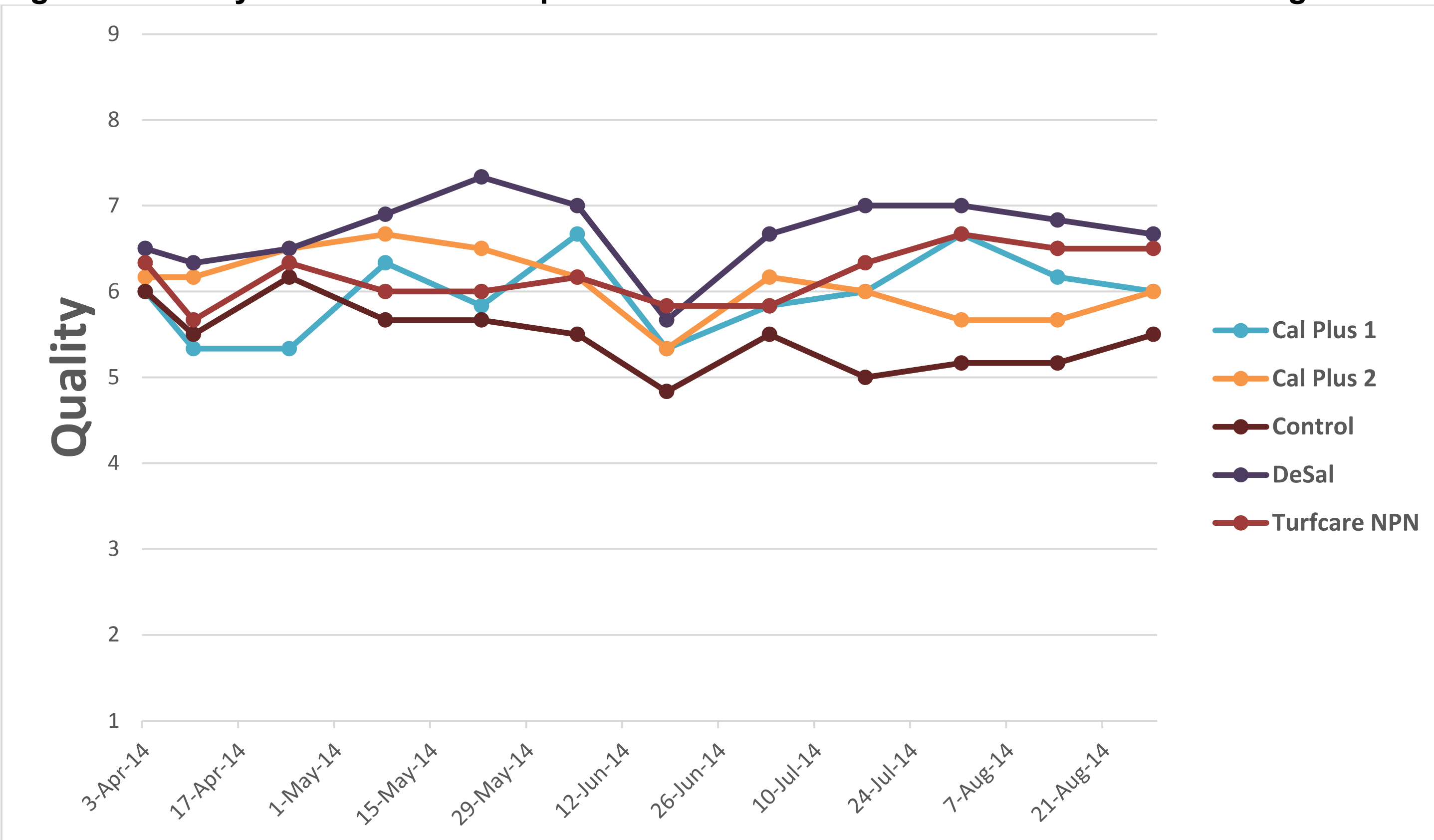
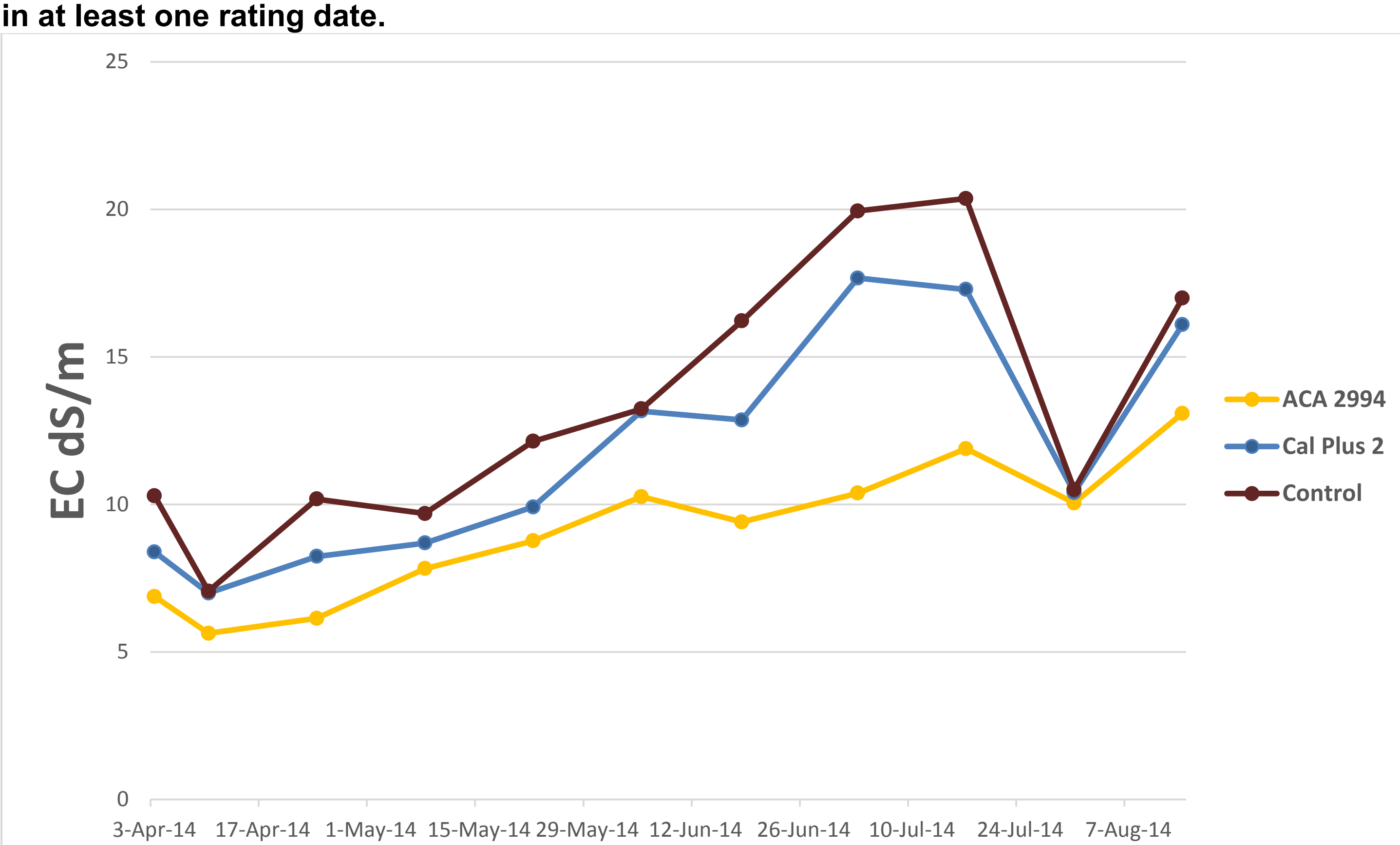


Figure 2. EC of leachate collected from plots that decreased salinity in comparison to control in at least one rating date.



Stop #6b: Evaluation of Products for Turfgrass Water Conservation Using a Linear Gradient Irrigation System (LGIS)

Marco Schiavon, Toan Khuong and Jim Baird

Objectives:

1. Determine effective irrigation and chemical management practices to reduce water use.
2. Evaluate the ability of products to maintain acceptable turf quality under reduced water use.

Methods:

The LGIS area was sodded with 'Tifway II' bermudagrass on 7 August 2012. Areas of each plot that receive 10, 25, 55, 60, 65, 70, 75, 80, and 85% Et_0 were determined using catch cans to capture irrigation water. This procedure was repeated and validated every month during the experiment. All treatments were applied initially on 23 May 2014. Every two weeks, plots were evaluated for turf quality, NDVI (measure of greenness), volumetric soil water content, and surface temperature in the irrigation zones representing 10 to 85% ET_0.

Treatments:

See Table 1.

Results:

No differences were found in turf quality among treatments. Bermudagrass showed an acceptable quality of 6 or superior when irrigated with 55% ET_0 or above. Although differences in turf quality were different only among ET_0 ranges, differences in NDVI among treatments were discovered recently during the study. Kelplex and Ultraplex had the highest NDVI during two rating dates, and its indices were constantly superior than the control. Neptune, PK plus and Primo Maxx also had NDVIs greater than the control on four rating dates (Figure 1).

Table 1. List of chemicals used in the LGIS study.

No.	Treatment	Type	Dosage (oz./M)	Application Interval (Days)
1 1	Primo Maxx Revolution	Plant Growth Regulator Surfactant	0.3 6.00	14
2	Amidas* spray	Nutrients	0.5 N	28
3	Calcinit* spray	Nutrients	0.5 N	28
4	Turf Royale* granular	Nutrients	0.5 N	28
5	Recovery Rx	Phosphite + Nutrients	5.00	14
6	PK Plus	Phosphite + Nutrients	6.00	14
7 7	Kelplex Ultraplex	Nutrients + Surfactant	2.00 4.00	7 7
8	Revolution	Surfactant	6.00	28
9	Neptune	Surfactant	6.00	28
10	Aquaplus	Polyacrylamide	3.00	28
11	Primo Maxx	Plant Growth Regulator	0.30	14
12	Control	--	--	--

All treatments applied in a carrier volume of 2 gal/M.

