UConn Soil Nutrient Analysis Laboratory
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Interpretation of Soil Test Results

Soil tests provide homeowners and growers with guidelines for both effective and environmentally-sound use of fertilizers, limestone and other soil amendments. Recommendations are based on University research and field studies. Our recommendations, however, are only as good as the sample you collect. Samples should be representative of the area being tested and should consist of a mixture of at least 6 subsamples obtained throughout the site. Poor sampling techniques may result in misleading recommendations. Soil test results will detect nutrient deficiencies, excesses or imbalances. They cannot, however, identify problems due to disease, insect pests, pesticides or poor cultural practices.

SOIL pH AND LIMESTONE RECOMMENDATIONS

Soil pH is a measurement of a soil's acidity. The pH scale ranges from 1 to 14, with a pH of 7 being neutral. Values below 7 are considered acidic while those above indicate alkaline conditions. The pH of a soil not only affects the availability of necessary plant nutrients but also the solubility of potentially toxic elements such as aluminum and lead.

Most garden plants prefer a pH between 6.0 and 6.8. Notable exceptions include acid-loving blueberries and ericaceous plants like rhododendrons, azaleas and mountain laurel. These plants prefer a pH of 4.5 to 5.3. Varieties of potatoes without scab resistance are also grown at a lower pH (5.2 to 5.4) to inhibit the growth of this disease organism. The majority of Connecticut soils tend to be acidic with pH values ranging from 4.8 and 5.5 due to the geology and climate of the region.

Ground limestone is usually recommended to correct acid soil conditions. Recommendations for limestone are based on the plants being grown, the soil's pH and its buffering capacity. In general, the lower the pH and the more clay and organic matter the soil contains, the greater the amount of limestone required to raise the soil pH to a desired level.

Limestone recommendations are made in tons/acre or pounds/100 or /1000 square feet depending on the crop. Unless the limestone is to be tilled in, apply no more than 50 - 75 lbs/1000 square feet (5 -7.5 lbs/100 sq. ft.) to the soil surface at one time. Reapply at one- to six-month intervals until the total recommended amount is administered. It will take several months to more than a year for the soil pH to increase. Occasionally, it is necessary to lower the pH of a soil. Sulfur is used to lower pH and, if needed, a recommendation will be included with your results.

EXTRACTABLE NUTRIENTS – PHOSPHOROUS, POTASSIUM, CALCIUM AND MAGNESIUM

The nutrient ions, phosphorus, potassium, calcium and magnesium are extracted from the soil using a modified-Morgan solution. Results provide an estimation of the nutrients available to plants during the growing season and are expressed as pounds per acre. Values on the report are classified as below optimum, optimum and above optimum and reflect the levels found in your soil. The objective when developing a fertility program is to achieve and maintain levels in the **optimum** range.

PHOSPHORUS

Phosphorus (P) is essential for root development and the production of flowers and fruit. Native Connecticut soils are generally low in phosphorus and much of what is present is bound in both organic and inorganic forms not readily available to plants. However, over-application has led to a 2013 law regulating the use of phosphorus on established lawns. Phosphorus is a serious pollutant of inland waterways leading to algal blooms and accompanying environmental and human health risks. Read more at soiltesting.cahnr.uconn.edu. Phosphorus is most available at a soil pH of around 6.5 and during moist, warm conditions. Soil tests provide an estimate of the amount of readily available phosphorus and recommendations are made accordingly.

POTASSIUM

Plants require large amounts of potassium (K). It is critical for numerous plant functions and especially aids in hardiness and disease resistance. Potassium is released from rocks and soil minerals as they weather. Often the supply of potassium from the soil is limited and inputs of this nutrient are required.

CALCIUM

A vital component of the cell manufacturing process, calcium (Ca) also improves the root uptake of other nutrients. Plant growing points are particularly sensitive to an insufficient calcium supply as evidenced by blossom end rot – those black sunken spots often discovered on the bottom of tomatoes and summer squash. Lack of moisture also contributes to this disorder. Soils that are properly limed generally contain adequate calcium because this nutrient is a major constituent of limestone.

MAGNESIUM

A key element in the development of chlorophyll, magnesium (Mg) also is crucial to seed formation. Like calcium, magnesium usually is supplied by liming materials. Dolomitic limestone contains about 20% magnesium. Epsom salts (magnesium sulfate) may be recommended where calcium and soil pH levels are adequate but soil magnesium is low.

NITROGEN

Part of all living cells, nitrogen (N) promotes green leafy growth. Lack of nitrogen commonly limits plant growth. Plants take up nitrogen in the form of nitrate (NO_3) or ammonium (NH_4) with the nitrate form preferred by many garden plants. Because nitrogen levels fluctuate widely depending on environmental conditions and can change during shipping, this element is not routinely measured. Nitrogen recommendations are based on crop needs as estimated by field studies combined with the presumption that little available nitrogen remains in the soil at the end of the growing season. Even if levels of all other nutrients are sufficient, you may need to add nitrogen to your lawn or garden each year and fertilizer recommendations are made accordingly.

PLEASE NOTE!

