

The Response of Kentucky Bluegrass Turf to Varying Nitrogen Sources
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Introduction:

The objectives of the 2005 nitrogen (N) source study were to compare the turf response and N release rates of various experimental fertilizer products being proposed for marketing to a number of industry standards, such as Milorganite, Sustane, Nature Safe, Corn Gluten Meal, Renaissance, and urea. An untreated control was also added for comparison. The research was conducted at the Iowa State University turfgrass research area north of Ames, Iowa on Nassau Kentucky bluegrass turf.

Materials and Methods:

The study included eighteen different N fertilizer treatments obtained from varying companies that produce fertilizer materials for the turf industry and an untreated control (Table 1). Urea is a synthetic-organic fertilizer. Some of the experimental materials contain urea in addition to natural organic nitrogen sources. The study was conducted as a randomized complete block with 3 replications. With nineteen treatments and 3 replications, this was a total of 57 plots. Each of the Nassau Kentucky bluegrass plots measured 5' x 5' (25ft²). Following an initial mowing at 1 and 11/16 inch mowing height, the fertilizers were applied at a rate of 1 lb N/1000ft². The first application date was May 28th, 2005.

The two 'Four All Seasons' materials are from Four All Seasons of Holstein, IA. The three Sustane products are from Sustane-Natural Fertilizer, Inc., Cannon Falls, MN.

Renaissance is from Renaissance Inc. of Minnetonka, MN.

Milorganite is a standard from Milorganite Inc. of Milwaukee, WI.

Nature Safe is from Nature Safe of Cold Spring, KY.

Safe and Secure is Corn Gluten Meal, it and the Grain Processing materials come from Grain Processing of Muscatine, IA.

The Leovex is an experimental product from Korea.

The Rootein and Nutrite materials are products of Ceres Inc. of Vaudreuil, Quebec, Canada.

The plots were again mown at a uniform height one week after fertilizers were applied. Data collection began one week following that mowing on June 9. Data were collected by harvesting the clippings separately from each plot at a mowing height of 1 11/16 inches. The width of the test strip was 19 ½ inches using a McClain reel mower with a catch basket. This resulted in clippings being collected from 8.125ft² of plot area. After all clippings were taken for a particular date, the remaining area on the plots was mowed to a uniform height of 1 11/16 inches and the clippings were then discarded in order to avoid any nitrogen being put back into the

soil. Following collection, the clippings were placed in an oven and allowed to dry for a minimum of 3 days at 67 C. They were then weighed and data were reported on the basis of grams of dry weight tissue/25 ft² plot (Table 1). Following the third week of clipping collection, an 18 inch wide Toro Greensmaster[®] 3000 set at 1 3/8 inch mowing height was used for data collection. Using this mower resulted in clipping collection from 7.5ft² of plot area. Data were again expressed in grams dry weight tissue/25 ft² plot.

Visual quality ratings based on color, density, and overall appearance were taken weekly on a scale of 9-1, with 9 being the highest quality and 1 being the lowest quality. A rating of 6 or higher was considered acceptable turf quality. The second application of N fertilizers was applied on July 14th and the third application of fertilizers was on September 9th. Both of these treatments were made uniformly at a rate of 1 lb N/1000 ft².

Drive[®] (quinclorac) was applied July 21 at a rate of 0.75 pounds active ingredient per acre for post emergence crabgrass control. Any broadleaves present throughout the growing season were spot-treated with Weed-B-Gone/Killex weed control.

Clippings were taken a total of twenty times. Every two weeks, weighed clippings were combined together and then ground through a Wiley mill with a twenty mesh screen. Since there were twenty collection dates, there were 10 dates of ground clippings. Once the clippings were ground, 0.1 grams of tissue was weighed, added to Kjeldahl tubes, and processed through the Micro-Kjeldahl procedure using a Lachat BD-46 block digester. The liquid solution resulting from the digestion process was then analyzed with a Lachat nitrogen analysis apparatus in accordance to the Salicylate Method for ammonium determination. The results of the procedure produced dry-weight percentages of N for each tissue sample (Table 3).