*Treatments first applied on July 25. Application interval was 14 days from initial application until September 5. Subsequently, applications were switched to monthly.

LGIS Study Plot Plan

East

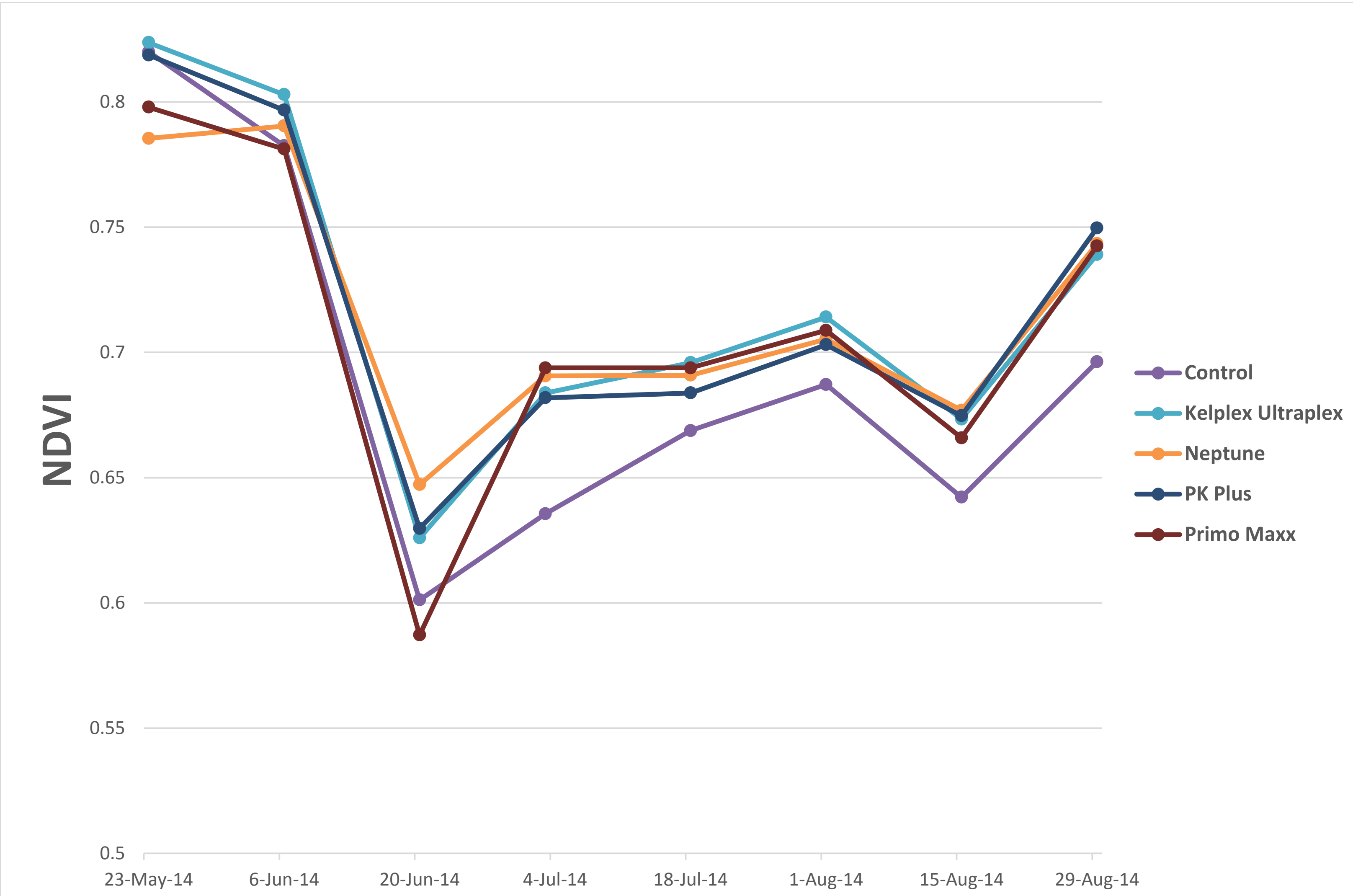
Replication 1												Replication 2											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***10***	***11***	***7***	***2***	***1***	***12***	***6***	***3***	***9***	***4***	***5***	***8***

11	***10***	***2***	***3***	***9***	***8***	***6***	***12***	***4***	***7***	***5***	***1***	***4***	***9***	***6***	***10***	***7***	***2***	***8***	***1***	***11***	***3***	***5***	***12***
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Replication 3												Replication 4											

West

(Road)

Figure 1. Naturalized Difference Vegetation Indexes (NDVI) of treatments that performed better than control.



Stop #7: Pre- and Postemergence Control of Crabgrass and Broadleaf Weeds in Bermudagrass and Tall Fescue

Jim Baird, Tyler Mock, and Priti Saxena

Preemergence Control in Bermudagrass

Species: 'Princess 77' Bermudagrass

Spray Information: CO_2-powered bicycle sprayer
TeeJet 8003VS nozzles; 19-inch spacing
1 gal/M

Design: Randomized complete block; 3 replications

Plot size: 7 ft x 10 ft; 4-ft alleys

Application Dates: 2 February 2014 (initial treatment)
27 March 2014 (6 WAIT)

Results:

- ✓ Crabgrass pressure was low and sporadic. Nevertheless, plots treated with Tenacity + Barricade were completely free of crabgrass and other weed species at the final rating date in August.

Notes:

2014 Preemergence Crabgrass Control in Bermudagrass

No.	Treatment	Company	Rate	Timing (wks)	Other Weed Cover Quality (1-9, 9 = best or none) 8/5/2014	Crabgrass% cover 8/5/2014
1	Control				6.3 abc	9.0 a
2 2	Tenacity 4SC NIS	Syngenta	5 oz/A 0.25% v/v	0, 6 0, 6	7.3 abc	2.7 a
3 3	Tenacity 4SC Barricade 65WG	Syngenta	5 oz/A 0.65 lb/A	0, 6 0, 6	9.0 a	0.0 a
4 4	Tenacity 4SC Monument 45WG	Syngenta	5 oz/A 10 g/A	0, 6 0, 6	4.7 c	15.7 a
5 5	Monument 45WG NIS	Syngenta	10 g/A 0.25% v/v	0,6 0,6	6.7 abc	8.0 a
6	Change Up	Nufarm	1 pt/A	0	5.0 bc	20.7 a
7 7	Change Up Sureguard	Nufarm Nufarm	1 pt/A 10 oz/A	0 0	7.0 abc	7.0 a
8	Sureguard	Nufarm	10 oz/A	0	7.3 abc	3.3 a
9	Specticle 0.0142% G	Bayer	272 lb/A	0	8.7 ab	0.3 a
10	Specticle 0.0213% G	Bayer	181 lb/A	0	7.3 abc	8.3 a
11	Specticle Flo	Bayer	8 oz/A	0	7.7 abc	5.3 a
12	Dimension 270G	Dow AgroScience	185 lb/A	0	6.3 abc	0.7 a
13	Dimension 2EW	Dow AgroScience	32 oz/A	0,6	7.7 abc	0.3 a
14	Pendulum Aqua Cap	BASF	3.1 pt/A	0,6	7.7 abc	0.7 a
15 15	Pylex Pendulum Aqua Cap	BASF	1 oz/A 3.1 pt/A	0,6	8.3 abc	1.3 a
16	Tower	BASF	32 oz/A	0,6	6.7 abc	4.7 a

Means followed by the same letter in a column are not significantly different (P = 0.05).

Postemergence Control in Bermudagrass

Species: 'GN-1' Hybrid Bermudagrass

Spray Information: CO_2-powered bicycle sprayer
TeeJet 8003VS nozzles; 19-inch spacing
1 gal/M

Design: Randomized complete block; 3 replications

Plot size: 7 ft x 10 ft; 4-ft alleys

Application Dates: 11 June 2014 (initial treatment)
23 July 2014 (6 WAIT)
28 August 2014 (11 WAIT)

Results:

- ✓ Crabgrass pressure was tremendous and this was considered a worst case scenario in terms of POST applications on mature (tillering) crabgrass.
- ✓ Problems with the sprayer during the second application resulted in misses and prompted a third application.
- ✓ Dimension provided the best crabgrass control in the study followed by MSMA. Barricade + Tenacity was the only other treatment that reduced crabgrass below that of the control.

Notes:

2014 Postemergence Crabgrass Control in Bermudagrass

No.	Treatment	Company	Rate	Timing (wks)	Crabgrass % cover (8/5/2014)	Crabgrass % cover (9/7/2014)
1	Control				56.7 a	85.0 a
2	Dimension 2EW	Dow AgroSciences	32 oz/A	0, 6	13.3 a	1.7 d
3	MSMA 6 Plus	Drexel	87 oz/A	0, 6	16.7 a	10.7 ab
4 4	Tenacity 4SC NIS	Syngenta	5 oz/A 0.25% v/v	0, 6 0, 6	23.3 a	35.0 a-d
5 5	Tenacity 4SC Barricade 65WG	Syngenta Syngenta	5 oz/A 0.65 lbs/A	0, 6 0, 6	30.0 a	20.0 bcd
6 6	Tenacity 4SC Monument 75WG	Syngenta Syngenta	5 oz/A 10 g/A	0, 6 0, 6	20.0 a	36.7 a-d
7	Monument 75WG	Syngenta	10 g/A	0, 6	23.3 a	41.7 a-d
8 8	OneTime MSO	BASF	64 oz/A 0.5% v/v	0, 6 0, 6	35.0 a	56.7 abc
9 9	Drive XLR8 MSO	BASF	64 oz/A 0.5% v/v	0, 6 0, 6	41.7 a	55.0 abc
10 10	Pylex Pendulum AquaCap	BASF BASF	1 oz/A 3.1 pt/A	0, 6 0, 6	20.0 a	38.3 a-d
11 11	Q4 NIS	PBI Gordon	128 oz/A 0.25% v/v	0, 6 0, 6	50.0 a	58.3 abc
12 12	Solitare NIS	FMC	16 oz/A 0.25% v/v	0, 6 0, 6	48.3 a	63.3 ab
13 13	Solitare NIS	FMC	24 oz/A 0.25% v/v	0, 6 0, 6	38.3 a	43.3 a-d

Means followed by the same letter in a column are not significantly different (P = 0.05).

