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Turfgrass & Landscape Research Field Day

September 17, 2015

University of California Agriculture and Natural Resources

UCR | Turfgrass Science

CA TURFGRASS & LANDSCAPE FOUNDATION
"Keeping California Green and Growing"

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Welcome to Field Day!

On behalf of the entire UCR Turfgrass and Landscape Team, welcome (back) to the 2015 UCR Turfgrass and Landscape Research Field Day. This marks the eighth 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. As the current drought has worsened, landscape plants and especially turf have taken more than their fair share of criticism in the court of public opinion and from those who regulate water use. UCR has been addressing turfgrass and landscape water conservation practices long before this drought and will continue to do so come future El Niños or not. Today, you will see and hear about cutting edge new and longstanding research that addresses pest, water, and salinity management issues on turf and landscape. For the fourth 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. 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 our new website, **turfgrass.ucr.edu**.

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, Rachel Anders, and Tianna Diaz. Production of this publication, signs, and online reports would not have been possible without assistance from Mr. Toan Khuong (Associate Specialist) and Ms. Magali Lopez (UCR Class of 2010). Staff and students from UCANR, 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 15, 2016.**

Sincerely,

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

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- West Coast Turf
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- Yara

CIMIS Data Sep. 2014 – Aug. 2015

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

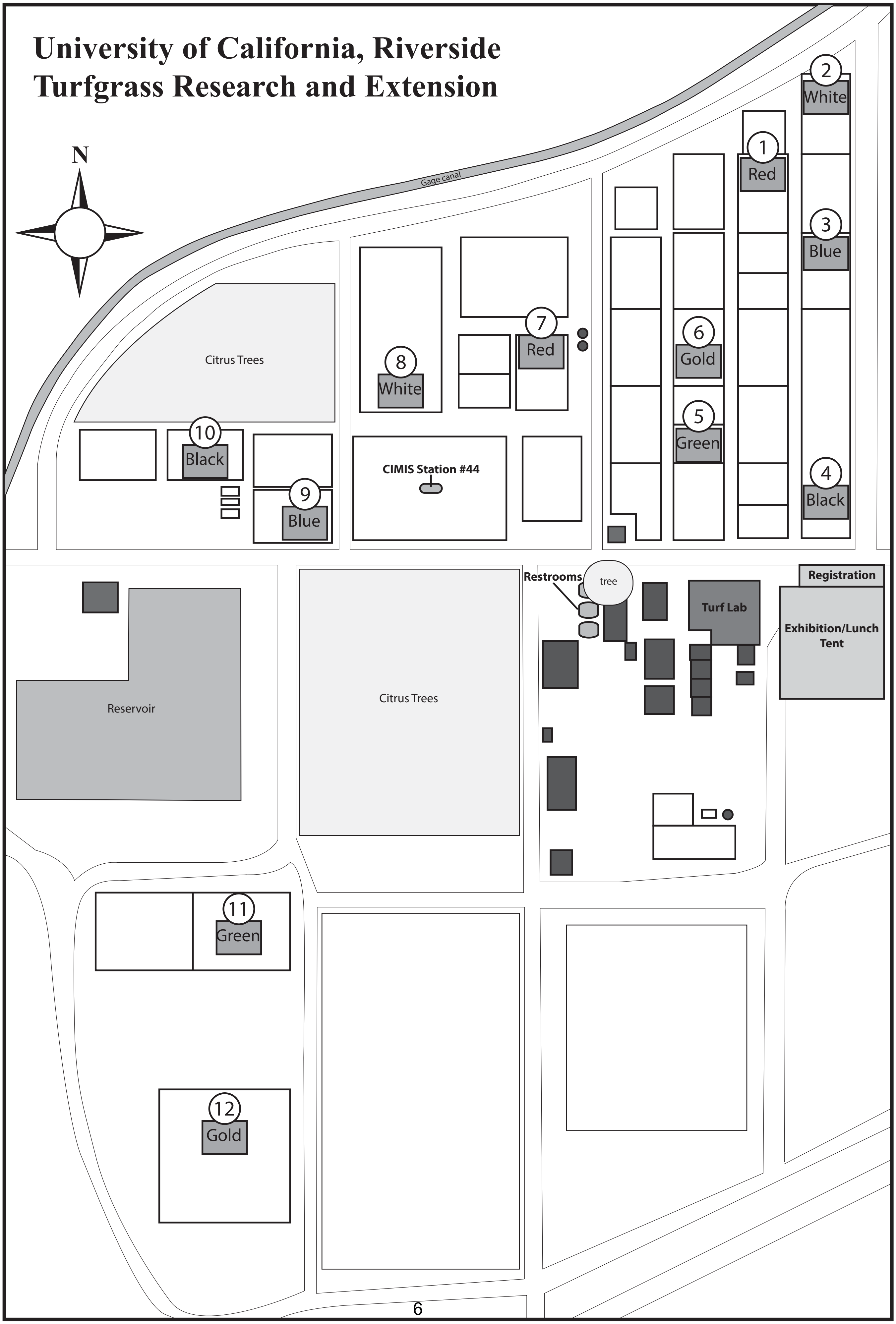
Month Year	Tot ETo (in)	Tot Precip (in)	Avg Sol Rad (Ly/day)	Avg Vap Pres (mBars)	Avg Max Air Tmp (F)	Avg Min Air Tmp (F)	Avg Air Tmp (F)	Avg Max Rel Hum (%)	Avg Min Rel Hum (%)	Avg Rel Hum (%)	Avg Dew Point (F)	Avg Wind Speed (mph)	Avg Soil Temp (F)
Sep 2014	6.19 K	1.45	538 K	14.7	91.6 K	64.6 L	76.7 K	72	27	48 K	54.6 K	3.8	73.4
Oct 2014	4.4 K	0.00 K	419 K	11.6 K	84.9	57.7	69.8 K	71 K	27 K	49 K	47.5 K	3.3 K	67.4 K
Nov 2014	3.21	0.20 K	297 K	7.5 K	75.0 K	49.7 K	62.2 K	61 K	25 K	41 K	34.4 K	3.6 K	59.4 K
Dec 2014	2.01 K	2.81 K	212	8.9 K	64.8 K	46.5 K	55.0 K	75	41	59 K	39.5 K	3.8 K	55.2
Jan 2015	2.83	0.53 K	262	7.1 K	70.5	46.1 K	57.5 K	66	27	45 K	34.3 K	3.8 K	52.1
Feb 2015	3.32	0.73 K	376 K	8.7 K	74.6 K	48.1	60.1 K	73	28	50 K	39.9 K	3.5 K	57.3 K
Mar 2015	5.85	0.24 K	509 K	8.0	79.3 K	51.6 K	65.0 K	64	22	40 K	37.6 K	4.2 K	60.1
Apr 2015	6.28	0.51 K	582 K	8.2 K	76.2	50.8 K	63.4	68	26	44 K	38.2 K	4.7 K	63.0 K
May 2015	5.37	0.71 K	515 K	11.2	73.6	53.7 L	62.5	77	40	59	47.3	4.3	66.1 K
Jun 2015	7.46 K	0.02	664 K	13.6	88.7 K	61.7 K	74.2 K	75	28	48 K	52.6 K	4.2	72.1
Jul 2015	6.75 K	1.19 K	583 K	16.1	87.4 K	64.1 L	74.3	79	35	56	57.3	4.3 K	74.3
Aug 2015	7.65	0 .00	632 K	15.0 K	92.8	65.4 L	78.0	72	26	47 K	55.1 K	4.0 K	75.0
Totals/Avgs	61.32	8.39	466	10.9	80.0	55.0	66.6	71	29	49	45	4.0	64.6

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	25.4 mm = inch	C = 5/9 * (F -32)

m/s = 0.447 mph	kPa = 0.1 mBars

University of California, Riverside
Turfgrass Research and Extension



Turfgrass and Landscape Research Field Day Agenda

<u>**7:00 am**</u>	**Exhibitor set-up**
<u>**7:30-8:30 am**</u>	**Registration and Trade Show**
<u>**8:30 am**</u>	**Welcome and Introductions** Steve Ries, Mikeal Roose, and Jim Baird
<u>**8:40-10:00 am**</u>	**Field Tour Rotation #1 (20 minutes/station; choose 4 stops)**
Stop #1 *Red Tent*:	**Effects of Fungicides and Wetting Agents on Drought Stress and Recovery from Aeration on a Creeping Bentgrass Putting Green** Tyler Mock
Stop #2 *White Tent*:	**Groundcovers and Buffalograss under Extreme Deficit Irrigation** Don Merhaut and Dennis Pittenger
Stop #3 *Blue Tent*:	**Evaluation of Natural and Hybrid Turf for Water Conservation** Jon Montgomery
Stop #4 *Black Tent*:	**Research Update: Minimum Irrigation Requirements of Large Publically and Privately Maintained Landscapes** Janet Hartin, Lorence Oki, Dave Fujino, and Bill Baker
Stop #5 *Green Tent*:	**NTEP Cultivar Trials: Tall Fescue, Fine Fescue, Bentgrass, Bermudagrass, Zoysiagrass** Jim Baird
Stop #6 *Gold Tent*:	**Best Management Practices for Turf under Drought or Water Use Restrictions** Marco Schiavon
<u>**10:00 – 10:30 am**</u>	**Break and Trade Show**
<u>**10:30 – 11:50 am**</u>	**Field Tour Rotation #2 (20 minutes/station; choose 4 stops)**
Stop #7 *Red Tent*:	**Evaluation of Products for Alleviation of Salinity and Drought Stress** Marco Schiavon and Matteo Serena
Stop #8 *White Tent*:	**Plant Growth Regulators for Bermudagrass Management** Pawel Petelewicz
Stop #9 *Blue Tent*:	**Preemergence Control of Crabgrass in Bermudagrass and Postemergence Control of Crabgrass in Tall Fescue** Jim Baird and Giulio Cremonese
Stop #10 *Black Tent*:	**Evaluation of Fungicides for Control of Anthracnose on Annual Bluegrass Putting Greens** Tyler Mock
Stop #11 *Green Tent*:	**UCR Turfgrass Breeding Project** Adam Lukaszewski
Stop #12 *Gold Tent*:	**Effects of Biochar and Biosolid Soil Amendments on Tall Fescue under Deficit Irrigation** Milt McGiffen and Jon Montgomery
<u>**12:00 – 1:30 pm**</u>	**Barbeque Lunch and Trade Show**
<u>**1:30 pm**</u>	**Adjourn**

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

STOP #1: Effects of Fungicide Programs on Creeping Bentgrass Quality and Recovery from Aeration and Drought Stress

Jim Baird, Marco Schiavon, Giulio Cremonese, and Tyler Mock
Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521

Background:

Certain fungicides can have secondary benefits on plant health in addition to providing disease control. Previous field and greenhouse research conducted by UCR has demonstrated that fungicide plant health benefits in response to water deficit stress are minimal when disease pressure is negligible or absent.

Objectives:

Evaluate fungicide program effects on the rate of recovery following core aeration and the onset of drought stress and recovery following irrigation.

Study Conditions:

Soil:	Sand
Species:	'Pure Distinction' Creeping Bentgrass
Height:	0.125 inches; 5 times/wk
Spray Information:	CO_2-powered backpack sprayer TeeJet 8003VS nozzles; 9-inch spacing; 2 gal/M
Design:	Randomized block (by drainage patterns/history of drought stress symptoms); 9 replications
Plot size:	4 ft x 6 ft; 2-ft alleys
Important Dates:	17 April 2015 (1st fungicide application) 1 May 2015 (2nd) 18 May 2015 (3rd) 29 May 2015 (4th) **4 June 2015 (1/2-inch tine core aeration + sand)** 14 June 2015 (5th) 27 June 2015 (6th) **29 June to 6 July 2015 (water withheld)** 10 July 2015 (7th) 28 July 2015 (8th) **5 August 2015 (solid tine aeration + sand)** 13 August 2015 (9th) 21 August 2015 (10th) 3 September 2015 (11th) **10 September 2015 (1/2-inch tine core aeration + sand)** 18 September 2015 (12th)

Treatments:

1. Syngenta Basic

Date	**Product**	**Rate (oz/M)**
April 17	Headway	3.0
May 1	Heritage Qualibra	0.4 6.0
May 18	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125
May 29	Heritage Qualibra	0.4 6.0
June 4	**Core Aeration**	
June 14	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125
June 27	Heritage Qualibra	0.4 6.0
June 29 to July 6	**Dry Down**	
July 10	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125
July 28	Daconil Weather Stik Signature Heritage Primo Maxx Qualibra	3.6 4.0 0.4 0.125 6.0
August 5	**Solid Tine Aeration**	
August 13	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125
August 21	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125
September 3	Heritage Qualibra	0.4 6.0
September 10	**Core Aeration**	
September 18	Daconil Weather Stik Signature Primo Maxx	3.6 4.0 0.125

2. Syngenta Premium

Date	Product	Rate (oz/M)
April 17	Headway Secure	3.0 0.5
May 1	Heritage Action Qualibra	0.4 6.0
May 18	Daconil Action Appear Primo Maxx	3.5 6.0 0.125
May 29	Heritage Action Qualibra	0.4 6.0
June 4		**Core Aeration**
June 14	Daconil Action Appear Velista Primo Maxx	3.5 6.0 0.5 0.125
June 27	Heritage Action Qualibra	0.4 6.0
June 29 to July 6		**Dry Down**
July 10	Daconil Action Appear Velista Primo Maxx	3.5 6.0 0.5 0.125
July 28	Daconil Action Appear Briskway Primo Maxx Qualibra	3.5 6.0 0.72 0.125 6.0
August 5		**Solid Tine Aeration**
August 13	Daconil Action Appear Velista Primo Maxx	3.5 6.0 0.5 0.125
August 21	Daconil Action Appear Velista Primo Maxx	3.5 6.0 0.5 0.125
September 3	Heritage Action Qualibra	0.4 6.0
September 10		**Core Aeration**
September 18	Briskway Appear Primo Maxx	0.72 6.0 0.125

3. Control (minimal fungicide inputs)

Date	Product	Rate (oz/M)
April 17	Daconil Weather Stik Heritage	3.6 0.4
May 1		
May 18		
May 29	Daconil Weather Stik	3.6
June 4		**Core Aeration**
June 14		
June 27	Heritage	0.4
June 29 to July 6		**Dry Down**
July 10		
July 28	Heritage	0.4
August 5		**Solid Tine Aeration**
August 13		
August 21	Daconil Weather Stik	3.6
September 3		
September 10		**Core Aeration**
September 18	Heritage	0.4

