WARM-SEASON TURFGRASS N RATES & IRRIGATION BMP VERIFICATION

DEP WM 869

COMPLETED STUDIES REPORT

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Table 69. Effects of Irrigation regime and Nitrogen fertilization on clipping yield of Bahiagrass

Factor	04/15	05/05	05/29	06/09	07/03
Irrigation	----------g/m^2----------				
Regime					
0.1" Daily	9.2	24.8	27.1b	55.5	120.5
0.5" 3X/wk	9.0	28.9	55.3a	60.1	133.8
Sig.	ns	ns	**	ns	ns
N Rate (lb 1000^{-1} yr^{-1}).					
1	4.6c	14.6b	25.6	36.5b	95.7c
2	6.0bc	22.0a	31.6	45.5b	109.1bc
4	14.6a	34.6a	56.8	74.1b	137.9ab
6	11.1ab	37.3a	50.9	75.4a	165.8a
Sig.	**	**	ns	**	**
Irr. X N Interaction					
Sig.	ns	ns	ns	ns	ns

**, and ns refer to $P < 0.01$, and $P > 0.05$, respectively

N SOURCE AND TIMING -FERTILIZER BLACKOUT STUDY

MATERIALS AND METHODS

The experiment was initiated June 3, 2009 at the University of Florida Fort Lauderdale Research and Education Center. Granular N sources (Table 70) were applied once to 6 replications of mature St. Augustinegrass at 2.0lbs.N 1000 ft.$^{-2}$ and watered in with 0.12 inch irrigation immediately following application. The experimental area had not received any fertilization for a period of 4 months and plots were randomized based on turfgrass quality, color and density. A single lysimeter was installed into each 2m x 4m plot. Lysimeters were constructed of heavy grade plastic with a leachate outflow pipe located on the bottom. PVC pipes attached to each lysimeter were connected to gravity flow collection points adjacent to the plots.

Turfgrass quality, color and density visual ratings (scale of 1-9 with 9=dark green, dense turf, 1=dead/brown turf, and 6=minimally acceptable turf) were taken throughout the experimental period. Turfgrass clipping samples were taken at a 3.0 inch height of cut approximately every 2 weeks or more when necessary. Tissue was oven dried at 60°C for a minimum of 48 hours before weighing.

Percolate water samples were collected weekly or more frequently following a rain event exceeding 0.25 inch. Samples were acid preserved and shipped to the UF Analytical Research Lab in Gainesville for NO_3-N analysis.

All data were subjected to statistical analysis and significant means were identified.

Table 70. N sources and manufacturers.

Code	Description	%N	Manufacturer
URE	granular urea	46	PCS Sales, Inc. Northbrook, IL
UXCU	70:30 urea:xcu	45	
BS	sewage sludge bio-solid	5	Milorganite, Milwaukee, WI
PCU	polymer coated urea	41	Pursell Inc., Sylacauga, AL
XCU	polymer coated urea	43	Agrium Advanced Technologies, AL

RESULTS

Turfgrass Quality, Color and Clipping Growth

Turfgrass quality was significantly affected by fertilizer treatment on most observation dates and the readily soluble N treatments generally had the quickest response with some slow and controlled release N forms providing better turfgrass quality over timeframe within the blackout period and then after that period (Tables 2a-2b). In the no-N check, turfgrass quality dipped below the 6.0 minimally acceptable rating on 6/25 and was consistently the lowest rated treatment (Tables 2a-2b). Turfgrass color ratings had similar treatment responses (Tables 3a-3b). Turfgrass clipping growth responded to the application of the various forms of N as anticipated by the availability of N from the N sources (Tables 4a-4b). The controlled release source PCU had the most clippings at the end of the reporting period while having the least early on (Tables 4a-4b).

N Leaching and Climatological Data

The trial was conducted during the rainy season months encompassing blackout period months. Thus, nearly 100 cm of rain and irrigation impacted the site during the trial months and June and July each had approximately 25 cm of rain (Figure 18).