Preemergence Control in Tall Fescue

Spray Information: CO_2-powered bicycle sprayer
TeeJet 8003VS nozzles; 19-inch spacing
1 gal/M

Design: Randomized complete block; 4 replications

Plot size: 7 ft x 10 ft

Application Dates: 2 February 2014 (initial treatment)
27 March 2014 (6 WAIT)

Results:

- ✓ Tenacity + Barricade provided the best crabgrass control followed by Pylex and Pendulum and Pendulum alone. All other treatments were not significantly different from the control.
- ✓ Oxalis pressure was significant but not uniform throughout the study area. Treatments containing Turflon Ester or Tower provide the best control of this species.

Notes:

2014 Preemergence Crabgrass Control in Tall Fescue

No.	Treatment	Company	Rate	Timing (wks)	Oxalis % cover (8/30/2014)	Crabgrass % cover (8/30/2014)
1	Control				7.5 a	33.8 a
2 2	Tenacity 4SC NIS	Syngenta	5 oz/A 0.25% v/v	0, 6 0, 6	2.5 a	36.3 a
3 3 3	Tenacity 4SC Turflon Ester 4EC NIS	Syngenta Dow AgroSciences	5 oz/A 16 oz/A 0.25% v/v	0, 6 0, 6 0, 6	0.0 a	25.0 abc
4 4	Tenacity 4SC Barricade 65WG	Syngenta Syngenta	5 oz/A 0.4 lbs/A	0, 6 0, 6	7.5 a	1.5 c
5	Dimension 2EW		32 oz/A	0, 6	5.0 a	13.8 abc
6 6	Pylex MSO		4 oz/A 0.5 % v/v	0, 6 0, 6	7.5 a	36.3 a
7 7	Pylex MSO		1 oz/A 0.5% v/v	0, 6 0, 6	10.0 a	35.0 a
8 8	Pylex MSO		1.5 oz/A 0.5% v/v	0, 6 0, 6	7.5 a	38.8 a
9 9 9	Pylex Turflon Ester 4EC MSO		1 oz/A 16 oz/A 0.5 % v/v	0, 6 0, 6 0, 6	0.0 a	27.5 ab
10 10	Pylex Pendulum Aqua Cap		1 oz/A 3.1 pt/A	0, 6 0, 6	8.8 a	5.3 bc
11	Tower		32 oz/A	0, 6	0.0 a	33.8 a
12	Pendulum Aqua Cap		3.1 pt/A	0, 6	5.0 a	6.5 bc

Means followed by the same letter in a column are not significantly different (P = 0.05).

Postemergence Control in Tall Fescue

Spray Information: CO_2-powered backpack sprayer
TeeJet 8003VS nozzles; 9-inch spacing
1 gal/M

Design: Randomized complete block; 4 replications

Plot size: 4 ft x 8 ft

Application Dates: 18 July 2014 (initial treatment)
28 August 2014 (6 WAIT)

Results:

- ✓ Overall, distribution of crabgrass and Oxalis was less than ideal and contributed to general lack of treatment separation.
- ✓ Tenacity + Barricade and Pylex alone or combined with Pendulum or Tower provided the best crabgrass control.
- ✓ The treatment containing Turflon Ester provided the best control of Oxalis.

Notes:

2014 Postemergence Crabgrass Control in Tall Fescue

No.	Treatment	Company	Rate	Timing (wks)	Crabgrass % cover (7/18/14)	Crabgrass % cover (8/28/14)	Oxalis% cover (7/18/14)	Oxalis% cover (8/28/14)
1	Control				15.0 a	20.0 a	20.0 a	31.3 a
2 2	Tenacity 4SC NIS	Syngenta	5 oz/A 0.25% v/v	0, 6 0, 6	12.5 a	13.8 a	18.8 a	31.3 a
3 3 3	Tenacity Turflon Ester NIS	Syngenta Dow	5 oz/A 16 oz/A 0.25% v/v	6 6 6	17.5 a	12.5 a-d	18.8 a	1.3 a
4 4	Tenacity 4SC Barricade 65WG	Syngenta Syngenta	5 oz/A 0.4 lbs/A	6 6	20.0 a	3.8 d	26.3 a	25.0 a
5 5 5	Pendulum Pylex MSO	BASF BASF	3.1 pt/A 1 oz/A 0.5% v/v	6 6 6	12.5 a	6.8 cd	23.8 a	19.3 a
6 6 6	Tower Pylex MSO	BASF BASF	32 oz/A 1 oz/A 0.5% v/v	6 6 6	12.5 a	8.8 bcd	21.3 a	20.0 a
7 7	Pylex MSO	BASF	1.5 oz/A 0.5% v/v	6 6	13.8	7.5 cd	17.5 a	25.0 a
8 8	Solitare NIS	FMC	16 oz/A 0.25% v/v	6 6	20.0 a	18.8 a-d	18.8 a	17.5 a

Means followed by the same letter in a column are not significantly different (P = 0.05).

Stop # 8: Anthracnose Fungicide Trial 2014

Tyler Mock and Jim Baird

Anthracnose

Fourteen fungicide treatments were evaluated for their ability to control anthracnose preventatively on an annual bluegrass green at the UCR Turfgrass Facility in Riverside. Soil is a Hanford fine sandy loam amended with sand. Inoculation was achieved through core aeration and dragging in order to spread the existing inoculum. The green was originally established in 2007 from seed with 'Peterson's Creeping' annual bluegrass. The green is mowed 5 times/wk at 0.2 inches and received 0.125 lb N/1000ft^2 monthly leading up to 27 June 2014, then again on 8 September 2014. The green was aerated with ¼-inch solid tines followed by sand topdressing on 28 August 2014.

The study was set up as a randomized complete block experiment with five replications on 4′ x 6′ plots. Fungicide treatments were initiated on 18 June 2014 (Application Code A) before disease symptoms were present. Treatments were sprayed every 14 days except for treatments 3 & 4, which were sprayed every 28 days. Final treatments were applied on 27 August 2014 (Application Code F). A CO_2 backpack sprayer with TeeJet 8004VS nozzles was used to provide a spray output of 2 gal/M.

Results and Conclusions:

- ✓ Overall, anthracnose disease pressure and distribution were moderate to heavy in 2014, with disease present in every replication towards the end of August.
- ✓ Most of the fungicide treatments significantly reduced disease pressure when compared with the control.
- ✓ Three treatments had excellent anthracnose control on the latest rating date of the study: Disarm C (treatment 4); A20964A, Daconil Action, and Primo Maxx applied together (treatment 10); and a fungicide regime (treatment 14) with a combination of seven different fungicides.
- ✓ Two treatments (10 & 14) received consistently high turf quality ratings throughout the study regardless of disease pressure (data not shown).

Table 1. Effects of fungicides and fungicide programs on anthracnose cover (0-100%). Disease and turf quality ratings were taken every 14 days throughout the study, but only the most recent anthracnose cover is shown below. Riverside, CA.

Trt No.	Treatment Name	Rate	Rate Unit	Application Code	Anthracnose Cover % 8-28-14
1	Control				48.0 a
2	ARY-0534-002	0.33	fl oz/1000 ft2	ABCDEF	3.0 c
3	Disarm T	0.89	fl oz/1000 ft2	ACE	7.0 c
4	Disarm C	6	fl oz/1000 ft2	ACE	0.0 c
5	Lexicon	0.47	fl oz/1000 ft2	ABCDEF	6.0 c
6	Lexicon	0.34	fl oz/1000 ft2	ABCDEF	17.0 c
	Affirm	0.88	fl oz/1000 ft2	ABCDEF	
7	Secure	0.5	fl oz/1000 ft2	ABCDEF	31.0 b
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEF	
	Signature	4	oz wt/1000 ft2	ABCDEF	
8	Secure	0.5	fl oz/1000 ft2	ABCDEF	10.0 c
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
9	A20964A	0.2	fl oz/1000 ft2	ABCDEF	8.0 c
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
10	A20964A	0.4	fl oz/1000 ft2	ABCDEF	0.0 c
	Daconil Action	7	fl oz/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
11	A20964A	0.2	fl oz/1000 ft2	ABCDEF	8.4 c
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEF	
12	Velista	0.5	oz wt/1000 ft2	ABCDEF	12.0 c
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
13	Velista	0.5	oz wt/1000 ft2	ABCDEF	8.6 c
	Secure	0.5	fl oz/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
14	Banner Maxx	2	fl oz/1000 ft2	A	0.0 c
	Daconil Action	3.5	fl oz/1000 ft2	ABCE	
	Signature	4	oz wt/1000 ft2	ABCDEF	
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEF	
	Briskway	0.5	fl oz/1000 ft2	CD	
	Secure	0.5	fl oz/1000 ft2	E	
	Velista	0.5	oz wt/1000 ft2	F	
15	Triton Flo	0.75	fl oz/1000 ft2	A	1.0 c
	Signature	4	oz wt/1000 ft2	BCDEF	
	Insignia	0.9	fl oz/1000 ft2	BD	
	Daconil Ultrex	3.2	oz wt/1000 ft2	CF	
	Medallion SC	1	fl oz/1000 ft2	E	

Means followed by same letter do not significantly differ (P=.05).
Each letter in application code represents a 14-day interval.