4. Bayer

Date	Product	Rate (oz/M)
April 17	Tartan	2.0
May 1	Signature Xtra Stressgard Daconil Action Revolution	4.0 3.2 6.0
May 18	Tartan	2.0
May 29	Signature Xtra Stressgard Daconil Action Revolution	4.0 3.2 6.0
June 4		**Core Aeration**
June 14	Signature Xtra Stressgard Daconil Action	4.0 3.2
June 27	Signature Xtra Stressgard Interface Revolution	4.0 4.0 6.0
June 29 to July 6		**Dry Down**
July 10	Signature Xtra Stressgard Daconil Action	4.0 3.2
July 28	Signature Xtra Stressgard Honor Revolution	4.0 1.1 6.0
August 5		**Solid Tine Aeration**
August 13	Signature Xtra Stressgard 26GT	4.0 4.0
August 21	Signature Xtra Stressgard Honor	4.0 1.1
September 3	Signature Xtra Stressgard Interface Revolution	4.0 4.0 6.0
September 10		**Core Aeration**
September 18	Interface	4.0

5. BASF

Date	Product	Rate (oz/M)
April 17	Encartis	0.3
May 1	Tourney Revolution	0.37 6.0
May 18	Signature Daconil Ultrex 26GT	2.0 3.2 4.0
May 29	Lexicon Intrinsic Revolution	0.34 6.0
June 4		**Core Aeration**
June 14	Lexicon Intrinsic Daconil Ultrex	0.34 3.2
June 27	Lexicon Intrinsic Revolution	0.34 6.0
June 29 to July 6		**Dry Down**
July 10	Signature Daconil Ultrex 26GT	2.0 3.2 4.0
July 28	Lexicon Intrinsic Revolution	0.34 6.0
August 5		**Solid Tine Aeration**
August 13	Segway Tourney Daconil Ultrex	0.9 0.37 3.2
August 21	Lexicon Intrinsic	0.34
September 3	Signature Daconil Ultrex Tourney Revolution	4.0 3.2 0.37 6.0
September 10		**Core Aeration**
September 18	Encartis	4.0

6. Control (no fungicides)

Date	Product	Rate (oz/M)
April 17		
May 1	Revolution	6.0
May 18	Primo Maxx	0.125
May 29	Revolution	6.0
June 4	**Core Aeration**	
June 14	Primo Maxx	0.125
June 27	Revolution	6.0
June 29 to July 6	**Dry Down**	
July 10	Primo Maxx	0.125
July 28	Primo Maxx Transition HC Revolution	0.125 3.0 6.0
August 5	**Solid Tine Aeration**	
August 13	Primo Maxx Transition HC	0.125 1.5
August 21	Primo Maxx Transition HC	0.125 1.5
September 3	Transition HC Revolution	3.0 6.0
September 10	**Core Aeration**	
September 18	Transition HC	1.5

Plot Plan (Field 12E-22):

North ↑

5	**3**	**2**	**1**	**4**
1	**4**	**4**	**6**	**3**
6	**2**	**5**	**3**	**5**
3	**6**	**1**	**2**	**4**
4	**1**	**2**	**6**	**3**
6	**5**	**X**	**2**	**1**
4	**3**	**1**	**5**	**1**
4	**5**	**6**	**3**	**6**
2	**3**	**4**	**2**	**5**
2	**2**	**4**	**6**	**3**
1	**5**	**6**	**5**	**1**

Results:

No.	Program	Green Cover (%) 29 June 2015	Green Cover (%) 6 July 2015	Green Cover (%) 14 August 2015
1	Syngenta Basic	98.3378 c	78.5517 d	79.5797 bc
2	Syngenta Premium	98.9906 b	86.7061 bcd	88.0794 ab
3	Control (Minimum inputs)	98.9633 b	93.2629 ab	75.2049 c
4	Bayer	99.7190 a	96.7210 a	87.2112 ab
5	BASF	99.0356 b	82.2748 cd	54.5170 d
6	Control (No fungicides)	98.1066 c	90.3167 abc	96.9729 a

Green cover analyzed using digital image analysis.
Means followed by the same letter in a column are not significantly different (P = 0.05).

Preliminary Results:

- ✓ Despite 9 replications and attempts to block accordingly, there was considerable variation in soil conditions ranging from severe drought stress/LDS (SE corner) to no turf stress (NW corner). Data shown include all 9 replications/treatment. Preliminary data analysis with outlier plots removed did not appear to resolve this dilemma.
- ✓ No significant treatment differences were found for turf quality or soil moisture (TDR) throughout the study.
- ✓ Differences in % Green Cover were detected between June 24 and July 6, and on August 7 and 14 only.
- ✓ Differences in NDVI occurred from 29 June to 2 July 2015 only (data not shown).
- ✓ It appeared that the Bayer program helped to expedite turf recovery following the first core aeration. However, this and most of the other programs were not different from the controls following subsequent dry down and aeration events. Bayer contained the darkest green pigment among the fungicide treatments, which usually resulted in higher visual turf quality ratings and may have been responsible for increased green cover ratings using digital image analysis. To test this theory, Transition HC pigment was incorporated into the no fungicide control treatment (#6) beginning July 28. The green was aerated using solid tines and topdressed on August 5 to help recovery from turf loss during the dry down in early July. Subsequent Green Cover measurements showed the highest value for treatment #6. On the other hand, when NDVI was significant, lowest values were recorded for treatment #4 (the darkest green pigment).
- ✓ Thus far, these data support previous findings at UCR that fungicides have little or no positive impact on turf health in an environment where there is low disease pressure. However, in a separate ongoing fungicide trial in northern California, the secondary benefits of fungicides on turf health are clearly evident among visible anthracnose and rapid blight disease pressure.
- ✓ Core aeration was repeated 10 September 2015 and recovery measurements are being collected until October.

Stop #2: Evaluation of Groundcovers with no Supplemental Summer Irrigation for Water Conserving Landscapes

Donald Merhaut[1], Dennis Pittenger[1], and Jim Baird[2]
[1]University of California Cooperative Extension;
[2]Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521

Project Overview:

In response to the required and/or voluntary reduction in irrigation application, we have continued the groundcover study to determine how plants perform when receiving no summer irrigation. Irrigation at 60% of ET_o was stopped in mid-June. The only irrigation event since then was July 29th, 2015, when the plots received 1.0 in. of water through overhead irrigation, and there was about 1.24 in. of precipitation July 18-19. There are 13 groundcover plant materials and one turfgrass managed as a groundcover. Plots have been established for 5 years. The plants represent a mix of native, so-called California-Friendly, and non-native as well as woody and herbaceous plant materials (Table 1). Replicated field plots were planted in late 2009 through early 2010.

Current Results:

To date, the best performers are: lantana, star Jasmine, honeysuckle, red apple, ice plant, rosemary, sedums, and juniper. These plants show very few signs if any of drought stress. Lantana has smaller leaves that are becoming more purple than green. Rosemary has slowed in growth but has good color. Star Jasmine is beginning to experience a small amount of leaf burn. The growth of honeysuckle has slowed and the new growth has smaller leaves, but there are no symptoms of leaf burn. Sedums have slowed in growth and are off-color with more red pigment in some of the plant material. Red apple and juniper are beginning to become off-color. Ice plant appears normal.

The groundcovers showing significant burning and/or dieback include correa (Australian fushia), salvia, and thyme. Buffalograss is generally brown and dormant. Correa, salvia and thyme appear to be dying in patches rather than showing uniform burning and dieback on the plot.

GROUNDCOVER RESPONSE TO NO SUMMER IRRIGATION STUDY – U.C. RIVERSIDE				
Specific Epithet	**Common Name**	**Source Size**[z]	**Date Planted**	**Notes**
1. Drosanthemum speciosum, Delosperma, Mesembryanthemum??	vygie, iceplant	Altman Plants #1 container	4-2-10	Newer iceplant introduction, spring flowering, re-flowers in summer, So. Africa native, (vygie is Afrikaans term for Mesembryanthemums, fam. Aizoaceae)
2. Rosmarinus officianalis 'Irene'	prostrate rosemary	Native Sons 4-in. pot	11-4-09	Drought tolerant low groundcover
3. Thymus pracox arcticus (T. praecox subsp. Arcticus; T. serpyllum) 'Pink Chintz'	creeping thyme	Native Sons 4-in. pot	11-4-09	Low growing thyme
4. Atriplex cinerea Poir.	coast or grey saltbush	Native Sons #1 container	11-4-09	Silver foliage, low-spreading, dioecious, Australian native
5. Correa X unk. 'Dusky Bells' ('Carmine Bells')	Australian fuchsia	Native Sons #1 container	11-4-09	Reported to be low wide-spreading, deep red flowers, Australian native
6. Juniperus horizontalis 'Wiltonii'	blue rug juniper	Monrovia #1 container	12-2-09	Very flat dense growing, trailing branches, silver blue foliage
7. Hypericum calycinum L.	creeping St. Johnswort, Aaron's beard	Expertise Growers cuttings in flats	10-29-09	Low-growing, widely adapted, flowers primarily in spring and periodically in summer
8. Salvia sonomensis 'Gracias' (S. sonomensis X S. clevelandii)	creeping sage	Las Palitas #1 container	9-11-09	California native, reported low growing, wide spreading, lavender-blue flowers, possibly a hybrid of S. sonomensis X S. clevelandii, flowers winter/spring
9. Aptenia cordifolia (L.f.) N.E. Br. 'Red Apple' (A. cordifolia X A. haeckeliana?)	red apple	Expertise Growers cuttings in flats	10-29-09 add plt 4-2-10	Ice plant relative
10. Lantana montevidensis	trailing purple lantana	Expertise Growers cuttings in flats	10-29-09 add plt 4-8-10	Common landscape lantana, purple flowers spr.-summer
11. Trachelospermum jasminoides	star jasmine	Expertise Growers cuttings in flats	10-29-09	Vigorous once established, widely adapted
12. Sedum spp.	mixed sedums	Altman Plants 8 ft. × 8 ft. mats	3-31-10	Sod-like product with cuttings of 4 sedum spp. Rooted in jute mat under laden with plastic netting
13. Buchloe dactyloides 'U.C. Verde'	buffalograss	Todd Valley Farms plugs	4-8-09	Warm-season grass, a standard of performance under limited irrigation
14. Lonicera japonica 'Halliana'	Hall's honeysuckle, Japanese honeysuckle	Expertise Growers cuttings in flats	10-29-09	Very vigorous, reported to be tolerates drought well

Stop #3: Evaluation of Natural and Hybrid Turf for Water Conservation

Jon Montgomery, Marco Schiavon, and Jim Baird
Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521

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 evaluated the use of CoverLawn with both tall fescue ‘New Millennia’ and bermudagrass ‘Princess-77’ turf, and their performance under reduced levels of irrigation. Plots were established in August-September 2014, turf was either left as is (control without CoverLawn), 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 is maintained at 2.5 inches weekly, while bermudagrass is maintained at 0.5 inches 3 time/wk. Two CoverLawn materials were evaluated for tall fescue: CL6003 (2.1-inch pile height; 1-inch hole size) and CL2003 (0.78-inch pile height; 1.18-inch hole size), and one for bermudagrass: CM2003 (same dimensions as CL2003, but different color). Each treatment consisted of a 6’ x 60’ strip of fabric overlain on turf or bare soil. Installation was completed on 3 September 2014.

Beginning 5/13/2015, each lane was split into 3 sections and subjected to varying degrees of ET_o replacement representing minimal irrigation and further reductions of 20 and 40% ET_o to evaluate performance under extreme water deficits. Minimal irrigation for tall fescue was equal to 100% ET_o replacement, and 80% ET_o replacement for bermudagrass. Due to heavy rain events, low temperatures, and subsequent delay of green-up of bermudagrass, deficit irrigation was delayed until 6/30/2015 when all turf reached acceptable quality. Bi-weekly measurements were taken beginning 7/09/2015 including: cover; surface canopy temperature; drought stress; visual quality; Digital Image Analysis (DIA); Normalized Difference Vegetation Index (NDVI) as measured by a Green Seeker instrument; and soil volumetric water content (SVWC). At the end of the growing season, winter color retention will be measured. In addition, clipping yield was collected on a monthly basis beginning 7/14/2015 through the end of the growing season on the tall fescue portion of the study. Our hypothesis was that the reduced density of living turf resulting from presence of CoverLawn could reduce irrigation requirements while maintaining acceptable turf quality.

Results

Tall Fescue:

- Clipping yield results from 7/14/2015 and 8/06/2014 show reduced clipping yield in those plots established on bare ground with CL2003 or CL6003 installed (Fig.1). These reductions in clipping yield did not lead to reduction in visual quality. In general, turf established from seed on bare ground produced fewer clippings compared to scalped turf or the control.
- All CoverLawn treatments except CL2003 applied to scalped turf outperformed control plots in visual quality as drought stress increased on the rating date 8/06/2015 (Fig.2).
- NDVI results showed that CL2003 installed on bare soil and CL6003 installed on scalped turf outperformed control plots on 7/24/2015, as well as CL2003 on scalped turf (data not shown). On 8/06/2015, all CoverLawn treatments outperformed the control plots except for CL2003 on scalped turf, which is comparable to visual quality measurements.
- On 7/24/2015, canopy temperature was reduced on plots established on bare soil with either CL2003 or CL6003 (data not shown).
- Percent green cover assessed with DIA increased on CoverLawn plots on 8/06/2015. Results matched those of visual quality, with only plots established on scalped turf with CL2003 having comparable cover to control plots (Fig.3).
- Differences in soil water content were detected on 7/09/2015 only. Control plots and those treated with CL2003 on scalped turf had the highest water content, while scalped control plots and CL2003 installed on bare, seeded soil had the lowest.
- Dark Green Color Index (DGCI) measured by DIA showed no differences among CoverLawn and control plots, except for on the rating date 8/06/2015, when CL2003 installed on bare soil showed decreased color quality.
- Tall fescue with CoverLawn product CL6003, which has more synthetic turf material, led to increases in DGCI as assessed by DIA when compared to those plots with CL2003 installed, though these results were transient.
- Interaction between ET_o replacement and treatment was never significant. However, ET_o replacement had an effect on all measurements, with 100% ET_o replacement resulting in the highest (most desirable) values.

Bermudagrass:

- Differences in turfgrass quality were detected on 7/09/2015 and 7/24/2015. On 7/04/2015, CM2003 installed on seeded bare ground and bare control plots demonstrated lower visual quality. On 7/24/2015, CM2003 had the highest visual quality, though not significantly different from control plots. CM2003 installed on seeded bare ground had the lowest quality (Fig.4).
- NDVI results showed differences on 7/09/2015 and 7/24/2015 based on treatment. On both dates bare controls and CM2003 on bare, seeded ground showed the lowest values (data not shown).

- No differences in canopy temperature were detected among treatments.
- Percent cover measured with DIA showed treatment effect on 8/20/2015. Bare ground controls and CM2003 installed on bare seeded ground resulted in increased cover (Fig. 5).
- Control plots had the highest soil water content, which was not significantly different from CM2003 on scalped turf. Scalped controls and CM2003 installed on seeded bare ground had the lowest water content (Fig. 6).
- Turf color as measured by DIA showed no differences based on treatment.
- Interaction between ET_o replacement and treatment was never significant. However, ET_o replacement had an effect on all measurements, with 80% ET_o replacement resulting in the highest values.

