

## TURFGRASS SOILS REPORT - 1982

Paul E. Rieke, Shawn L. McBurney, and Richard A. Bay  
Department of Crop and Soil Sciences  
Michigan State University

### Effect of Soil pH on Turfgrasses

A study on the effect of soil pH on three turfgrasses was established in August, 1981 at the Hancock Turfgrass Research Center. Ground limestone (1.5, 3.0 and 6.0 tons per acre) and sulfur (0.5 and 1.0 ton per acre) applications were made and rototilled to a depth of 3 inches. Three turfgrasses were seeded after treatment - Baron Kentucky bluegrass, Pennlawn red fescue and Manhattan perennial ryegrass. Soil pH tests for samples taken 1 year after application are given in Table 1. The higher limestone rates raised pH to about 7.5 in the surface 2 inch layer while the sulfur treatments caused significant lowering of pH. Some injury occurred on the Kentucky bluegrass and red fescue in the corner of one replication of the highest sulfur treatment. No other injury to the grasses was apparent throughout the other plots.

The effects of pH on other soil tests for the check, and the highest limestone and sulfur treatments are shown in Table 2. Although acidifying the soil increased the phosphorus tests, the differences were not statistically significant. Changing soil pH had no effect on the potassium test but did significantly reduce the available calcium and magnesium tests.

A greenhouse study was established with an undergraduate student, Robert Maibusch, in which 4 different particle size ranges of sulfur were mixed with a loam soil. These materials were applied at 4 different rates. Two months after application the soil was sampled for pH determination. Soil pH values are given in Table 3. Clearly, the finer particle size sulfur material was oxidized faster than the coarser material resulting in a faster pH reduction. This is consistent with previous field observations that sulfur products composed of powdered (or very finely ground) sulfur react faster than more coarsely ground materials. Because of the high surface area of the sulfur, the sulfur-oxidizing organisms convert the sulfur to sulfate much faster resulting in greater potential for turf injury.

### Nitrogen Rate Effect on Penncross, Penneagle and Emerald Creeping Bentgrass Greens

Nitrogen rates ranging from 1 to 8 pounds nitrogen per 1000 square feet annually were applied to Emerald, Penneagle and Penncross creeping bentgrass greens at the Hancock Turfgrass Research Center. Generally, the Emerald plots had lower ratings (Table 4) than the other grasses during the growing season. There was little difference in the quality ratings between Penncross and Penneagle.

Table 1. Soil pH control study on sandy loam at the Hancock Turfgrass Research Center. Treatments applied August, 1981. Averages for 3 replications. Samples taken August, 1982.

Treatment		Depth of sampling, inches	
Chemical	Rate, tons/A	0-2	2-4
Limestone	6.0	7.5a <sup>x</sup>	7.0ab
Limestone	3.0	7.6a	6.6bcc
Limestone	1.5	7.0ab	6.1cd
Check	---	6.0cd	5.5d
Sulfur	0.5	4.1ef	4.6e
Sulfur	1.0	3.4g	3.8fg

<sup>x</sup> - means followed by the same letter are not significantly different from each other at the 5% level using Duncan's Multiple Range Test.

Table 2. Soil pH control study on sandy loam at the Hancock Turfgrass Research Center. Treatments applied August, 1981. Samples taken August, 1982. Averages for 3 replications.

Treatment		Depth of sample	pH	Available nutrient test, pounds/A			
Chemical	Rate, tons/A			P	K	Ca	Mg
Limestone	6.0	0-2	7.5a <sup>x</sup>	65	183ab	2867a	638a
		2-4	7.0a	76	98c	1433b	590a
Check	---	0-2	6.0b	86	188ab	1433b	268b
		2-4	5.5b	104	123bc	1233b	220b
Sulfur	1.0	0-2	3.4c	125	206a	433c	90c
		2-4	3.8c	132	169ac	700c	77c

<sup>x</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using Duncan's Multiple Range Test.

Table 3. Effect of sulfur particle size and rate of pH on a loam soil seeded to Manhattan perennial ryegrass in the greenhouse. Averages for 8 replications. Samples taken 2 months after application.

Treatment		Depth of sample, inches					
S rate lbs/1000	Particle size mm	0-.5	.5-1	1-2	2-3	3-4	4-5
0	--	8.1	8.1	8.0	8.0	8.0	8.0
10	<.05	7.7	7.9	7.8	7.7	7.8	7.8
10	0.1-0.25	7.9	7.9	7.9	7.9	7.9	7.9
10	0.5-1.0	8.0	8.0	8.0	7.9	7.9	7.9
10	2.0-4.0	8.0	8.0	8.0	7.9	7.9	7.9
20	<.05	7.6	7.7	7.7	7.8	7.8	7.8
20	0.1-0.25	7.7	7.8	7.8	7.9	7.9	7.9
20	0.5-1.0	7.9	7.9	8.0	7.9	7.9	7.9
20	2.0-4.0	8.0	8.0	8.0	7.9	7.9	7.9
40	<.05	7.3	7.5	7.6	7.6	7.6	7.6
40	0.1-0.25	7.5	7.7	7.8	7.8	7.8	7.8
40	0.5-1.0	7.9	7.9	7.9	7.9	7.9	7.9
40	2.0-4.0	8.0	7.9	7.9	7.9	7.9	7.9
80	<.05	7.3	7.4	7.6	7.6	7.7	7.7
80	0.1-0.25	7.5	7.7	7.7	7.8	7.8	7.8
80	0.5-1.0	7.8	7.9	7.8	7.8	7.8	7.9
80	2.0-4.0	7.9	7.9	7.9	7.9	7.9	7.9

Table 4. Effect of nitrogen rate on quality of Penncross, Penneagle and Emerald creeping bentgrass putting greens at the Hancock Turfgrass Research Center. Treatments initiated in 1982. Plot size is 3 feet by 6 feet. Three replications. All plots receive 2 pounds  $K_2O$  per 1000 square feet annually.