Anthracnose Study Plot Map
North/Trees

		8	9	11	7	12	11	5	2	3	12
		7	10	13	6	9	1	12	15	10	9
		6	11	9	3	6	3	14	11	15	2
		5	12	12	X	X	15	6	1	5	6
		4	13	2	X	X	7	8	7	1	13
		3	14	4	14	5	14	9	4	7	8
		2	15	5	1	10	8	3	10	4	14
		1	10	8	15	13	4	2	13	11	

Stop #8b: The LDS All Star Game

Jon Montgomery and Jim Baird

Introduction

In 2013, five trials were conducted on three golf courses in northern California and at the UC Riverside turfgrass research facility. Three experiments were conducted on putting greens and two on fairway turf. LDS was variable both among and within experimental areas, but several products were identified as top performers. Following the conclusion of last year's study, it was determined that more research was necessary to determine which products are truly most effective for prevention/alleviation of LDS. Therefore, the best performing products from 2013 trials were selected for inclusion in a 2014 All Star study on a bentgrass putting green at the UC Riverside turfgrass research facility.

Methods

Initial ratings were taken on July 9, 2014. TDR data from these ratings were used to select plots with similar soil moisture in an attempt to control for the high variability in occurrence of LDS. Products were applied monthly beginning July 10, 2014, and immediately watered in. All ratings were collected on a bi-weekly basis. Irrigation was reduced gradually over the course of the study.

Sprayer Information

CO_2-powered backpack hand boom
Four TeeJet 8004VS flat fan nozzles; 9.5-inch spacing
Pressure: 30 psi; Groundspeed: 2 mph; Output: 2 gal/M

Ratings:

- Turf Quality (1 to 9 scale, 9 = best)
- Localized Dry Spot (0 to 100%)
- Soil Moisture (%)
- Green Firmness (Clegg Impact Tester)

Spray Record

Timing	A	B	C
Date	10 June 2014	7 August 2014	4 September 2014
Time	6:00 to 7:30 AM	6:00 to 7:30 AM	2:00 to 3:00 PM
Temperature	65.1F	61.0F	83.7F
Wind	Calm	Calm	Calm
Conditions	Clear	Clear	Clear

Results:

- All products included in this trial were among the best out of more than 30 products tested in 2013.
- No significant differences were detected for firmness and soil moisture at all rating dates.
- A16982A from Syngenta produced the best turf quality and least LDS by the final rating date before publication.
- TriCure AD and Revolution tied for second place. The remainder of the products were not significantly different from the control with respect to %LDS.

2014 UCR Putting Green LDS Study
Riverside, CA
(North↑)

							3					
	7										4	
			1		3							
	5	2	6	2	7							
			4				5					
7	1	3				1		2	4	5	7	6
6												

No.	Treatment	Company	Rate (oz/M)
1	Control	--	--
2	Revolution	Aquatrols	6.0
3	TriCure AD	Mitchell Products	6.0
4	A16982A	Syngenta	12.6
5	Affinity	BASF	6.0
6	Neptune	Numerator Technologies	6.0
7	NT-0949	Numerator Technologies	6.0

Table 1. Bentgrass quality and %LDS in response to wetting agents applied June 10 and August 7, 2014. Riverside, CA.

		Turf Quality (1-9, 9 = best)					%LDS				
No.	**Product**	7/09	7/23	8/07	8/21	9/03	7/09	7/23	8/07	8/21	9/03
1	Control	7.0A	5.8AB	6.0A	5.3BC	4.8AB	5.0A	3.8A	10.0A	13.8A	38.8A
2	Revolution	6.8A	6.3AB	6.5A	6.5ABC	6.0A	6.3A	2.5A	3.8A	6.3A	11.3B
3	TriCure AD	7.5A	6.5AB	6.8A	7.3A	5.8AB	5.0A	1.3A	5.0A	2.5A	13.8B
4	A16982A	7.5A	7.3A	6.8A	7.0AB	6.3 A	2.5A	0.0A	3.8A	3.8A	7.5C
5	Affinity	6.8A	6.0AB	5.8A	5.5ABC	4.8AB	8.8A	2.5A	11.3A	16.3A	28.8AB
6	Neptune	6.8A	5.5B	5.5A	5.8ABC	3.8B	5.0A	2.5A	7.5A	8.8A	51.3AB
7	NT-0949	6.8A	5.0B	5.0A	5.0C	4.3AB	6.3A	11.3A	22.5A	13.8A	40.0A

Means followed by the same letter in a column are not significantly different (P = 0.05).

Stop #9: UCR Turfgrass Breeding Project

Adam Lukaszewski, Priti Saxena, and Jim Baird

Introduction

A new turfgrass breeding program has been launched at University of California, Riverside. Due to increased concerns about drought and diminishing potable water supplies, it's important to develop drought tolerant turfgrass cultivars for semi-arid regions, and more specifically California climates. The objective of this program is to develop cultivars with improved drought, heat, and salt tolerance as well as winter color retention. Currently, the major efforts are being employed in selecting superior germplasm and early cycles of hybridizations in tall fescue, bermudagrass, perennial ryegrass and Fescue-*Lolium* (Festulolium). Irrigation has been installed on 10,000 ft^2 of new land designated for breeding and germplasm collections; and additional irrigated land will be made available as the program expands.

Tall fescue

In fall 2013, 36 tall fescue accessions selected from the USDA collection (25 individual plants of each accession) were planted into the field. There were several criteria for this selection: location of the original population (mostly Mediterranean but also as far as Afghanistan, Japan, and South Africa), harsh climate conditions and, if noted, salt stress. We are evaluating individual plants under normal (non-stress) condition this spring, select superior types, clone them and establish a new nursery where plants will be stressed, originally for drought, later also for salinity. Selected plants will be inter-mated with established turf accessions, and the process of selection will start. The goal is to select more drought/heat tolerant/resistant accessions locally and internationally and broaden the genetic pool of turf type tall fescue. Selected genotypes will be incorporated in the hybridization and selection cycles to develop elite tall fescue lines through recurrent selection, which could be further utilized in synthetic cultivar(s) development. Currently, more selections have been made from local uncultivated areas and from the USDA repository to enhance the genetic variation. The selected plants will be planted in field in November 2014 for inter-mating in the spring, 2015. The progenies will be evaluated for drought, heat, and salt stresses.

Bermudagrass

We have established a collection of 68 accessions representing all distinct species of bermudagrass. These were obtained from USDA and other sources. It is clear that there is clear variation for the onset of dormancy among the accessions. So far we identified six variants that maintained green color after frost in late November and early December, well past the onset of dormancy for a majority of the accessions and most commercial varieties. These will be the focus of future mating and selection efforts.

Individual crosses were set up in 2013 (the detached tiller approach) between individual accessions of *Cynodon transvaalensis, C. dactylon*, *C. barberi* and *C. plectostachus*. Viable seed was obtained and germinated from a cross involving *C. dactylon x C. incompletus* and reciprocal crosses involving different accessions of *C. dactylon, C. transvaalensis* and *C. barberi* (a total of six hybrids). In addition, we harvested seed from open pollination among all collection accessions in the field. Since all these accessions represent single plants, and bermudas are known for self-incompatibility, all seed was assumed to be from cross-pollination. Viable (germinating) seed was obtained from 12 accessions, including *C. dactylon, C. transvaalensis, C. radiatus, C. incompletus* and *C. barberii*. The total number of seedlings obtained was ca. 420 but seedling mortality reduced it to ca. 350. Viable plants were transplanted to the field where they showed enormous variation for every observable characteristic. Based on visual evaluation under normal growing conditions, 35 hybrids were selected for further observation on 4ft x 4ft plots, established in mid-August. Based on the observed characteristics of the collection accessions, another 15 accessions were selected in spring 2014 for controlled interspecific crosses in the greenhouse. These included individual accessions of *C. transvaalensis*, *C. dactylon*, *C. radiatus* and C. *plectostachus* (a total of 30 cross combinations). The harvested seeds are sown in Petri plates and seedlings will be planted in the field. Once again, seed were harvested from open pollination of the collection accessions for another round of selection.

Festuca-Lolium Hybrids

Populations of perennial ryegrass (*Lolium perenne*) with introgressions of chromosome 3S from meadow fescue (*Festuca pratensis*) were intermated in the field in 2013 and collected seed were sown in fall 2013. These plants would be part of the large scale commercial perennial ryegrass dry-down experiment. Larger seed samples that were generated in 2012 from populations of *L. perenne* with *F. pratensis* introgression 3S were sown in dense seeding in the field in April 2013 for another round of screening for survival under the ultimate drought stress. Irrigation was turned off in August and surviving plants were selected in October 2013 and transplanted with the populations described above to the new breeding area for intermating in 2014. Perhaps because of a very mild winter, heading and flowering of the transplants were poor and uneven, and we did not manage to harvest the expected amount of seed.

A total of 138 *Festuca-Lolium* hybrids from a new round of hybridization were transplanted to the field in March 2014 and are under evaluation for drought and heat tolerance. Thirty-six *Lolium perenne* plants from accession ‘SR4550’ were selected in February 2014 from a field under saline irrigation based on their performance under water deficit and high salinity conditions. These plants are maintained in the green house and will soon be planted in the field for further screening of drought tolerance along with other collected germplasm.

Summary

Persistent efforts are continuing to enhance genetic variation and adaptability of turfgrasses in southern California. With the onset of initial cycles of breeding and expanding germplasm collections the future of the breeding program at UCR focuses on the development of germplasm with improved drought and heat tolerance characteristics while maintaining aesthetic value (e.g., year round green color).

EFFECTS OF BIOCHAR ON TURF ESTABLISHMENT

Jon Montgomery, Jim Baird, and Milt McGiffen

Introduction: Biochar is a form of charcoal that can be made from lawn clippings and other carbon waste. Biochar persists in the soil for years, reducing the need for water and fertilizer with no need for further intervention. Projected work at this site will quantify tall fescue water use when planting into soil amended with biochar and greenwaste or biosolid compost. Here, initial results regarding the effect of biochar and compost incorporation on establishment rates of tall fescue are presented, along with results from a companion study on biochar's effect on nitrate, ammonium, and phosphate leaching.

Objectives: **1)** Measure effects of biochar and compost incorporation on turf establishment rates.
2) Evaluate biochar and compost's ability to reduce turfgrass irrigation requirements.