Summary:

At this point, there is no strong evidence to indicate improved performance of drought stressed turf when CoverLawn is installed. Improvements to visual quality were inconsistent, but indicate that the CoverLawn product may improve visual appearance of turf under stress. It appears that installing on bare seeded ground is the most effective use of the product, especially on tall fescue. In addition, both turfgrass species established equally well from seed that was sown underneath the CoverLawn fabric despite super optimal air and soil temperatures for germination.

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 Bare ground
2	Coverlawn CL2003 Bare ground
3	Coverlawn CL6003 Scalped
4	Coverlawn CL2003 Scalped
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 Bare ground
2	Coverlawn CM2003 Scalped
3	Bermudagrass Bare ground
4	Bermudagrass Scalped
5	Bermudagrass Control

Figure 1: Tall fescue clipping yield during study period

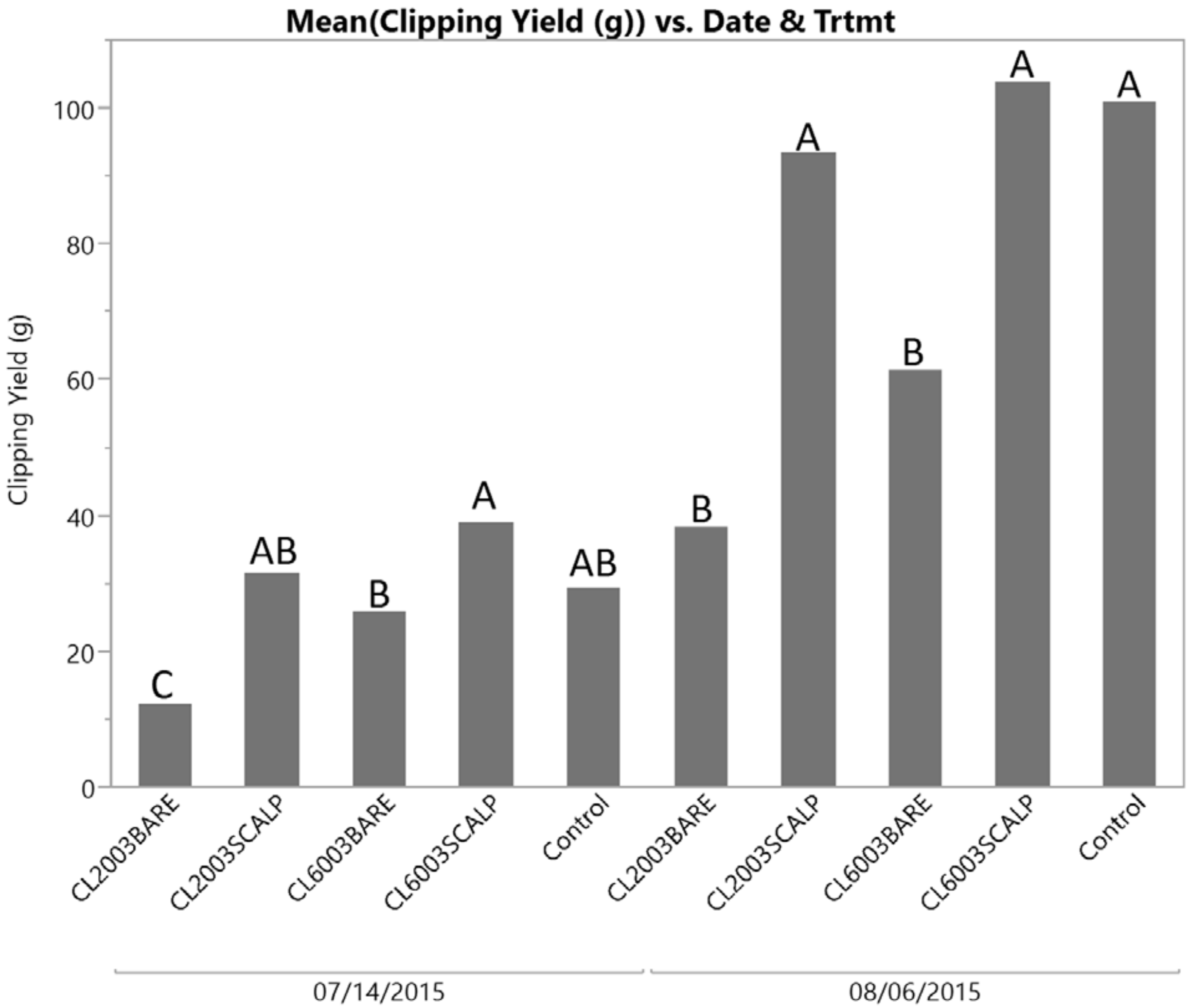


Figure 2: Tall fescue visual quality during study period

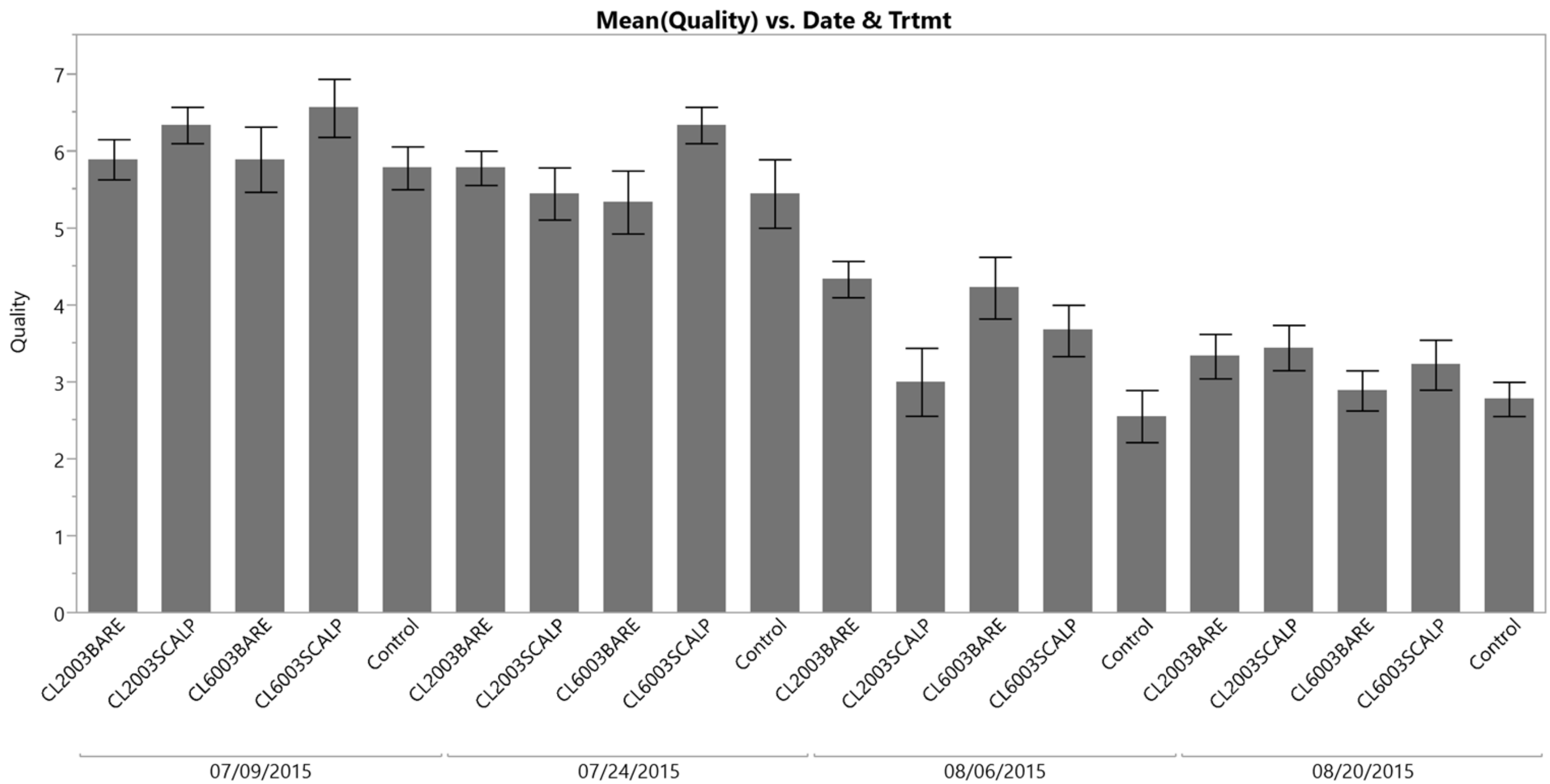


Figure 3: Tall fescue cover during study period

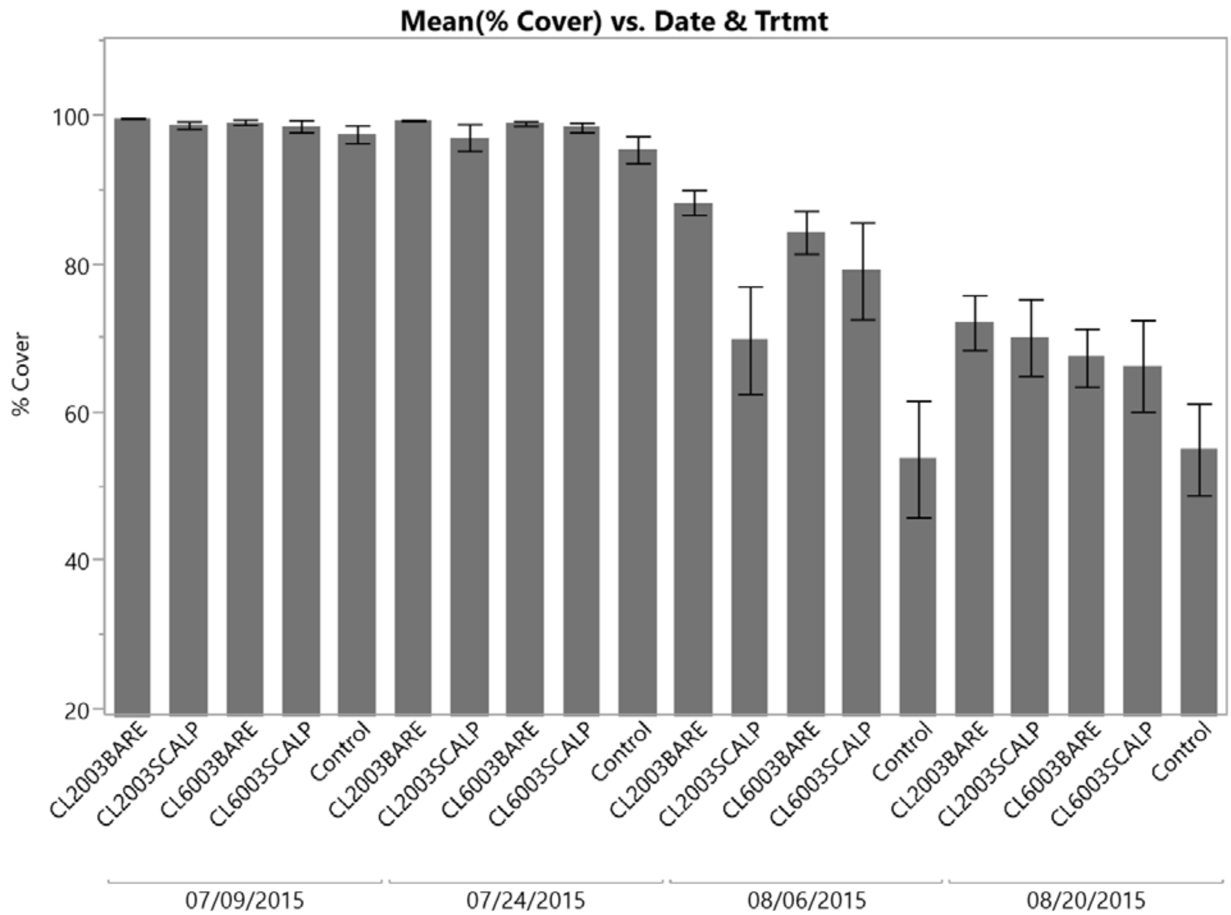
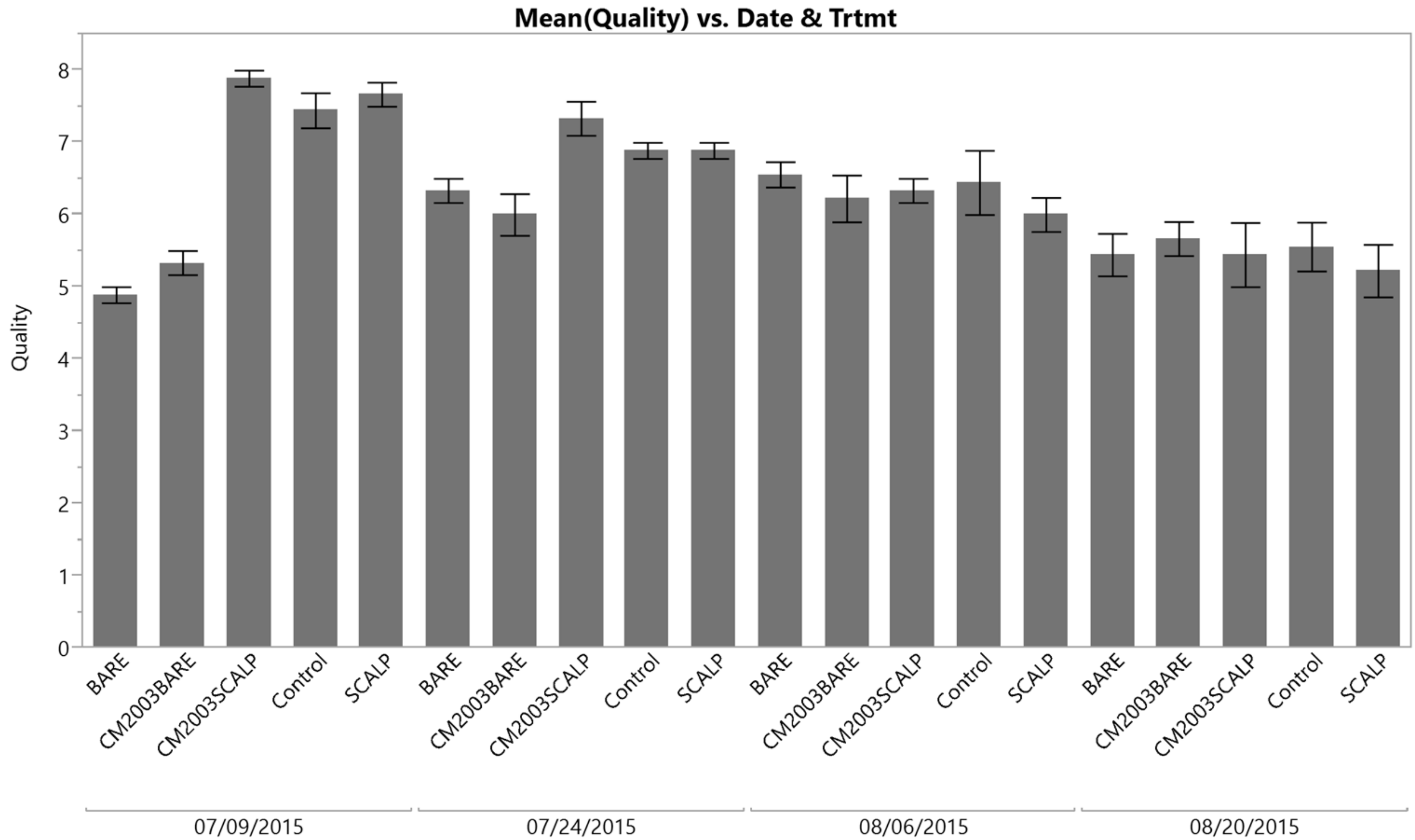


