DESIGNING FERTILIZER PROGRAMS FOR YOUR TURF

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Planning a fertilizer program for athletic fields, parks, and cemeteries requires a different approach than for home lawns. While the basic factors of soil tests, soil texture, grass species present and aesthetic quality desired are the same, other factors must be considered in planning for "utility" turf maintenance. Some of these factors are: 1) intensity, time and duration of use, 2) desired mowing frequency, 3) level of irrigation and, 4) your budget.

As with all turf situations, there are minimum fertilizer requirements to maintain a quality utility turf. The nitrogen levels listed in Table 1 assume adequate levels of the other required turfgrass nutrients. Potassium and phosphorus must be maintained at optimum levels in the soil if the turfgrass is to benefit from the applied nitrogen. The best method to be sure of adequate soil nutrient levels is to perform a soil test.

Soil testing should be the bench mark for all fertilizer programs. Soil test recommendations such as those in Tables 2 and 3 are intended as guidelines when planning a fertilizer program. Soil tests for nutrients other than phosphorus, potassium, calcium and magnesium may be requested but deficiencies of these nutrients are rarely a problem on turfs in Michigan. Exceptions to this generalization include: 1) occasional iron (Fe) deficiencies which may be naturally occurring or induced by excessive soil phosporus levels and 2) micronutrient deficiencies which may be induced by extremely high or low soil pH levels.

Phosphorus is not required at levels as high as other soil macronutrients to maintain adequate turf growth. When this nutrient is required to meet recommended levels, it may be applied in a number of ways. Application timing for phosphorus is not as critical as for nitrogen and potassium and can be applied with any of the combination fertilizers or by itself. Phosphate (P_2O_5) carriers are available in a variety of forms including: 1) treble superphosphate (0-46-0), 2) superphosphate (0-20-0) and 3) complete fertilizers such as (18-5-9), (20-5-10) and (31-3-10). One application annually will supply the turf requirements for a much longer period of time than similar applications of nitrogen or potassium. Phosphorus related deficiencies of other nutrients may occur if fertilizer applications greatly exceed recommended soil phosphorus levels. Phosphorus is a relatively immobile nutrient in the soil so leaching is seldom a problem unless excessive rates are applied.

Potassium behaves uniquely in soil. There are some soils that are rarely deficient in potassium, but these are not typical in Michigan. Soils with an increasingly sandy nature usually require increased amounts of supplemental potassium. Lighter-textured soils which receive supplemental irrigation are particularly prone to potassium leaching. Table 3 illustrates the soil levels of potassium based on soil tests required to insure adequate turf growth. Potash (K_2O) may be applied alone or as a part of a complete fertilizer. On the sandy soils, potassium should be applied at least twice a year and at least 3 to 4 times annually on intensively maintained turfs. Potassium sources available are: muriate of potash (0-0-60), potassium sulfate (0-0-50), many complete fertilizers and sulfur-coated formulations which release the potassium over long periods of time in an attempt to decrease

leaching losses.

Nitrogen, almost without question, is the most frequently needed nutrient to attain and maintain a healthy turf. The rate and timing of nitrogen application is usually determined by several factors. The species of grass present will partially determine the total pounds per year (N/1000 sq ft) required. The intensity and timing of turf use play a primary role in deciding yearly nitrogen rates and the timing of application. Table 4 illustrates possible rates and timing of nitrogen applications on some utility turfs. Nitrogen is available in several forms. Nitrogen can be purchased in fast-release forms such as urea (45-0-0), ammonium nitrate (33-0-0) or potassium nitrate (13-0-44). Slow release nitrogen carriers, which produce an extended growth response, include sulfur-coated urea, IBDU, Milorganite, and several carriers based on urea formaldehyde.

Scheduling of nutrient applications must be done with consideration of the previously mentioned factors. Table 5 illustrates an example fertilization schedule for a fall-use athletic turf in the southern one-third of Michigan. The purpose of this two part table is to show how soil test recommendations are used and just one example of possible fertilizer carriers and notes which can be used to meet the soil test recommendations. The recommended nitrogen, phosphorus, and potassium recommendations on the top half of the table have been taken from Tables 1,2, and 3, respectvely. A slow-release nitrogen source was applied in June to insure adequate turf density before the summer stress period begins yet to minimize mowing. A 1/2# N/1000 ft^2 application in early October will keep the turf actively growing, for the balance of the season and a mid-Novmeber (late season) application will supply nitrogen required for some fall recovery and spring growth to rebuild the turf from the fall damage. For more northern sites, the late season applications would need to be applied at an earlier date. As in the example of table 5, use of complete fertilizers can partially or fully satisfy phosphorus and potassium requirements, while minimizing labor input. The annual total application of phosphorus at 0.7#/1000 ft^2, is somewhat short of the recomended 1#/1000ft^2 as noted in the top half of Table 5. The difference between recommended nutrient rates and actual rates applied, is often acceptable if the difference is not large because the rates recommended are just that, recommended rates. Supplementary irrigation is recommended for intensively used turfs to maximize the effectiveness of the fertilizer program.