Nitrate-N leaching was significantly-affected by N treatment with the urea treatment having the most cumulative leaching followed by the 70:30 soluble/slow combination treatment and other treatments (Table 74a-e, Figure 19). The 3 slow or controlled release N products had Nitrate-N leaching totals that were statistically—equal to the no-N check, were lower than the urea treatment, and statistically-equal to the 70:30 combination treatment (Tables 74a-e). Most of the leaching occurred during the first month after application (Table 74a). Thereafter, there were no significant differences in leaching.

In conclusion, while the application of N at a high rate to compensate for black out restrictions improved visual ratings and growth, there was increased N leaching from turf receiving readily-available N. Using complete slow or controlled-release N reduced N leaching to statistically-equal amounts achieved the no-N check and improved turfgrass visual ratings and growth at the end of the study.

Table 71a. N Timing: Turfgrass quality ratings.

TRT	5/18/09	6/15	6/22	6/25	7/2	7/10	7/20	8/6
URE	6.8	7.8a	7.9a	8.2bc	7.3b	7.0	7.2a	6.6b
UXCU	6.8	7.8a	7.9a	8.6ab	8.1a	6.7	7.0a	6.8ab
BS	6.7	6.9bc	7.2b	7.8c	7.2b	7.3	7.3a	6.7b
PCU	6.7	6.5c	5.8c	5.7d	6.1c	6.8	7.3a	7.2a
XCU	6.5	7.2b	8.1a	9.0a	8.4a	6.9	7.4a	6.8ab
CHK	6.7	6.5c	6.0c	5.8d	5.7c	6.3	5.8b	5.4c
Signif.	ns	**	**	**	**	ns	**	**

ns and ** = P>0.05 and P<0.01
Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.
Turfgrass quality ratings based on a 1-9 scale with 9=dark green turf, 1=dead/brown turf, and 6=minimally acceptable turf.

Table 71b. N Timing: Turfgrass quality ratings.

TRT	8/21/09	9/3	9/18	10/2
URE	6.4b	6.5ab	6.8b	6.7b
UXCU	6.5b	6.2b	6.4b	6.4b
BS	6.8b	6.7ab	7.2ab	6.8ab
PCU	7.4a	7.0a	7.7a	7.5a
XCU	6.8b	6.6ab	6.7b	6.5b
CHK	5.6c	5.4c	5.5c	5.3c
Signif.	**	**	**	**

** = P<0.01
Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.
Turfgrass quality ratings based on a 1-9 scale with 9=dark green turf, 1=dead/brown turf, and 6=minimally acceptable turf.