Annual N rate lbs/1000 sq ft	N carrier	Grass	Turfgrass quality rating (9=best)	
			Nov 2	Dec 15
1	Urea	Emerald	3.7h <sup>y</sup>	1.7i
2	Urea	Emerald	4.5gh	3.7gh
3	Urea	Emerald	4.5gh	4.0fh
4	Urea	Emerald	5.2fg	4.7ef
6	Urea	Emerald	5.5dg	4.7ef
8	Urea	Emerald	5.7dg	4.7ef
4L <sup>x</sup>	Urea	Emerald	5.3eg	8.8a
4L	Milorganite	Emerald	3.7h	5.7cd
4	Ammonium nitrate	Emerald	4.8fh	3.7gh
1	Urea	Penneagle	6.0cf	3.3h
2	Urea	Penneagle	7.2ac	4.0fh
3	Urea	Penneagle	7.2ac	4.2fh
4	Urea	Penneagle	7.8ab	5.3ce
6	Urea	Penneagle	7.8ab	5.7cd
8	Urea	Penneagle	8.0a	5.8c
4L <sup>x</sup>	Urea	Penneagle	7.0ac	7.3b
4L	Milorganite	Penneagle	6.0cf	5.8c
4	Ammonium nitrate	Penneagle	7.2ac	4.8df
1	Urea	Penncross	5.3eg	4.5eg
2	Urea	Penncross	6.7bd	4.8df
3	Urea	Penncross	6.7bd	4.2fh
4	Urea	Penncross	7.2ac	5.7cd
6	Urea	Penncross	8.0a	6.0c
8	Urea	Penncross	8.2a	5.8c
4L <sup>x</sup>	Urea	Penncross	7.2ac	8.3a
4L	Milorganite	Penncross	4.5gh	5.7cd
4	Ammonium nitrate	Penncross	6.5ce	4.8df

<sup>x</sup> - L refers to late season nitrogen application at 1.5.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

### Nitrogen Fertility Programs for a Penncross Creeping Bentgrass Green

A study evaluating the effect of several nitrogen fertility programs on the turf quality of Penncross creeping bentgrass was established in the fall of 1981. This is a joint study with J. M. Vargas, Jr. Treatments are outlined in Table 5 and data for 1982 are given in Table 6. Note the dollarspot ratings taken in November.

A similar study was initiated on annual bluegrass in the fall of 1982 mowed at fairway height. Since the study was just started, no data were taken.

### Effect of Nitrogen Fertilization and Topdressing Programs on the Quality of Penneagle Creeping Bentgrass

A study on the effect of annual rate of nitrogen application (3 or 6 pounds N per 1000 square feet annually) and topdressing program on the quality of the turf and the putting surface of Penneagle creeping bentgrass was established in July, 1982. The topdressing treatments included applications of a) 3 cubic feet sand per 1000 square feet every 3 weeks; b) 6 cubic feet and every 6 weeks; c) 12 cubic feet sand spring and fall; and d) 12 cubic feet of a sand loamy sand topdressing mix, spring and fall, as well as e) a plot which receives no topdressing. The objective is to determine if nitrogen rate affects the frequency and rate of topdressing required in a sand topdressing program.

Through 1982 no major responses occurred except for the color and growth response from the higher nitrogen application. Preliminary stimpmeter readings did not reveal any differences due to treatments. This study will be continued for several years to determine the effect of treatments on the development of layers in the green.

### Wetting Agent Effects on a Penncross Creeping Bentgrass Green

A long-term study on the effect of monthly use of 2 wetting agents (Aqua-Gro and Hydro-Wet) at 3 rates (0, 4 and 8 ounces per 1000 square feet) was established in July, 1982 at the Hancock Turfgrass Research Center on three soils: a) a sand-peat mix; b) a Purr-Wick (dune sand) green; and c) an unmodified sandy loam soil. No differences occurred during 1982.

### Potash Rate Effects on the Quality of a Penncross Creeping Bentgrass Green on Three Soils

A study on the effects of varying the rate of potash on the quality of Penncross creeping bentgrass was established in July, 1982 at the Hancock Turfgrass Research Center on three soils: a) a sand-peat mix; b) a Purr-Wick green (dune sand); and (c) an unmodified sandy loam soil. All plots receive 4 pounds of nitrogen annually and 1 pound of P<sub>2</sub>O<sub>5</sub> per square feet. The potash treatments are 0, 1, 2, 4, 6 and 8 pounds K<sub>2</sub>O per 1000 square feet annually as well as potash rates based on soil test and two times soil test recommendations. No differential responses occurred in 1982. Soil tests showed that little potassium was held in the sandy soils even at the very high rates of application. This is because of the lack of cation exchange capacity in the sandy soils. This has also been observed at Traverse City on sandy soils.