Treatments: Water use study: The experiment is a split plot design, with subplots of either Full (80% of ET) or reduced (50% of ET), and main plot treatments of biochar or compost (see treatment list and plot plan on following page). Tall fescue was planted May 5, 2014, and will be top dressed in fall 2014. All plots are being watered fully during the current establishment phase. Drought stress will be induced May-October 2015 in the reduced irrigation plots. Turf quality, clippings, root growth, and water use efficiency will be measured and correlated with irrigation regime and soil amendment.

Results:

- There was no statistical difference in establishment rate between grasses grown in untreated and biochar-amended soils.
- Grasses grown in compost-amended soils took longer to fully establish, but reached comparable levels of coverage.
- The rate of biochar or compost amendment did not significantly affect establishment rate.

Plot Plan and Treatment List

(North)

Block								
Block 1	Irrigation Treatment B							
	F	C	B	G	D	E	H	A
	Irrigation Treatment A							
	E	B	H	F	D	A	G	C
Block 2	Irrigation Treatment B							
	C	H	E	B	G	A	D	C
	Irrigation Treatment A							
	E	G	A	C	F	B	H	D
Block 3	Irrigation Treatment B							
	E	C	A	B	H	D	G	F
	Irrigation Treatment A							
	G	E	B	A	H	D	F	C
Block 4	Irrigation Treatment B							
	B	A	C	D	H	F	E	G
	Irrigation Treatment A							
	B	H	D	E	A	C	G	F

Irrigation Treatment	
A	80% ET_o
B	50% ET_o

Amendment Treatment	
A	Control
B	1 Ton/Acre Biochar
C	5 Ton/Acre Biochar
D	10 Ton/Acre Biochar
E	2 Inches Composted Biosolids
F	2 Inches Composted Greenwaste
G	2 Inches Composted Greenwaste + 5 Ton/Acre Biochar
H	4 Inches Composted Greenwaste

EFFECTS OF BIOCHAR ON FERTILIZER LEACHING

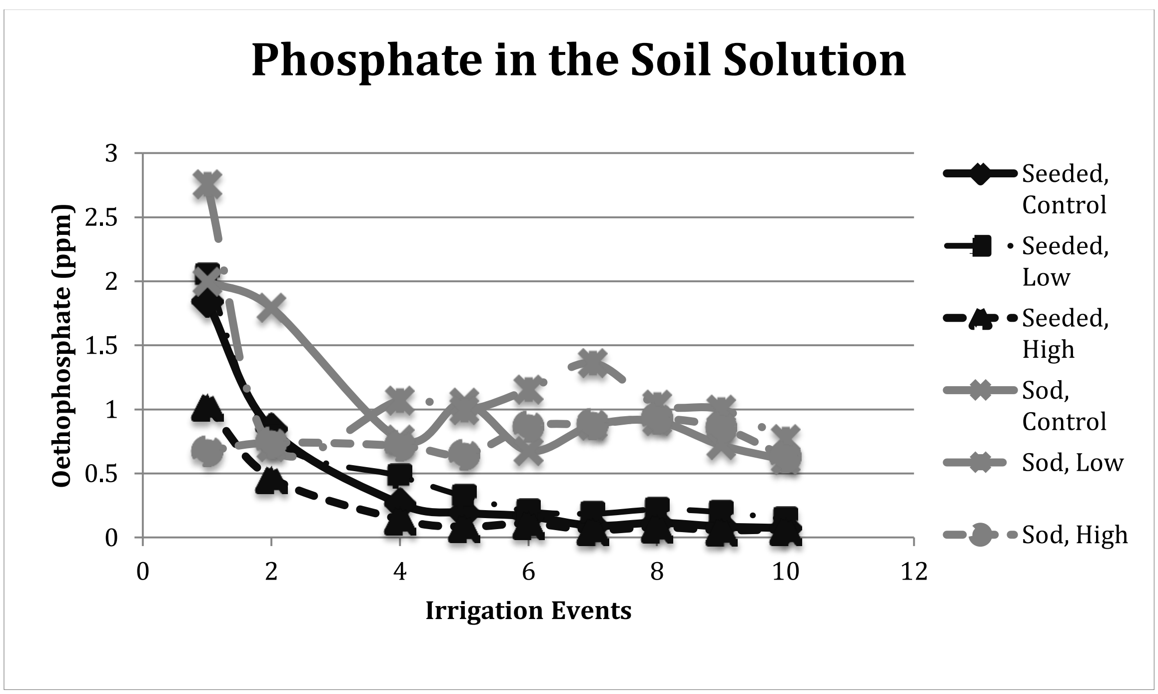
Elizabeth Crutchfield, Jim Baird, and Milt McGiffen

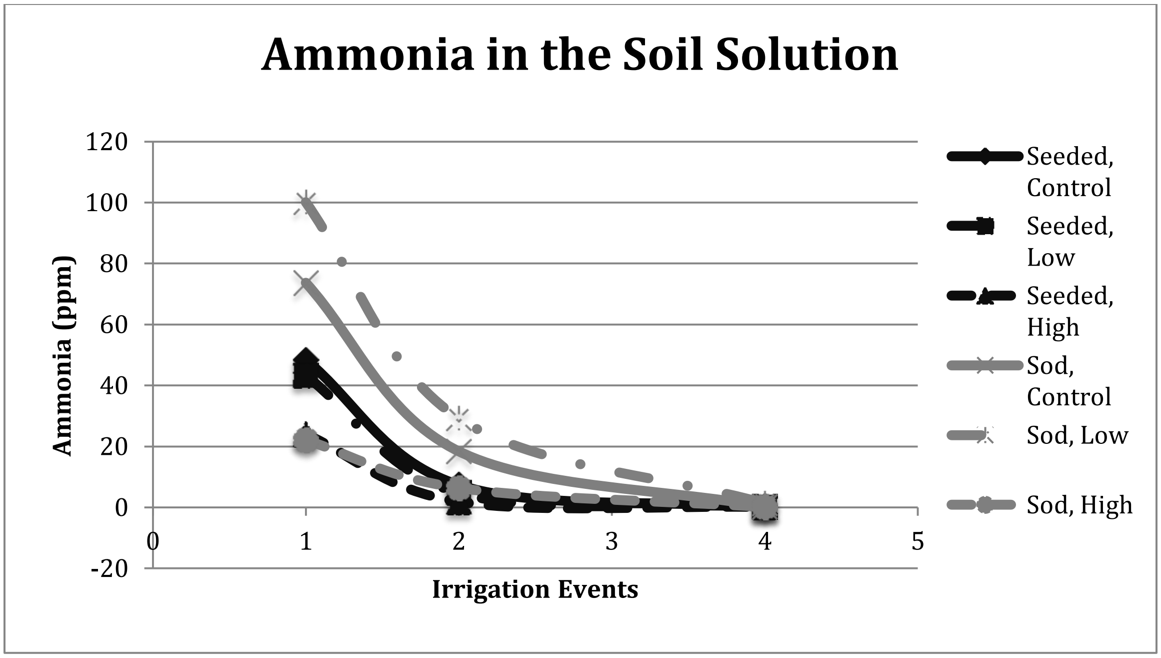
Objectives: To evaluate biochar's ability to reduce nutrient leaching from lawn grass.

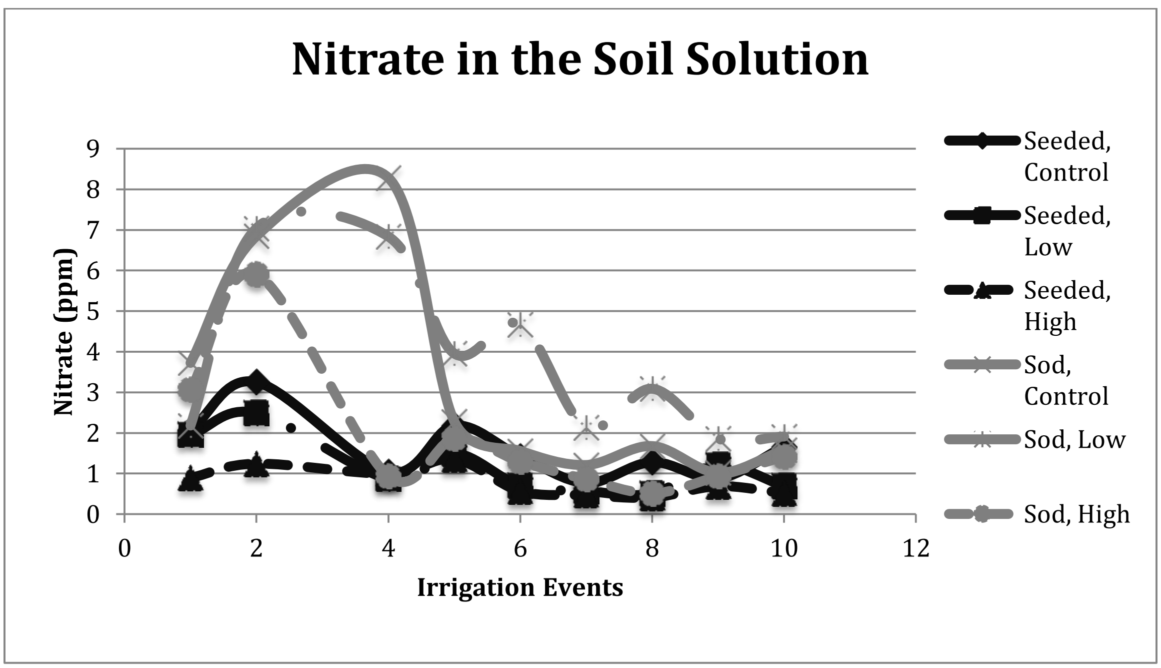
Methods: Biochar (Blue Sky Biochar) and tall fescue seed (450 lb/acre) were sown at roughly the same time, both at UC Riverside and at the West Coast Turf farm in Escondido. Later, the sod from West Coast Turf was transplanted into plots along side the seeded plots at UCR Turfgrass Research Facility. Suction lysimeters were installed in each plot. The plots were fertilized with 2 lb N / 1000 ft^2 using a 15-5-8 fertilizer (BEST Microgreen). Following fertilization, soil solution samples were taken from the lysimeters (Irrometer) after irrigation for 7 weeks. The soil solution was analyzed for nitrate, ammonia and ortho-phosphate concentrations.