Figure 4: Bermudagrass quality during study period



<u>Figure 5: Bermudagrass cover during study period</u>

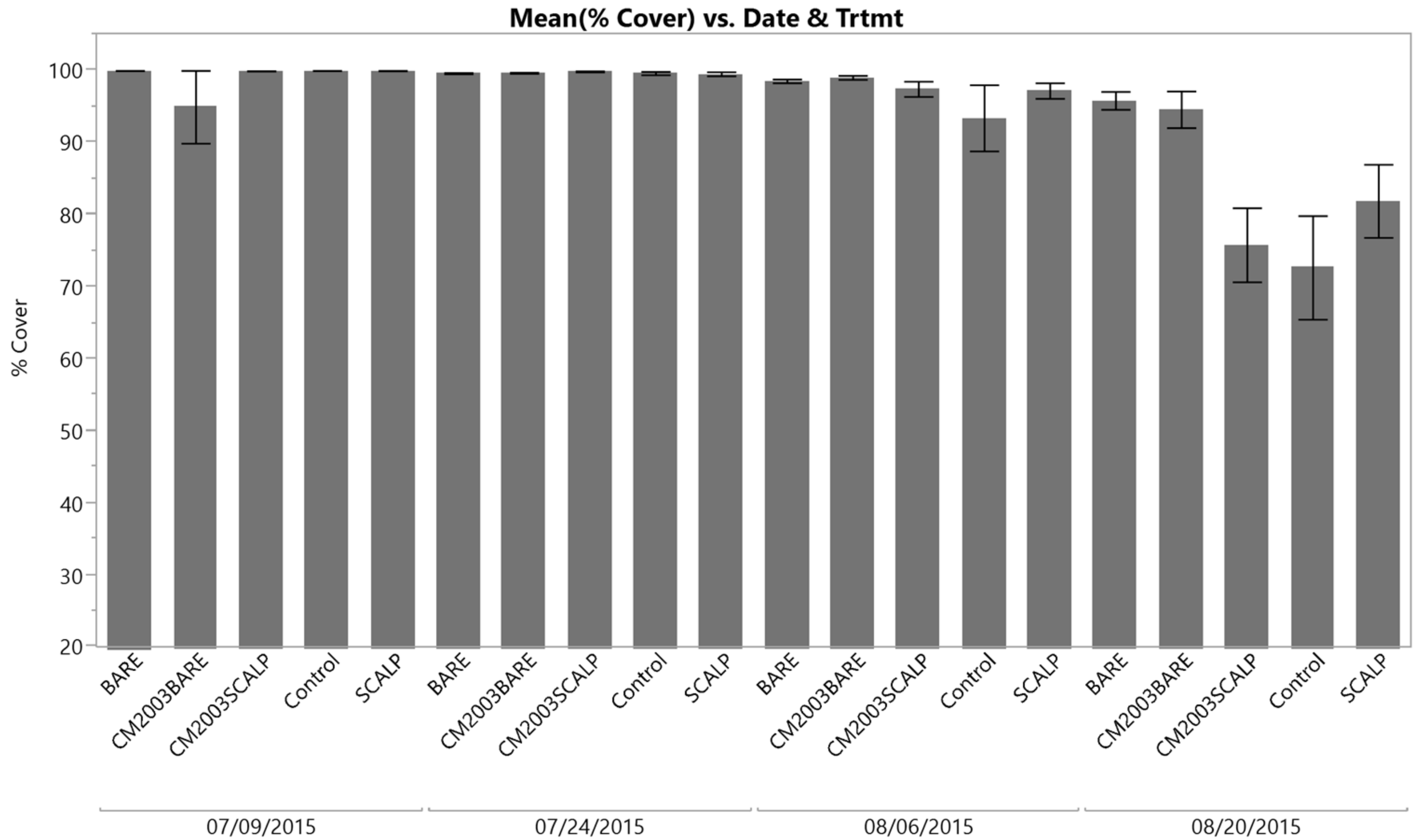
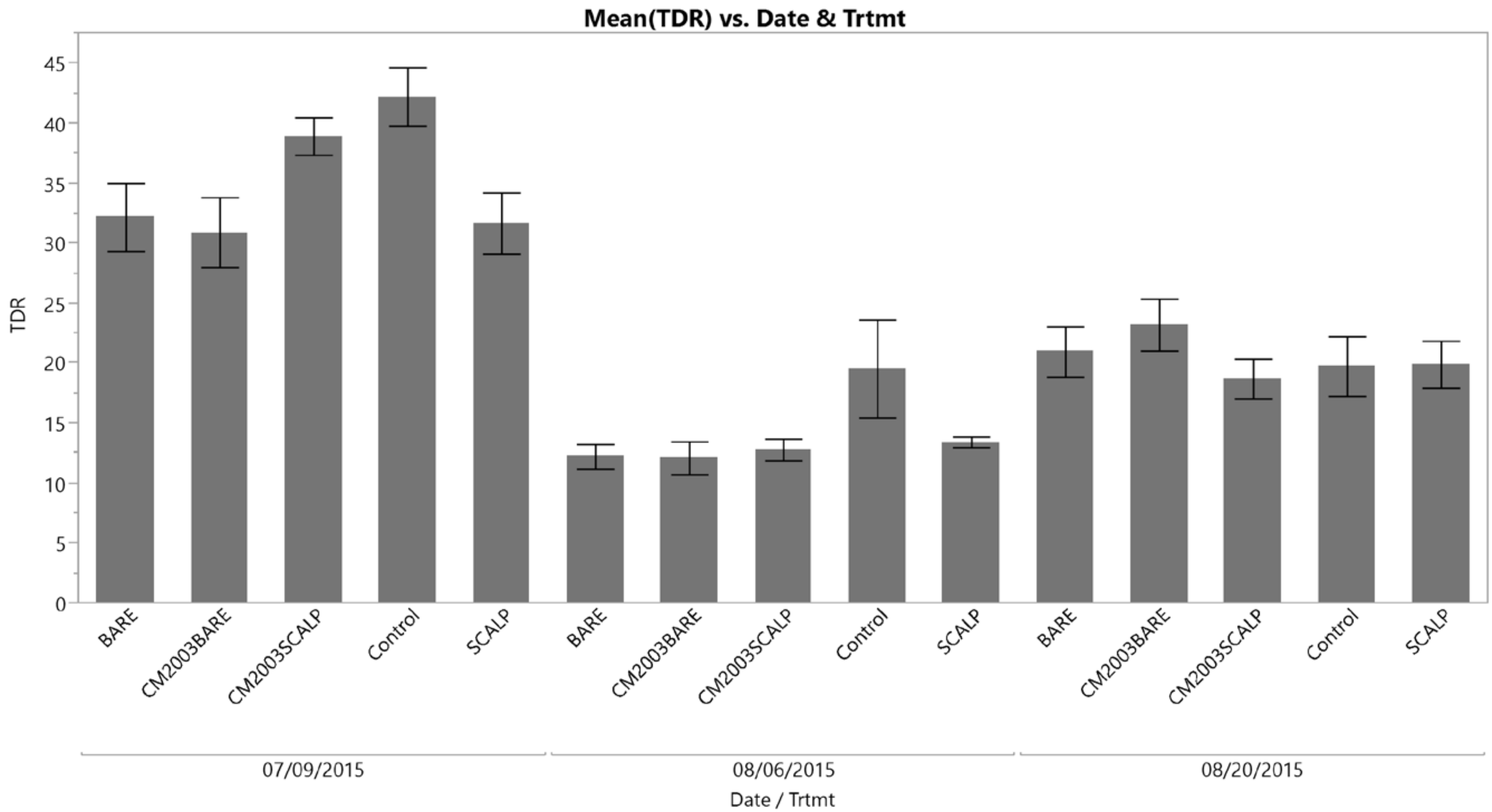


Figure 6: Bermudagrass soil water content during study period



Stop #4: Updates on Evapotranspiration Adjustment Factor Project (A contract from CA Dept. of Water Resources)

Principal Investigators: David Fujino[1], Janet Hartin[1], and Loren Oki[2]
Project Cooperators: Karrie Reid[2] and Chuck Ingels[2]
[1]California Center for Urban Horticulture, University of California, Davis, CA 95616;
[2]University of California Cooperative Extension;
[3]Department of Plant Sciences, University of California, Davis, CA 95616

Project Contractor: William Baker & Associates, LLC

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 40-50 percent of household water use is used outdoors to irrigate urban landscapes.

2014 and the first half of 2015 were some of the driest periods on record in the state. 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 enhanced water conserving measures in urban landscapes. In December, 2015 a revised ETAF of .55 ETo for new landscapes over 500 square feet replaces the current .7 ETo necessitating even greater conservation. The .55 MAWA is a 21.4% reduction from the current .7 MAWA. It is important to note that recreational turf and food crops will remain exempt.

The goal of our California Department of Water Resources (DWR) project is to measure water use at 30 large urban landscapes in six climate zones that include a variety of ornamental plants with varying water use rates growing under a wide mixture of plant densities and microclimates. A further goal is to work with site managers to improve irrigation system distribution uniformity (DU) and overall irrigation efficiency at each site.

The Maximum Applied Water Allowance formula follows.

*Maximum Applied 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 MAWA in Riverside, CA at .7 ETAF</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/year

<u>Example of MAWA in Riverside, CA at .55 ETAF</u>

Hypothetical Landscape Area = 50,000 sq ft
MAWA = (ETo) (0.55) (LA) (0.62)
MAWA = (51.1) (0.55) (50,000 sq ft) (0.62)
MAWA = 871,255 gallons/year (21.4% reduction versus .7 ETAF)

Findings to date include:

- 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.
- Distribution uniformity can most often be increased without major redesign and installation efforts by switching to rotary sprinkler heads.
- Properly irrigating plants based on species, density, and climate and microclimate considerations can significantly reduce landscape water waste
- Landscapes consisting solely of cool season turfgrass (not deemed recreational and therefore non-exempt from the regulation) use water in excess of the .7 ETAF standard.
- 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, low and very low water using plant species that are drip irrigated and mulched can include small areas of turfgrass and not exceed .7 ETAF. When a greater balance of low water using plants is included, ETAF of.55 is achieved.
- A 3 inch layer of mulch around ornamental plantings can significantly reduce water waste by reducing water evaporation from soil.

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

Dave Fujino
California Center for Urban Horticulture
University of California, Davis, CA 95616

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.

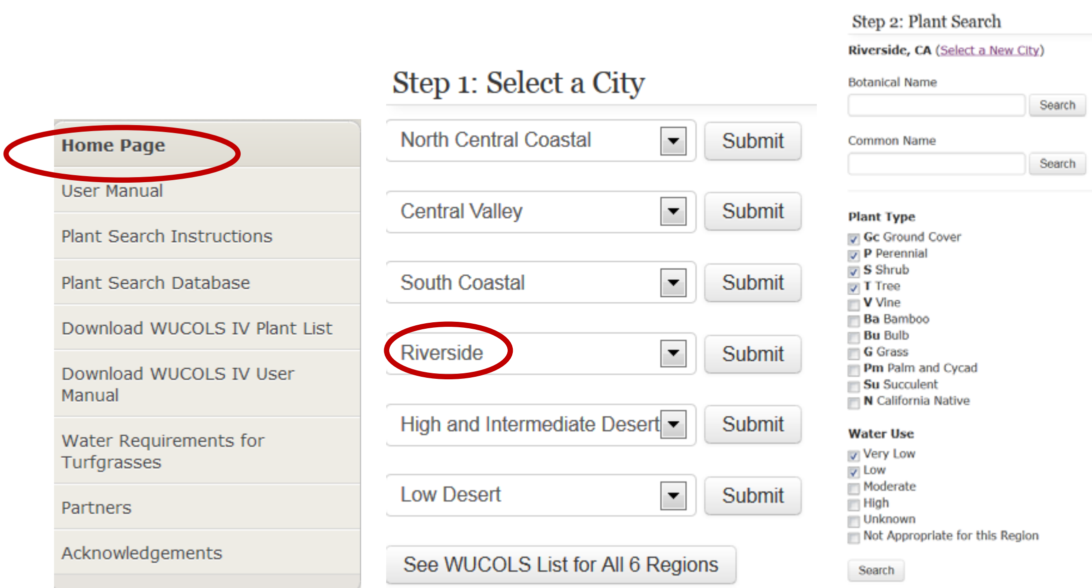
In addition, a number of species evaluations made in previous editions were revisited by the regional committees. If the committees believed that the evaluation of plant water needs should be changed (raised or lowered), it was changed. In some cases, a "?" was replaced by VL, L, M, or H (see the section "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 5% of species in WUCOLS 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 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.

Under the Model Water Efficient Landscape Ordinance (MWELO), the plant factors used for calculating the landscape water budget “SHALL” be from WUCOLS**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

Stop #5: National Turfgrass Evaluation Program

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Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521

Introduction

The National Turfgrass Evaluation Program (NTEP) is designed to develop and coordinate uniform evaluation trials of turfgrass varieties and promising selections in the United States and Canada. Test results can be used by national companies and plant breeders to determine the broad picture of the adaptation of a cultivar. Results can also be used to determine if a cultivar is well adapted to a local area or level of turf maintenance. For more information, please visit **ntep.org**.

UCR currently manages 9 NTEP tests: 5 in Riverside; 1 in the Coachella Valley; 1 in Los Angeles; and 2 in San Francisco.