Effect of Nitrogen-Potassium Balance and Irrigation  
on the Quality of a Penncross Creeping Bentgrass  
Putting Green and on Adelphi Kentucky Bluegrass

A study to evaluate the effect of varying ratios of nitrogen to potash and irrigation program on the quality of a Penncross creeping bentgrass putting green was initiated in 1982 at the Hancock Turfgrass Research Center. Three levels of irrigation will be utilized starting in 1983. Annual nitrogen rates are 0, 2 or 4 pounds annually. In this first year, no unusual results occurred.

A companion study was begun in 1982 on Adelphi Kentucky bluegrass. Irrigation treatments utilized were: a) 20 minutes of irrigation daily at noon; b) 80% of open pan evaporation; and c) on wilt. There were no unusual responses observed other than that the plots receiving daily irrigation were somewhat green through the latter part of the growing season.

Effect of Late Fall Nitrogen on Annual Bluegrass

Fall nitrogen treatments outlined in Table 7 were applied to annual bluegrass turf at the Hancock Turfgrass Research Center mowed at fairway height. This was a cooperative study with 2 students, Kurt Galisdorfer and Jeff Holmes. Application of ferrous sulfate did not improve quality ratings when nitrogen was applied. Nitrogen carriers gave responses as would be expected.

Table 5. Treatments applied in Penncross bentgrass nitrogen carrier fertility study at the Hancock Turfgrass Research Center. Treatments initiated in 1982. Plot size is 6 feet by 6 feet. Three replications.

No.	Treatment N carrier	Month of application, pounds N per 1000 sq ft						
		Nov	Apr	May	June	July	Aug	Sept
1	IBDU (coarse)	1.0	---	---	0.5	0.5	0.5	1.0
2	Sulfur coated urea	1.0	---	---	0.5	0.5	0.5	1.0
3	Powder blue + urea	0.5 0.5	---	---	0.25 0.25	0.25 0.25	0.25 0.25	0.5 0.5
4	Powder blue + urea	---	---	0.5 0.5	0.75 0.5	----	----	1.0 1.0
5	Urea	1.0	---	---	0.5	0.5	0.5	1.0
6	Check	---	---	---	----	----	----	---
7	Urea	---	1.0	---	----	----	----	1.0
8	Urea	---	1.0	1.0	1.0	----	----	1.0
9	Urea	---	2.0	2.0	2.0	----	----	2.0
10	IBDU (coarse)	---	1.0	1.0	1.0	----	----	1.0
11	Sulfur coated urea	---	1.0	1.0	1.0	----	----	1.0
12	Powder blue + urea	---	0.5 0.5	0.5 0.5	0.75 0.5	----	----	1.0 1.0
13	Urea	---	1.0	1.0	----	----	1.0	1.0
14	Ammonium nitrate	1.0	---	---	0.5	0.5	0.5	1.0
15	Ammonium nitrate	---	1.0	1.0	1.0	----	----	1.0
16	Milorganite	1.0	---	---	0.5	0.5	0.5	1.0
17	Milorganite	---	1.0	1.0	1.0	----	----	1.0
18	Oxamide	1.0	---	---	0.5	0.5	0.5	1.0
19	Oxamide	---	1.0	1.0	1.0	----	----	1.0

Table 6. Effect of nitrogen carriers on quality of a Penncross creeping bentgrass green at the Hancock Turfgrass Research Center.

No.	Treatment Carrier	Turfgrass quality rating (9=best)			Relative dollarspot density (1=least)
		July 2	Nov 2	Dec 15	Nov 2
1	IBDU	4.1j <sup>y</sup>	5.1fg	6.9ad	5.4ce
2	S.C. urea	5.4gh	5.1fg	7.1ac	5.5cf
3	P.B. + urea	5.0hi	5.5ef	7.4ac	5.0be
4	P.B. + urea	5.5g	7.1bc	4.9ce	3.9ac
5	Urea	3.4k	6.5ce	8.3a	4.3ad
6	Check	1.6l	3.6h	4.5de	4.8be
7	Urea	4.1j	5.6ef	5.8ae	3.6ac
8	Urea	8.0b	6.3ce	6.2ae	5.3ce
9	Urea	9.0a	8.9a	7.6ab	2.5a
10	IBDU	7.1de	4.3gh	4.3e	7.5g
11	S.C. urea	8.0b	5.0fg	6.1ae	6.5eg
12	P.B. + urea	7.5cd	7.6b	7.5ac	3.1ab
13	Urea	4.9i	6.4ce	5.9ae	3.1ab
14	Am. nit.	6.0f	7.0bd	8.3a	3.6ac
15	Am. nit.	8.0b	6.0df	5.3be	4.5ae
16	Milorg.	5.0hi	5.6ef	4.9ce	4.6be
17	Milorg.	7.0e	4.9fg	6.1ae	6.0dg
18	Oxamide	6.3f	3.5h	5.9ae	7.5g
19	Oxamide	7.8bc	3.3h	5.0ce	7.4fg

<sup>x</sup> - for specific treatment descriptions see Table 5 .