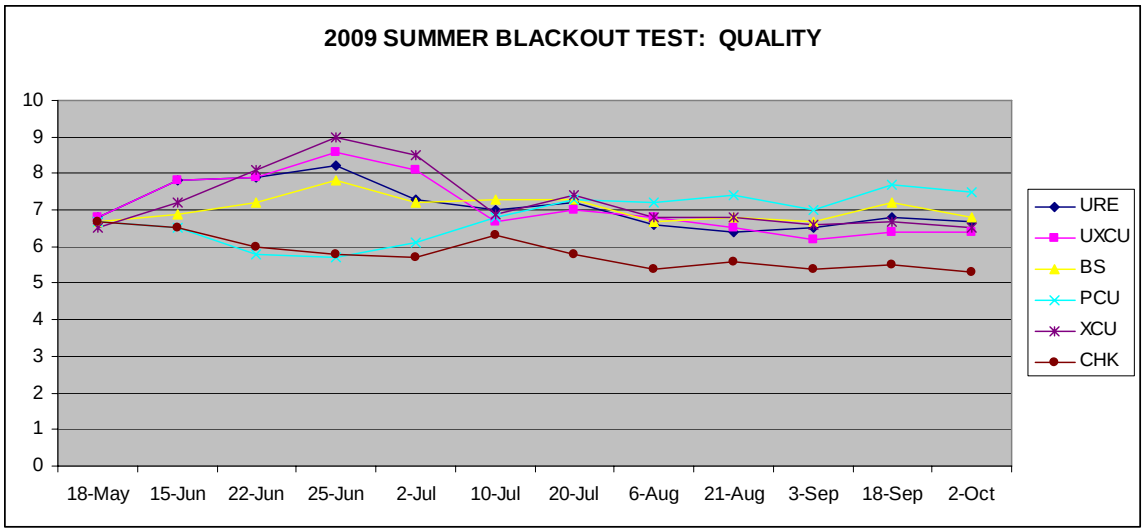

Figure 15. N Timing Blackout Test: Overall visual quality from 18 May—2 Oct. 2009.

Table 72a. N Timing: Turfgrass color ratings.

TRT	5/18/09	6/15	6/22	6/25	7/2	7/10	7/20	8/6
URE	6.4	8.1a	8.3a	8.2b	7.7b	7.2	7.3a	6.7b
UXCU	6.6	8.0a	8.3a	8.4ab	8.5a	6.8	7.2a	7.1ab
BS	6.3	7.3b	7.4b	7.4c	7.4b	7.7	7.4a	7.0ab
PCU	6.3	6.8bc	6.3c	5.6d	6.3c	7.1	7.5a	7.4a
XCU	6.3	7.2b	8.6a	9.0a	8.6a	7.3	7.7a	7.3a
CHK	6.5	6.5c	6.1c	5.5d	5.8c	6.3	6.0b	5.6c
Signif.	ns	**	**	**	**	ns	**	**

ns and ** = P>0.05 and P<0.01
Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.
Turfgrass color ratings based on a 1-9 scale with 9=dark green turf, 1=dead/brown turf, and 6=minimally acceptable turf.

Table 72b. N Timing: Turfgrass color ratings.

TRT	8/21/09	9/3	9/18	10/2
URE	6.7b	6.8b	6.8b	6.2b
UXCU	6.9b	6.6b	6.6b	5.9b
BS	6.9b	6.8b	7.1ab	6.3b
PCU	7.4a	7.5a	7.5a	7.2a
XCU	7.0b	6.8b	6.9ab	6.2b
CHK	6.1c	5.8c	5.8c	5.3c
Signif.	**	**	**	**

** and * = P<0.01 and P<0.05
Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.
Turfgrass color ratings based on a 1-9 scale with 9=dark green turf, 1=dead/brown turf, and 6=minimally acceptable turf.

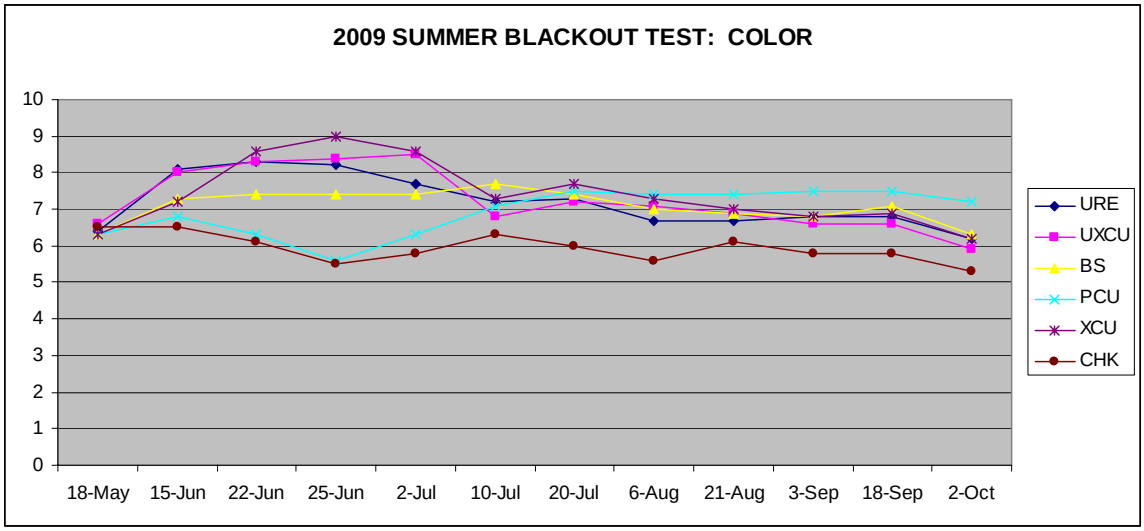

Figure 16. N Timing Blackout Test: Overall visual color from 18 May—2 Oct. 2009.

