Spectrum Analytic
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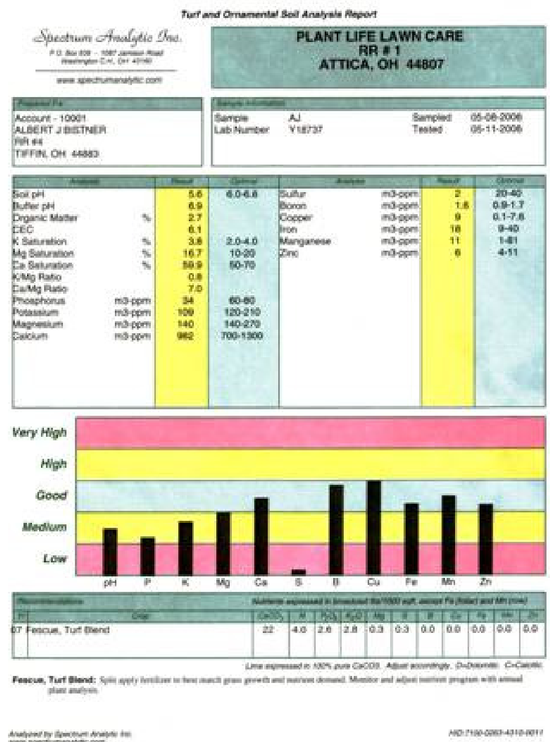
Interpreting Lawn and Garden Soil Test Results

garden, interpret, lawn, ornamental, result, soil, soil report, soil result, soil test, turf, yard

The soil test report for your lawn or garden soil sample will mean little to you unless you understand the terms and numbers used. This guide provides definitions of terms and the acceptable ranges for the figures listed. The Spectrum Analytic soil test report, see figure to the right, includes the analytical results, a graphic representation of those results which includes the status levels and nutrient recommendations, if requested. This information should help you in planning your soil management program.

To aide the homeowners and gardeners in calculating fertilizer needs, we have 2 other papers that cover these subjects: Area calculations will help you in calculating the amount of area to be covered by fertilizer. Fertilizer and lime applications will help to explain how to come up with the analysis or analyzes to suit your soil test recommendations.

The standard test results for your lawn or garden soil sample will mean little to you unless you understand the terms and numbers used. This fact sheet provides definitions of terms and the acceptable ranges for the figures listed. Recommendations for corrections are made on your test result form if values are not within the acceptable ranges. A typical results form appears to the right. Terms and numbers will be explained in sequence from top to bottom. This information should help you in planning your soil management program.


Turf and Ornamental Soil Analysis Report

PLANT LIFE LAWN CARE
RR # 1
ATTICA, OH 44807

Account - 10001
ALBERT J BISTNER
RR #4
TIFFIN, OH 44883

Sample AJ Sampled 05-08-2006
Lab Number Y18737 Tested 05-11-2006

Analysis		Result	Optimal	Analysis		Result	Optimal
Soil pH		5.6	6.0-6.8	Sulfur	m3-ppm	2	20-40
Buffer pH		6.9		Boron	m3-ppm	1.8	0.9-1.7
Organic Matter	%	2.7		Copper	m3-ppm	9	0.1-7.6
CEC		6.1		Iron	m3-ppm	18	9-40
K Saturation	%	3.8	2.0-4.0	Manganese	m3-ppm	11	1-81
Mg Saturation	%	16.7	10-20	Zinc	m3-ppm	6	4-11
Ca Saturation	%	59.9	50-70				
K/Mg Ratio		0.8					
Ca/Mg Ratio		7.0					
Phosphorus	m3-ppm	34	60-80				
Potassium	m3-ppm	109	120-210				
Magnesium	m3-ppm	140	140-270				
Calcium	m3-ppm	962	700-1300				

07 Fescue, Turf Blend 22 4.0 2.6 2.8 0.3 0.3 0.0 0.0 0.0 0.0 0.0

Soil pH

The term pH is used to express the acidity or alkalinity of the soil. It is measured on a 0-14 scale. Seven is neutral, while values below 7 are acid and values above 7 are alkaline. The pH is important because it affects the availability of nutrients in the soil that are essential for plant growth.

The availability of most nutrients is best at a pH of 6.2- 6.8. When the pH is higher, micronutrients such as iron (Fe), manganese (Mn), boron (B), copper (Cu) and zinc (Zn) become less available. This is because soil pH affects the solubility of plant nutrients in the soil, some of them becoming more soluble as pH increases, others as the pH decreases.

Most turfgrass, flowers, ornamental shrubs, fruits, and vegetables grow best in slightly acid soils of pH 6.1 to 6.9. Some plants require even more acidic soil for best growth. These include rhododendron, azalea, pieris, mountain laurel, some wildflowers, some conifers, and blueberries, which grow best at a pH between 4.9 and 5.5.