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.



Table 7. Late fall nitrogen fertility study on annual bluegrass at the Hancock Turfgrass Research Center. Three replications. Nitrogen applied at one pound per 1000 square feet.

Treatment		Carrier	Fe SO <sub>4</sub>	Turfgrass quality rating (9=best)		
Date	N rate			Nov 12	Nov 24	Dec 15
lbs/1000		oz/1000				
Oct 18	2	Am. nitrate	-	9.0a <sup>x</sup>	9.0a	9.0a
Oct 18	1	Am. nitrate	-	7.7bc	7.7bc	7.7bc
Oct 18	1	Am. nitrate	3	7.8b	7.5bc	7.2c
Oct 18	1	Am. nitrate	6	7.8b	8.0b	8.0b
Oct 18	1	S.C. urea	-	7.0c	7.2c	7.2c
Oct 18	1	Milorganite	-	5.2d	5.2d	5.2ef
Oct 18	1	UBDU-coarse	-	4.8d	4.8df	4.8f
Oct 18	0	--	3	4.5d	4.5ef	4.5f
Nov 19	2	Am. nitrate	-	5.0d	4.3f	6.2d
Nov 19	1	Am. nitrate	-	4.5d	4.7df	6.0d
Nov 19	1	Am. nitrate	3	4.5d	4.8d	5.7de
Nov 19	1	S.C. urea	-	4.8d	5.0de	5.7de
Nov 19	1	Milorganite	-	5.0d	4.7df	4.7f
Nov 19	1	IBDU-coarse	-	4.8d	4.8df	4.7f
Nov 19	0	--	3	4.8d	4.7df	4.3f
-----	0	Check	-	4.7d	4.5ef	4.5f

<sup>x</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Effect of Nitrogen Rate and Timing on Quality of  
Kentucky Bluegrasses, Perennial Ryegrasses and Coarse and Fine Fescues

Nitrogen rate and timing studies were initiated in 1982 on 8 Kentucky bluegrass cultivars, 9 perennial ryegrasses, 2 tall fescues, 1 meadow fescue, and 3 fine fescues. Treatment outlines are given in Table 29 for the fine fescues and in Table 8 for all other grasses. These are long-term studies designed to determine which of these grasses will maintain adequate density and quality under low nitrogen fertilization. Data for 1982 are given in Tables 9 to 28 and 30 to 32. One criterion in selecting a cultivar is color, thus a question to be asked is will a cultivar such as Bristol Kentucky bluegrass which has a dark color maintain good color and density under low nitrogen levels?

Another key is how grasses which responded to late fall nitrogen fertilization such as Derby, Fiesta or Pennfine perennial ryegrasses will withstand winter injury. These and other responses will be evaluated and reported at future conferences and field days.

Table 8. Treatments applied in nitrogen fertility studies on Kentucky bluegrasses, perennial ryegrasses and coarse fescues at the Hancock Turfgrass Research Center. Treatments initiated in 1982. Plot size is 4 feet by 6 feet. Three replications. Nitrogen applied as urea.

Treatment designation		Pounds N applied per 1000 sq ft					
Annual N rate	Months of application	May	June	July	August	Sept	Nov
0	--	---	---	---	---	---	---
1	Ma, Sp	0.5	---	---	---	0.5	---
2	Ma, Sp	1.0	---	---	---	1.0	---
4	Ma, Jn, Ag, Sp	1.0	1.0	---	1.0	1.0	---
6	Ma, Jn, Ag, Sp	1.5	1.5	---	1.5	1.5	---
3	Ma, Jn, Sp	1.0	1.0	---	---	1.0	---
3	Jn, Jl, Ag	---	1.0	1.0	1.0	---	---
3	Ma, Ag, Sp	1.0	---	---	1.0	1.0	---
3	Jn, Sp, No	---	1.0	---	---	1.0	1.0

