

Tall Fescue Lawn Turf Response to Various Phosphorus Containing Fertilizers

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Introduction: The potential for excess fertilization of lawn turf with nitrogen (N) and phosphorus (P) is an important topic related to declining water quality throughout the USA. An established turf-type tall fescue lawn turf grown on a silt-loam was fertilized for five years with six different granular fertilizers at 196 kg N ha⁻¹ yr⁻¹ using sources that ranged from a 1:1:1 N-P-K ratio to zero P fertilizers, and compared to a non-fertilized control. Additionally the turf was mown with either clippings returned or removed during the study. The turf and soil were periodically sampled to monitor soil and leaf tissue P levels. Visual turf appearance, green color and shoot density were also monitored. Fertilized turf had superior appearance, color, vigor and density. Soil test, turf quality, and clipping management results will be discussed.



Materials and Methods

Six fertilizer treatments with various N:P ratios ranging from 1:1 to 7:1 were evaluated on a calcareous silt loam soil (initial Bray-1 STP = 33 ppm) in West Lafayette, Indiana. Products were applied four times annually for a total annual rate of 196 kg N ha⁻¹ yr⁻¹. The effect of a second factor, clipping management (returned vs. removed) was also studied.



Grass clippings were both returned and removed for each treatment in separate plots (14 total treatments).



Results:

Table 1. Turf quality of a turf-type tall fescue as affected by various fertilizers with N:P ratios ranging from 1:1 to 7:1 and two clipping management practices conducted for six years.†

Treatment	Nutrient Ratio	Visual quality (0-10 =optimal rating scale) ‡						Study Mean
		2012	2013	2014	2015	2016	Mean	
General Purpose (12-12-12)	1:1:1	7.1 ab	7.1 b	7.5 abc	6.9 b	7.5 ab	7.1 b	
Lawn fertilizer (22-3-10)	7:1:3	6.8 b	6.9 b	7.6 ab	6.9 b	7.5 ab	6.9 ab	
Urea-only program	1:0:0	7.3 a	7.6 a	7.8 a	7.6 a	7.9 a	7.5 a	
Biosolids (6-2-0)	3:1:0	6.8 b	6.5 c	7.2 c	6.7 b	7.2 b	6.7 c	
Consumer organic lawn (11-2-0)	5.5:1:0	7.0 ab	7.0 b	7.6 ab	6.7 b	7.2 b	7.0 b	
Composted poultry manure (5-3-2)	1.8:1:1	7.0 ab	6.8 bc	7.4 bc	6.8 b	7.1 b	6.9 bc	
Unfertilized control	----	5.5 c	4.4 d	3.5 d	3.6 c	4.1 c	4.6 d	
Clipping management								
Returned		6.9 a	6.8 a	7.1 a	6.7 a	7.2 a	6.8 a	
Removed		6.7 b	6.4 b	6.8 b	6.2 b	6.6 b	6.5 b	
ANOVA								
Fertilizer (F)		***	***	***	***	***	***	
Clipping Management (CM)		*	***	**	***	***	***	
F x CM		NS	NS	NS	NS	NS	NS	

† A turf-type tall fescue blend was planted in June 2010 and initial fertilizer treatments applied July 2010. All fertilized plots received 196 kg N ha⁻¹ yr⁻¹ divided into four 49 kg N ha⁻¹ applications (May, July, Sept., and Oct.). The composition of the urea-only program consisted of a mixture of urea (46-0-0) and sulfur coated urea (31-0-0) which varied depending upon the time of year.
‡ Visual quality was rated using a 0-10 scale where 10=optimal greenness, density and uniformity, 6=minimally acceptable lawn turf.
*, **, *** and NS refer to significant at the 0.05, 0.01, 0.001 and non-significant, respectively. Mean in the same column followed by the same letter within fertilizer or clipping management factors are not significantly different according to Fisher's protected LSD.

Table 2. Changes in Bray-1 soil test phosphorus (P) and differences in tall fescue leaf tissue P as affected by fertilizer and clipping management programs.†

Treatment	Clipping management	Soil P (0-8 cm)			Study Change	Tissue P (ppm)
		2010	2012	2016		
General purpose (12-12-12)	Returned	17 a	79 a	105 a	88	7700 a
General purpose (12-12-12)	Removed	18 a	70 a	96 a	78	7500 a
Lawn fertilizer (22-3-10)	Returned	19 a	43 c	36 cd	17	NM
Lawn fertilizer (22-3-10)	Removed	18 a	39 c	NM	NM	5700 c
Urea-only program	Returned	17 a	43 bc	27 d	10	NM
Urea-only program	Removed	18 a	45 bc	NM	NM	8000 a
Biosolids (6-2-0)	Returned	20 a	64 ab	92 a	72	NM
Biosolids (6-2-0)	Removed	16 a	61 ab	NM	NM	NM
Consumer organic lawn (11-2-0)	Returned	18 a	48 bc	45 c	27	NM
Consumer organic lawn (11-2-0)	Removed	18 a	49 bc	NM	NM	NM
Composted poultry manure (5-3-4)	Returned	19 a	75 a	90 ab	71	8100 a
Composted poultry manure (5-3-4)	Removed	16 a	63 ab	73 b	57	7900 a
Unfertilized control	Returned	18 a	42 c	38 cd	20	6500 b
Unfertilized control	Removed	20 a	36 c	31 cd	11	NM

