HOW TO INTERPRET SOIL TEST RESULTS FOR TURFGRASSES

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Maintenance of a good quality turf requires an adequate fertilization program. Selecting a turfgrass fertilization program involves a consideration of several factors including:

a. Soil test results;
b. Turfgrass species;
c. Time of year;
d. Soil texture;
e. Irrigation level and frequency;
f. Clipping removal;
g. Fertilizer materials and application costs;
h. The intensity of turfgrass culture desired;

This discussion will be devoted to the interpretation of soil test results. The fertilization programs and carriers will be discussed later in this session. Soil test results from samples that are representative of a given soil are essential for predicting certain plant nutrient requirements. The results can be used as guidelines for developing a fertilization program. The soil samples should be taken from a 0-2 inch depth with the verdure and thatch discarded. A one-half pint sample should be sent to the soil testing laboratory. It should be taken with clean sampling equipment, air-dried, and well mixed.

It is preferable to send samples to the same soil testing laboratory each year. Laboratories may use different soil testing procedures, making it difficult to compare soil test results.

Soil pH:

Soil pH markedly influences microorganism activity and nutrient availability. A pH above 7.5 may induce iron deficiency on bentgrass and Poa annua turfs, especially greens. However, iron deficiency is seldom a problem in Kentucky bluegrass and red fescue in Michigan. The need for supplemental micronutrients in turfgrass fertilization programs will be discussed later in this session. Microorganism activity may be limited if a soil pH is too acid (pH = 5.5 or below).

Lime should generally be applied when the soil pH drops below 5.8. A maximum application of 50 pounds of limestone per 1000 sq. ft. should be used for most turfs. A pH around 5.1 may require as much as 100 pounds of limestone per 1000 sq. ft. Lime is normally applied to the surface of established turf. If rates as high as one to two tons per acre (about 50-100 pounds per 1000 sq. ft.) are applied to established turf, it may be beneficial to apply the lime after coring the area. This will allow for quicker penetration of some of the lime into the rooting area of the grasses.

Magnesium deficiencies are most common on extremely sandy soils in Michigan. If the soil is deficient in magnesium, but has an adequate soil pH,

magnesium sulphate ($MgSO_4$) or Epsom salts should be applied at a rate of 10 to 20 pounds per acre. Magnesium sulphate can be applied foliarly to correct deficiencies.

Nitrogen:

There is no soil test for predicting nitrogen nutritional needs for turf. Nitrogen recommendations are based on field observations. This information is printed out separately and is included as an appendage with soil test results. The annual nitrogen requirement for several turfgrass species growing in Michigan are included in Table-1. Ranges have been given to allow for factors such as:

a. Soil texture;
b. Irrigation level and frequency;
c. Clipping removal;
d. Various other cultural and environmental factors;

If clippings are returned, the annual nitrogen requirement can be reduced by 20-40 percent. This is reflected in Table-1 when comparing nitrogen recommendations for greens and fairways. An increase of 20-40 percent may be necessary for sandy soils that are heavily irrigated. A word of caution should be expressed in this area. On sandy-sites located around lakes or streams, it is best to use a turfgrass species such as red fescue that has a low nitrogen requirement. This reduces the amount of nitrogen needed as well as the possibility of pollution by leaching.

Phosphorus and Potassium:

Phosphorus and potassium applications should be based upon soil test recommendations. When soil test results are determined by the Michigan State University Soil Testing Laboratory procedures, Tables-2 and 3 will serve as guides for determining application rates. Phosphorus does not normally leach to any significant degree. Therefore, it tends to accumulate in the soil surface, and high soil phosphorus tests may be obtained in turf areas such as greens which have received complete fertilizers for many years. One caution worthy of note, is the fact that arsenates can increase soil phosphorus test results, especially if the soil phosphorus level is low.

Since potassium can be leached, especially on sandy soils with heavy irrigation, more frequent potassium applications may be necessary. Split applications of potassium in the spring and fall can be used.

Other Soil Tests:

Other soil tests such as those for sulfate, iron, copper, manganese and zinc, are difficult to interpret in turf. It is difficult to show reliable responses to many of these nutrients under turfgrass conditions in Michigan. Iron deficiency is occasionally a problem at pH levels above 7.5. The conditions of a very basic pH and high soil phosphorus levels may induce manganese, zinc, or copper deficiencies in some crops, but this has not been observed under turfgrass conditions in Michigan.

Soluble salts can also be determined. Tests for soluble salts may be beneficial in testing soils that have received applications of salt for melting snow, or for the determination of quality of a water source.

Summary Comments:

1. To determine which fertilizer to apply, the suggestions in Tables 1-3

should be used. A proper fertilizer can then be selected on basis of the ratio which most closely resembles the recommended nutrients.

2. Generally, no more than 1.5 to 2.0 pounds of any one nutrient should be applied with any particular application. This is especially true with water soluble forms of nitrogen which can cause severe burning to turf if improperly handled or applied.

3. If the soil test results indicate that the phosphorus and potassium levels are high, a straight nitrogen fertilizer can be used. Supplemental potassium can be applied to improve drouth and wear tolerance as needed.

4. Phosphorus and lime should be applied at establishment when needed, since they move slowly in the soil.

5. It is best to use the same soil testing laboratory for repeated tests. If possible, the results should be indicated as high, medium, or low levels of phosphorus and potassium. Thus qualitative comparisons can be made between tests.

6. Keep a good file on soil test records. Soil test records are a good way to follow changes over a period of years. They are especially important for following pH changes.

7. Personal judgment must be used in developing a fertilization program from the suggested guidelines offered from soil test results. The turfgrass manager must evaluate the turfgrass nutritional needs, especially nitrogen, and make compensations to maintain the desired quality of turf.

TABLE 1. Annual Nitrogen Requirements for Michigan Turfgrasses.

Species of Grass	Pounds Nitrogen Per 1000 sq Ft.
Merion Kentucky Bluegrass	5-7
Kentucky Bluegrasses (Delta, Park, Kenblue)	2-4
Other Kentucky Bluegrasses	3-6
Creeping Red Fescue, sunny areas	2-4
Creeping REd Fescue, shady areas	1-2*
Colonial Bentgrasses	3-6
Greens, Tees	4-8
Fairways	2-5

* with deep root feeding of trees

TABLE 3. Annual Phosphate Applications Based on Soil Test (Bray P_1 extractable).

Soil Test (Lbs. P/Acre)	Pounds Phosphate (P_2O_5) Recommended General Turf Per 1000 Sq Ft	General Turf Per Acre	High Maintenance Turf Per 1000 Sq Ft
Less than 15 (very low)	3	130	4
16-25 (low)	2	85	3
26-40 (medium)	1	45	2
41-70 (high)	0	0	1
More than 70 (very high)	0	0	0

* High maintenance turf would include golf greens.

TABLE 4. Annual Potash Application Based on Soil Test (neutral normal ammonium acetate extractable).

Soil Test (Lbs. K/Acre)	Pounds Potash (K_2O) Recommended General Turf Per 1000 Sq Ft	General Turf Per Acre	High Maintenance Turf* Per 1000 Sq Ft
Less than 50 (very low)	4	170	5
51-101 (low)	3	130	4
101-175 (medium)	2	85	3
175-250 (high)	1	45	2
More than 250 (very high)	0	0	1

* Including Golf greens and other high maintenance turf on sandy soils with high irrigation rates.