Treatments: 3 rates of biochar were applied to each the transplanted grass and the seeded grass: the control rate of 0 tons/acre, the low rate of 2.8 tons/acre, and the high rate of 14 tons/acre.

Results:







Discussion: With phosphate and the ammonia, there is a sharp decrease during the first few irrigation events as the nutrient is taken up by the grass or washed away. The nitrate instead increases as the ammonia nitrifies into nitrate and then decreases as it too is washed away or absorbed. The sod treatments almost always had higher values in all three tested ions, likely because transplanting severs roots of the plants. In most cases the high rate of biochar resulted in lower concentrations of each ion in the soil solution than the corresponding control and low treatments.

Stop # 11: Kikuyugrass Irrigation Deficit Study

Tyler Mock, Jim Baird, and Jon Montgomery

Kikuyugrass (*Pennisetum clandestinum* Hochst. ex Chiov.) is considered either an invasive weed or the desired species on many golf courses and other turf areas along coastal and inland California. As part of a comprehensive project aimed at kikuyugrass improvement and management, a field study was initiated on 10 August 2014 to identify chemical practices in association with deficit irrigation that produce the best possible turf quality. The cultivar 'Whittet' was established from sod on a Hanford fine sandy loam. A two-level, four-factor factorial design was used to evaluate: deficit irrigation (50% ETo vs. 80% ETo), Primo Maxx (0 vs. 0.3 oz/1000 ft^2 biweekly), nitrogen (2 vs. 4 lbs/1000 ft^2/yr), and a wetting agent (0 vs. Revolution 6 oz/1000 ft^2/monthly). Turf quality was assessed visually and using Digital Image Analysis (DIA). Water content was measured using a Time-Domain Reflectometry (TDR) probe.

Location:	UCR Turf Facility
Soil:	Hanford fine sandy loam
Experimental Design:	2^4 Factorial with three replications
Plot Size:	Main plots (irrigation treatment) are 16 ft x 16 ft; Sub-plots (N, Revolution, Primo Maxx) are 4 ft x 8 ft
Sod Established:	25 July 2011
Species/Cultivars	Kikuyugrass 'Whittet'
Fertility:	0.5 lbs N /1000ft^2 $(NH4)_2SO_4$ was applied in January 2014 to entire field. Plots receiving higher N treatment were treated on 10 August 2014 and 7 September with 0.5 lbs N /1000ft^2 $(NH4)_2SO_4$. Total nitrogen was 1.5 lbs N/year and 0.5 lbs N/year on the high and low treatments, respectively by date of the 2014 field day.
Mowing and cultivation:	0.45 inches 3 days/wk using a Baroness walk-behind tee mower. Verticutting on 2 June 2014 using a Ryan Mataway walk behind machine
Irrigation Regime:	50% ETo vs 80% ETo replacement.
Data Collection:	Bi-monthly turfgrass quality, TDR, and DIA ratings.

Preliminary Results and Conclusions:

- ✓ Since the study was started in August 2014 there have been only two rating dates, the first of which showed no differences among any treatments, including ET.
- ✓ Turf quality and Digital Image Analysis results for ratings taken on 3 September 2014 showed significantly higher ratings for treatments 3, 6, and 7 (Figs. 1 and 2). All three treatments contain added nitrogen.
- ✓ Only nitrogen seems to be affecting higher turf quality for now but more significant results are expected over time as stress from the two deficit irrigation treatments begin to show.

Data:

LSD All-Pairwise Comparisons Test of TQ for Treatment

Table 1. Analysis of Variance (ANOVA) results for turf quality rating on 3 Sep 2014. Means followed by the same letter do not significantly differ from one another (p=0.5)

Treatment	Mean	Homogeneous Groups
6	6.1667	A
7	5.7500	AB
3	5.5833	AB
2	5.2500	BC
5	5.2500	BC
1	5.1667	BC
8	5.0000	BC
4	4.5833	C

LSD All-Pairwise Comparisons Test of DIA for Treatment

Table 2. Analysis of Variance (ANOVA) results for Digital Image Analysis rating on 3 Sep 2014. Means followed by the same letter do not significantly differ from one another (p=0.5).

Treatment	Mean	Homogeneous Groups
6	81.312	A
7	76.196	AB
3	71.516	ABC
5	71.414	BC
1	71.113	BC
8	70.076	BC
2	67.895	BC
4	65.054	C

Treatment List:

1. Primo 0.3 oz/M
2. Revolution 6 oz/M
3. Ammonium Sulfate 0.5 lb N/M
4. Primo + Revolution
5. Primo + Ammonium Sulfate
6. Revolution + Ammonium Sulfate
7. Primo + Revolution + Ammonium Sulfate
8. Control

Field Map

*			*			*
	4	6		6	4	
80% ET	3	8		5	3	50% ET
	7	2		2	7	
	5	1		8	1	
*			*			*
	3	8		7	4	
50% ET	2	5		1	6	80% ET
	4	1		3	2	
	7	6		8	5	
*			*			*
	2	8		5	4	
	1	6		8	1	
50% ET	7	3		6	3	80% ET
	5	4		2	7	
*			*			*

Road

North

Stop #12: Updates on Evapotranspiration Adjustment Factor and Spanish Language Materials for Professional Landscapers Projects

2014 UCR Field Day

Janet Hartin and David Fujino, PhD

(jshartin@ucdavis.edu dwfujino@ucdavis.edu)

UC Cooperative Extension and California Center for Urban Horticulture, respectively

Evapotranspiration Adjustment Factor Project
(a contract received from California Department of Water Resources)

Principal Investigators: David Fujino (UC Davis), Janet Hartin (UC Cooperative Extension), & Loren Oki (UC Davis). Project Contractor: Bill Baker (William Baker & Associates).

California's population exceeded 38 million in 2013 and is expected to reach 45 million by the year 2020. This projected increase, coupled with a severe multi-year drought and a statewide water distribution problem, necessitates further conservation of an already limited water supply. Landscape irrigation uses a significant amount of water. Approximately 50 percent of water used to irrigate urban landscapes is used outdoors.

2013 was one of the driest years on record in the state. Governor Jerry Brown recently declared a statewide drought emergency outlining 20 measures to reduce water waste including a 20 percent voluntary water consumption reduction spearheaded by the Department of Water Resources. Increasing the use of practices leading to greater water use efficiency of large-acreage landscapes is consistent with goals of the CALFED Bay-Delta program to maximize existing water resources for assuring a steady and reliable water source for the future of California. California Assembly Bill 1881 resulted in California enacting a law on January 1, 2010 reducing the Evapotranspiration Adjustment Factor (ETAF) from .8 to .7 in new landscapes over 2,500 square feet, mandating further water conserving measures in urban landscapes.

Several 'best management practices' have been developed within UC ANR that can help the landscape industry maintain healthy landscapes and irrigate at or below the newly instated .7 ETAF, including: proper plant selection; proper irrigation system design and installation; hydrozoning; proper irrigation scheduling; mulching; and, regular maintenance of irrigation systems.

The goal of our California Department of Water Resources (DWR) project is to reduce water waste and increase adoption of .7ETAF by the landscape industry by setting up 30 large demonstrations sites at publically and commercially maintained landscape sites that exemplify research-based 'best management practices.' The sites represent a variety of ornamental plants with varying evapotranspiration rates growing under a wide array of plant densities and microclimates.

*Maximum Allowable Water Allowance (MAWA) = (ETo) (0.7) (LA) (0.62)
ETo = Reference Evapotranspiration (inches per year)
0.7 = ET Adjustment Factor
LA = Landscaped Area (square feet)

0.62 = Conversion factor (to gallons)
*Maximum Applied Water Allowance = _______ gallons/year

<u>Example of Maximum Applied Water Allowance (MAWA): Riverside, California</u>

Hypothetical Landscape Area = 50,000 sq ft
MAWA = (Eto) (0.7)* (LA) (0.62)**
MAWA = (51.1) (0.7) (50,000 sq ft) (0.62)
MAWA = 1,108,870 gallons per year
*ET Adjustment Factor ** Conversion factor from inches to gallons

Findings to date include:

- A 3 inch layer of mulch around ornamental plantings can significantly reduce water waste by reducing soil evaporation.
- Landscapes consisting solely of cool season turfgrass (not deemed recreational and therefore non-exempt from the regulation) exceed .7 ETAF.
- Landscapes consisting solely of warm season turfgrass (not deemed recreational and therefore non-exempt from the regulation) often exceed .7 ETAf due to poor irrigation uniformity.
- Landscapes consisting of a mixture of mostly medium and low water using plant species that are drip irrigated and mulched can contain small areas of turfgrass and not exceed .7 ETAF.
- Properly functioning irrigation systems can significantly reduce water waste. Systems with matched heads, proper spacing, proper pressure, and unclogged heads can significantly reduce landscape water waste.
- Irrigating plants based on species, density, and climate and microclimate considerations can significantly reduce landscape water waste.

Water Use Classification of Landscape Species (WUCOLS) Project
(Funded by the California Department of Water Resources & CA Horticulture Industry)

Water conservation is an essential consideration in the design and management of California landscapes. Effective strategies that increase water use efficiency must be identified and implemented. One key strategy to increase efficiency is matching water supply to plant needs. By supplying only the amount of water needed to maintain landscape health and appearance, unnecessary applications that exceed plant needs can be avoided. Doing so, however, requires some knowledge of plant water needs.

WUCOLS IV (the 4th edition, 2014) represents a substantial expansion in the number of plant evaluations. Over 1,500 entries have been added to the 3rd edition list, for a total of 3,546 entries. Essentially, the great majority of taxa available from wholesale nurseries in California are included.