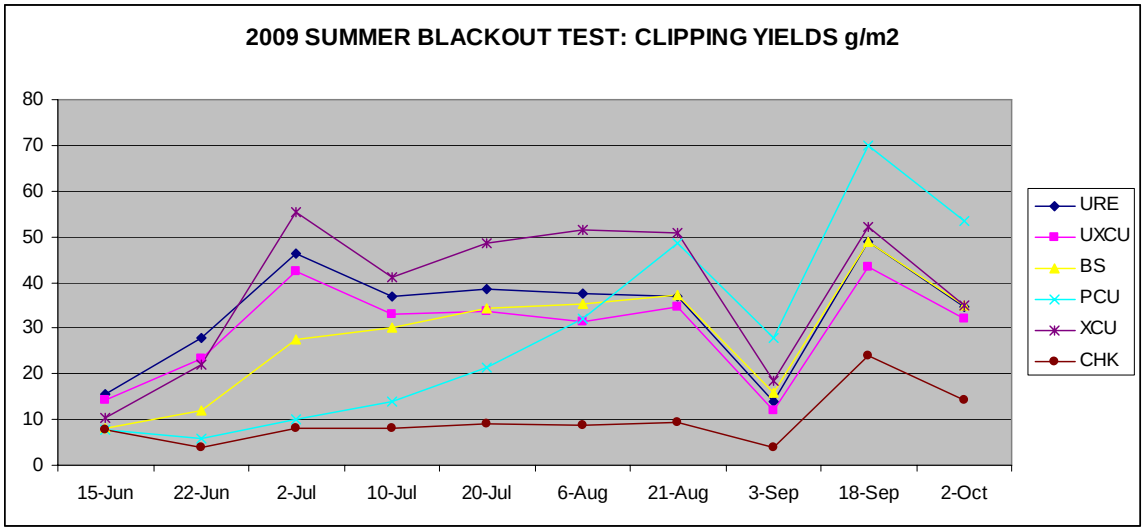

Figure 17. N Timing Blackout Test: Clipping tissue growth from 15 June—Oct. 2, 2009.

Table 73a. N Timing: Turfgrass clipping yields.

TRT	6/15/09	6/22	7/2	7/10	7/20
URE	15.6a	27.8a	46.2ab	36.8a	38.5b
UXCU	14.1a	23.2a	42.4b	33.1a	33.7b
BS	8.0b	11.9b	27.6c	30.0a	34.2b
PCU	7.8b	5.8b	10.1d	13.9b	21.4c
XCU	10.5ab	21.9a	55.3a	41.1a	48.7a
CHK	7.8b	3.9b	8.1d	8.2b	9.1d
Signif.	*	**	**	**	**

* and ** = P<0.05 and P<0.01

Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

.Table 73b. N Timing: Turfgrass clipping yields.

TRT	8/6/09	8/21	9/3	9/18	10/2
URE	37.5b	36.8ab	13.8b	48.8b	34.6b
UXCU	31.5b	34.8b	12.1b	43.5b	32.2b
BS	35.2b	37.3ab	15.8b	48.8b	35.1b
PCU	32.1b	48.5ab	27.9a	70.1a	53.6a
XCU	51.4a	50.7a	18.5b	52.1b	35.1b
CHK	8.8c	9.4c	3.9c	24.1c	14.2c
Signif.	**	**	**	**	**