If your results state that both the phosphorus and potassium levels are above optimum, only a nitrogen recommendation will be provided. For each pound of nitrogen recommended you may use your choice of 8.3 lbs of bloodmeal (12-0-0), 11 lbs. of corn gluten (9-0-0) or 2.2 lbs of urea (46-0-0) per 1000 square feet.

MICRONUTRIENTS, SULFUR AND ALUMINUM

Soil test reports indicate the amount of several extractable **micronutrients** in parts per million (ppm). Micronutrients are elements that are required by plants in extremely small amounts. Their availability often correlates well with soil pH and organic matter levels. If these two factors are in a desirable range for the crop being grown, micronutrient deficiencies or excesses seldom occur. The levels of the micronutrients, boron (B), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) are compared with typical soil background levels for diagnostic purposes. Recommendations for micronutrient additions to soil are not made because adjusting the soil pH and/or soil organic matter levels usually rectifies any micronutrient problems that may exist.

Plants need **sulfur** to synthesize amino acids which are essential components of proteins. Sulfur is also essential for the synthesis of chlorophyll as well as the ability of legume root bacteria to assimilate atmospheric nitrogen. For a long time, Northeast gardeners and growers have not had to add any sulfur to their soils because sulfur had been inadvertently added either as an ingredient in fertilizers or as a component of acid rain. Some growers are concerned about sulfur nutrition because improved crop varieties have greater sulfur demand, and the amount of sulfur entering soils in the Northeast has not kept pace with crop requirements. Soils are not receiving as much sulfur because fertilizer production has become more efficient with impurities, like sulfur, reduced, and environmental regulations have limited the amount of sulfur released by industries. Presently, no recommendations for sulfur applications are made except for lowering soil pH because an optimal level of sulfur based on our extraction technique has not been identified.

Aluminum is a common constituent of New England soils. It is not an essential plant nutrient and may cause injury to sensitive plant species like lettuce and beets. High levels of aluminum in the soil can also interfere with plant uptake of phosphorus. As the soil pH decreases, the solubility of aluminum increases. Soil test results often indicate elevated aluminum levels in soils with pH levels below 5.0. Liming soils to an acceptable level for the crop being grown will reduce the amount of aluminum available to plants. Acid loving plants like rhododendrons, blueberries, and azaleas have high tolerance to soil aluminum levels. Aluminum is also responsible for the blue color of hydrangeas because of its effect on pigment formation, which is why the blue flowering hydrangeas are grown at low soil pH levels.

Lead is a natural occurring element in soils and typically is present in soils in the range of 5 to 100 ppm total lead. Only when total lead levels exceed 400 ppm does the U.S. Environmental Protection Agency (EPA) list it as an element of concern. Soil test results indicate our estimation of total lead. A correlation has been developed between our routine soil testing methodology and more rigorous EPA testing. If the lead levels are elevated, you will receive appropriate information about potential problems with elevated lead levels and gardening practices to minimize exposure to lead.

ESTIMATED CATION EXCHANGE CAPACITY

A soil's cation exchange capacity is a measurement of its ability to hold and supply nutrients, most notably positively charged nutrients such as calcium, potassium, magnesium, ammonium and many micronutrients. It is expressed in units of of millequivalents of plus charge per 100 grams of soil (meq/100 g). Typically values range from 5 to 20 meq/100 g with 10 being adequate for most crops. (Note: 1 meq/100 g soil is equivalent to 1 cmol(+)/kg).

BASE SATURATION

The percentage of a soil's cation exchange capacity occupied by calcium, magnesium and potassium is referred to as base saturation. The ratio of these 3 elements in soils are of interest to some people so this information is provided.

ADDITIONAL TESTS (EXTRA FEE/NO RECOMMENDATIONS)

Soluble salt levels may be elevated in areas close to roads where salt compounds are used for deicing or where excessive fertilizer has been applied. High soluble salt levels can cause severe water stress and nutrient imbalances in plants. As measured by this lab, values for mineral soils less than 0.4 mmho/cm are low, values between 0.4 and 0.8 are slightly saline and may cause some injury to salt sensitive plants. Values between 0.81 and 1.2 are moderately saline and will restrict the growth of many plants, while those above 1.2 are considered high and likely to cause damage. Soluble salt levels can be reduced by repeated, thorough irrigation.

Organic matter benefits the soil by improving water and nutrient holding capabilities, encouraging better soil structure that enhances root growth and increases aeration, providing a more hospitable environment for soil organisms and serving as a reservoir for plant nutrients. Sources of organic matter include leaf mold, peatmoss, compost and manure. The ideal amount of organic matter varies by crop and by soil type. For instance, sandy soils may benefit from greater additions of organic matter than finer textured loams. Large additions of compost or manure can result in excessive application of phosphorus. It is easy to apply excessive amounts of phosphorus – regular applications of greater than ¼ inch of manure-based or other composts or manure may supply an excess of phosphorus. Monitor soil phosphorus levels with regular testing. While the UConn lab cannot test manures or composts for nutrients, the UMaine and Penn State University labs can. Soil organic matter is determined by loss on ignition

A soil textural analysis determines the relative proportions of sand, silt and clay in a sample. The textural class is based on the USDA's textural triangle classification. Sandy soils may have good aeration and drainage but limited ability to retain water and nutrients. The opposite is true for fine-textured silt and clay soils.