Results and Discussion:

Weekly clipping data are listed in table 1. Clippings provide a more objective measurement of turf response than do the subjective quality ratings. The value of this data will be a demonstration of how the grass responded to each product versus the untreated control. It also shows how quickly the grass responded to the various treatments and how long that response lasted.

Weekly quality data for June 9 to October 27 are listed in table 2. We have not attempted to make graphic representations of the comparative data because of the large numbers of treatments.

Table 3 includes data on the uptake of nitrogen by the grass on a % dry tissue basis in response to each treatment over the entire season. Again, we grouped clippings from two week time periods for N analysis. This data gives additional objective measurements that can be used to compare individual products to the control and to other industry standards.

Table 1a. Clipping weights of Kentucky bluegrass during the 2005 season.

Treatment	9-Jun	17-Jun	23-Jun	1-Jul	7-Jul	14-Jul	21-Jul	28-Jul	4-Aug	11-Aug	18-Aug	24-Aug
Control	24.8	15.0	10.5	23.7	13.7	12.7	16.3	23.6	24.7	19.3	12.9	19.0
Four: All Seasons 9-1-1	41.1	30.2	17.3	30.1	19.0	17.4	21.8	24.1	22.0	20.5	16.7	23.0
Four: All Seasons 11-1-1	39.3	26.0	19.7	34.5	18.7	18.0	22.7	31.8	25.6	22.4	19.6	27.3
Sustane (All Natural) 5-2-4	40.9	21.7	13.5	32.5	19.3	16.9	21.8	30.2	25.8	21.4	19.6	25.9
Sustane (Natural Base) 5-2-4	41.9	25.5	14.7	28.7	14.6	13.3	18.6	33.9	24.2	19.1	16.6	22.8
Sustane (Green Grade) 8-2-4	35.4	24.5	14.9	29.5	17.6	15.1	24.4	29.3	27.8	20.5	16.2	22.3
Renaissance 8-2-6	40.9	32.9	19.8	35.9	20.4	17.9	25.7	37.6	29.8	25.9	20.4	29.5
Milorganite 6-2-0	37.3	26.5	15.4	34.6	17.0	15.7	22.1	21.1	20.7	19.2	16.0	21.9
Nature Safe 10-2-8	37.9	29.4	19.8	34.1	20.4	19.1	26.4	22.8	21.4	20.7	17.3	23.7
Secure and Safe 9-0-0	37.3	34.0	22.6	34.0	18.9	17.1	21.5	27.6	21.8	20.0	18.0	26.3
Urea 46-0-0	60.3	36.1	21.1	40.5	21.5	16.9	33.7	36.8	31.2	26.6	21.7	31.2
Leovex 8-0-7	24.0	26.7	13.1	30.6	16.7	13.2	17.7	25.5	23.1	20.5	15.0	23.7
Rootein Summer Nourish 12-5-3	64.3	43.8	22.9	35.8	19.9	16.0	30.8	27.9	24.2	23.0	17.8	25.1
Rootein Spring Green-up 17-6-2	66.8	45.7	20.3	40.7	22.0	18.6	34.6	35.2	29.3	25.5	20.0	27.8
Nutrite Turf 12-0-4	75.9	46.3	31.0	39.3	25.2	23.9	32.9	35.2	25.5	23.1	21.8	28.6
Nutrite Turf 4-0-12	45.6	35.7	21.2	34.7	18.2	16.0	31.1	26.7	20.3	20.4	16.8	22.4
Nutrite Turf 9-1-4	61.1	39.9	22.0	40.6	17.9	18.8	30.3	36.2	31.7	28.4	23.1	31.3
Grain Processing 15-0-4	40.2	30.6	17.5	34.3	19.1	16.6	27.9	30.2	25.1	22.4	18.3	26.4
Grain Processing 12-0-6	42.4	36.1	20.3	32.0	18.6	15.2	25.9	31.1	22.6	21.3	18.7	25.7
LSD (0.05)	19.0	8.6	7.5	NS	6.4	6.2	9.1	NS	NS	NS	NS	NS

Table 1b. Clipping weights of Kentucky bluegrass during the 2005 season.