** and ns = P<0.01 and P>0.05

Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

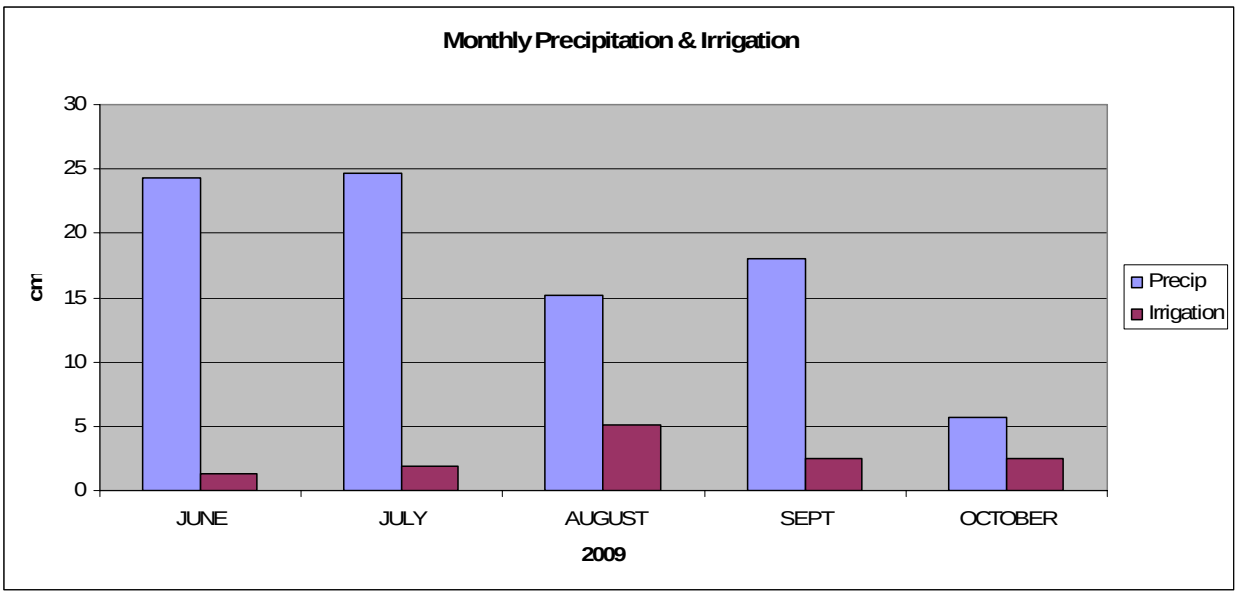

Figure 18. N Timing Blackout Test: Rainfall and irrigation June—October 2009.

Table 74a. N Timing: NO_3-N leached (mg m^{-2})

TRT	6/3/09	6/8	6/10	6/15	6/17	6/24	6/29
URE	0	9.3	6.5	1107.3a	799.5a	985.6a	24.7
UXCU	0	3.1	2.8	565.1ab	127.0b	522.4ab	38.7
BS	0	13.2	8.2	55.6b	28.4b	50.9b	24.5
PCU	0	5.1	5.3	22.7b	3.8b	34.4b	7.1
XCU	0	4.4	1.5	34.4b	18.6b	189.7b	32.9
CHK	0	0.8	0.3	4.5b	0.0b	9.1b	0.8
Signif.	ns	ns	ns	**	**	**	ns

ns and ** = P>0.05 and P<0.01
Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

Table 74b. N Timing: NO_3-N leached (mg m^{-2})

TRT	7/1/09	7/3	7/6	7/15	7/20	7/27
URE	14.5	2.3	0.10	9.8	9.6	6.7
UXCU	15.0	6.2	1.2	16.8	17.5	13.7
BS	20.6	9.4	1.5	28.3	23.0	19.9
PCU	16.3	9.3	0.05	12.5	27.1	20.8
XCU	25.4	10.5	0.4	9.2	42.4	19.0
CHK	0.4	0.0	0.04	0.0	0.7	3.3
Signif.	ns	ns	ns	ns	ns	ns

ns = P>0.05

Table 74c. N Timing: NO_3-N leached (mg m^{-2})

