

1977 TURFGRASS SOILS RESEARCH REPORT
NITROGEN CARRIER EVALUATIONS

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Evaluations of nitrogen carriers were conducted again at East Lansing and at Traverse City in 1977. The philosophy followed in these nitrogen carrier evaluations is that a carrier is studied more extensively if there is private funding for study of that carrier. These are compared against "standard" carriers which are being used commercially and from which the nitrogen response can normally be predicted. Occasionally as time and plot area allow, a commercially available complete fertilizer is included in the study, but this is rare. If a particular product is included in a study this does not suggest endorsement of that product by Michigan State University; and if a product is not studied this does not imply that it would not perform well. The objective of these studies is to better understand the type of nitrogen response which will result under field conditions from some of the newer and less studied nitrogen carriers.

The evaluation of response is based on the visual turfgrass quality. Ratings are composed of a combined evaluation of color, density and vigor. A rating of 1 to 3 is considered acceptable, while a rating of 5 indicates a significant decline in the above factors and a rating of 9 indicates essentially no green color with very poor density of plants. A rating of 1 would indicate a very dark green color and in some cases may promote too much growth.

The data in Table 1 summarize the results from treatments applied to the green at Traverse City. Appreciation is expressed to Ed Karcheski, Golf Course Superintendent at the Traverse City Country Club and to the club for the use of these facilities for research. The nitrogen was applied at an annual rate of 6 pounds per 1000 square feet, divided into 1 pound applications per month or 2 pounds every other month beginning May 14. There were 4 replications of each treatment. The soil is a sand which is well irrigated.

The sulfur coated urea in this study is from Canadian Industries, Limited (CIL). There was a standard particle size fertilizer and a fine grade for use on greens. The 20-0-15 and 20-5-10 are complete fertilizers containing sulfur coated urea from CIL. The 18-5-9 is from the Anderson's Company and the 30-3-10 from FDS Fertilizers, both of which contain some sulfur coated urea as the slow release nitrogen source. The IBDU is the coarse grade from Swifts. The two experimental liquids are two different formulations of soluble nitrogen sources and contain some P_2O_5 and K_2O . The urea-Terrazole materials are experimentals from Olin-Mathison, with the Terrazole presumably providing nitrification inhibition.

All carriers performed well but ureaformaldehyde, especially the standard 38% which resulted in poorer ratings. The powder form of urea-formaldehyde gave faster and more efficient response than the standard grade. The powder form is being utilized effectively in liquid applications to commercial turfs where proper equipment for agitation and spraying is used. Foliar and dry applications of ammonium nitrate and urea gave similar results. The sulfur coated urea treatments resulted in good ratings as has been observed in previous years. On the green the finer particle grade was slightly better than the coarser grade.

The monthly applications of most materials gave more consistent ratings than bimonthly applications for all carriers, but especially for those materials which provide a shorter term response. No attempt was made to evaluate if any fertilizer had been picked up by the mower. The first mowing after fertilization the

clippings are returned; after that all clippings (and any fertilizer) would be removed.

The results of the nitrogen carrier study on the bentgrass green at East Lansing are shown in Table 2. The soil is 2 parts coarse sand, 1 part peat and 1 part fine sandy loam. The ratings taken June 12 were not used to calculate the averages for the year, but it is interesting to note that within 5 days after application in early June the urea and sulfur-coated urea treatments gave significant responses. The extended period between the August 5 treatment and the October 2 rating resulted in poorer ratings in October for those materials containing more water soluble nitrogen. The cooler soil temperatures at the time of the October 5 treatment caused the poorer ratings observed for the organic carriers, Milorganite and 27-0-0 (the latter an experimental fertilizer from Lakeshore-LESCO) while those treatments with the most water soluble nitrogen gave the best ratings on the November 1 evaluation date. There was some phytotoxicity evident on the urea-Terrazole treated plots during late summer apparently from the July 15 treatment. This injury was not observed on any of the other studies either on bentgrass or Kentucky bluegrass during 1977.

Four pounds of nitrogen per 1000 square feet was applied during the year on predominantly red fescue turf at Traverse City (Table 3). Most carriers performed more uniformly when applied as 1 pound of N on 4 dates than when applied as 2 pounds of N on 2 dates. The only exception was on the first date of evaluation (June 4), 3 weeks after the first application when the lower application rates in May gave poorer ratings. The response to carriers with more water soluble nitrogen tended to be depleted between the May 12 and August 4 application dates when 2 pounds N was applied in May as would be expected. The heavy rainfall at Traverse City during late August and early September apparently tended to leach the nitrogen from the plots receiving the more water soluble carriers as reflected in the poorer ratings on the September 27 evaluation date.