Table 9. Nitrogen fertility study on Adelphi Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.0c <sup>y</sup>	3.0e	2.5d
1	Ma, Sp	5.7b	4.0d	3.3c
2	Ma, Sp	5.7b	4.3cd	3.8bc
4	Ma, Jn, Ag, Sp	6.3ab	5.3a	4.5a
6	Ma, Jn, Ag, Sp	6.3ab	5.3a	4.7a
3	Ma, Jn, Sp	6.3ab	4.7bc	3.8bc
3	Jn, Jl, Ag	7.0a	4.2cd	3.3c
3	Ma, Ag, Sp	6.0ab	5.2ab	4.2ab
3	Jn, Sp, No	6.0ab	4.7bc	4.2ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 10. Nitrogen fertility study on Baron Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)	
		Nov 18	Dec 15
0	--	3.7d <sup>y</sup>	2.8d
1	Ma, Sp	4.3cd	3.5bc
2	Ma, Sp	4.7ac	3.7ac
4	Ma, Jn, Ag, Sp	5.3ab	4.0ac
6	Ma, Jn, Ag, Sp	5.5a	4.2ab
3	Ma, Jn, Sp	4.8ac	3.8ac
3	Jn, Jl, Ag	4.2cd	3.3cd
3	Ma, Ag, Sp	5.0ad	3.8ac
3	Jn, Sp, No	4.5bd	4.3a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 11. Nitrogen fertility study on Bristol Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	6.0a <sup>y</sup>	3.8b	3.0c
1	Ma, Sp	6.3a	4.5ab	4.0b
2	Ma, Sp	6.3a	5.2a	4.3ab
4	Ma, Jn, Ag, Ap	6.7a	5.3a	5.0ab
6	Ma, Jn, Ag, Sp	6.0a	5.7a	5.3a
3	Ma, Jn, Sp	7.0a	4.7ab	4.2b
3	Jn, Jl, Ag	6.7a	4.5ab	4.3ab
3	Ma, Ag, Sp	5.7a	5.5a	4.7ab
3	Jn, Sp, No	6.3a	4.8ab	4.8ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 12. Nitrogen fertility study on Cheri Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.7c <sup>y</sup>	3.7c	2.7c
1	Ma, Sp	6.0ab	4.3c	2.8bc
2	Ma, Sp	6.3ab	5.0ac	3.8ac
4	Ma, Jn, Ag, Sp	7.0a	6.2ab	4.5a
6	Ma, Jn, Ag, Sp	7.0a	6.5a	4.8ab
3	Ma, Jn, Sp	6.7ab	5.2ac	4.0ab
3	Jn, Jl, Ag	6.7ab	4.8ac	3.7ac
3	Ma, Ag, Sp	6.3ab	5.0ac	4.2a
3	Jn, Sp, No	5.7bc	4.7bc	4.0ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 13. Nitrogen fertility study on Kenblue Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.3b <sup>y</sup>	3.7d	2.7e
1	Ma, Sp	6.3a	4.5cd	3.0e
2	Ma, Sp	6.7a	4.7c	3.7d
4	Ma, Jn, Ag, Sp	7.0a	5.5bc	4.5bc
6	Ma, Jn, Ag, Sp	6.7a	6.7a	5.2a
3	Ma, Jn, Sp	6.3a	5.8ab	4.2bd
3	Jn, Jl, Ag	7.0a	5.2bc	4.0cd
3	Ma, Ag, Sp	6.0a	5.5bc	4.0cd
3	Jn, Sp, No	6.0a	4.7c	4.7ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 14. Nitrogen fertility study on Merit Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.0c <sup>y</sup>	4.3d	2.5c
1	Ma, Sp	6.0b	5.5bc	3.0c
2	Ma, Sp	7.3ab	6.0ab	3.0c
4	Ma, Jn, Ag, Sp	6.7ab	6.5a	4.0ab
6	Ma, Jn, Ag, Sp	7.3ab	6.7a	4.5a
3	Ma, Jn, Sp	7.0ab	6.2ab	4.2ab
3	Jn, Jl, Ag	7.7a	5.2c	2.8c
3	Ma, Ag, Sp	6.7ab	6.0ab	3.3bc
3	Jn, Sp, No	6.0b	6.0ab	4.0ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 15. Nitrogen fertility study on Ram I Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.0d <sup>y</sup>	4.5a	2.8e
1	Ma, Sp	5.3c	5.0a	3.7d
2	Ma, Sp	5.7bc	5.7a	4.0cd
4	Ma, Jn, Ag, Sp	7.0a	5.2a	5.7a
6	Ma, Jn, Ag, Sp	7.0a	6.0a	5.8a
3	Ma, Jn, Sp	6.7a	5.8a	4.7bc
3	Jn, J1, Ag	6.3ab	4.3a	4.2cd
3	Ma, Ag, Sp	5.7bc	5.8a	5.0ab
3	Jn, Sp, No	6.0bc	6.0a	5.2ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 16. Nitrogen fertility study on Victa Kentucky bluegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	4.3a <sup>y</sup>	3.8c	2.2d
1	Ma, Sp	6.0a	4.0bc	2.8d
2	Ma, Sp	7.0a	5.2a	4.0bc
4	Ma, Jn, Ag, Sp	6.3a	5.5a	4.3ab
6	Ma, Jn, Ag, Sp	5.7a	5.3a	4.2ac
3	Ma, Jn, Sp	7.0a	4.7ac	4.3ab
3	Jn, J1, Ag	4.3a	5.0a	3.5c
3	Ma, Ag, Sp	6.3a	4.8ab	4.0bc
3	Jn, Sp, No	7.0a	5.5a	4.8a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 17. Nitrogen fertility study on Delray perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	3.0d <sup>y</sup>	3.0d	2.7b
1	Ma, Sp	5.0c	3.7bd	2.7b
2	Ma, Sp	5.7ac	3.8ac	2.8ab
4	Ma, Jn, Ag, Sp	5.7ac	4.3ab	3.0ab
6	Ma, Jn, Ag, Sp	5.3bc	4.2ac	3.0ab
3	Ma, Jn, Sp	6.7ab	4.5a	3.0ab
3	Jn, Jl, Ag	5.3bc	3.5cd	2.7b
3	Ma, Ag, Sp	7.0a	4.2ac	3.2ab
3	Jn, Sp, No	5.3bc	3.8ac	3.7a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 18. Nitrogen fertility study on Derby perennial ryegrass. 1982 data. Hancock Turfgrass Research center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	5.3c <sup>y</sup>	3.5b	3.7c
1	Ma, Sp	6.0bc	4.2ab	3.8bc
2	Ma, Sp	7.0ab	5.0a	4.76ac
4	Ma, Jn, Ag, Sp	7.7ab	5.0a	4.8ab
6	Ma, Jn, Ag, Sp	8.3a	5.2a	5.0a
3	Ma, Jn, Sp	7.3ab	5.2a	4.8ab
3	Jn, Jl, Ag	8.3a	4.8a	5.0a
3	Ma, Ag, Sp	7.7ab	4.8a	4.7ac
3	Jn, Sp, No	7.0ab	5.2a	5.7a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.