2012 NTEP Tall Fescue Test

- UC Riverside
- 116 Entries

2013 USGA/NTEP Warm-Season Putting Green Test

- Tamarisk CC, Rancho Mirage
- Bermudagrass, Zoysiagrass, Seashore Paspalum entries

2013 NTEP Zoysiagrass Ancillary Shade Test

- UC Riverside
- 35 Entries
- 60% Shade

2013 NTEP Bermudagrass Test

- UC Riverside
- 35 Entries

2014 NTEP Bentgrass Green Ancillary Golf Course On-Site Test

- Bel-Air CC, Los Angeles
- California Golf Club of San Francisco
- 20 Entries

2014 NTEP Bentgrass Fairway/Tee Ancillary Reduced Irrigation Test

- UC Riverside
- 18 Entries

2012 NTEP Fineleaf Fescue Test

- Ancillary No Mow, UC Riverside
- Ancillary Fairway Traffic, California Golf Club of San Francisco
- 42 Entries

Stop #6: Best Management Practices for Turf under Drought or Water Use Restrictions

Marco Schiavon, Pawel Petelewicz, Giulio Cremonese, and Jim Baird
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Objective:

Determine if management practices such as the use of plant growth regulators (PGRs), wetting agents, proper fertilization, or combinations of the three can help 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 3, the plots received either 40% or 70% of previous week's ET_0, as determined by an on-site CIMIS station. Treatments were arranged in a split-plot design with 3 different factors randomized within ET_0 replacement plots and 3 replicates. Plant Growth Regulator (Primo Maxx) serves as split plot; wetting agent (Revolution) as split-split-plot; finally, fertilizer products (see Table below) were randomized inside the wetting agent plots (plot size 24 ft^2) and applied monthly beginning July 31, 2014. Each treatment received an equivalent of 1 lb N/M/month except for Yara Vera (urea), which received ½ lb N/M/month and served as control. Prior to application of fertilizer treatments, the entire field received no N in 2015. Every two weeks, plots were evaluated for turf quality, volumetric soil water content, Normalized Difference Vegetation Index (NDVI), and Digital Image Analysis (DIA).

Results:

All ratings collected at the beginning of the study showed that bermudagrass was significantly affected by lack of N fertilization (Figs. 1-3). However, one month after the first application of N was applied, grass recovered and no differences between ET_0 replacements were found (data not shown). After 3 rating dates, only fertilizer products had an effect on turf visual quality, with 4 products (Best Nitra King, Gro-Power, Loveland, and Turf Royale) performing better than the ½ rate urea control (Fig. 1), and achieving acceptable quality despite deficit irrigation. These results were corroborated by those of Dark Green Color Index (DGCI) and NDVI, where Best Nitra King, Loveland, and Gro-Power all performed better in comparison to urea. No beneficial effect of Primo Maxx was detected one month after the beginning of the study, while application of Revolution had a positive effect on turf visual quality (data not shown). Preliminary results so far suggest that proper N management during the summer months could help save 30% water to irrigate bermudagrass.

PGR, wetting agent, and fertilization Study Treatment List 2015

Plot	Treatment	Company	Rate	Frequency (weeks)
Whole Plot	ET_0 replacement	---	40%/70%	Mon-Wed-Fri
Split	Primo Maxx	Syngenta	0.3 oz/M	2
Split-split-plot	Revolution	Aquatrols	6 oz/M	4
Split-split-split-plot	Gro-Power (5-3-1)	Gro-Power	1 lb N/M	4
Split-split-split-plot	WIL-GRO with Infiltrate (16-16-16)	Wilbur-Ellis	1 lb N/M	4
Split-split-split-plot	Vera (46-0-0)	Yara	½ lb N/M	4
Split-split-split-plot	Best Nitra King (21-2-4)	Simplot	1 lb N/M	4
Split-split-split-plot	Loveland (5-29-12)	Loveland	1 lb N/M	4
Split-split-split-plot	Turf Royale (21-7-14)	Yara	1 lb N/M	4

PGR Wetting Agent and Fertilization Study Treatment List and Plot Plan

Rep 1	70% ET_0	19	20	12	9		13	18	4	3	40% ET_0
		21	22	11	7		15	16	1	2	
		23	24	8	10		17	14	6	5	
		14	18	5	2		9	8	19	21	
		13	17	1	6		11	7	22	24	
		16	15	3	4		10	12	23	20	

Rep 2	70% ET_0	5	6	15	16		5	3	13	17	40% ET_0
		2	3	17	14		6	2	14	16	
		1	4	18	13		1	4	18	15	
		23	19	10	12		9	11	22	19	
		21	22	8	9		10	12	20	21	
		24	20	7	11		8	7	23	24	

Rep 3	40% ET_0	13	16	2	5		23	19	7	11	70% ET_0
		15	17	1	3		22	21	10	12	
		14	18	6	4		20	24	9	8	
		11	8	20	19		2	3	18	14	
		10	7	24	23		1	6	13	17	
		9	12	22	21		4	5	16	15	

Trt #	Fertilizer	Primo Maxx	Revolution	Trt #	Fertilizer	Primo Maxx	Revolution
1	Gro-Power			13	Gro-Power		x
2	WIL-GRO			14	WIL-GRO		x
3	Yara Vera			15	Yara Vera		x
4	Best Nitra King			16	Best Nitra King		x
5	Loveland Mini			17	Loveland Mini		x
6	Yara Turf Royale			18	Yara Turf Royale		x
7	Gro-Power	x		19	Gro-Power	x	x
8	WIL-GRO	x		20	WIL-GRO	x	x
9	Yara Vera	x		21	Yara Vera	x	x
10	Best Nitra King	x		22	Best Nitra King	x	x
11	Loveland Mini	x		23	Loveland Mini	x	x
12	Yara Turf Royale	x		24	Yara Turf Royale	x	x

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

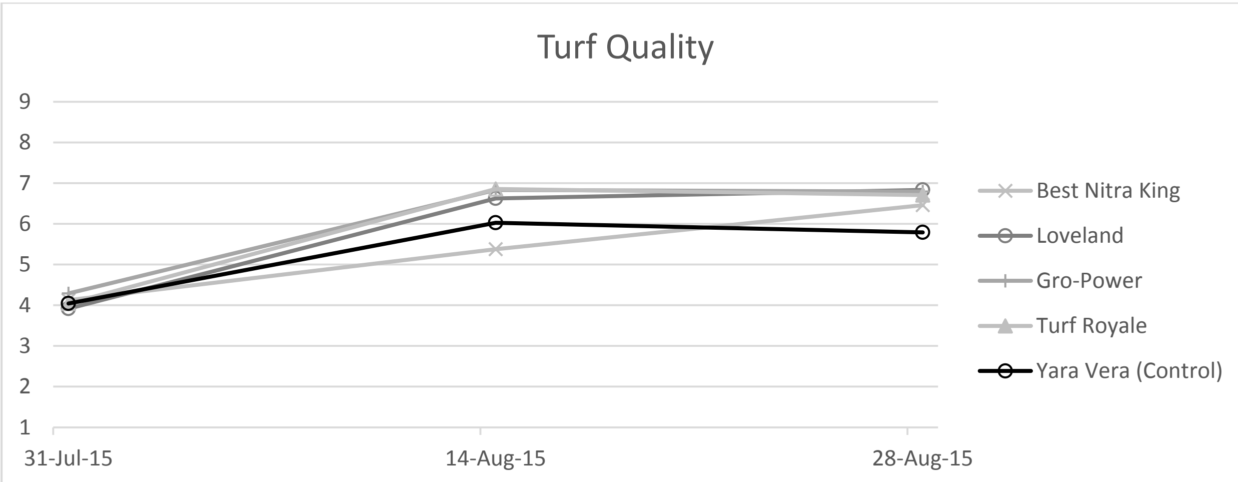


Figure 2. DGCI of fertilizer products that performed better than control in at least one rating date.

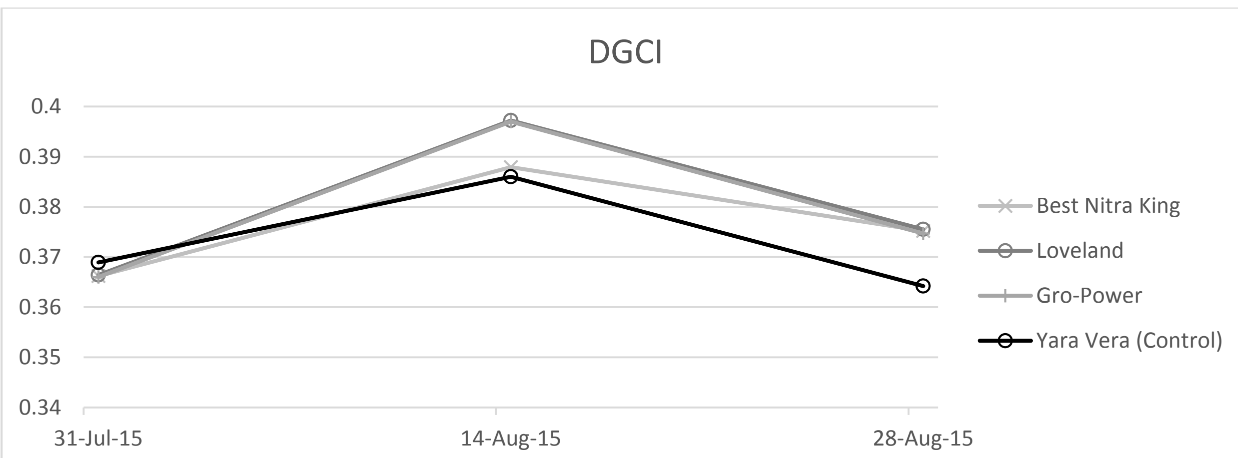
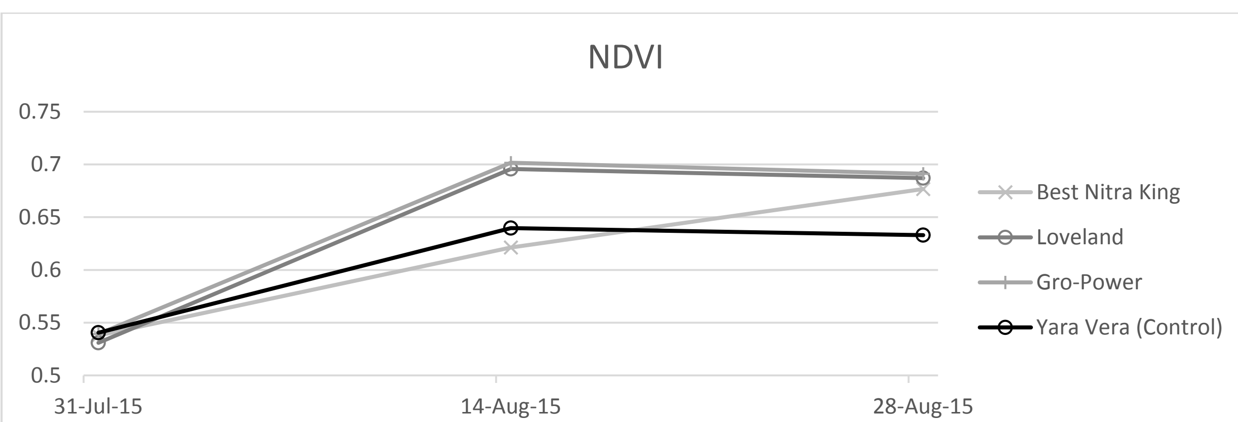


Figure 3. NDVI of fertilizer products that performed better than control in at least one rating date.



Stop #7: Evaluation of Products for Alleviation of Salinity

Marco Schiavon, Pawel Petelewicz, Giulio Cremonese, Toan Khuong, and Jim Baird
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University of California, Riverside, CA 92521

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 a Hanford fine sandy loam with no pre-existing salinity issues. All treatments were applied initially on 6 June 2014. The turf is mowed three times per week at 0.625 inches. Standard bermudagrass cultural practices are maintained throughout the study, including 6 lbs N/M/yr and verticutting once/yr (May). 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, NDVI 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 (2 gal/M). Treatments are watered in with over 1 cm of water immediately following application. For treatment list see table on next page.

Results:

For the third year in a row, DeSal was the treatment that improved turf quality and Dark Green Color Index (DGCI) the most. However, HM1239 also showed positive effects on turf quality and DGCI (Figure 1). NDVI did not detect any differences among treatments. The combination of ACA 2994 and 3245 was the only treatment that reduced EC in the leachate (Figure 2). Nevertheless, no positive effect on bermudagrass was observed on those plots.

Salinity Alleviation Study Treatment List 2015

No.	Treatment	Company	Rate	Frequency (weeks)
1	Untreated Control	--	--	--
2	ACA 2994	Aquatrols	8 oz/M	2
3a 3b	ACA 3248 ACA 2994	Aquatrols	6 oz/M 8 oz/M	2 8
4 4	ACA 2994 ACA 3245	Aquatrols	8 oz/M 8 oz/M	2 2
5a 5b	ACA 1849 Gypsum	Aquatrols	3 oz/M 5 lbs/M	2 4
6a 6b 6b	MST-1410 SMS-0114 Gypsum	Macrosorb	6 oz/M 64 oz/A 10 lbs/M	2 4 4
7 7 7	DeSal StressRx Exp 5-0-1	Ocean Organics	0.75 oz/M 6 oz/M 6 oz/M	2 2 2
8	Crossover pHacid Revert	Numerator Technologies	5 lb/M 2.5 oz/M 6 oz/M	4 2 2
9	HM9926	Helena	1.5 oz/M	2
10	HM1239	Helena	1.5 oz/M	2

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

North

113 1	213 4	313 2	413 5	513 3	613 7
114 2	214 7	314 10	414 4	514 2	614 5
115 3	215 2	315 3	415 7	515 6	615 4
116 4	216 10	316 5	416 10	516 9	616 2
117 5	217 3	317 7	417 1	517 10	617 3
118 6	218 5	318 4	418 8	518 7	618 1
119 7	219 1	319 9	419 2	519 5	619 8
120 8	220 8	320 6	420 9	520 4	620 6
121 9	221 6	321 1	421 3	521 1	621 10
122 10	222 9	322 8	422 6	522 8	622 9

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

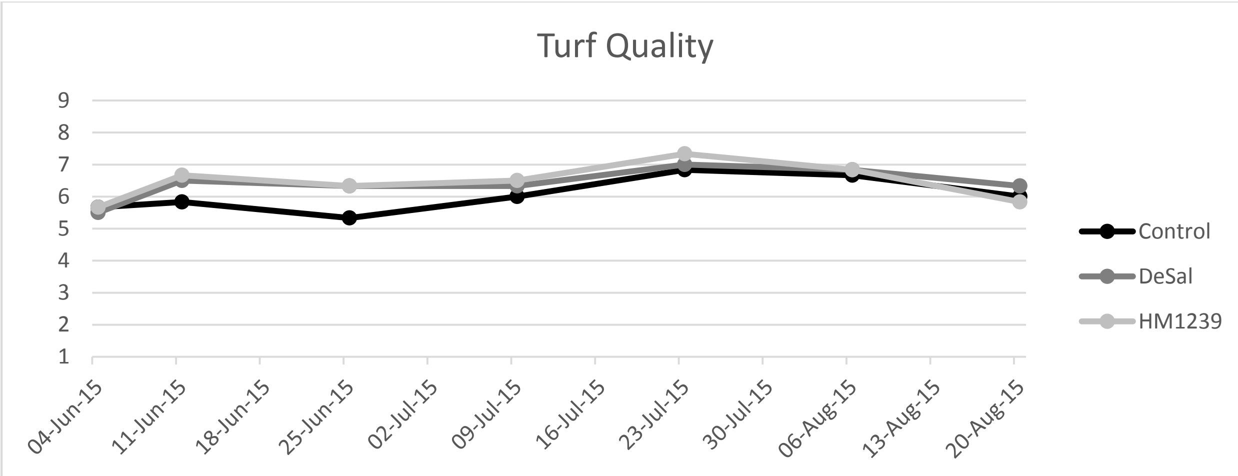


Figure 2. Quality of treatments that performed better than control in at least one rating date.