Soil pH can be raised by adding lime ($CaCO_3$) or lowered by adding elemental sulfur (S) or iron sulfate (Fe_2SO_3). Do not arbitrarily add these materials to your soil to change the pH unless soil test recommendations indicate such amendments are needed. Do not expect a long-term change in pH, since a soil will tend to return to its native pH over time. Therefore, plants for landscape plantings, as well as turf, should be selected based on the existing pH, rather than trying to manipulate the pH to suit the plants. Planting beds used for annual flowers and vegetables, on the other hand, lend themselves more readily to the regular addition of amendments, including lime or sulfur.

Buffer pH (BpH)

Soil pH measures active acidity or alkalinity, while the buffer pH measures the reserved soil acidity. Buffer pH is used to determine the actual lime requirement. The lower the buffer pH, the more the soil will resist a change in pH. Therefore, more lime will be required to raise the pH to the desirable level. There is no good or bad buffer pH, that is why no optimal range is listed.

P, K, Ca, Mg Levels

Phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) are important plant macronutrients that are required in relatively large amounts for optimum plant growth. The presence of these macronutrients is expressed in ppm (parts per million). Acceptable ranges for these elements are as follows:

Available P	60 to 80 ppm
Exchangeable K	120 to 510 ppm
Exchangeable Ca	700 to 1300 ppm
Exchangeable Mg	140 to 270 ppm

Available P and Exchangeable K, Ca, and Mg refer to the amount of each element that is expected to become available to the plants over a normal growing season.

Cation Exchange Capacity (C.E.C.)

C.E.C. is a measure of the capacity of a soil to hold exchangeable nutrients that have a positive electrical charge (cations), such as hydrogen (H^+), calcium (Ca^{++}), magnesium (Mg^{++}), and potassium (K^+). Soils with a high C.E.C. can supply large amounts of nutrients. However, they also require large amounts of fertilizer to be considered “fertile”. Low C.E.C. soils, such as sand, have low nutrient holding and supplying power. Therefore, more frequent applications of low rates of fertilizer are normally preferred.

Both clay and organic matter serve as potential sources of nutrients by attracting cations. Soils with large amounts of clay or organic matter have higher exchange capacities than sandy soils, which are usually low in organic matter. Much more exchange capacity, however, is provided by the presence of even moderate amounts of organic matter, which also benefits the soil in other ways, such as improving soil tilth.

The range for C.E.C. that can be expected with different soil textures are as follows:

Soil Textures	Common C.E.C. Ranges
Coarse (sands)	5-15
Medium (silts)	8-30
Fine (clays)	25-50 plus

Base Saturation

Base saturation is the percentage of total C.E.C. occupied by the basic cations calcium, magnesium, and potassium. The ease with which cations are absorbed by plant roots increases with the degree of base saturation. In slightly acidic to neutral soils, calcium and magnesium account for 80 percent or more of the exchangeable cations, while potassium accounts for only a small percentage. The percent base saturation of these cations usually will be within the following ranges:

Range in Percent Saturation	
Calcium (Ca^{++})	40%-80%
Magnesium (Mg^{++})	10%-40%
Potassium (K^+)	1%-9%

Fertilizer and Lime Applications for Homeowners

Plant nutrient requirements can be supplied by a wide range of fertilizer products that are available in all areas. As a laboratory serving many parts of the country, Spectrum Analytic is not able to recommend specific fertilizers for each situation. ***If you are not comfortable with determining the correct products and rates of application, you should contact a reputable garden center, or local University Extension personnel.*** Use the following information to determine the fertilizer products that best satisfy the nutrient requirements for each situation.

Calculating the Area to be Fertilized

The first step in applying fertilizer is to determine how much land is to be fertilized. Recommendations are made in terms of pounds per 1000 square feet (lb./1000 sq. ft.). This works well for lawns, but is a bit un-handy for small, or odd-shaped areas. Some formulas and conversion tables are included in this paper to help with the arithmetic and measurements.

Fertilizer Analysis

Fertilizer is labeled with 3 numbers (for example 18-6-12). These numbers are the percent of N, P_2O_5, and K_2O respectively. In the case of 18-6-12, it contains 18% N, 6% P_2O_5, and 12% K_2O. Fertilizer recommendations are also made in terms of N, P_2O_5, and K_2O. To apply the recommended amount of each nutrient, you must apply the correct amount of fertilizer to supply the needed nutrients contained in that fertilizer. Therefore, you must do some calculations, as shown in this paper.

Determining a Fertilizer Application Rate

If 1 lb. of N per 1000 sq. ft. is recommended, and you have a fertilizer with an analysis of 18-6-12, you must first convert the percentage of N in the fertilizer (18%) to a decimal (18% = .18). Next you divide the N recommendation by the decimal (1 / .18 = 5.5). The answer is the amount of this fertilizer needed to supply the recommended amount of N. However, if you apply 5.5 lb./1000 sq. ft. of 18-6-12, you will also be applying P_2O_5, and K_2O. To determine how much of these nutrients you will be applying, simply convert the percentage of both nutrients to a decimal (6% = .06, and 12% = .12), then multiply these decimals times the amount of fertilizer that you plan to apply (.06 × 5.5 = 0.33, and .12 × 5.5 = .66). The resulting amounts of P_2O_5, and K_2O may be more or less than is recommended. If they are only a little higher than recommended, it is probably OK to use this fertilizer. However, if they are much higher, you might want to look for a different analysis of fertilizer to use. If the resulting amounts P_2O_5, and K_2O that will be applied are lower than recommended, you will want to apply another fertilizer that has little or no N, but a significant amount of the needed nutrient(s).

