DETERMINING NITROGEN AND PHOSPHORUS RECOMMENDATIONS FOR TURFGRASS GROWN ON A PHOSPHORUS DEFICIENT SOIL

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Introduction & Objective

Phosphorus is a primary and essential nutrient for plant growth and routinely used as fertilizer on urban landscapes. However, one of the primary contaminants of surface water resources in Michigan is phosphorus. Reducing the loading of phosphorus from urban landscapes is a major concern for local communities as they strive to meet federally mandated total maximum daily loads for nutrients.

Turfgrass fertility programs for lawns are primarily based on the application of nitrogen while phosphorus in most cases is applied based on a pre-determined ratio of nitrogen to phosphorus. As a result, phosphorus can be applied when a soil test would suggest no applications. The attention phosphorus has garnered has certainly drawn the attention of turf professionals and led many to reduce or eliminate phosphorus from their agronomic programs relying on the assumption that soil phosphorus levels are adequate or application of phosphorus is unnecessary.

The study was conducted to determine turf response to phosphorus fertilizer programs in order to facilitate development of fertilizer best management practices for turfgrass grown on a phosphorus deficient soil.

Materials and Methods

Research was initiated in the spring of 2004. The plot area was stripped of the existing turfgrass, the soil was prepared, and Kentucky bluegrass sod donated from Green Acres Turf in Mason was planted on the site on May 18. Fertilizer treatments were initiated on June 18. The nitrogen treatments were 2, 3.2, and 4.25 lbs. N/1000 $ft.^2$/yr. The low, medium, and high nitrogen treatments were applied over 2, 4, and 6 applications, respectively. Nitrogen was applied using a formulation containing slow and fast release nitrogen sources that are representative of typical home lawn fertilizers. The phosphorus treatments were 0, 0.5, and 1.0 lbs. P_2O_5/1000 $ft.^2$/yr. Phosphorus was applied according to the application schedule for the nitrogen treatments.

Turfgrass color and quality ratings were taken every two weeks throughout 2004 and 2005. Turfgrass clippings were collected every two weeks, weighed and analyzed for nitrogen, phosphorus, and potassium. Soil tests were taken monthly and analyzed for phosphorus and potassium levels.

Results

Statistical analysis of data from 2004 and 2005 indicate there were no significant interactions between nitrogen and phosphorus for turfgrass color, quality, or clipping dry weights with the exception of only one date, 15 weeks after treatment (WAT) in 2005. Overall, there was no effect of phosphorus on turfgrass color, quality, or clipping weights in both 2004 and 2005. There were only a few sampling dates when differences were observed among P treatments. There was a significant P treatment effect for turfgrass quality on only one date, 10 WAT in 2004. At 10 WAT, the high P treatment had the highest turfgrass quality rating, and the medium P rate treatment had higher turfgrass quality than the low P treatment. Clipping dry weights were significantly different among P treatments at 6, 8 and 16 WAT in 2004 and at 8 and 16 WAT in 2005 (Table 1). On both dates the medium and high P treatments had the highest clipping weights.

Processing of soil samples is still occurring but for the samples that have been processed there was a significant effect of soil depth on soil P level during 2004. Soil samples for the surface 0 – 2 in. depth had higher soil P levels.

There was a significant N rate main effect for turfgrass color and clipping dry weights. The high N rate treatment had the highest turfgrass color from 10 to 16 WAT in 2004 and from 2 to 20 WAT in 2005 (Table 2). The high N rate treatment also produced the largest clipping weights from 8 to 16 WAT in 2004 and 2 to 20 WAT in 2005 (Table 4). Overall, the low and medium N treatments had acceptable (> 6) turfgrass color ratings throughout 2004 and 2005 without high clipping yields.

Funding Support

Funding support for this research is provided by the Michigan Turfgrass Foundation, Project GREEEN, and Lesco.

Table 1.Mean turfgrass clipping dry weight for phosphorus rate main effect.

P rate[†]	Week after treatment										
	2	4	6	8	10	12	14	16	18	20	22
	----------					2004					----------
0	7.1[‡]	4.7	7.1 b[§]	1.6 b	3.0	2.1	3.6	0.2 b	0.5	0.1	--
24	8.8	6.8	9.3 a	2.8 a	4.1	3.1	3.6	0.3 ab	0.6	0.1	--
49	6.7	6.1	8.2 ab	2.4 ab	3.8	2.5	4.0	0.4 a	0.6	0.1	--
	----------					2005					----------
0	17.8	41.9	26.4	11.9 ab	11.6	3.1	3.4	3.6 b	10.6	4.4 b	2.4
24	18.8	45.1	28.5	13.1 a	12.9	3.8	4.1	4.5 a	12.1	5.2 a	2.8
49	19.5	47.0	31.0	11.5 b	12.2	3.3	3.7	3.7 ab	12.4	4.9 ab	2.8

[†] P rate units are kg ha^{-1}

[‡] Clipping dry weight units are g m^{-2}

[§] Means in a column followed by the same letter are not significantly different according to Fisher's LSD (P=0.05).