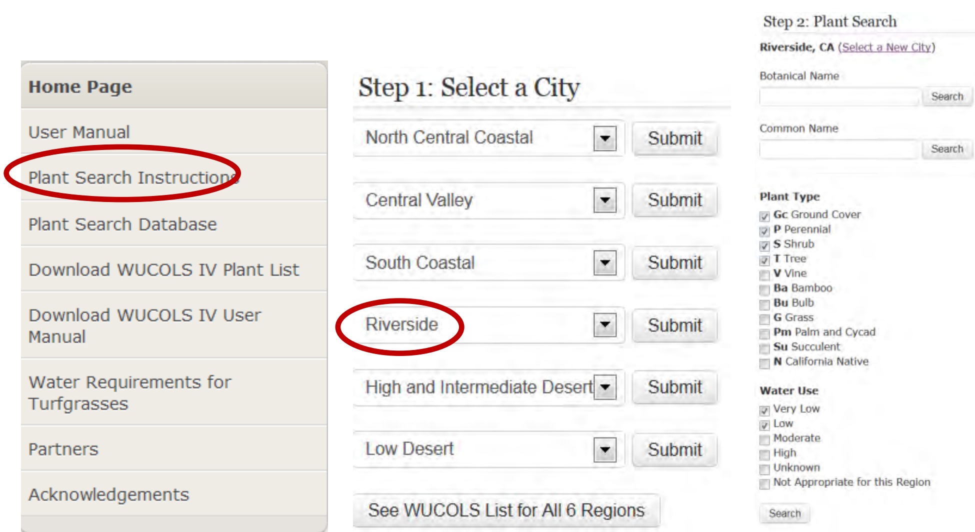
In addition, a number of species evaluations made in previous editions were revisited by the regional committees. If the committees believed that the evaluation of plant water needs should be changed (raised or lowered), it was changed. In some cases, a "?" was replaced by VL, L, M, or H (see the section "Categories of Water Needs"). As a result, users should be aware that species assignments from WUCOLS I, II, or III may not be the same as those found in WUCOLS IV.

WUCOLS IV "Key" Points

1. WUCOLS is a **guide** to plant water needs and is not a method for estimating landscape water needs.
2. WUCOLS evaluations were made by leading horticultural professionals representing 6 different climatic regions in California.
3. Plant water use designation was based on the collective field experience and observations of evaluators. Although limited, available field research was included as well.
4. Plant water use assignments were made by consensus agreement of the evaluators. If a committee did not know a plant, it was not evaluated. If the plant was not appropriate for a region, it was so noted.
5. WUCOLS is a list of 3,546 taxa. Less than 2% of species have been evaluated for water use through field research.
6. WUCOLS evaluations have been adopted for use in many sectors (e.g., academic, professionals, municipalities and water agencies)
7. WUCOLS evaluations serve as an important guide in the selection of species for hydrozones.
8. WUCOLS is not perfect, it is based on "horticultural experience & wisdom", and it serves as a "bridge" to meet a critical need until a "science-based tool or methodology is developed and adopted.

WUCOLS IV Website (http://ucanr.edu/sites/wucols/)

If you are using the WUCOLS list for the first time, it is essential that you read the *User Manual*. The manual contains very important information regarding the evaluation process, categories of water needs, plant types, and climatic regions. It is necessary to know this information to use WUCOLS evaluations and the plant search tool appropriately. To access the *User Manual*, click on the tab (on left) and view specific topics.



WUCOLS IV "Downloadable" Plant List (Riverside Example)

Riverside, CA			
Type	Botanical Name	Common Name	Water Use
S N	Abutilon palmeri	Indian mallow	Low
T	Acacia decurrens	green wattle	Low
P N	Acmispon glaber (Lotus scoparius)	deer weed	Very Low
P	Anacyclus pyrethrum depressus	Mount Atlas daisy	Low
S T N	Arctostaphylos manzanita	common manzanita	Low
S T	Callistemon citrinus	bottle brush	Low
S N	Ceanothus "Ray Hartman"	Ray Hartman ceanothus	Low
Gc N	Ceanothus maritimus "Valley Violet"	Valley Violet ceanothus	Low
P	Coreopsis auriculata "Nana"	dwarf coreopsis	Low
P	Crocosmia hybrids (Tritonia)	montbrieta	Low
Gc P	Dymondia margaretae	dymondia	Low
S N	Ericameria arborescens	golden fleece	Low
S N	Eriogonum giganteum	St. Catherine"s lace	Very Low

Expanding IPM Education to Southern California Spanish-speaking Landscapers

(a contract received from CA Department of Pesticide Regulation)

Principal Investigator: Janet Hartin

Soil runoff and groundwater pollution are leading sources of water quality degradation in urban areas of Southern California and are largely due to overuse and improper use of pesticides and fertilizers. Approximately 75,000 Spanish-speaking landscapers and gardeners make decisions and/or apply pesticides and fertilizers annually in Southern California. Many lack adequate expertise in Integrated Pest Management (IPM) and safe use of pesticides in part due to inadequate training opportunities available in Spanish. Increasing educational services stressing pest prevention to this large clientele – which has quadrupled over 20 years - can significantly reduce overuse and misuse of pesticides in urban environments and improve the health and safety of the work environment for this segment of the profession.

A group of UC and external industry partners developed and provided educational services to over 400 Spanish-speaking landscapers at 13 workshops throughout Southern California that included hands-on as well as classroom training. Specific curriculum and activities used in the training was based on the results of focus groups and individual interviews that assessed the specific needs of this large clientele.

Subject matter for the workshops included peer-reviewed materials from UC and other sources.

Specific practices taught included:

- Proper plant selection (based on climate and microclimate conditions)

- Proper planting techniques (planting depth, planting density to prevent poor air circulation etc.)

- Proper irrigation system design and installation

- Use of recommended maintenance practices to prevent pest outbreaks such as

    - irrigation scheduling based on plant water needs (as estimated by plant symptoms/health; weather-based measurements measured by CIMIS (temperature, solar radiation, relative humidity, and wind speed)

- fertilization (correct rate, method, timing)

- recommended pruning practices

- other (turf mowing, aeration, verticutting)

- Regular monitoring for pest outbreaks/Early pest detection and identification

- Use of chemical pesticides as a last resort in a safe and effective manner (this module will include laws and regulations regarding safe pesticide handling and use)

The project includes strong evaluation elements that will measure its impact. Specific tools include measuring change in subject matter expertise 'pre' and 'post' training and an assessment of pesticide use three months post-training which will be compared to benchmark data established before training occurred. The project was built on and greatly expanded work previously completed on a DPR Alliance grant to provide enhanced educational services to Spanish-speaking residential gardeners in San Luis Obispo County and is oriented more to public and private landscape clientele rather than residential gardeners.

National Turfgrass Evaluation Program Tests

University of California, Riverside

Priti Saxena and Jim Baird

Introduction

National Turfgrass Evaluation Program (NTEP) is a program recognized world-wide that evaluates turfgrass cultivars and selections in more than forty U.S. states and seven Canadian provinces (www.ntep.org). The objective of NTEP is to provide information about turfgrass cultivars that can be utilized by the turfgrass researchers, extension specialists, breeders, sod growers, and other landscape/government personnel for their respective turfgrass uses and management. Evaluations are performed on turfgrass quality, density, drought tolerance, diseases and other abiotic and biotic stresses at different locations. This information is helpful in determining the performances of cultivars and selections in various environments.

UCR currently manages 4 NTEP tests with 5 new tests planned for fall 2014. The evaluation ratings are sent to NTEP personnel for further analysis and publications.

NTEP Tall fescue trial: 2012-2017

- Establishment: Three replications of each entry established in randomized complete block design in 25 sq. ft. treatment plots.
- Management: Mowing height: 2.0” to 3.0”
- Nitrogen rate: 0.25 – 0.5 lbs N/1000sq. ft./growing month
- Irrigation: 80-95% of potential ET; or to prevent stress dormancy

2012 NTEP Tall Fescue

12 E-1 (North↑)

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99
100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117

(5 ft x 5 ft plot)

No.	Name	No.	Name	No.	Name
1	Terrano	41	Burl TF-2(GTO)	81	PPG-TF-157
2	Ky-31	42	Burl TF-136(Hot Rod)	82	PPG-TF-169
3	Regenerate	43	LTP-FSD	83	PPG-TF-170
4	Fesnova	44	LTP-TWUU	84	PPG-TF-137
5	ZW 44	45	LTP-F5DPDR	85	PPG-TF-135
6	W45	46	IS-TF 289	86	PPG-TF-115
7	U43	47	MET 6 SEL	87	PPG-TF-105
8	LSD(rhambler 2 SRP)	48	IS-TF 330	88	PPG-TF-172
9	Aquaduct	49	IS-TF-287	89	PPG-TF-151
10	Catalyst	50	IS-TF 307 SEL	90	PPG-TF-152
11	Marauder	51	IS-TF 308 SEL	91	PPG-TF-148

12	Warhawk	52	IS-TF 311	92	PPG-TF-150
13	Annihilator	53	IS-TF 285	93	BIZEM
14	Comp. Res. SST	54	IS-TF 310 SEL	94	CCR2
15	204 Res. Blk4	55	IS-TF 272	95	MET-3
16	JS 819	56	ATF 1736	96	W41
17	JS 818	57	ATF 1754	97	PPG-TF-145
18	JS 809	58	Hemi	98	PPG-TF-138
19	JS 916	59	Firebird 2	99	PPG-TF-139
20	JS 825	60	Bullseye	100	PPG-TF-142
21	MET 1	61	PST-5EV2	101	RAD-TF-89
22	F711	62	PST-5GRB	102	RAD-TF-92
23	IS-TF 291	63	PST-5SALT(Saltillo)	103	GO-DFR
24	IS-TF 276 M2	64	PST-5SDT(Rain Dance)	104	K12-MCD
25	IS-TF 305 SEL	65	PST-5DZP	105	PST-5EX2
26	IS-TF 269 SEL	66	PST-5RO5	106	PST-5MVD
27	IS-TF 282 M2	67	PST-5BPO	107	RAD-TF-83
28	IS-TF 284 M2	68	PST-5BRK	108	RAD-TF-88
29	OR-21(Temptation)	69	DB1	109	BAR Fa 120878
30	TY 10 (Caesar)	70	RZ2	110	BAR Fa 121089
31	Exp TF-09(Frontline)	71	TD1	111	BAR Fa 121091
32	SRX-TPC	72	DZ1	112	BAR Fa 121095
33	PSG-WE1	73	T31	113	PST-R5NW(Inspiration)
34	Pick-W43	74	PSG-GSD	114	Burl TF-69
35	Grande 3	75	PSG-8BP2	115	Falcon IV
36	PSG-PO1	76	PSG-TT4	116	Falcon V
37	U45	77	Faith	117	Blank
38	B23	78	K12-13		
39	ATF 1612	79	K12-05		
40	ATF 1704	80	PPG-TF-156		

<u>NTEP Zoysiagrass shade study</u>: 2012 -2017

- Establishment: Three replications of each entry established in 2012 in randomized complete block design in 25 sq. ft. treatment plots
- Management: Mowing height: 1.5” to 2.0”
- Nitrogen rate: 0.0 – 0.25 lbs N/1000sq. ft. /growing month
- Irrigation: to prevent dormancy or severe stress
- Pre-emergence grass control and broadleaf weed control were applied to control weeds.
- 60% shade cloth was installed 15 August 2014.