Table 19. Nitrogen fertility study on Elka perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)		
		July 17	Nov 18	Dec 15
0	--	3.0c <sup>y</sup>	3.2c	2.0b
1	Ma, Sp	5.0b	5.0a	2.2b
2	Ma, Sp	5.3b	4.7ab	2.7ab
4	Ma, Jn, Ag, Sp	6.0ab	5.0a	3.3a
6	Ma, Jn, Ag, Sp	6.0ab	4.8ab	3.0ab
3	Ma, Jn, Sp	6.3ab	5.8a	4.2a
3	Jn, Jl, Ag	7.0ab	4.5cd	3.5ac
3	Ma, Ag, Sp	6.7ab	5.5ab	4.0a
3	Jn, Sp, No	5.7b	4.7bd	4.3a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test

Table 20. Nitrogen fertility study on Fiesta perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Annual N, lbs/1000	Treatment <sup>x</sup> Months of application	Turfgrass Quality Rating (9=best)	
		July 17	Nov 18
0	--	4.0a <sup>y</sup>	2.5c
1	Ma, Sp	4.7a	4.7ab
2	Ma, sp	6.3a	5.2a
4	Ma, Jn, Ag, Sp	6.0a	5.5a
6	Ma, Jn, Ag, Sp	5.3a	4.7ab
3	Ma, Jn, Sp	5.3a	5.3a
3	Jn, Jl, Ag	4.0a	3.5bc
3	Ma, Ag, Sp	5.7a	5.2a
3	Jn, Sp, No	4.3a	4.7ab

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 21. Nitrogen fertility study on Loretta perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	3.7c <sup>y</sup>	3.8b	2.8b
1	Ma, Sp	5.3b	4.3ab	3.0b
2	Ma, Sp	6.3ab	4.8ab	3.8ab
4	Ma, Jn, Ag, Sp	6.3ab	5.5a	4.2ab
6	Ma, Jn, Ag, Sp	6.7a	5.0ab	4.0ab
3	Ma, Jn, Sp	7.0a	4.8ab	4.0ab
3	Jn, Jl, Ag	6.7a	5.0ab	3.8ab
3	Ma, Ag, Sp	6.3ab	4.3ab	3.0b
3	Jn, Sp, No	6.0ab	5.0ab	4.7a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 22. Nitrogen fertility study on Manhattan perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	4.3b <sup>y</sup>	4.0b	3.7d
1	Ma, Sp	6.3a	4.5ab	4.2cd
2	Ma, Sp	6.3a	4.5ab	4.3bd
4	Ma, Jn, Ag, Sp	6.7a	4.8a	4.7ac
6	Ma, Jn, Ag, Sp	7.3a	4.7a	4.8ac
3	Ma, Jn, Sp	7.0a	4.8a	5.0ab
3	Jn, Jl, Ag	7.0a	4.7a	4.8ac
3	Ma, Ag, Sp	6.7a	4.7a	4.5bc
3	Jn, Sp, No	6.7a	4.5ab	5.3a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 23. Nitrogen fertility study on NK-200 perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	4.0cY	4.3d	2.8bc
1	Ma, Sp	5.7b	4.2d	2.7c
2	Ma, Sp	6.7ab	5.3ac	3.3ac
4	Ma, Jn, Ag, Sp	7.3ab	5.5ab	3.3ac
6	Ma, Jn, Ag, Sp	7.7a	5.7a	3.8ab
3	Ma, Jn, Sp	6.3ab	5.8a	4.2a
3	Jn, J1, ag	7.0ab	4.5cd	3.5ac
3	Ma, Ag, Sp	6.7ab	5.5ab	4.0a
3	Jn, Sp, No	5.7b	4.7bd	4.3a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 24. Nitrogen fertility study on Norlea perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	5.0bY	5.0ab	3.5bc
1	Ma, Sp	5.7ab	4.5ab	2.8c
2	Ma, Sp	6.3a	4.8ab	3.5bc
4	Ma, Jn, Ag, Sp	6.0ab	4.8ab	3.7bc
6	Ma, Jn, Ag, Sp	6.0ab	4.7ab	3.3bc
3	Ma, Jn, Sp	5.3ab	5.0ab	4.0b
3	Jn, J1, Ag	5.3ab	4.8ab	3.7bc
3	Ma, Ag, Sp	3.0c	4.3b	3.0c
3	Jn, Sp, No	5.3ab	5.2a	5.2a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 25. Nitrogen fertility study on Pennfine perennial ryegrass. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)	
Annual N, lbs/1000	Months of application	July 17	Nov 18
0	--	3.7c <sup>y</sup>	3.7d
1	Ma, Sp	4.7bc	3.8cd
2	Ma, Sp	5.7ab	5.0ab
4	Ma, Jn, Ag, Sp	7.0ab	5.2a
6	Ma, Jn, Ag, Sp	7.3a	5.0ab
3	Ma, Jn, S	5.7ab	4.3bd
3	Jn, Jl, Ag	7.0a	4.5ac
3	Ma, Ag, Sp	6.3a	4.5ac
3	Jn, Sp, No	6.0ab	4.5ac