TRT	8/6/09	8/12	8/17	8/24	8/31
URE	1.5	0.0	0.0	0.0	0.0
UXCU	9.5	2.5	41.1	13.4	38.8
BS	16.0	10.8	33.2	10.4	12.9
PCU	24.3	3.6	38.0	7.6	17.5
XCU	19.1	0.0	30.3	2.2	18.1
CHK	0.0	0.0	0.0	0.3	0.0
Signif.	ns	ns	ns	ns	ns

ns = P>0.05

Table 74d. N Timing: NO_3-N leached (mg m^{-2})

TRT	9/4/09	9/7	9/11	9/14	9/21
URE	0.0	0.3	0.1	0.0	0.0
UXCU	1.64	2.0	31.2	31.5	14.3
BS	0.0	2.0	12.7	10.3	7.1
PCU	0.7	0.6	13.8	18.2	7.4
XCU	0.6	2.2	23.3	28.1	7.2
CHK	0.0	0.2	0.0	0.0	0.0
Signif.	ns	ns	ns	ns	ns

ns = P>0.05

Table 74e. N Timing: NO_3-N leached (mg m^{-2})

TRT	9/28/09	10/6/09	TOTAL (6/8/09-10/6/09)
URE	0.0	0.0	3111.2a
UXCU	25.0	39.6	1596.4b
BS	9.9	9.5	408.7bc
PCU	8.0	10.7	307.4bc
XCU	15.1	24.1	541.4bc
CHK	0.0	0.0	20.5c
Signif.	ns	ns	**

ns and ** = P>0.05 and P<0.01

Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

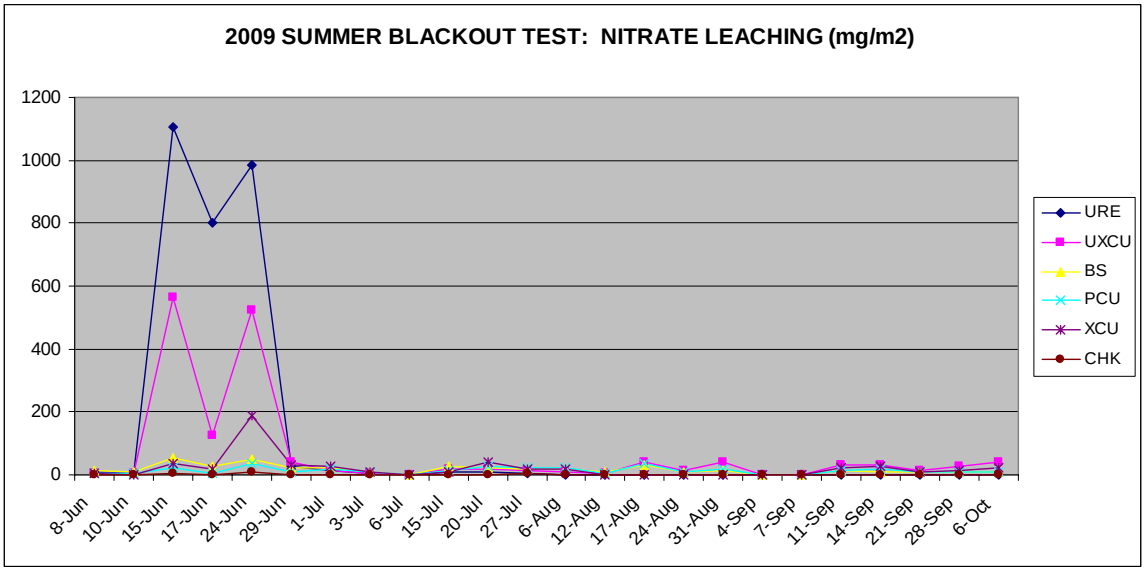

Figure 19. N Timing Blackout Test: Nitrate Leaching from 8 June – October 6, 2009.