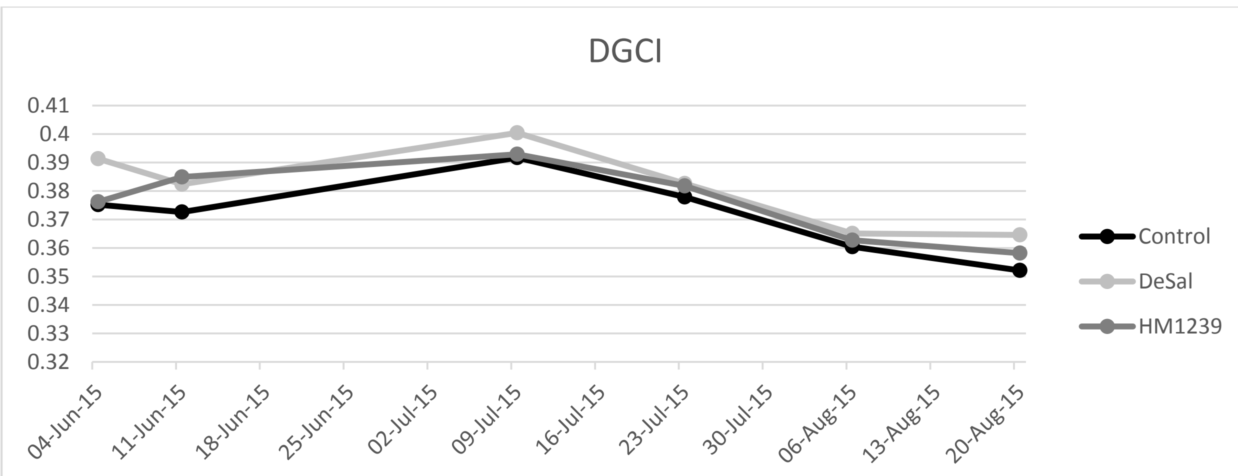
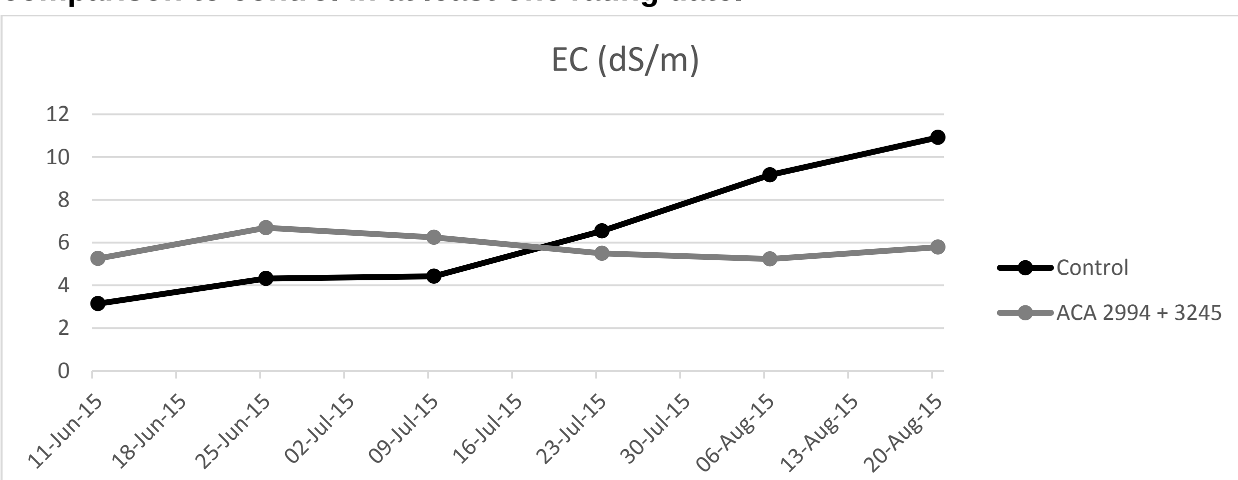


Figure 3. EC of leachate collected from plots that decreased salinity in comparison to control in at least one rating date.



Stop #8a: Evaluation of Plant Growth Regulators on Bermudagrass Turf

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Objective:

This study was conducted to quantify effects of Cutless MEC (flurprimidol), Primo Maxx (trinexapac-ethyl), Trimmit (paclobutrazol) and Anuew (prohexadione calcium) on growth regulation, injury and visual turfgrass quality of 'Tifway II' hybrid bermudagrass maintained as a golf course fairway.

Materials and methods:

The study was conducted on mature bermudagrass (*Cynodon dactylon*) turf grown on a Hanford fine sandy loam and mowed at 0.625 inches three times/wk. Turf received 4 lbs N/M/yr and verticutting in May 2015. The study was setup as a randomized complete block, with 4 replications on 4'x10' plots. Treatments were applied with a CO_2-powered backpack sprayer with TeeJet 8003VS nozzles (9-inch spacing; 2 gal/M) on June 26 (initial treatment), July 17 (3 WAIT), August 7 (6 WAIT) and August 28 (9 WAIT). Plots were evaluated for turf quality and injury 5 days and 3, 6 and 9 weeks after initial treatment.

Results:

On 2 July 2015, Anuew (16 oz/A) and Cutless MEC (15 oz/A) treatments resulted in improvements of turfgrass quality, while Anuew (8 oz/A) resulted in the lowest quality ratings. There was no significant difference among treatments on 16 July 2015. Primo Maxx resulted in highest quality rating on 6 August 2015, while there were no statistical differences among the other treatments in comparison to control. On 27 August 2015, Primo Maxx also resulted in highest ratings. There were no statistical differences among untreated control, Cutless MEC (15 oz/A), Anuew (8 oz/A), Anuew (16 oz/A) and Trimmit treatments, while Cutless MEC (25 oz/A), and Cutless MEC (35 oz/A) resulted in higher ratings in comparison to control.

On 2 July 2015 turfgrass injury was highest from the Cutless MEC (25 oz/A) treatment and lowest in untreated blocks. Results were similar on July 16th 2015. There was no statistical difference between all treatments on 6th August 2015. On 27th August 2015 injury was higher in all treatments in comparison to control but there were no differences between each treatment.

Treatments:

No.	Treatment	Company	Rate (oz/A)	Frequency (wks)
1	Untreated Control	-	-	-
2	Cutless MEC (15 oz/A)	SePRO	15	3
3	Cutless MEC (25 oz/A)	SePRO	25	3
4	Cutless MEC (35 oz/A)	SePRO	35	3
5	Primo Maxx	Syngenta	11	3
6	Anuew (8 oz/A)	Nufarm	8	3
7	Anuew (16 oz/A)	Nufarm	16	3
8	Trimmit	Syngenta	24	3

Plot plan:

Bermudagrass PGR Study (12F6)
North

101	**Trt 3**	201	**Trt 7**
102	**Trt 6**	202	**Trt 5**
103	**Trt 2**	203	**Trt 3**
104	**Trt 7**	204	**Trt 8**
105	**Trt 4**	205	**Trt 2**
106	**Trt 8**	206	**Trt 1**
107	**Trt 1**	207	**Trt 4**
108	**Trt 5**	208	**Trt 6**

LGIS STUDY PLOT

301	**Trt 1**	401	**Trt 6**
302	**Trt 4**	402	**Trt 1**
303	**Trt 7**	403	**Trt 5**
304	**Trt 2**	404	**Trt 3**
305	**Trt 5**	405	**Trt 8**
306	**Trt 6**	406	**Trt 4**
307	**Trt 3**	407	**Trt 7**
308	**Trt 8**	408	**Trt 2**

Tables: Effects of PGRs on bermudagrass quality and injury.

No.	Treatment	Turfgrass Quality (0-9)			
		7/02/2015	7/16/2015	8/6/2015	8/27/2015
1	Untreated Control	5.75 **ab**	6.00 **a**	4.25 **bc**	4.25 **d**
2	Cutless MEC (15 oz/A)	6.25 **a**	5.50 **a**	5.00 **bc**	5.00 **bcd**
3	Cutless MEC (25 oz/A)	5.50 **ab**	4.75 **a**	5.00 **bc**	5.75 **b**
4	Cutless MEC (35 oz/A)	5.75 **ab**	5.75 **a**	6.00 **ab**	5.50 **bc**
5	Primo Maxx	5.75 **ab**	5.50 **a**	7.25 **a**	7.00 **a**
6	Anuew (8 oz/A)	4.75 **b**	5.25 **a**	5.25 **bc**	4.75 **cd**
7	Anuew (16 oz/A)	6.25**a**	5.75 **a**	5.75 **b**	4.75 **cd**
8	Trimmit	5.75 **ab**	5.00 **a**	4.75 **bc**	4.50 **d**

No.	Treatment	Turfgrass Injury (0-100%)			
		7/02/2015	7/16/2015	8/6/2015	8/27/2015
1	Untreated Control	11 **b**	15 **b**	15 **a**	2 **b**
2	Cutless MEC (15 oz/A)	15 **ab**	18 **ab**	15 **a**	9 **a**
3	Cutless MEC (25 oz/A)	20 **a**	25 **a**	15 **a**	7 **a**
4	Cutless MEC (35 oz/A)	14 **ab**	18 **ab**	10 **a**	9 **a**
5	Primo Maxx	16 **ab**	18 **ab**	4 **a**	5 **a**
6	Anuew (8 oz/A)	18 **ab**	19 **ab**	11 **a**	7 **a**
7	Anuew (16 oz/A)	14 **ab**	19 **ab**	8 **a**	9 **a**
8	Trimmit	14 **ab**	24 **ab**	16 **a**	9 **a**

Stop #8b: Evaluation of Plant Growth Regulators on Kikuyugrass Turf

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Objective:

These studies were conducted to quantify effects of Legacy (flurprimidol + trinexapac-ethyl), Primo Maxx (trinexapac-ethyl), Anuew (prohexadione calcium) and Trimmit (paclobutrazol) on growth regulation, injury and visual turfgrass quality of kikuyugrass maintained as a golf course fairway.

Materials and methods:

The study was conducted on mature 'Whittet' kikuyugrass (*Pennisetum clandestinum*) turf on a Hanford fine sandy loam and mowed at 0.450 inches three times/wk. Turf receives 2 lbs N/M/yr and verticutting during the summer. The study was setup as a randomized complete block, with 4 replications on 4'x10' plots. Treatments were applied with a CO_2-powered backpack sprayer with TeeJet 8003VS nozzles (9-inch spacing; 2 gal/M) on June 26 (initial treatment), July 17 (3 WAIT), August 7 (6 WAIT) and August 28 (9 WAIT). Plots were evaluated for turf quality and injury 5 days and 3, 6 and 9 weeks after initial treatment.

Results:

On 2 July 2015 Legacy (30 oz/A) and Primo Maxx treatments resulted in improvements of turfgrass quality in comparison to control, while Anuew (8 oz/A), Anuew (16 oz/A) and Trimmit (24 oz/A) resulted in the lowest ratings. On 16 July 2015 highest rating were obtained with the Primo Maxx treatment. Legacy (20 oz/A), Anuew (8 oz/A) and Trimmit (16 oz/A) resulted in lowest ratings. On 6 August 2015 Trimmit (24 oz/A) treatment resulted in a lower rating in comparison to the control. Similar results were observed on 27 August 2015.

On 2 July 2015 there were no significant differences in turfgrass injury among treatments. On 16 July 2015 Primo Maxx treatment resulted in lowest turfgrass injury, while Anuew (16 oz/A) and both Trimmit treatments resulted in highest injury. Also on 6 August 2015 Primo Maxx resulted in lowest injury, as well as Legacy (30 oz/A) and both Anuew treatments. Trimmit (24 oz/A) resulted in highest injury. On 27 August 2015 Anuew (8 oz/A) and Anuew (16 oz/A), Legacy (20 oz/A) and Primo Maxx treatments resulted in lowest injury, which is comparative to untreated control. Trimmit (24 oz/A) treatment resulted in highest injury.

Treatment list:

No.	Treatment	Company	Rate (oz/A)	Frequency (wks)
1	Untreated Control	-	-	-
2	Legacy (20 oz/A)	SePRO	20	3
3	Legacy (30 oz/A)	SePRO	30	3
4	Primo Maxx	Syngenta	13	3
5	Anuew (8 oz/A)	Nufarm	8	3
6	Anuew (16 oz/A)	Nufarm	16	3
7	Trimmit (16 oz/A)	Syngenta	16	3
8	Trimmit (24 oz/A)	Syngenta	24	3

Plot plan:

Kikuyugrass PGR Study (16L)

North

101 **Trt 1**	102 **Trt 6**	103 **Trt 3**	104 **Trt 7**	105 **Trt 4**	106 **Trt 8**	107 **Trt 2**	108 **Trt 5**

201 **Trt 2**	202 **Trt 4**	203 **Trt 5**	204 **Trt 1**	205 **Trt 7**	206 **Trt 3**	207 **Trt 6**	208 **Trt 8**

301 **Trt 7**	302 **Trt 5**	303 **Trt 1**	304 **Trt 8**	305 **Trt 6**	306 **Trt 4**	307 **Trt 2**	308 **Trt 3**

401 **Trt 2**	402 **Trt 6**	403 **Trt 4**	404 **Trt 5**	405 **Trt 1**	406 **Trt 8**	407 **Trt 3**	408 **Trt 7**

Tables: Effects of PGRs on kikuyugrass quality and injury.

No.	Treatment	Turfgrass Quality (0-9)			
		7/02/2015	7/16/2015	8/6/2015	8/27/2015
1	Untreated Control	3.25 **b**	4.00 **ab**	4.25 **ab**	4.00 **ab**
2	Legacy (20 oz/A)	3.50 **ab**	3.50 **b**	4.00 **ab**	4.00 **ab**
3	Legacy (30 oz/A)	4.50 **a**	4.25 **ab**	4.00 **ab**	3.5 **abc**
4	Primo Maxx	4.50 **a**	4.75 **a**	4.75 **a**	4.25 **ab**
5	Anuew (8 oz/A)	3.25 **b**	3.50 **b**	4.25 **ab**	4.75 **a**
6	Anuew (16 oz/A)	3.00 **b**	3.75 **ab**	4.00 **ab**	4.00 **ab**
7	Trimmit (16 oz/A)	3.50 **ab**	3.50 **b**	3.75 **ab**	3.25 **bc**
8	Trimmit (24 oz/A)	3.25 **b**	3.75 **ab**	3.00 **b**	2.5 **c**

No.	Treatment	Turfgrass Injury (%)			
		7/02/2015	7/16/2015	8/6/2015	8/27/2015
1	Untreated Control	40 **a**	44 **ab**	21 **bc**	26 **bcd**
2	Legacy (20 oz/A)	45 **a**	48 **ab**	33 **ab**	19 **d**
3	Legacy (30 oz/A)	40 **a**	43 **ab**	31 **abc**	36 **abc**
4	Primo Maxx	41 **a**	36 **b**	15 **c**	21 **cd**
5	Anuew (8 oz/A)	54 **a**	51 **ab**	21 **abc**	16 **d**
6	Anuew (16 oz/A)	45 **a**	53 **a**	25 **bc**	23 **bcd**
7	Trimmit (16 oz/A)	55 **a**	53 **a**	33 **ab**	36 **ab**
8	Trimmit (24 oz/A)	53 **a**	54 **a**	41 **a**	49 **a**

Stop #9a: All Star Preemergence Crabgrass Trial

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Objectives:

1. Compare efficacy of Specticle (indaziflam) for preemergence crabgrass control against the top three (authors' opinion) turf preemergence herbicides: Barricade (prodiamine); Dimension (dithiopyr); and Pendulum (pendimethalin).