Table 2. Mean turfgrass color for nitrogen rate main effect.

N rate†	Week after treatment										
	2	4	6	8	10	12	14	16	18	20	22
	----------					2004					----------
98	7.9‡	8.0	7.3 b§	6.6 b	6.7 c	6.6 c	7.3 c	7.3 b	7.1	5.8 b	6.0 b
156	7.7	8.0	8.0 a	7.8 a	7.5 b	7.3 b	7.7 b	7.2 b	7	6.5 a	6.7 a
208	7.7	8.0	8.0 a	8.0 a	8.2 a	8.3 a	8.3 a	7.6 a	7.3	6.6 a	6.6 a
	----------					2005					----------
98	7.6 b	6.9 c	6.8 b	6.6 a	6.0 c	5.9 c	5.7 c	5.2 c	6.8 b	6.8 b	7.0
156	8.0 ab	7.2 b	7.9 a	8.0 a	7.1 b	6.9 b	7.0 b	6.3 b	7.4 a	7.4 a	7.8
208	8.1 a	7.4 a	7.9 a	8.0 a	8.0 a	8.0 a	8.0 a	7.6 a	7.8 a	7.8 a	7.8

† N rate units are kg ha^{-1}

‡ Kentucky bluegrass color was rated from 1 to 9 (1 = straw brown, 9 = dark green, and 6 = acceptable).

§ Means in a column followed by the same letter are not significantly different according to Fisher's LSD (P=0.05).

Table 3. Mean turfgrass quality for nitrogen rate main effect.

N rate†	Week after treatment										
	2	4	6	8	10	12	14	16	18	20	22
	----------					2004					----------
98	7.9‡	8.0	7.5 b§	6.8 b	6.7 c	6.9 c	7.3 c	7.0	6.9	6.0 b	5.8 b
156	7.8	8.0	8.0 a	7.8 a	7.6 b	7.5 b	7.6 b	7.0	6.9	6.5 a	6.4 a
208	7.6	8.0	8.0 a	7.9 a	8.3 a	8.3 a	8.4 a	7.3	7.2	6.6 a	6.5 a
	----------					2005					----------
98	7.3 b	6.8 b	6.7 b	6.7 b	6.7 c	5.8 c	5.9 c	5.2 c	7.0	7.2 b	--
156	7.9 a	7.0 a	7.8 a	8.0 a	7.0 b	6.8 b	6.9 b	6.0 b	7.3	7.8 a	--
208	8.0 a	7.1 a	7.7 a	8.0 a	8.0 a	8.0 a	7.3 a	7.3 a	7.4	7.6 ab	--

† N rate units are kg ha^{-1}

‡ Kentucky bluegrass quality was rated from 1 to 9 (1 = worst, 9 = best, and 6 = acceptable).

§ Means in a column followed by the same letter are not significantly different according to Fisher's LSD (P=0.05).

Table 4. Mean turfgrass clipping dry weight for nitrgen rate main effect.

N rate†	Week after treatment									
	2	4	6	8	10	12	14	16	18	20
	----------					2004				----------
98	7.8‡	5.7	6.3 c§	0.7 b	1.1 c	0.5 b	1.6 c	0.2 b	0.4	0.1
156	7.3	5.8	9.3 a	3.4 a	3.9 b	1.4 b	3.2 b	0.2 b	0.6	0.1
208	7.6	6.1	9.0 b	2.8 a	6.0 a	5.9 a	6.3 a	0.5 a	0.8	0.1
	----------					2005				----------
98	11.6 c	36.9 c	18.6 c	8.1 c	5.6 c	1.6 c	2.0 c	2.1 c	10.3 b	4.6 b
156	18.7 b	44.4 b	30.1 b	12.9 b	10.7 b	3.0 b	3.1 b	3.4 b	10.4 b	4.2 b
208	25.7 a	52.6 a	37.1 a	15.5 a	20.4 a	5.6 a	6.1 a	6.4 a	14.4 a	5.7 a

† N rate units are kg ha^{-1}

‡ Clipping dry weight units are g m^{-2}

§ Means in a column followed by the same letter are not significantly different according to Fisher's LSD (P=0.05).