Fertilizer Measurement			
	Approximate Volume Per Pound		
Fertilizer Material	Cups	Tablespoons	Tablespoons Per Ounce
Ground limestone	1.5	24	1.5
TSP (0-46-0)	2.25	36	2.25
DAP (18-46-0)	2.67	42	2.67
MAP (11-52-0)	2.6	42	2.6
Potash (0-0-60)	2.1	34	2.1
Sulfur (90%-S)	2.25	36	2.25
Most “complete fertilizers”			
(5-10-10, 12-12-12, etc.)[1]	2.25	36	2.25
Ammonium nitrate (33-0-0)	3.4	54	3.4
Urea (46-0-0)	3.4	54	3.4
Ammonium sulfate (21-0-0)	2.4	38	2.4

General Suggestions on Applying Lime and Fertilizer

Soil pH

1. There is a correct soil pH range for all plants. When the soil pH is either below or above this range, nutrient uptake is reduced and plant performance is hurt. Therefore apply only the recommended amounts of lime (to increase the soil pH) or sulfur (to lower the soil pH).
2. Split applications lime into no more than 90 lb./1000 sq. ft. (9 lb./100 sq. ft.) Spring & fall.
3. Split applications sulfur into no more than 10 lb./100 sq. ft. (1 lb./100 sq. ft.) Spring & fall

Nitrogen (N)

1. Don't apply much more than is recommended. Excess N makes plants more succulent and susceptible to disease.
2. Too little N reduces plant vigor and growth, plus reduces the uptake of most other nutrients.
3. Grasses (don't forget that corn is also a grass) tend to need more N than other plants. However, it is usually best to split the total N recommendation into multiple, smaller applications spaced throughout the growing season.
4. Don't apply N to perennial plants after about mid-September. Excess N in the fall can increase the plants susceptibility to winter damage.

Phosphorous (P, P_2O_5)

1. If your soil test is Poor or Medium, you can apply more phosphorus than is recommended. However, a higher rate of application will primarily increase the soil test and is not likely to improve plant growth in the year it is applied.
2. If your soil phosphorus is already high, it could be interfering with the uptake of some micronutrients like zinc (Zn), copper (Cu), or others, and more will only make the problem worse.

Potassium (K, K_2O), Calcium (Ca), and Magnesium (Mg)

1. These three elements tend to compete with each other for uptake by the plant. An excess of one can tend to suppress the uptake of the others.
2. If the soil test for any of them is Low or Medium, you can apply a little more than is recommended. However, a higher rate of application will primarily increase the soil test and is not likely to improve plant growth in the year it is applied.
3. If one or more of them is already high, it could be interfering with the uptake of the others, and more will only make the problem worse.

Micronutrients (B, Cu, Mn, Fe, Zn)

Plants need very small amounts of any of the micronutrients, and an excess of most of them can be very toxic to plants. For example, when a farmer's corn crop needs additional boron, a typical recommendation is 1 lb./acre (43,560 sq. ft.). Since the need is so small, and the risks from excess application are high, homeowners are advised to apply these nutrients as part of a pre-mixed fertilizer that contains the very small amounts needed.

Conversion Factors		
Dry Volume		
3 teaspoons (level)	equals	1 Tablespoon (level)
16 Tablespoons (level)	equals	1 cup
2 cups	equals	1 pint
2 pints	equals	1 quart
4 quarts	equals	1 gallon
Liquid		
80 Drops	equals	1 teaspoon
3 teaspoons	equals	1 Tablespoon
1 fluid oz.	equals	2 Tablespoons
8 fluid oz.	equals	1 cup
2 cups	equals	1 pint
2 pints	equals	1 quart
4 quarts	equals	1 gallon
1 gallon, water	equals	8.33 pounds

Weight		
28.35 grams	equals	1 ounce
16 ounces	equals	1 Pound
454 grams	equals	1 Pound
Area		
1 acre	equals	43,560 sq. ft.
1 sq. yd	equals	9 sq. ft.
1 sq. ft	equals	144 sq. in
Square or Rectangle	Multiply the length × height to get square feet	
Circle	3.14 × (radius^2)	
Triangle	(length × width) / 2	
Pentagon (5 equal sides)	length of one side squared × 1.7	
Hexagon (6 equal sides)	length of one side squared × 2.6	
Octagon (8 equal sides)	length of one side squared × 4.84	

[1] If the fertilizer has high N, and low P_2O_5 and K_2O, use values between “complete fertilizers” and urea