Understanding Your Soil Analysis

Had your soil tested and are looking at the report—wondering what it means? The report has three sections—recommendations, interpretations and test results. The lime and fertilizer to apply and other management information is listed in the **Recommendation** section of the report. These recommendations are followed by graphical interpretation of the results of the laboratory analysis in the **Test Interpretation** section. The actual results of the sample analysis are listed in the **Laboratory Analysis** section of the report. The tests that are reported include pH, organic matter, plant available phosphorus and plant available potassium. Notice there are no measures for nitrogen levels in your soil. Soil nitrogen exists in many forms and none are stable enough to provide a good measure of plant available levels. Instead, nitrogen recommendations are based on expected plant needs and an estimate of the release of nitrogen from organic matter decay. Do not try to build up nitrogen levels in your soil by applying above recommended amounts of nitrogen fertilizer — excess nitrogen may delay crop maturity and can leach beyond the crop root zone to contribute to groundwater problems.

Soil pH

Soil pH is a measure of soil acidity or alkalinity. Your soil is acidic if the pH is lower than seven. A neutral soil has a pH of about seven. If your soil has a pH above seven, it is basic, or alkaline. Optimum nutrient availability and microbial activity are maintained when soil pH is between 6 to 7. Some soils, especially those of central and northwestern Wisconsin and many coarse-textured soils may test below the optimum. However soils in the southern and eastern region generally have high pH and may contain calcium carbonate. Add lime only if recommended by your soil test report — the amount to add will depend on the pH of your soil and the amount of soil organic matter present.

Maximum effectiveness of lime applications depends on thorough mixing and repeated tillage. Topdressing or spreading lime on the surface without incorporating is not very effective. Use finely ground 80-89 dolomitic limestone for best results. One pound of limestone is equivalent to 1 cup. Alternate liming materials such as barn lime or wood ashes can be substituted. Use about 1 1/3 cup of barn lime or 4 cups of wood ash for every pound of limestone recommended. It may take 2 to 3 years for lime to completely react.

Most crops including vegetables and turf are quite tolerant of alkaline soil conditions. However, some specialty crops such as blueberries and azaleas and sensitive ornamentals such as pin oak and roses require acid soil. Most soils will require the application of a sulfur amendment to decrease pH to the required level. Either aluminum sulfate or elemental sulfur can be added to reduce pH. Elemental sulfur should be applied and incorporated to a depth of 6-8 inches well in advance of planting. The pH change will take 2-3 months. Aluminum or iron sulfate “works” much faster, however about six times more is needed to get the same pH change. One pound of either elemental sulfur or iron/aluminum sulfate is equivalent to 2 cups. If your soil has pH greater than 7.5 you will probably not be able to easily achieve or maintain acid soil conditions with reasonable applications of a sulfur amendment.

Organic Matter

Soil organic matter consists of plant and animal residues, in various stages of decay, living microbial cells and residues of dead ones and decomposition products of plant and animal residues. Most medium and fine textured soils in Wisconsin have between 2 and 4% organic matter. Sandy soils usually have less than 2%. Adding organic materials such as manure, compost, peat moss or chopped leaves will improve the physical characteristics of soil, such as water holding capacity, drainage, and tilth, but have little influence on the actual amount of organic matter measured by the test. The amount measured is inherent to each different soil and very difficult to change. For every 100 lbs of organic residues added, only 10 lbs will remain at the end of the first growing season as stable organic matter — the other 90 lbs is used as food by microbes and released as carbon dioxide and water.

Available Phosphorus and Potassium
The interpretation section of the soil test report indicates graphically if there is an adequate or optimum amount of each nutrient, a potential for deficiency or an excess. If quantities are low or optimum, the recommendations section will indicate how much extra phosphate and/or potash fertilizer is needed. If there is excess, no additional phosphate or potash fertilizer will be recommended.

Phosphorus stimulates root growth and flowering in plants and is needed for energy transfer reactions in plant cells. Shallow rooted plants, such as carrots, onions, and radishes need more phosphorus than deep rooted plants such as corn, beans or peas. The optimum amount for your soil will in part depend on the crops that you grow.

Potassium activates plant enzyme systems and is involved in water movement. It helps promote disease resistance and winter hardiness in perennials. Optimum potassium levels also depend in part on the crop to be grown. Root crops such as potatoes require higher levels than tree fruits for example.

Phosphorus and potassium additions can accumulate in soils. Most home garden and turf soils typically have high to excessive levels of available phosphorus. Excessive phosphorus will not be detrimental to plant growth. However, adding more phosphate either from fertilizer blends or organic sources will not benefit crops and may contribute to environmental degradation. If your soil is high in either phosphorus or potassium, minimize use of 'balanced blend' fertilizers and most organic fertilizers. 'Balanced blend' fertilizers are those with equal amounts of nitrogen, phosphate and potash such as 10-10-10. Most organic fertilizers are 'complete', having nitrogen, phosphate and potash and should also be used sparingly if soil test phosphorus and/or potassium are excessive.

Fertilizer Recommendations
Fertilizer is any material that supplies one or more plant essential elements and traditionally falls into two categories — inorganic or organic. Inorganic fertilizers are chemically much simpler than organic fertilizers and are generally obtained from non-living sources. Organic fertilizers are complex chemical substances containing carbon. Most are naturally occurring or are by-products or manufactured wastes. Inorganic fertilizers such as urea, triple superphosphate, muriate of potash or blends of these are very soluble and dissolve rapidly. Nutrients in organic fertilizers become available slowly because organic compounds must be broken down by soil microorganisms to release nutrients in the inorganic form used by plants. Plants cannot distinguish nor do they discriminate between nutrients provided from inorganic or organic sources.

The grade or analysis of a fertilizer is expressed as a series of numbers and is always printed on the label. For example, 27-3-3 is a common 'regular' or high nitrogen turf blend. The analysis is in units of percent and in the order nitrogen (N), phosphorus expressed as phosphate (P_2O_5) and potassium expressed as potash (K_2O). One hundred pounds of a 27-3-3 fertilizer blend contains 27 lbs of N, 3 lbs available P_2O_5 and 3 lbs available K_2O. The other 67 pounds consists of carrier and anticaking agents to minimize water adsorption and evenly-size particles for uniform spreading. About 2 cups of fertilizer is equivalent to 1 pound.

Annual nitrogen applications either from a high nitrogen turf fertilizer or urea will almost always be suggested on the report. Depending on the phosphorus and potassium soil test levels, starter (high phosphate) and/or winterizer (high potash) turf fertilizer blends are "mixed and matched" with the nitrogen application. This allows for gradual buildup of soil test P and/or K to optimum levels or gradual draw down of soil P and/or K if soil test levels are above optimum.