† A turf-type tall fescue blend was planted in June 2010 and initial fertilizer treatments applied July 2010. All fertilized plots received 196 kg N ha⁻¹ yr⁻¹ divided into four 49 kg N ha⁻¹ applications (May, July, Sept., and Oct.). The composition of the urea-only program consisted of a mixture of urea (46-0-0) and sulfur coated urea (31-0-0) which varied depending upon the time of year.
NM = not measured

Table 3. Canopy greenness of a turf-type tall fescue as affected by various fertilizers with N:P ratios ranging from 1:1 to 7:1 and two clipping management practices conducted for six years.†

Treatment	Nutrient Ratio	Canopy Greenness ‡						Study Mean
		2012	2013	2014	2015	2016	Mean	
General Purpose (12-12-12)	1:1:1	0.652 bc	0.667 b	0.702 ab	0.691 b	0.705 ab	0.684 b	
Lawn fertilizer (22-3-10)	7:1:3	0.657 b	0.667 b	0.695 abc	0.683 bc	0.696 abc	0.680 bc	
Urea-only program	1:0:0	0.675 a	0.683 a	0.704 a	0.705 a	0.711 a	0.696 a	
Biosolids (6-2-0)	3:1:0	0.639 c	0.646 c	0.686 c	0.676 c	0.681 c	0.666 d	
Consumer organic lawn (11-2-0)	5.5:1:0	0.647 bc	0.656 bc	0.695 abc	0.681 bc	0.689 c	0.674 cd	
Composted poultry manure (5-3-2)	1.8:1:1	0.648 bc	0.660 b	0.692 bc	0.688 b	0.695 bc	0.677 bc	
Unfertilized control	----	0.596 d	0.596 d	0.632 d	0.634 d	0.624 d	0.616 e	
Clipping management								
Returned		0.651 a	0.660 a	0.694 a	0.684 a	0.695 a	0.677 a	
Removed		0.639 b	0.648 b	0.680 b	0.675 b	0.677 b	0.664 b	
ANOVA								
Fertilizer (F)		***	***	***	***	***	***	
Clipping Management (CM)		**	**	***	***	***	***	
F x CM		NS	NS	NS	NS	NS	NS	

† A turf-type tall fescue blend was planted in June 2010 and initial fertilizer treatments applied July 2010. All fertilized plots received 196 kg N ha⁻¹ yr⁻¹ divided into four 49 kg N ha⁻¹ applications (May, July, Sept., and Oct.). The composition of the urea-only program consisted of a mixture of urea (46-0-0) and sulfur coated urea (31-0-0) which varied depending upon the time of year.

‡ Canopy greenness was measured using a hand-held reflectance meter (Spectrum Technologies TCM-500) with 10 measurements per individual plot averaged into a single plot value.
*, **, *** and NS refer to significant at the 0.05, 0.01, 0.001 and non-significant, respectively. Mean in the same column followed by the same letter within fertilizer or clipping management factors are not significantly different according to Fisher's protected LSD.

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DON'T BAG IT!

Returning clippings increased organic matter in soil on average by... **7%**

Turf appearance/quality was superior when clippings were returned by an average of... **6%**

Conclusions:

- Providing turf-type tall fescue with supplemental nitrogen resulted in superior green color and vigor regardless of fertilizer source compared to unfertilized turfgrass.
- By year 3, mean STP levels ranged 36-79 ppm and fertilizers with N:P ratios of 1:1 or 3:1 caused substantial STP increases (> 60 ppm) regardless of clipping management strategy.
- Where initial STP levels are sufficient, a healthy TTF can be grown using N only fertilizers.
- Continued application of fertilizers with N:P ratios of < 3:1 could eventually result in excess P loading and environmental loss.
- Strategies for reducing N and P inputs from urban areas continues to be an important topic for research and community education.
- Adequate P levels may exist in many urban soils. Soil testing prior to selecting a fertilizer product selection and development of an annual feeding program is prudent and responsible to minimize any potential for any excess nutrient enrichment of surface and groundwater.



A properly nourished turf can produce a dense vegetative canopy that effectively traps sediment and storm runoff, making responsibly maintained turf an environmental asset in many landscapes that will help preserve and protect water quality.