2. Evaluate single vs. split/sequential application strategies.

3. Evaluate preemergence broadleaf control among these herbicides.

Soil:	Hanford fine sandy loam
Species:	'GN-1' Hybrid Bermudagrass Smooth crabgrass (*Digitaria ischaemum*)
Height:	0.625 inches; 3 times/wk
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; 4-ft alleys
Application Dates:	3 March 2015 (initial treatment) 14 April 2015 (6 WAIT)

Preliminary Results:

- ✓ Despite a later than desired initial application, all of the herbicides significantly reduced crabgrass cover in comparison to untreated control.
- ✓ Although not statistically significant, this study demonstrated that split/sequential applications of preemergence herbicides generally result in better weed control.
- ✓ Sequential applications of Barricade prevented crabgrass emergence into July and only 1% mean cover was observed in September.
- ✓ Specticle demonstrated that it deserves to be among this group of preemergence crabgrass herbicides. Furthermore, in this particular study and contrary to the other herbicides, Specticle provided postemergence control of persistent perennial ryegrass leftover from overseeding in 2013 in addition to *Poa annua*. Hence, plots appeared cleaner (data not shown).
- ✓ Wild parsley, *Oxalis*, and swinecress have been observed in plots but populations were sporadic and less than 5% in cover. Consequently, it was difficult to summarize herbicide efficacy against these species.

Table 1. Effects of preemergence herbicides on crabgrass cover (0-100%) in bermudagrass turf. Riverside, CA.

No.	Treatment	Company	Rate	Timing (wks)	6/20/15	7/13/15	8/12/15	9/2/15
1	Control	--	--	--	46 a	70 a	86 a	91 a
2	Specticle FLO	Bayer	9 oz/A	0	3 bc	5 bc	18 bc	21 bc
3	Specticle FLO	Bayer	4.5 oz/A	0, 6	1.2 bc	2.2 cd	6 cde	9 cd
4	Specticle FLO	Bayer	6 oz/A 3 oz/A	0 6	1.0 bc	3.5 bcd	10 cde	12 cd
5	Barricade 65WG	Syngenta	1.5 lb/A	0	0.2 bc	0.5 cd	2 e	2 d
6	Barricade 65WG	Syngenta	0.75 lb/A	0, 6	0 c	0 d	0.2 e	1 d
7	Dimension 2EW	DowAgro	2 pt/A	0	0.8 bc	2.8 cd	6 cde	11 cd
8	Dimension 2EW	DowAgro	1 pt/A	0, 6	0 c	0.8 cd	4 de	8 cd
9	Pendulum AquaCap	BASF	4.2 pt/A	0	4.8 b	7.8 b	24 b	34 b
10	Pendulum AquaCap	BASF	2.1 pt/A	0, 6	0.5 bc	2.2 cd	13 bcd	16 c

Means followed by the same letter in a column are not significantly different (P = 0.05).
Herbicides were applied on March 3 and April 15, 2015.

Plot Plan (Field 12G-1):

West ↑

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
9	**10**	**6**	**1**	**3**	**4**	**8**	**10**
2	**5**	**7**	**9**	**5**	**9**	**8**	**2**
1	**6**	**3**	**10**	**4**	**7**	**10**	**6**
9	**2**	**7**	**8**	**3**	**5**	**1**	**4**

Stop #9b: Postemergence Control of Crabgrass and Broadleaf Weeds in Tall Fescue

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Objectives:

Evaluate new and existing herbicides and combinations for postemergence control of mature smooth crabgrass (*Digitaria ischaemum*) in tall fescue turf.

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; 4 ft alleys
Application Dates:	18 August 2015 (initial treatment) 10 September 2015 (3 WAIT)

Results:

- ✓ Crabgrass was mature (tillering) and pressure was high at the beginning of the study.
- ✓ Two WAIT, no treatments appeared to significantly decrease crabgrass populations.
- ✓ Pylex + MSO, Tenacity + NIS, and Tenacity + Dismiss injured crabgrass the most following initial application. Nevertheless injury didn't lead to decrease of crabgrass in the plots.
- ✓ Results of repeat herbicide applications will be evident at Field Day.

2015 Postemergence Crabgrass Control in Tall Fescue

No.	Treatment	Company	Rate	Timing (wks)	Crabgrass % Cover (08/24/15)	Crabgrass % Injury (08/24/15)
1	Control				61 abc	0 e
2	Last Call	Nufarm	4 pts/A	0, 3	51 cd	13 cde
3 3	Last call NIS	Nufarm	4 pts/A 0.25% v/v	0, 3 0, 3	44 d	20 cd
4 4	Drive XLR8 MSO	BASF	1.45 oz/M 0.5% v/v	0, 3 0, 3	54 bcd	4 de
5 5	Last Call SureGuard	Nufarm	4 pts/A 0.67oz/A	0, 3 0, 3	46 cd	30 bc
6	F7214-3 6.6%	FMC	4 oz/M	0, 3	50 cd	4 de
7	F7214-3 6.6%	FMC	5 oz/M	0, 3	55 bcd	4 de
8	SOLITARE 75DF	FMC	0.367 oz/M	0, 3	53 bcd	4 de
9	SOLITARE 75DF	FMC	0.478 oz/M	0, 3	53 bcd	5 de
10 10	Pylex MSO	BASF	1.45 oz/A 0.5% v/v	0, 3 0, 3	68 ab	56 a
11 11	Tenacity NIS	Syngenta	5 oz/A 0.25% v/v	0, 3 0, 3	74 a	55 a
12 12	Tenacity Turflon Ester	Syngenta Dow	5 oz/A 16 oz/A	0, 3 0, 3	58 abcd	8 de
13 13	Tenacity Dismiss	Syngenta FMC	5 oz/A 4 oz/A	0, 3 0, 3	61 abc	51 a
14 14	Tenacity Dismiss	Syngenta FMC	5 oz/A 8 oz/A	0, 3 0, 3	57 bcd	44 ab

Means followed by the same letter in a column are not significantly different (P = 0.05).
Herbicides were applied on 18 August and 10 September 2015.

Plot plan for the study area

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

N↑

CIMIS station

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

Stop #10: Anthracnose Fungicide Trial 2015

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Anthracnose:

Eleven fungicide treatments are being evaluated for their ability to control anthracnose preventatively on an annual bluegrass green. Inoculation was achieved through core aeration and dragging in order to spread the existing inoculum. The plot was originally established in 2007 from seed with 'Peterson's Creeping' annual bluegrass. The study was set up as a randomized complete block with four replications. Fungicide treatments were initiated on 2 June 2015 before disease symptoms were present. Treatments were sprayed every 14 days. The plot receives 0.125 lb N/1000ft^2 every 14 days. The plot was topdressed on 15 May 2015, 18 August 2015, and deep tined on 15 May 2015. The most recent rating date was 27 August 2015.

Location: UCR Turf Facility

Soil: Hanford fine sandy loam

Experimental Design: Complete randomized block with 4 replications

Plot Size: 4′ X 6′

Application Information: CO_2 Backpack sprayer with TeeJet 8004VS nozzles
Output: 2 gal/M

Mowing Regime: 0.125 inches 3 days/wk

Results and Conclusions:

- ✓ Overall, anthracnose disease pressure and distribution were moderate to heavy, with disease present in every replication by mid-June.
- ✓ All of the fungicide treatments significantly reduced disease pressure when compared with the control, but no significance has been seen when comparing different treatments.
- ✓ Two treatments (4 & 5) received consistently high turf quality and Normalized Difference Vegetation Index (NDVI) ratings throughout the study.
- ✓ Summer patch disease pressure was present but sporadic this year. Treatments that did not contain fungicides for summer patch and anthracnose control suffered most from the disease.

Data:

Table 1. Effects of fungicides and fungicide programs on turf quality (1-9) and Normalized Difference Vegetation Index (NDVI 0-1). Disease and turf quality ratings were taken every 14 days but only the two most recent rating dates are shown.

Trt	Treatment Name	Rate	Rate Unit	Appl Code	Turf Quality 8/13/15 1-9	Turf Quality 8/27/15 1-9	NDVI 8/13/15 0-1	NDVI 8/27/15 0-1
1	Control				3.88 b	3.75 b	0.730 b	0.693 b
2	Chipco Signature	4	oz wt/1000 ft2	ACDEFGH	6.25 a	6.25 a	0.848 a	0.870 a
	Daconil Ultrex	3.2	oz wt/1000 ft2	ADFH				
	Mirage SC	1	fl oz/1000 ft2	BG				
	Insignia	0.7	fl oz/1000 ft2	CE				
3	Signature Stressgard	4	oz wt/1000 ft2	ACDEFGH	7.38 a	7.00 a	0.868 a	0.870 a
	Daconil Ultrex	3.2	oz wt/1000 ft2	ADFH				
	Mirage SC	1	fl oz/1000 ft2	BG				
	Insignia	0.7	fl oz/1000 ft2	CE				
4	Velista	0.5	oz wt/1000 ft2	ACEG	7.63 a	7.38 a	0.870 a	0.870 a
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH				
	Appear	6	fl oz/1000 ft2	ABCDEFGH				
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH				
	Heritage Action	0.4	oz wt/1000 ft2	BDFH				
5	Heritage Action	0.2	oz wt/1000 ft2	ABCDEFGH	7.50 a	7.25 a	0.850 a	0.875 a
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH				
	Appear	6	fl oz/1000 ft2	ABCDEFGH				
6	Velista	0.5	oz wt/1000 ft2	ABCDEFGH	6.88 a	6.13 a	0.860 a	0.868 a
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH				
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH				
7	Velista	0.5	oz wt/1000 ft2	ABCDEFGH	6.13 a	5.63 a	0.835 a	0.835 a
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH				
	Appear	6	fl oz/1000 ft2	ABCDEFGH				
8	A20581A	0.34	fl oz/1000 ft2	ABCDEFGH	6.38 a	6.00 a	0.848 a	0.858 a
9	Briskway	0.7	fl oz/1000 ft2	AH	7.50 a	7.00 a	0.873 a	0.853 a
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH				
	Velista	0.5	oz wt/1000 ft2	BDF				
	Appear	6	fl oz/1000 ft2	BCEFG				
	Heritage Action	0.4	oz wt/1000 ft2	CEG				
	Daconil Action	3.5	fl oz/1000 ft2	CDEG				
10	Encartis	4	fl oz/1000 ft2	ABCDEFGH	5.75 a	4.50 b	0.840 a	0.808 a
11	Lexicon Intrinsic	0.47	fl oz/1000 ft2	ACEG	6.38 a	6.13 a	0.853 a	0.860 a
	Encartis	4	fl oz/1000 ft2	BDFH				
	Trinity	1	fl oz/1000 ft2	BDFH				
12	Clearys 3336	4	oz wt/1000 ft2	AB	6.88 a	6.88 a	0.865 a	0.865 a
	Velista	0.5	oz wt/1000 ft2	CDEFGH				
	Daconil Action	3.5	fl oz/1000 ft2	CDEFGH				
	Primo Maxx	0.1	fl oz/1000 ft2	CDEFGH				

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

Application Code
A = 2 June 2015
B = 16 June 2015
C = 30 June 2015
D = 14 July 2015
E = 28 July 2015
F= 11 August 2015
G = 25 August 2015
H = 8 September 2015

Table 2. Effects of fungicides and fungicide programs on turf color (1-9), summer patch cover (%), and anthracnose cover (%). Disease and turf quality ratings were taken every 14 days but only the two most recent rating dates are shown.

Trt	Treatment Name	Rate	Rate Unit	Appl Code	Turf Color 8/13/15 1-9	Turf Color 8/27/15 1-9	Summer Patch 8/13/15 %	Summer Patch 8/27/15 %	Anthracnose 8/13/15 %	Anthracnose 8/27/15 %
1	Control				3.75 c	3.50 c	0.0 a	0.0 c	48.8 a	55.0 a
2	Chipco Signature	4	oz wt/1000 ft2	ACDEFGH	6.13 ab	6.25 ab	0.6 a	0.0 c	0.0 b	0.0 b
	Daconil Ultrex	3.2	oz wt/1000 ft2	ADFH						
	Mirage SC	1	fl oz/1000 ft2	BG						
	Insignia	0.7	fl oz/1000 ft2	CE						
3	SignatureStressgard	4	oz wt/1000 ft2	ACDEFGH	7.50 a	7.00 a	0.0 a	0.0 c	0.0 b	0.0 b
	Daconil Ultrex	3.2	oz wt/1000 ft2	ADFH						
	Mirage SC	1	fl oz/1000 ft2	BG						
	Insignia	0.7	fl oz/1000 ft2	CE						
4	Velista	0.5	oz wt/1000 ft2	ACEG	7.75 a	7.38 a	0.6 a	0.0 c	0.0 b	0.0 b
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH						
	Appear	6	fl oz/1000 ft2	ABCDEFGH						
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH						
	Heritage Action	0.4	oz wt/1000 ft2	BDFH						
5	Heritage Action	0.2	oz wt/1000 ft2	ABCDEFGH	7.75 a	7.25 a	0.8 a	0.0 c	0.0 b	0.0 b
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH						
	Appear	6	fl oz/1000 ft2	ABCDEFGH						
6	Velista	0.5	oz wt/1000 ft2	ABCDEFGH	7.38 a	6.38 ab	2.1 a	5.0 c	0.0 b	0.0 b
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH						
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH						
7	Velista	0.5	oz wt/1000 ft2	ABCDEFGH	6.13 ab	5.88 ab	3.1 a	11.8 b	0.0 b	2.5 b
	Daconil Action	3.5	fl oz/1000 ft2	ABCDEFGH						
	Appear	6	fl oz/1000 ft2	ABCDEFGH						
8	A20581A	0.34	fl oz/1000 ft2	ABCDEFGH	6.50 ab	6.13 ab	0.0 a	3.0 c	6.3 b	6.3 b
9	Briskway	0.7	fl oz/1000 ft2	AH	7.88 a	7.38 a	0.8 a	0.0 c	0.0 b	0.0 b
	Primo Maxx	0.1	fl oz/1000 ft2	ABCDEFGH						
	Velista	0.5	oz wt/1000 ft2	BDF						
	Appear	6	fl oz/1000 ft2	BCEFG						
	Heritage Action	0.4	oz wt/1000 ft2	CEG						
	Daconil Action	3.5	fl oz/1000 ft2	CDEG						
10	Encartis	4	fl oz/1000 ft2	ABCDEFGH	5.25 b	4.63 bc	3.3 a	28.8 a	0.0 b	2.0 b
11	Lexicon Intrinsic	0.47	fl oz/1000 ft2	ACEG	6.25 ab	6.38 ab	0.0 a	1.3 c	0.0 b	0.0 b
	Encartis	4	fl oz/1000 ft2	BDFH						
	Trinity	1	fl oz/1000 ft2	BDFH						
12	Clearys 3336	4	oz wt/1000 ft2	AB	7.25 a	7.13 a	0.0 a	0.0 c	0.0 b	0.0 b
	Velista	0.5	oz wt/1000 ft2	CDEFGH						
	Daconil Action	3.5	fl oz/1000 ft2	CDEFGH						
	Primo Maxx	0.1	fl oz/1000 ft2	CDEFGH						