Treatment	1-Sep	9-Sep	16-Sep	23-Sep	29-Sep	7-Oct	13-Oct	27-Oct
Control	15.2	14.6	14.5	9.1	9.8	8.3	4.0	4.5
Four: All Seasons 9-1-1	19.0	17.6	15.5	13.1	14.9	11.9	6.4	7.5
Four: All Seasons 11-1-1	23.4	20.4	17.7	14.8	17.4	14.5	7.6	9.1
Sustane (All Natural) 5-2-4	22.8	20.3	17.4	13.2	14.7	12.0	6.4	7.9
Sustane (Natural Base) 5-2-4	20.5	16.1	16.6	14.1	15.3	11.9	6.5	7.0
Sustane (Green Grade) 8-2-4	17.8	16.9	13.4	11.5	14.0	10.7	5.3	6.2
Renaissance 8-2-6	23.8	22.2	19.9	17.2	19.5	14.9	8.2	8.6
Milorganite 6-2-0	18.2	15.9	15.3	15.0	15.0	12.5	6.4	8.0
Nature Safe 10-2-8	19.7	17.4	16.6	14.3	15.8	14.2	7.2	9.6
Secure and Safe 9-0-0	22.4	19.6	17.2	14.4	17.4	14.9	8.5	11.7
Urea 46-0-0	24.9	21.1	21.3	19.4	21.6	16.0	7.7	8.3
Leovex 8-0-7	17.5	19.7	17.4	12.5	15.3	12.5	5.8	7.2
Rootein Summer Nourish 12-5-3	21.6	18.1	17.3	18.2	18.9	15.1	7.6	8.2
Rootein Spring Green-up 17-6-2	20.4	22.1	22.4	20.0	23.7	17.7	8.3	10.4
Nutrite Turf 12-0-4	23.9	19.9	18.3	17.7	19.8	15.3	7.8	11.4
Nutrite Turf 4-0-12	19.0	16.5	17.4	16.5	18.3	13.8	6.6	7.2
Nutrite Turf 9-1-4	25.2	21.4	20.7	19.5	20.8	15.7	7.2	7.4
Grain Processing 15-0-4	21.0	19.3	19.2	17.1	18.6	14.9	7.5	8.3
Grain Processing 12-0-6	19.0	18.2	18.0	17.0	18.5	14.7	7.9	9.8
LSD (0.05)	NS	NS	NS	5.8	4.9	3.5	2.2	3.4

Table 2a. Quality ratings of Kentucky bluegrass during the 2005 season.