In a second study at Traverse City on Kentucky bluegrass (Table 4) there was little difference in the response observed between sulfur coated urea from CIL (Canadian Industries, Limited) and TVA (provided by LESCO). As in other studies this year IBDU gave slow responses in the spring and early summer when there was more limited rainfall but performed well in late summer and early fall where there was more rainfall.

In Table 5 the results are summarized from the 1977 nitrogen carrier study at East Lansing on Merion Kentucky bluegrass. At some times during the season there was no difference among any of the treatments. No ratings were taken at these times for this reason, especially in late August when all carriers were giving good response. Then with the extensive rainfall in early September the nitrogen from all treatments seemed to be depleted. Again there were essentially no differences apparent among treatments. The late application in October did not give differential responses by November 1. Clippings are returned to these plots grown on a very good soil. This reduced the relative response predicted since the nitrogen in the clippings is recycled. The residual response in the spring of 1978 will be evaluated.

In summary most of the carriers performed well if applied at rates and times appropriate for the conditions and the carrier. These data help up to understand the relative response rate so we can predict how a given carrier will respond under a given set of conditions.

Effect of Mowing, Traffic and Clipping Return on Nitrogen Release from Sulfur Coated Ureas

When applying slow release nitrogen carriers which have a relatively large particle size to a green there is a good possibility of the fertilizer being picked

Table 1. 1977 Nitrogen Carrier Study on a creeping bentgrass green at Traverse City. The nitrogen was applied at the rate of 6 pounds of N per 1000 square feet, divided into equal monthly or bimonthly applications beginning May 14. Bimonthly applications were made on May 14, June 29 and September 7. Averages of 4 replications.

Carrier	TREATMENT Time of Application	Turfgrass Quality Ratings (1 = ideal; 9 = poor)						Average
		June 4	June 29	Aug 4	Sept 7	Sept 28	Oct 20	
Urea (dry)	Monthly	2.8 j-j*	2.0 a-b	3.1 d-g	3.0 d-h	3.0 f-j	3.9 e-h	3.0
	Bimonthly	1.6 a-d	4.1 h-k	3.1 d-g	4.1 k-m	2.4 b-f	5.4 k-l	3.5
Urea (foliar)	Monthly	2.8 h-j	2.4 a-d	3.6 f-j	3.4 f-j	3.4 i-l	4.4 g-i	3.3
Ammonium nitrate (dry)	Monthly	2.9 i-k	2.4 a-d	4.1 h-l	3.3 f-j	3.1 g-k	5.0 i-k	3.5
	Bimonthly	1.9 b-f	5.5 m	3.0 c-g	4.1 k-m	1.8 a-b	5.3 j-l	3.6
Ammonium nitrate (foliar)	Monthly	2.5 g-j	2.0 a-b	4.1 h-l	3.0 d-h	3.6 j-m	4.5 h-j	3.3
S-coated urea (CIL) (32-0-0) standard	Monthly	2.6 h-j	2.8 b-f	3.5 e-i	2.8 c-f	3.0 f-j	2.6 b-c	2.9
	Bimonthly	1.9 b-f	4.9 h-l	2.8 b-e	3.5 g-k	2.5 c-g	4.6 h-k	3.4
S-coated urea (CIL) (32-0-0) Fine	Monthly	2.5 g-j	2.3 a-d	2.4 a-d	2.0 a-b	2.8 e-i	2.6 b-c	2.4
	Bimonthly	1.5 a-c	3.4 e-h	3.0 c-g	3.5 g-k	2.4 b-f	4.6 h-k	3.1
20-0-15 (CIL)	Monthly	2.8 h-j	3.1 d-g	2.0 a-b	1.6 a	2.6 d-h	2.1 a-b	2.4
	Bimonthly	1.8 a-e	4.1 h-k	2.9 c-f	3.0 d-h	2.6 d-h	4.1 f-i	3.1
20-5-10 (CIL)	Monthly	2.6 h-j	3.1 d-g	2.5 a-d	2.5 b-e	2.5 c-q	2.9 b-d	2.7
	Bimonthly	1.8 a-e	4.3 h-l	1.8 a	3.3 f-j	2.1 a-e	3.9 e-h	2.8
18-5-9 (Tee Time)	Monthly	2.8 h-j	2.8 b-f	4.0 h-l	3.5 g-k	2.5 c-q	3.9 e-h	3.2
	Bimonthly	1.6 a-d	3.9 g-j	2.8 b-e	4.4 l-m	2.0 a-e	5.3 j-l	3.3
30-3-10 (FDS)	Monthly	3.0 j-l	2.4 a-d	3.4 e-h	3.0 d-h	3.0 f-j	3.6 d-g	3.1
	Bimonthly	2.1 d-h	5.1 l-m	3.1 d-g	3.9 j-k	2.0 a-d	4.5 h-j	3.5