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 26. Nitrogen fertility study on K-31 tall fescue. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	5.0b <sup>y</sup>	3.8c	2.0b
1	Ma, Sp	6.3a	4.3bc	2.5ab
2	Ma, Sp	6.3a	4.5bc	2.5ab
4	Ma, Jn, Ag, Sp	6.7a	5.3a	3.2a
6	Ma, Jn, Ag, Sp	6.3a	4.8ab	3.0ab
3	Ma, Jn, Sp	6.7a	4.2bc	2.5ab
3	Jn, Jl, Ag	6.7a	4.7ab	2.5ab
3	Ma, Ag, Sp	6.7a	4.8ab	3.0ab
3	Jn, Sp, No	6.7a	4.2bc	3.3a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 27. Nitrogen fertility study on Rebel tall fescue. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	5.3c <sup>y</sup>	3.8b	2.3d
1	Ma, Sp	5.3c	3.8b	2.5cd
2	Ma, S	6.3ab	4.5ab	3.2ac
4	Ma, Jn, Ag, Sp	7.0a	5.0a	3.3ab
6	Ma, Jn, Ag, Sp	6.7ab	5.2a	3.2ac
3	Ma, Jn, Sp	7.0a	4.5ab	3.3ab
3	Jn, Jl, Ag	7.0a	4.3ab	2.7bd
3	Ma, Ag, Sp	6.0bc	4.5ab	2.8ad
3	Jn, Sp, No	6.3ab	4.7ab	3.5a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 28. Nitrogen fertility study on Beaumont meadow fescue. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	5.3c <sup>y</sup>	3.8b	2.7de
1	Ma, Sp	5.3c	3.8b	2.3e
2	Ma, Sp	6.3ab	4.5ab	3.0cd
4	Ma, Jn, Ag, Sp	7.0a	5.0a	3.3bc
6	Ma, Jn, Ag, Sp	6.7ab	5.2a	3.7ab
3	Ma, Jn, Sp	7.0a	4.5ab	3.2cd
3	Jn, Jl, Ag	7.0a	4.3ab	3.0cd
3	Ma, Ag, Sp	6.0bc	4.5ab	3.2cd
3	Jnb, Sp, No	6.3ab	4.7ab	4.0a

<sup>x</sup> - for specific treatments see Table 8.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 29. Treatments applied in nitrogen fertility studies on fine fescues at the Hancock Turfgrass Research Center. Nitrogen applied as urea. Treatments initiated 1982. Plot size is 4 feet by 6 feet. Three replications.

Treatment designation		Pounds N applied per 1000 sq ft					
Annual N rate	Months of application	May	June	July	August	Sept	Nov
0	--	---	---	---	---	---	---
1	Ma	1.0	---	---	---	---	---
1	Sp	---	---	---	---	1.0	---
1	Ma, Sp	0.5	---	---	---	0.5	---
2	Ma, Sp	1.0	---	---	---	1.0	---
3	Ma, Jn, Sp	1.0	1.0	---	---	1.0	---
3	Ma, Ag, Sp	1.0	---	---	1.0	1.0	---
3	Jn, Sp, No	---	1.0	---	---	1.0	1.0
4	Ma, Jn, Ag, Sp	1.0	1.0	---	1.0	1.0	---

Table 30. Nitrogen fertility study on Biljart hard fescues. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	4.3b <sup>y</sup>	2.5d	1.7f
1	Ma	5.7a	3.0cd	2.2e
1	Ma, Sp	4.0b	4.3ab	3.0d
1	Ma, Sp	5.3a	3.7bc	2.3e
2	Ma, Sp	6.0a	4.5a	3.3cd
3	Ma, Jn, Sp	5.3a	5.0a	4.5ab
3	Ma, Ag, Sp	6.0a	4.7a	3.7c
3	Jn, Sp, No	5.7a	4.7a	4.7a
4	Ma, Jn, Ag, Sp	6.0a	5.0a	4.2b

<sup>x</sup> - for specific treatments see Table 29.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 31. Nitrogen fertility study on Jamestown chewings fescue. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	5.0c <sup>y</sup>	3.0c	2.3c
1	Ma	6.3ab	3.0c	2.3c
1	Ma, Sp	6.0bc	3.2c	3.0c
1	Ma, Sp	5.0c	4.2ab	2.5c
2	Ma, Sp	7.0ab	3.8bc	2.8c
3	Ma, Jn, Sp	7.3a	5.0a	3.8ab
3	Ma, Ag, Sp	6.7ab	4.3ab	3.2c
3	Jn, Sp, No	6.7ab	4.7ab	4.3a
4	Ma, Jn, Ag, Sp	7.0ab	5.0a	4.0a

<sup>x</sup> - for specific treatments see Table 29.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 32. Nitrogen fertility study on Pennlawn red fescue. 1982 data. Hancock Turfgrass Research Center. Averages for 3 replications. Treatments initiated July, 1982.