In summary, while every turfgrass site has its own particular requirements, the planning and scheduling of a fertilizer program requires consideration of the same basic factors to be successful. The manager must know which nutrients are limiting and what amounts are needed to insure good turf. He must know when to apply these nutrients and at what rates. Finally, the manager must be able to do all these things within the constraints of his budget.

Table 1. Annual nitrogen requirements for general turfgrasses in Michigan.

Grass Species	Level of Use	#N/1000 ft^2/yr
"Improved" Kentucky Bluegrass	Medium - low	2 - 3
"Improved" Kentucky Bluegrass	High	4 - 5
Fine Fescue	Medium	2 - 3
Perennial ryegrass	Medium - high	3 - 5
Minimum maintenance turfs	Low	1 - 2

Table 2. Annual phosphate (P_2O_5) applications based on soil tests (Bray P_1 Extractable) at the M. S. U. Soil Testing Lab.

Soil test	Pounds phosphate (P_2O_5) recommended		
	General turf		High maintenance turf [a]
(lbs P/acre)	Per 1000 sq. ft.	Per acre	Per 1000 sq. ft.
0 - 14 (very low)	3	130	4
15 - 24 (low)	2	85	3
25 - 39 (medium)	1	45	2
40 - 69 (high)	0	0	1
70+ (very high)	0	0	0

[a] High maintenance turf would include intensively used athletic fields, golf greens and tees, tennis courts, and for establishment recommendations.

Table 3. Annual potash (K_2O) applications based on soil tests (neutral normal ammonium acetate extractable) at the M. S. U. Soil Testing Lab.

Soil test (lbs K/acre)	Pounds of potash (K_2O) recommended			
	General turf		High maintenance turf [a]	New turf [b]
	Per 1000 sq. ft.	Per acre	Per 1000 sq ft	
0 - 49 (very low)	4	170	5	5
50 -99 (low)	3	130	4	4
100 - 174 (medium)	2	85	3	3
175 - 249 (med. - high)	1	45	2	2
250 - 349 (high)	0	0	1	1
350+ (very high)	0	0	1	0

[a] High maintenance turf would include intensively used athletic field, golf greens and tees, and tennis courts.

[b] Place up to half of this amount in the seedbed at higher rates recommended, applying the rest during the growing season.

Table 4. Calendar for nitrogen applications suggested to maintain turfs.[a]

Turf Use	Level of Management	Month of Application							Annual total
		May	June	July	Aug	Sept	Oct	Nov	
		lbs N/1000 ft^2							
Baseball field	medium - high	0.5	0.5	0.5	0.5	1.0	-	1.0[c]	4.0
Baseball field	medium	-	1.0	-	-	1.0	-	1.0[c]	3.0
Baseball field	low	1.0	-	-	-	1.0	-	-	2.0
Baseball field	low	-	0.5	-	-	1.0	-	1.0[c]	2.5
Soccer field	medium - high	0.5	0.5	0.5	0.5	1.0	-	1.0[c]	4.0
Soccer field	low	0.5	0.5	0.5	-	1.0	-	-	2.5
Soccer field	low	-	0.5	-	-	1.0	-	1.0[c]	2.5
Football field	medium - high	-	0.5	0.5	0.5	0.5	0.5	1.5[c]	4.0
Football[b] field	medium - high	1.0	-	0.5	0.5	0.5	0.5	1.5[c]	4.5
Football field	medium	-	0.5	0.5	0.5	0.5	0.5	1.0[c]	3.5
Football field	medium	1.0	-	-	0.5	0.5	-	0.5[c]	2.5
Park - cemetery	medium - high	0.5	0.5	0.5	-	1.0	-	1.0[c]	3.5
Park - cemetery	low	1.0	-	-	-	1.0	-	-	2.0

[a] dates suggested are for the 15th of each month

[b] field has very thin turf in the spring.

[c] fertilizer should contain some slow release nitrogen to reduce leaching

Table 5. Athletic Field Fertilizer Scheduling Example.

USE: Intensive (football, Aug. 1-Nov. 15)
IRRIGATION: Supplemental, during stress periods
SOIL TYPE: Sandy Loam
GRASS SPECIES: Kentucky Bluegrass

Nutrient	Soil Test Level	Recommendation lbs/1000 sq. ft/yr
pH	6.9	No lime required
Nitrogen	--	4 - 5
Phosphorus	55 lbs/A	1
Potassium	125 lbs/A	3

FERTILIZING SCHEDULE FOLLOWED

Nutrient applied	Pounds nutrient applied per 1000 sq ft.					
	June[1]	Aug[2]	Sept[3]	Oct[2]	Nov[4]	Total Annual
Nitrogen	0.76	.50	1.00	.50	1.44	4.2
Phosphate	0.20	.13	.25	.13	-	0.7
Potash	0.98	.25	.50	.25	1.0	3.0

1 - Applied 3.8 pounds/1000 sq. ft of 20-5-10 containing some slow release nitrogen and 1.0 pound 0-0-60.
2 - Applied 2.5 pounds/1000 sq. ft. of 20-5-10 containing some slow release nitrogen
3 - Applied 5.0 pounds/1000 sq. ft. of 20-5-10 containing some slow release nitrogen
4 - Applied 4.5 pounds/1000 sq. ft. of 32-0-0 containing slow release nitrogen and 1.7 pounds 0-0-60.