Table 1 (Con't)

Carrier	TREATMENT Time of Application	Turfgrass Quality Ratings (1 = ideal; 9 = poor)						Average
		June 4	June 29	Aug 4	Sept 7	Sept 28	Oct 20	
UF-standard (38-0-0)	Monthly	4.3 n	5.1 l-m	3.8 g-k	3.6 h-k	5.0 p-q	3.6 d-g	4.2
	Bimonthly	2.9 i-k	4.3 h-l	3.8 g-k	3.8 i-l	4.3 m-o	3.9 e-h	3.8
UF-Powder Blue (38-0-0)	Monthly	4.3 n	4.6 j-m	3.6 f-j	2.9 d-g	4.8 o-q	3.3 c-e	3.9
	Bimonthly	2.1 d-h	4.3 h-l	3.1 d-g	3.8 i-l	3.9 l-n	4.0 e-h	3.5
Milorganite (6-2-0)	Monthly	2.9 i-k	3.5 f-i	2.4 a-d	2.4 b-d	4.8 o-q	2.6 b-c	3.1
	Bimonthly	2.5 g-j	5.0 k-m	2.4 a-d	3.6 h-k	4.8 o-q	4.0 e-h	3.7
IBDU (31-0-0) Coarse	Monthly	3.9 m-n	3.9 g-j	2.5 a-d	2.4 b-d	3.4 i-l	1.8 a	3.0
	Bimonthly	3.0 j-l	4.4 i-l	2.3 a-c	2.3 b-c	3.8 k-n	2.3 a-b	3.0
Expt'l Liquid B (16%)	Monthly	2.0 c-g	2.0 a-b	3.1 d-g	2.9 d-g	2.6 d-h	3.4 c-f	2.7
	Bimonthly	1.3 a	3.0 c-g	3.1 d-g	3.9 j-l	2.0 a-d	5.1 i-l	3.1
Expt'l Liquid W (16%)	Monthly	2.3 e-i	1.8 a	3.4 e-h	3.1 e-h	2.4 b-f	3.6 d-g	2.8
	Bimonthly	1.4 a-b	4.1 h-k	3.4 e-h	3.6 h-k	1.6 a	5.1 i-l	3.2
Urea-1% Terrazole	Monthly	2.6 h-j	2.3 a-d	3.6 f-j	3.0 d-h	2.6 d-h	4.1 f-h	3.1
	Bimonthly	2.4 f-j	4.5 j-l	2.5 a-d	3.8 i-l	1.8 a-c	5.0 i-k	3.5
Urea-1/2% Terrazole	Monthly	2.9 i-k	2.1 a-c	3.8 g-k	2.9 d-g	3.3 h-l	4.5 h-j	3.2
Urea-1% Terrazole (3 lbs N/M/Yr)	Monthly	3.5 l-m	2.4 a-d	4.5 k-l	3.3 f-j	3.9 l-n	4.4 g-i	3.7
	Bimonthly	3.0 j-l	4.8 j-m	4.1 h-l	4.4 l-m	3.1 q-k	5.1 i-l	4.1
Urea-1/2% Terrazole (3 lbs N/M/Yr)	Monthly	3.4 k-m	2.3 a-d	4.4 j-l	4.1 k-m	4.4 n-p	5.9 l-m	4.1
	Bimonthly	3.0 j-l	5.5 m	4.5 k-l	4.6 m	3.6 j-m	6.4 m	4.6
Urea (3 lbs N/M/Yr)	Monthly	3.4 k-m	2.5 a-e	4.4 j-l	4.4 l-m	5.1 q	5.9 l-m	4.3
	Bimonthly	2.5 g-j	5.1 l-m	4.3 i-l	4.8 m	4.3 m-o	6.6 m	4.6

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Numbers in vertical columns not followed by the same numbers are significantly different at the 5% level by the Duncan's Multiple Range Test.