NTEP Zoysiagrass
12F-1 (North↑)

(5 ft x 5 ft plot)

1	10	8	21	20	35	6	14	9
2	11	5	7	31	25	12	28	24
3	32	29	34	22	18	30	17	19
23	33	7	4	13	36	16	15	26
22	14	32	25	34	13	11	7	24
26	35	20	10	15	4	33	16	5
9	6	1	36	29	19	3	12	23
28	17	30	8	27	21	31	18	2
28	13	2	9	36	26	19	24	10
23	32	4	6	15	21	31	20	5
7	16	34	25	14	29	3	12	11
8	22	30	35	17	27	33	18	1

No.	**Name**	**Type**	**No.**	**Name**	**Type**
1	Meyer	Vegetative	19	FAES 1309	Vegetative
2	Zeon	Vegetative	20	FAES 1310	Vegetative
3	Empire	Vegetative	21	FAES 1312	Vegetative
4	10-TZ-35	Vegetative	22	FAES 1313	Vegetative
5	10-TZ-1254	Vegetative	23	FAES 1314	Vegetative
6	09-TZ-5320	Vegetative	24	FAES 1315	Vegetative
7	09-TZ-54-0	Vegetative	25	FAES 1316	Vegetative
8	CGZ504	Vegetative	26	FAES 1317	Vegetative
9	11-TZ-4321	Vegetative	27	FAES 1318	Vegetative
10	DALZ 1303	Vegetative	28	FAES 1319	Vegetative
11	CSZ 1105	Vegetative	29	FAES 1322	Vegetative
12	CSZ 1109	Vegetative	30	FAES 1328	Vegetative
13	FAES 1303	Vegetative	31	FAES 1329	Vegetative
14	FAES 1304	Vegetative	32	DALZ 1301	Vegetative
15	FAES 1305	Vegetative	33	DALZ1302	Vegetative
16	FAES 1306	Vegetative	34	KSUZ 1201	Vegetative
17	FAES 1307	Vegetative	35	A-1	Vegetative
18	FAES 1308	Vegetative	36	Blank	

NTEP Bermudagrass: 2012-2017

- Establishment: Three replications of each entry established in 2012 in randomized complete block design in 25 sq. ft. treatment plots
- Management: Mowing height: 0.5” to 1.0”, mowing frequency: 2-4 times/week
- Nitrogen rate: 0.5 – 1.0 lbs N/1000sq. ft./growing month
- Irrigation: to prevent stress

NTEP Bermudagrass
12E-8 (North ↑)

(5 ft x 5 ft plot)

1	10	8	21	20	35	6	14	9
2	11	5	27	31	25	12	28	24
3	32	29	34	22	18	30	17	19
23	33	7	4	13	36	16	15	26
22	14	32	25	34	13	11	7	24
26	35	20	10	15	4	33	16	5
9	6	1	36	29	19	3	12	23
28	17	30	8	27	21	31	18	2
28	13	2	9	36	26	19	24	10
23	32	4	6	15	21	31	20	5
7	16	34	25	14	29	3	12	11
8	22	30	35	17	27	33	18	1

No.	Name	Type	No.	Name	Type
1	Tifway	Vegetative	19	North Shore SLT	Seeded
2	Latitude 36	Vegetative	20	12-TSB-1	Seeded
3	Patriot	Vegetative	21	MSB 281	Vegetative
4	Celebration	Vegetative	22	11-T-251	Vegetative
5	NuMex-Sahara	Seeded	23	11-T-510	Vegetative
6	Princess 77	Seeded	24	DT-1	Vegetative
7	MBG 002	Seeded	25	FAES 1325	Vegetative
8	OKS 2009-3	Seeded	26	FAES 1326	Vegetative
9	OKS 2011-1	Seeded	27	FAES 1327	Vegetative
10	OKS 2011-4	Seeded	28	PST-R6P0	Seeded
11	JSC 2-21-1-v	Vegetative	29	PST-R6T9S	Seeded
12	JSC 2-21-18-v	Vegetative	30	PST-R6CT	Seeded
13	JSC 2007-8-2	Seeded	31	BAR C291	Seeded
14	JSC 2007-13-s	Seeded	32	OKC 1131	Vegetative
15	JSC 2009-2-s	Seeded	33	OKC 1163	Vegetative
16	JSC 2009-6-s	Seeded	34	OKC 1302	Vegetative
17	Riviera	Seeded	35	Astro	Vegetative
18	Yukon	Seeded	36	Blank	

NTEP Perennial Ryegrass: 2008-2013

- Establishment: Three replications of each entry established in 2008 in randomized complete block design in 24 sq. ft. treatment plots.
- Management: Mowing height 2.25" – 2.5"
- Nitrogen rate: 0.25 – 0.5 lbs N/1000sq. ft./growing month
- Irrigation: to prevent stress
- Pre-emergence and herbicide to control broadleaf weeds and other grasses

NTEP Perennial Ryegrass
12E-6 (North↑)

(4 ft x 6 ft plot)

81	42	58	80	88	14	80
72	34	57	79	87	63	40
7	3	56	78	86	60	67
87	59	55	77	85	35	81

86	47	54	76	84	87	56
71	61	53	75	83	66	27
73	68	52	74	82	20	11
30	19	51	73	81	54	62
60	83	50	72	12	16	7
77	18	49	71	62	21	9
82	31	48	70	43	36	51
13	23	47	69	15	10	64
36	76	46	68	48	24	4
53	88	45	67	38	25	30
85	63	44	66	29	79	75
6	65	43	65	57	71	45
64	80	42	64	88	38	29
10	66	41	63	58	34	31
39	54	40	62	5	59	47
1	32	39	61	68	55	18
84	74	38	60	83	28	86
4	58	37	59	33	53	13

No.	**Name**	**No.**	**Name**
1	Rinovo	45	Vintage (ISG-36)
2	CL 11601	46	Excellence (ISG-31)
3	Pizzazz 2 GLR (PR 909)	47	A-35
4	Pangea GLR (CL 11701)	48	CS-PR66

5	Sunstreaker (APR 2036)	49	Pillar (CST)
6	Linn	50	JR-178
7	Uno	51	JR-192
8	DLF LGD-3026	52	SR 4650 (PSRX-3701)
9	DLF LGD-3022	53	Karma (PICK 10401)
10	Sideways (PSRX-S84)	54	Mach I
11	Wicked (SRX-4RHD)	55	RAD-PR62
12	Playoff 2 (P02)	56	RAD-PR55R
13	Evolution (S85)	57	Riptide (IS-PR 409)
14	LTP-RAE	58	Bandalore (IS-PR 463)
15	Allante	59	Thrive (IS-PR 469)
16	Insight	60	Hancock (IS-PR 479)
17	Sienna	61	Stamina (IS-PR 487)
18	Brightstar SLT	62	Monsieur (IS-PR 488)
19	CL 307	63	Banfield (IS-PR 489)
20	APR 2320	64	Aspire (IS-PR 491)
21	Haven (APR 2038)	65	Diligent (IS-PR 492)
22	Green Supreme (PPG-PR 121)	66	DLF LGT 4182
23	PPG-PR 128	67	Seductive (ISG-30)
24	Fastball RGL (PPG-PR 133)	68	Salinaii (PST-204D)
25	Stellar 3GL (PPG-PR 134)	69	PST-2NKM
26	LTP-PR 135	70	PST-2DR9
27	PPG-PR 136	71	Pacific GEM (PST-2MG7)
28	Premium (PPG-PR 137)	72	PST-2TQL
29	Amazing A+ (PPG-PR 138)	73	Dominator (PST-2AG4)
30	Apple SGL (PPG-PR 140)	74	MANHATTAN 6 GLR (PST-2MAGS)
31	PPG-PR 142	75	PST-2K9
32	Provost (PPG-PR 143)	76	PST-2BNS
33	Grand Slam GLD (PPG-PR 164)	77	PST-2ACR
34	PPG-PR 165	78	Rio Vista
35	BAR Lp 10969	79	Octane
36	BAR Lp 10972	80	Bonneville
37	BAR Lp 10970	81	PSRX-4CAGL
38	PST-2NJK	82	GO-DHS
39	BAR Lp 7608	83	GO-PR60
40	Pinnacle	84	Sox Fan (GM3)
41	APR 2445	85	PRX-4GM1
42	Fiesta 4	86	SR4660ST (SRX-4MSH)
43	GO-G37	87	Pick 4DFHM
44	Prominent (CS-20)	88	Palmer V

Summary:

- NTEP is essential to compare cultivars at different locations of USA and Canada

- The standards of NTEP help individuals, institutes and companies to make decisions regarding the best performing cultivars and selections for a particular region.
- UCR manages all NTEP trial as per required standards and ratings.

Save the Date

UCR Turfgrass & Landscape
Research Field Day

Thursday, September 17, 2015

See you then!

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