Treatment	9-Jun	17-Jun	23-Jun	1-Jul	7-Jul	14-Jul	21-Jul	28-Jul	4-Aug	11-Aug	18-Aug	24-Aug
Control	5.7	6.7	6.0	6.0	5.7	5.7	5.7	7.3	7.0	8.0	6.3	5.7
Four: All Seasons 9-1-1	6.3	7.3	7.3	7.3	6.3	5.3	6.7	7.7	8.0	8.7	6.7	7.0
Four: All Seasons 11-1-1	7.0	8.3	8.3	8.3	7.0	6.3	7.0	8.7	8.7	8.7	7.7	7.0
Sustane (All Natural) 5-2-4	6.7	7.0	7.3	7.3	6.3	6.3	7.0	8.3	8.7	8.3	7.3	7.3
Sustane (Natural Base) 5-2-4	7.3	7.3	7.0	7.3	6.7	6.0	7.0	8.3	8.3	8.0	6.7	7.0
Sustane (Green Grade) 8-2-4	7.0	7.7	7.7	7.3	6.0	6.3	7.0	8.3	8.3	8.3	6.7	6.7
Renaissance 8-2-6	7.7	7.7	7.3	8.0	7.0	6.7	7.3	8.7	9.0	8.7	7.7	7.3
Milorganite 6-2-0	7.0	7.7	7.7	7.0	6.0	6.0	6.7	7.7	8.3	8.0	6.3	7.3
Nature Safe 10-2-8	7.0	7.3	7.7	7.7	6.7	6.3	7.0	8.3	9.0	9.0	7.7	7.3
Secure and Safe 9-0-0	6.7	8.0	8.0	7.3	6.0	6.3	6.3	8.3	9.0	9.0	7.3	7.3
Urea 46-0-0	8.7	9.0	8.7	8.3	6.3	6.3	8.0	8.7	8.7	8.7	7.0	6.7
Leovex 8-0-7	6.0	7.0	7.0	7.0	5.7	5.0	5.7	7.3	8.3	8.3	6.3	7.0
Rootein Summer Nourish 12-5-3	9.0	8.3	7.7	7.7	6.3	5.7	7.7	8.3	8.7	8.3	6.3	6.7
Rootein Spring Green-up 17-6-2	9.0	9.0	8.7	8.0	6.7	6.3	8.0	8.7	9.0	9.0	7.7	7.3
Nutrite Turf 12-0-4	9.0	9.0	8.7	8.7	7.3	7.0	9.0	9.0	9.0	9.0	7.7	7.3
Nutrite Turf 4-0-12	8.3	8.7	8.0	8.0	7.0	6.0	7.0	8.0	9.0	8.7	7.0	7.0
Nutrite Turf 9-1-4	9.0	8.3	8.0	8.0	7.3	6.3	8.0	9.0	9.0	8.7	7.0	7.0
Grain Processing 15-0-4	8.0	8.7	7.7	8.0	6.7	5.7	7.0	8.3	9.0	8.3	7.0	6.7
Grain Processing 12-0-6	8.3	8.0	8.0	7.7	6.3	6.3	7.0	9.0	9.0	9.0	7.3	7.0
LSD (0.05)	0.7	0.7	1.1	1.1	NS	NS	1.2	NS	0.7	NS	NS	0.8

Table 2b. Quality ratings of Kentucky bluegrass during the 2005 season.

Treatment	1-Sep	9-Sep	16-Sep	23-Sep	29-Sep	7-Oct	13-Oct	27-Oct
Control	6.0	5.3	5.3	6.0	5.7	5.7	4.7	5.0
Four: All Seasons 9-1-1	7.0	6.7	6.7	7.0	7.3	7.0	5.7	5.7
Four: All Seasons 11-1-1	7.0	6.3	6.7	7.0	7.0	7.3	5.7	6.0
Sustane (All Natural) 5-2-4	6.7	6.0	6.7	6.7	6.7	6.3	5.3	5.7
Sustane (Natural Base) 5-2-4	7.0	6.0	7.0	7.3	7.0	6.7	6.0	6.0
Sustane (Greens Grade) 8-2-4	6.7	5.7	6.3	7.3	6.7	6.3	5.0	6.0
Renaissance 8-2-6	7.0	6.3	6.7	7.3	7.3	7.3	5.7	6.0
Milorganite 6-2-0	7.0	5.7	7.0	7.3	7.0	7.0	5.3	6.0
Nature Safe 10-2-8	7.0	6.3	6.7	8.0	7.3	6.7	5.7	6.0
Secure and Safe 9-0-0	7.0	6.3	7.3	7.0	7.3	8.0	6.0	6.0
Urea 46-0-0	7.0	6.0	7.3	8.3	7.7	7.0	5.7	6.0
Leovex 8-0-7	7.0	6.3	7.3	7.0	6.7	7.0	6.0	6.0
Rootein Summer Nourish 12-5-3	6.7	6.0	8.0	8.3	7.3	7.0	6.0	6.0
Rootein Spring Green-up 17-6-2	6.7	6.3	8.0	8.7	8.0	7.7	6.0	6.0
Nutrite Turf 12-0-4	7.3	6.0	8.0	8.3	7.7	7.0	5.7	6.0
Nutrite Turf 4-0-12	7.0	6.3	8.0	8.3	7.7	7.7	5.7	6.0
Nutrite Turf 9-1-4	6.7	6.0	7.7	8.3	7.0	7.0	5.7	6.0
Grain Processing 15-0-4	6.7	6.0	7.3	7.7	7.7	7.3	5.7	5.7
Grain Processing 12-0-6	7.0	6.0	7.7	8.3	8.0	7.7	6.0	6.0
LSD (0.05)	NS	NS	1.2	0.8	0.8	0.9	NS	NS