Table 2. 1977 Nitrogen Carrier Study on a Cohansey bentgrass green at East Lansing. The nitrogen was applied at the rate of 2 pounds N per 1000 square feet on June 5, July 15 and October 5. Averages of 3 replications.

Nitrogen Carrier	Turfgrass Quality Ratings (1 = ideal; 9 = poor)						
	June 12	Jul 2	Aug 5	Oct 2	Nov 1	Dec 5	Average
Urea	2.8 b-c*	1.8 a-b	2.3 b-c	4.3 f	1.5 a-c	1.5 a-b	2.3
Urea-1/2% Terrazole	1.8 a	2.3 b-c	2.3 b-c	3.8 e-f	1.8 a-d	1.5 a-b	2.3
Urea-1% Terrazole	2.3 a-c	3.0 d-e	2.5 b-c	3.5 d-e	1.3 a-b	1.5 a-b	2.4
Sulfur-coated urea (CIL)†	3.2 c-d	1.7 a	1.8 a-b	2.8 c-d	2.0 b-d	1.8 a-b	2.0
20-5-10 (CIL)	3.2 c-d	2.5 c-d	1.2 a	3.0 d	2.2 c-d	1.8 a-b	2.1
20-0-15 (CIL)	5.2 e	3.2 e	1.8 a-b	2.8 c-d	2.5 d	2.8 b-c	2.6
18-5-9 (Tee Time)	2.5 a-c	2.2 a-c	3.2 c-d	4.2 e-f	1.2 a	1.2 a	2.4
30-3-10 (FDS)	2.7 a-c	2.3 b-c	2.0 a-b	4.2 e-f	1.5 a-c	1.3 a-b	2.3
27-0-0 (LESCO-experimental)	7.8 f	4.5 f	5.0 g	2.8 c-d	5.3 f	5.3 e-f	4.6
Milorganite (6-2-0-)	7.7 f	3.3 e	2.5 b-c	1.7 a	5.0 f	3.8 c-d	3.3
IBDU (31-0-0) Coarse	7.8 f	2.5 c-d	1.2 a	1.8 a	3.8 e	3.7 c-d	2.6

† The sulfur-coated urea used was the fine grade for use on greens.

* Numbers in vertical columns not followed by the same letter are significantly different at the 5% level by the Duncan's Multiple Range Test.

Table 3. 1977 Nitrogen Carrier Study on a Predominantly Red Fescue Turf at Traverse City. Averages for 3 replications.

Carrier	TREATMENT				TURFGRASS QUALITY RATING (1 = ideal; 9 = poor)					
	N applied - lbs/1000 sq ft				Jun 4	Jun 29	Aug 4	Sept 27	Oct 30	Average
	May 12	Jun 4	Aug 4	Sept 27						
Urea	1	1	1	1	3.8 d-e*	2.2 a-b	2.8 a-b	3.7 g	1.8 c-3	2.9
	2		2		2.0 a-b	3.3 d-e	3.5 c-e	3.3 f-g	1.2 a-b	2.7
Urea - 1/2% Terrazole	1	1	1	1	3.8 d-e	2.3 a-b	2.7 a-b	3.2 e-g	1.7 b-d	2.7
	2		2		2.2 a-b	3.3 d-e	3.0 b-c	3.0 d-g	1.5 a-c	2.6
Urea - 1% Terrazole	1	1	1	1	4.0 d-e	2.5 b	2.3 a	2.5 a-e	1.7 b-d	2.5
	2		2		2.3 b-c	3.3 d-e	3.0 b-c	2.5 a-e	1.3 a-c	2.5
Sulfur-coated Urea (CIL)	1	1	1	1	4.0 d-e	2.2 a-b	3.0 b-c	2.5 a-e	2.3 e	2.7
	2		2		2.3 b-c	2.5 b	3.2 b-d	2.5 a-e	1.7 b-d	2.4
S-coated urea (CIL) Fine	1	1	1	1	4.0 d-e	2.2 a-b	2.7 a-b	1.8 a	1.7 b-d	2.5
	2		2		2.3 b-c	2.7 b-c	3.0 b-c	2.8 c-f	1.0 a	2.4
25-4-10	1	1	1	1	3.8 d-e	2.3 a-b	2.3 a	2.0 a-b	1.7 b-d	2.4
	2		2		2.0 a-b	2.7 b-c	2.8 a-b	2.0 a-b	1.0 a	2.1
18-5-9 (Tee Time)	1	1	1	1	4.0 d-e	2.5 b	2.7 a-b	2.8 c-f	1.8 c-e	2.8
	2		2		2.3 b-c	3.5 d-f	3.8 d-e	2.7 b-f	1.5 a-c	2.7
30-3-10 (FDS)	1	1	1	1	3.8 d-e	2.2 a-b	3.0 b-c	3.0 d-g	1.8 c-e	2.8
	2		2		2.2 a-b	3.8 e-f	3.8 e	3.2 e-g	1.2 a-b	2-8
20-0-15 (CIL)	2		2		1.8 a	2.7 b-c	2.8 a-b	2.2 a-c	1.7 b-d	2.2
20-5-10 (CIL)	2		2		2.2 a-b	2.7 b-c	3.2 b-d	2.3 a-d	1.0 a	2.3
IBDU (31-0-0)	2		2		3.8 d-c	4.0 f	3.0 b-c	2.2 a-c	3.2 f	3.2
UF (38-0-0)	2		2		3.8 d-e	4.8 g	4.0 e	2.0 a-b	3.0 f	3.5
Milorganite 33-0-0	1	1	1	1	4.2 e	3.2 c-d	2.8 a-b	2.0 a-b	4.2 g	3.3
	1	1	1	1	3.7 c-d	1.8 a	2.7 a-b	3.2 e-g	1.7 b-d	2.6
Liquid B (16%)	1	1	1	1	4.0 d-e	2.0 a-b	3.0 b-c	3.0 d-g	1.8 c-e	2.8
Liquid W (16%)	1	1	1	1	4.0 d-e	2.0 a-b	3.0 b-c	2.7 b-f	2.2 d-e	2.8