Treatment <sup>x</sup>		Turfgrass Quality Rating (9=best)		
Annual N, lbs/1000	Months of application	July 17	Nov 18	Dec 15
0	--	4.0b <sup>y</sup>	2.7b	2.7d
1	Ma	5.7a	2.7b	2.5d
1	Ma, Sp	4.0b	4.5a	3.7c
1	Ma, Sp	5.7a	2.5b	2.5d
2	Ma, Sp	6.0a	4.5a	4.2bc
3	Ma, Jn, Sp	6.0a	5.2a	4.2bc
3	Ma, Ag, Sp	6.0a	4.8a	4.3bc
3	Jn, Sp, No	5.7a	5.0a	5.5a
4	Ma, Jn, Ag, Sp	6.3a	5.2a	4.7ab

<sup>x</sup> - for specific treatments see Table 19.

<sup>y</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Effect of Foliar Applications of Urea Nitrogen and  
Ferrous Sulfate on Quality of Adelphi Kentucky Bluegrass

Foliar applications of urea nitrogen and ferrous sulfate were made to Adelphi Kentucky bluegrass on July 21. Ferrous sulfate improved turf color one week after application when no nitrogen was applied but the effect dissipated within a few days (See Table 33). When nitrogen was applied, there was no response to the ferrous sulfate treatments.

Fall Nitrogen Study on Omega Perennial Ryegrass

A study to evaluate the response of Omega perennial ryegrass to fall applications of 3 sources of nitrogen, ammonium nitrate and two organic nitrogen materials from the Ringer Corporation, Lawn Keeper and Lawn Restore. Treatment and data are given in Table 34., Responses were somewhat variable depending on date of application. The Lawn Keeper and Lawn Restore material are also being evaluated for their effects on controlling thatch. Results are still preliminary.



Table 33. Effect of nitrogen and iron treatments on color of Adelphi Kentucky bluegrass at the Hancock Turfgrass Research Center. Treatments applied July 21. Averages for 3 replications.

Treatment/1000 sq ft		Turfgrass quality rating (9=best)				
N, lbs	Fe SO <sub>4</sub> , oz	July 22	July 24	July 28	July 31	Aug 13
0	0	4.2b <sup>x</sup>	4.2d	4.2c	4.3e	4.2e
0	2	5.0ab	4.8cd	5.5b	5.7d	5.3de
0.5	0	4.7ab	5.2bc	6.2b	6.7cd	6.3cd
0.5	2	4.8ab	5.3ac	6.7b	7.3bc	6.8cd
0.5	4	5.2a	5.8ab	6.7b	7.3bc	7.3bc
1	0	5.2a	5.8ab	8.2a	8.5ab	8.7ab
1	2	5.5a	6.0a	8.3a	8.8a	9.0a

<sup>x</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.

Table 34. Fall nitrogen fertility study on Omega perennial ryegrass at the Hancock Turfgrass Research Center. Treatments initiated in 1982. Three replications. Nitrogen applied at 1 pound per 1000 square feet.

Treatment		Turfgrass quality rating (9=best)					
Date of application	Carrier	Sept 28	Oct 4	Oct 11	Oct 19	Nov 16	Dec 15
--	Check	4.2c <sup>x</sup>	3.5b	4.2eg	3.3d	3.2d	2.5e
Sept 17	Am. nitrate	6.0b	4.7a	5.3bc	4.7bc	5.0bc	5.0bd
Sept 17	Lawn Keeper	6.8ab	5.2a	6.0b	5.2b	5.3bc	5.2bd
Sept 17	Lawn Restore	7.3a	5.3a	5.8b	4.7bc	4.2cd	3.7de
Oct 4	Am. nitrate	4.3c	3.3b	7.2a	7.3a	7.2a	7.8a
Oct 4	Lawn Keeper	4.3c	3.5b	4.8ce	5.5b	5.7b	6.5ab
Oct 4	Lawn Restore	4.0c	3.5b	5.0cd	5.5b	5.7b	5.8bc
Oct 26	Am. nitrate	4.2c	3.3b	3.5g	3.2d	3.3d	4.0ce
Oct 26	Lawn Keeper	4.0c	3.3b	4.2eg	3.2d	3.2d	5.3bd
Oct 26	Lawn Restore	4.8c	3.8b	4.0fg	3.3d	3.2d	5.5bd
Nov 2	Am. nitrate	4.2c	3.2b	4.0fg	3.0d	3.3d	4.2ce
Nov 2	Lawn Keeper	4.7c	3.7b	4.3df	3.3d	3.2d	5.5bd
Nov 2	Lawn Restore	4.5c	3.3b	4.3df	3.3d	3.5d	5.7bc
Nov 16	Am nitrate	4.7c	3.3b	3.8fg	3.3d	3.0d	6.5ab
Nov 16	Lawn Keeper	4.3c	3.3b	3.7fg	3.2d	2.8d	5.5bd
Nov 16	Lawn Restore	4.3c	3.5b	4.2eg	3.5cd	3.2d	5.7bc

<sup>x</sup> - means in columns followed by the same letter are not significantly different from each other at the 5% level using the Duncan's Multiple Range Test.