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

North/Trees

EXP	10	EXP	EXP	9	
EXP	5	EXP	EXP	7	
11	4	7	4	10	2
10	EXP	EXP	2	EXP	7
9	EXP	6	EXP	1	9
8	1	3	11	3	EXP
7	EXP	2	EXP	EXP	8
6	9	EXP	3	6	EXP
5	EXP	11	8	EXP	EXP
4	EXP	8	1	11	10
3	EXP	EXP	5	5	EXP
2	EXP	6	EXP	EXP	4
1	EXP	12	12	12	12

Anthracnose 2015 12-G4

Stop #11: UCR Turfgrass Breeding Project

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Introduction:

A new turfgrass breeding program has been launched at the 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. In 2014 another 26 accessions were added. There were several criteria for selection of collection accessions: 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) conditions hoping to 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 intermated with established turf accessions, and the process of selection will start. The goal is to widen the genetic base of turf tall fescues, primarily by making use of more drought/heat tolerant/resistant exotic accessions. Our biggest problem at the moment is poor vernalization and hence, poor and uneven flowering which makes making crosses almost impossible.

Bermudagrass:

In the past we have established a collection of 68 accessions representing all distinct species of bermudagrass. These were obtained from USDA and other sources. In the past year we added another 45 accessions, mostly from the USDA collection of Bermuda grass; two were provided by Mr. Tremmel and several were collected locally from abandoned sites. There is clear variation essentially every identifiable characteristic among the accessions, including the onset of winter dormancy. In 2013 we made a range of individual crosses between selected 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). We also harvested seed from open pollination among all collection accessions in the field. Since all these accessions represent single plants, and bermudagrasses 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* and we ended up with ca. 350 viable hybrids. To determine the male cross parent in hybrids from open pollination of the collection accessions we run two plates (188 entries) of DArT DNA markers. The mass of data is still being processed but we assume that the parentage of most hybrids will be established and in the process, the hybrids themselves will become fingerprinted. From among the hybrids we selected a total of 30 with interesting characteristics, planted them on larger plots in several locations to test their performance including: Arizona Country Club, Scottsdale; Coachella Valley Agricultural Research Station, Thermal; and Preserve Golf Club, Carmel. Some will be tested under extreme drought; all will be scored for the onset of winter dormancy. Crosses were repeated again in 2014 but as of August 2015 we do not see any germination, with a single exception of a hybrid of *C. transvaalensis*. We repeated controlled crosses in 2015 but at this point we do not know how successful they were.

Festuca-Lolium Hybrids:

We continue working with populations of perennial ryegrass (*Lolium perenne*) with introgressions of chromatin from meadow fescue (*Festuca pratensis*). Most work is done in the greenhouse on individually karyotyped plants. As with tall fescue, in the field we have serious problems with inadequate vernalization over the last two winters, hence we were unable to produce sufficient seed for dry-down experiments. For the time being we keep adding to the pollination block all plants with introgressions of *F. pratensis* chromosome 3, known to be involved in stress tolerance in Festulolium. We assume the first winter with a typical temperature will solve our vernalization problems and adequate amount of seed will be produced to start another round of selection under extreme drought. In the meantime, new sets of lines are generated under controlled conditions in the greenhouse.

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).

Stop #12: Effects of Biochar on Turf Establishment

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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 without the 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 biosolids compost. Initial results regarding the effect of biochar and compost incorporation on establishment rates of tall fescue are presented, along with results from the first year of drought stress currently underway.

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 ETo) or reduced (50% of ETo), and main plot treatments of biochar or compost (see treatment list and plot plan on following page). Tall fescue was seeded on May 5, 2014 at a rate of 8 lbs/1000 ft^2, and topdressed in fall 2014. All plots were irrigated sufficiently during the establishment phase. Drought stress was induced on May 4, 2015 in the reduced irrigation plots. Turf quality, clipping yield, 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.
- Root measurements collected at the beginning of drought stress show that those plots treated with either 4 or 2 inches of composted greenwaste as well as those treated with 2 inches composted greenwaste and biochar demonstrate the greatest rooting depth, while amendment with 2 inches of composted biosolids reduced rooting depth compared to control plots (Fig.1).
- Amendment with 2 inches composted greenwaste also increased root volume compared to controls (Fig.2).

- Under reduced irrigation, plots amended with 1 ton/acre biochar had increased clipping yields compared to all other treatments and control.
- Compost amended plots showed increases in soil moisture compared to control plots beginning 6/15/2015. The most consistent improvements were achieved with both composted greenwaste treatments, the composted biosolids treatment, and the combined compost and biochar amendment (Fig. 3).
- On the rating date of 6/30/2015, visual quality was improved compared to controls with all biochar amendments, 2 inches composted greenwaste, and the combined biochar and compost amendment under deficit irrigation.
- NDVI data consistently demonstrate reduced plant health and appearance with composted biosolids treatment beginning 6/30/2015. On 8/24/2015, the 5 ton/acre biochar and combined biochar and compost amendments also reduced NDVI compared to controls.
- Turf cover as measured by digital image analysis shows that, on 7/27/2015, composted biosolids reduced coverage under both high and low irrigation rates, though this reduction was very small (approximately 1%).

Summary:

- The most consistent effect of compost amendments was an increase in soil water content. Under drought conditions this would be especially desirable.
- Combined biochar and compost amendments result in increased soil water content and rooting depth.

Plot Plan and Treatment List

(North)

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

Figure 1: Root length by soil amendment, collected 5/04/2015

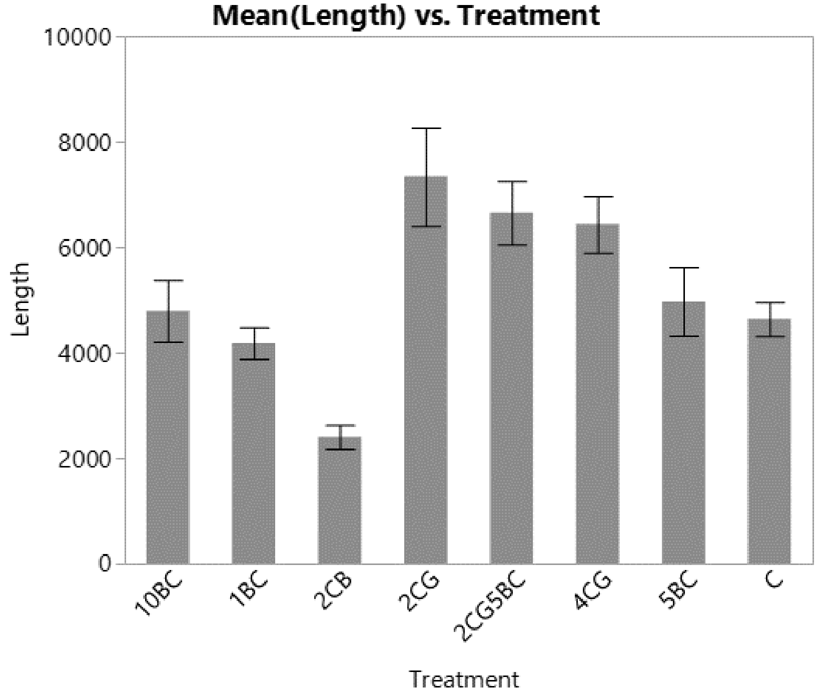
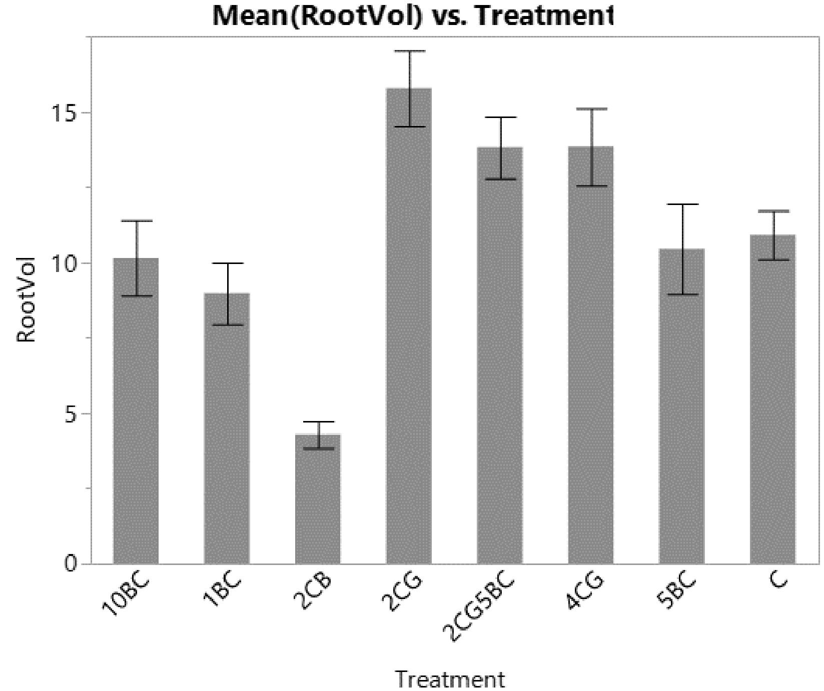
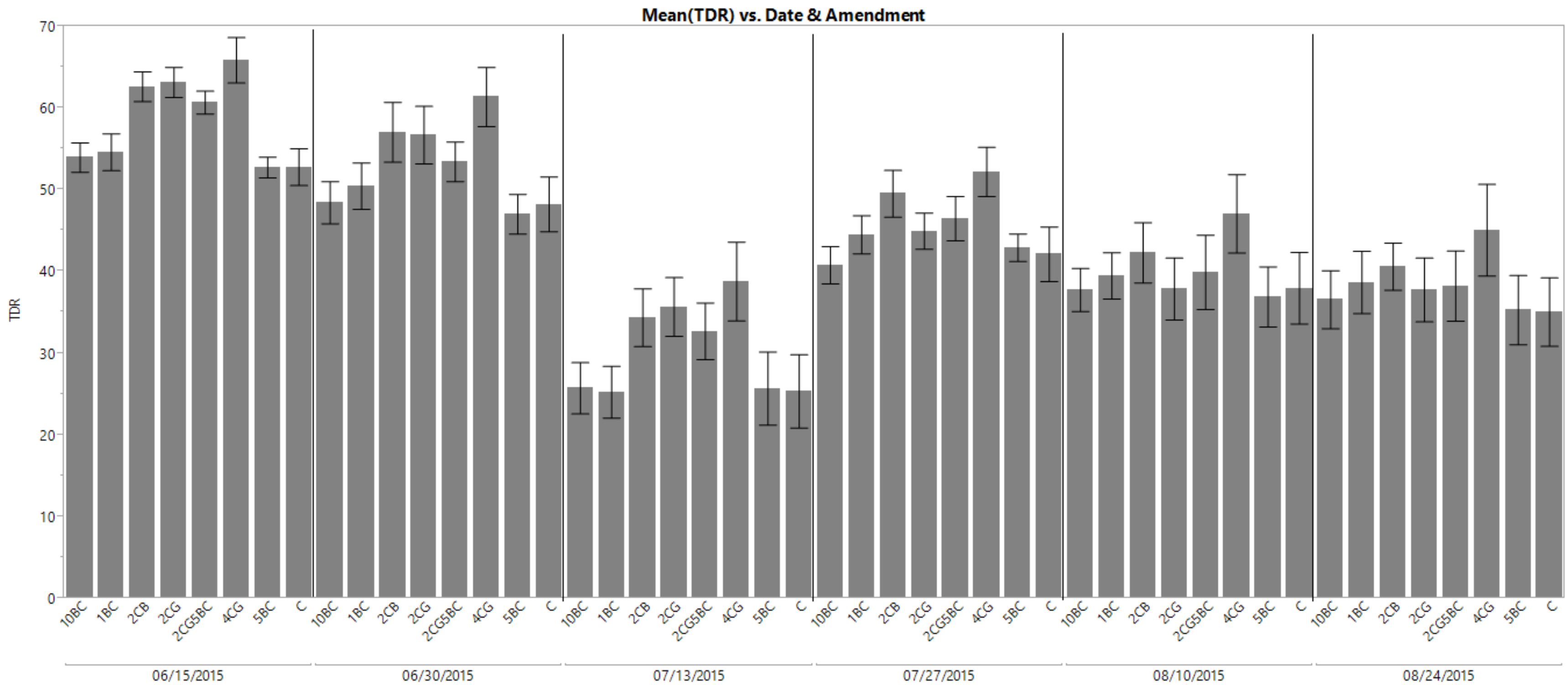


Figure 2: Root volume by soil amendment, collected 5/04/2015



Key	
CL: Control low irrigation	2CBL: 2 inches Composted Biosolids Low Irrigation
CH: Control high irrigation	2CBH:2 inches Composted Biosolids High Irrigation
1BCL: 1 ton/A Biochar low irrigation	2CGL: 2 inches Composted Greenwaste Low Irrigation
1BCH: 1 ton/A Biochar high irrigation	2CGH: 2 inches Composted Greenwaste High Irrigation
5BCL: 5 ton/A Biochar low irrigation	2CG5BCL: 2 Inches Composted Greenwaste plus 5 ton/A Biochar Low Irrigation
5BCH: 5 ton/A Biochar high irrigation	2CG5BCH: 2 Inches Composted Greenwaste plus 5 ton/A Biochar High Irrigation
10BCL: 10 ton/A Biochar low irrigation	4CGL: 4 inches Composted Greenwaste Low Irrigation
10BCH: 10 ton/A Biochar high irrigation	4CGH: 4 inches Composted Greenwaste High Irrigation

Figure 3: Soil moisture comparison between compost and control plots beginning 6/15/2015



Save the Date

UCR Turfgrass & Landscape
Research Field Day

Thursday, September 15, 2016

See you then!

UC RIVERSIDE
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Turfgrass Science