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Numbers in vertical columns not followed by the same letter are significantly different at the 5% level.

Table 4. 1977 Nitrogen Carrier Study on Kentucky Bluegrass at Traverse City. The nitrogen was applied at the rate of 1 or 2 pounds N per 1000 square feet on June 4. Averages of 3 replications.

Carrier	TREATMENT		Turfgrass Quality Rating (1 = ideal; 9 = poor)				
	N Rate lbs/1000 sq. feet		June 29	Aug 4	Sept 27	Oct 20	Average
Urea	1		1.7 a-c*	2.8 b-c	4.3 h	4.0 d-e	3.2
	2		1.3 a	1.3 a	3.0 d-f	3.2 b-d	2.2
S-coated urea (TVA) (36-0-0)	1		2.5 d-f	2.8 b-c	3.3 e-g	3.3 b-d	3.0
	2		2.2 b-d	1.7 a	2.5 b-e	2.5 b	2.2
S-coated urea (CIL) (32-0-0) Standard	1		2.7 d-g	2.8 b-c	2.5 b-e	3.7 c-e	2.9
	2		2.0 a-d	1.5 a	1.8 a-b	2.7 b	2.0
S-coated urea (CIL) (32-0-0) Fine	1		3.3 g-i	3.2 c	2.8 c-f	3.7 c-e	3.3
	2		1.5 a-b	1.5 a	2.0 b-c	2.7 b	1.9
27-0-0 (LESCO)	1		3.0 e-h	4.2 d	4.2 g-h	4.5 e	4.0
	2		2.3 c-e	2.5 b	3.2 e-f	3.2 b-d	2.8
IBDU (31-0-0) Coarse	1		4.2 i	3.2 c	2.2 b-d	3.0 b-c	3.1
	2		3.2 f-h	1.5 a	1.0 a	1.7 a	1.8
Milorganite	1		3.7 h-i	3.2 c	3.5 f-h	4.0 d-e	3.6
	2		2.3 c-e	1.8 a	2.7 b-f	2.7 b	2.4

* Numbers in vertical columns not followed by the same letter are significantly different at the 5% level by the Duncan's Multiple Range Test.

Table 5. 1977 Nitrogen Carrier Study on Merion Kentucky Bluegrass at East Lansing. Nitrogen was applied at the rates shown on June 4 and October 20. Averages for 3 replications.