Table 3. Percentage nitrogen in the tissue of Kentucky bluegrass during the 2005 season.

Treatment	Wk 2	Wk 4	Wk 6	Wk 8	Wk 10	Wk 12	Wk 14	Wk 16	Wk 18	Wk 20
Control	2.79	3.12	3.25	3.29	3.58	3.94	3.69	3.71	3.41	3.12
Four: All Seasons 9-1-1	3.16	3.45	3.31	3.44	3.95	4.04	3.87	4.18	3.72	3.27
Four: All Seasons 11-1-1	3.08	3.3	3.26	3.47	3.96	3.97	3.77	3.97	3.67	3.32
Sustane (All Natural) 5-2-4	2.76	3.25	3.15	3.31	3.63	3.83	3.60	3.74	3.46	3.10
Sustane (Natural Base) 5-2-4	3.11	3.19	3.17	3.37	3.72	4.04	3.69	3.96	3.58	3.20
Sustane (Green Grade) 8-2-4	3.04	3.25	3.17	3.55	3.74	3.98	3.82	4.05	3.68	3.25
Renaissance 8-2-6	3.12	3.43	3.42	3.52	3.90	4.11	3.86	4.20	3.74	3.30
Milorganite 6-2-0	2.99	3.24	3.16	3.49	3.88	3.99	3.75	4.07	3.61	3.18
Nature Safe 10-2-8	3.01	3.35	3.28	3.69	3.81	3.93	3.75	3.95	3.73	3.26
Secure and Safe 9-0-0	3.24	3.46	3.30	3.55	4.22	4.08	3.87	3.88	3.93	3.48
Urea 46-0-0	3.46	3.27	3.29	3.73	3.77	4.06	3.84	4.48	3.67	3.38
Leovex 8-0-7	3.09	3.56	3.54	3.52	4.38	4.35	4.13	4.05	3.87	3.44
Rootein Summer Nourish 12-5-3	3.29	3.31	3.30	3.75	4.11	4.16	3.85	4.45	3.64	3.30
Rootein Spring Green-up 17-6-2	3.48	3.38	3.30	3.92	3.84	4.12	3.75	4.50	3.73	3.23
Nutrite Turf 12-0-4	3.33	3.37	3.24	3.72	3.77	4.13	3.54	4.29	3.60	3.20
Nutrite Turf 4-0-12	3.34	3.41	3.35	3.62	4.01	4.03	3.74	4.28	3.73	3.30
Nutrite Turf 9-1-4	3.47	3.45	3.44	3.76	4.09	4.13	3.89	4.43	3.74	3.38
Grain Processing 15-0-4	3.34	3.71	3.40	3.59	3.93	4.08	3.71	4.20	3.70	3.33
Grain Processing 12-0-6	3.33	3.34	3.42	3.67	3.95	3.96	3.83	4.39	3.90	3.36
LSD (0.05)	0.32	NS	NS	0.22	0.31	NS	NS	0.30	0.18	0.15