TREATMENT		Turfgrass Quality Rating (1 = ideal; 9 = poor)				
Carrier	N Rate	Jun 17	Jul 2	Aug 8	Nov 6	Average
	lbs/1000 sq. ft.					
Urea	1	2.2 d-f	3.3 e-h	4.3 k-l	4.8 j-k	3.7
	2	1.0 a	1.3 a	3.0 e-h	3.7 f-i	2.3
Urea-1/2% Terrazole	1	2.0 c-e	3.5 e-h	3.7 h-k	4.2 h-j	2.3
	2	1.3 a-b	2.0 a-c	2.7 c-g	3.3 d-g	2.3
Urea-1% Terrazole	1	2.2 d-f	3.2 d-g	3.5 g-j	3.8 g-i	3.1
	2	1.3 a-b	1.7 a	2.0 a-c	3.0 c-f	2.0
S-coated urea 32-0-0 (CIL)	1	2.7 f-g	4.3 h-j	3.7 h-k	3.3 d-g	3.5
	2	1.7 b-d	1.8 a-b	2.3 b-e	2.2 a-b	2.0
S-coated urea Fine (CIL)	1	2.0 c-e	3.2 d-g	3.2 f-h	2.8 b-e	2.8
	2	1.5 a-c	2.2 a-d	2.8 d-g	2.7 a-d	2.3
25-4-10 (CIL)	1	2.5 f	3.0 c-f	3.0 e-h	3.2 c-g	2.9
	2	1.3 a-b	1.8 a-b	1.5 a	2.0 a	1.7
20-5-10 (CIL)	1	2.7 f-g	4.2 g-j	2.8 d-g	3.2 c-g	3.2
	2	2.0 c-e	3.2 d-g	2.2 a-d	2.8 b-e	2.5
20-0-15 (CIL)	1	2.7 f-g	4.2 g-j	3.2	d-g	3.4
	2	2.0 c-e	3.3 e-h	2.0 a-c	2.5 a-c	2.5
18-5-9 (Tee Time)	1	2.3 e-f	3.2 d-g	4.0 i-k	5.2 k	3.7
	2	1.5 a-c	2.0 a-c	2.8 d-g	3.7 f-i	2.5

Table 5 (Con't.)

TREATMENT		Turfgrass Quality Rating (1 = ideal; 9 = poor)				
Carrier	N Rate	Jun 17	Jul 2	Aug 8	Nov 6	Average
	lbs/1000 sq. ft.					
30-3-10 (FDS)	1	2.5 f*	3.0 c-f	3.2 g-h	4.7 j-k	3.3
	2	1.3 a-b	1.8 a-b	2.7 c-g	3.0 c-f	2.2
UF (38-0-0) Powder Blue UF (Chip)	2	3.2 g-h	4.0 f-i	3.7 h-k	2.8 b-e	3.4
	2	4.0 i-j	5.5 k-l	4.2 j-l	3.3 d-g	4.3
S-Coated Urea 36-0-0 (TVA)	1	3.5 h-i	5.0 i-k	3.5 g-j	3.5 e-h	3.6
	2	3.2 g-h	3.5 e-h	3.5 g-j	2.8 b-e	3.3
IBDU - Coarse	1	4.5 i-k	6.2 l	4.0 i-k	2.8 b-e	3.5
	2	4.0 i-j	5.2 j-l	3.0 e-h	2.0 a	4.4
Liquid B (16% N)	1	1.8 b-e	3.2 d-g	3.2 f-h	4.7 j-k	3.2
	2	1.3 a-b	1.8 a-b	1.8 a-b	3.3 d-g	2.1
Liquid W (16% N)	1	2.3 e-f	3.3 e-h	3.3 f-i	4.3 i-j	3.3
	2	1.8 b-e	2.0 a-c	2.3 b-e	3.5 e-h	2.4
27-0-0 (LESCO)	1	4.7 k	5.8 k-l	4.8 l	4.2 h-j	4.9
	2	3.2 g-h	4.2 g-j	3.5 g-j	3.0 c-f	3.5
18-4-9 (Lebanon)	2	1.8 b-e	3.0 c-f	2.8 d-g	3.0 c-f	2.7
30-3-10 (Scotts)	2	2.0 c-e	2.8 b-e	2.5 b-f	2.5 a-c	2.5
19-5-9 (U.S. Steel)	2	2.0 c-e	3.2 d-g	3.2 f-h	3.2 c-g	2.9
Milorganite	2	3.5 h-i	4.0 f-i	2.3 b-e	3.5 e-h	3.3

* Numbers in vertical columns not followed by the same letter are significantly different at the 5% level by the Duncan's Multiple Range Test.