Colorado State University Extension

Colorado Master Gardener[sm] Program

CMG GardenNotes #221

Soil Tests

Outline:

Value of a Soil Test

In agronomic crops, greenhouse crops and turf, an extensive research base for interpretation of soil test results makes soil testing a key tool in crop management for commercial producers.

In the home garden setting, soil testing is valuable to establish a base line on soil limitations related to pH, salt levels, and the need for phosphate and potash fertilizers. A special lead test would be of concern to homeowners with lead-based paints on older homes.

In some gardening situations, soil testing has limited value. For example, soil testing for nitrogen has limited use for the home gardener because the nitrogen level constantly changes in response to soil organic matter additions, soil microorganism activity, and temperature, moisture levels, leaching and nitrogen consumption by plants and other soil life.

The research base for interpreting results is also lacking for landscape plants. For example, a test for a maple tree, native plants, or a gardener's favorite peony would be difficult to interpret based on standards used for general agronomic crops.

Finally, a standard soil test will not identify common garden problems related to over-watering, under-watering, poor soil drainage, soil compaction, diseases, insects, weed competition, environmental disorders, too much shade, poor varieties, or simple neglect.

Typical Test

A standard soil test typically includes the following:

- Texture (estimated by the hand-feel method)
- Organic matter (reported as a percent of the total soil)

    - About two-thirds of a pound of nitrogen per 1,000 square feet will be released (mineralized to nitrate) during the growing season for each one percent organic matter present.
- pH
- Lime ($CaCO_3$ reported by percent)
    - On soils with "free lime", sulfur will not effectively lower the pH
- Soluble salts (reported in mmhos/cm or dS/m)
- Nutrients (reported in parts per million)
    - Nitrate nitrogen
    - Phosphorus
    - Potassium
    - Micronutrients such as copper, iron, manganese and zinc

Additional tests could be run for special needs like lead content or sodium problems. For additional details on soil testing, refer to CSU Extension fact sheet #0.502, *Soil Test Explanation*.

Frequency

For a gardener a soil test gives a useful base line on soil salts, phosphorus, potassium, pH and *free lime* content (or buffer index if acid).

In the neutral and alkaline soils of Colorado, repeat the test when dramatic changes are made to the soil (such as addition of larger quantities of manure, biosolids, or compost that may be high in salts) or approximately every 4-8 years to reestablish the base line.

In other parts of the country where lime is routinely added to raise the pH on acid soils, a soil test may be needed annually.

Taking a Soil Sample

A soil sample may be taken at any time of year, although spring or fall sampling is usually the most convenient.

The results of a test are no better than the quality of the sample sent to the laboratory. The sample must be representative of the yard or garden being considered. Gardeners who try to shortcut the sampling procedure will not receive a reliable result.

Submit a sample for each area that receives different fertilizer and soil management treatments. For example, if the front and back lawn are fertilized the same, the sample should include subsamples taken from each and mixed together. Because garden areas are managed differently from lawns, the garden should be sampled separate from the lawn. Sample various garden beds that receive differing amounts of fertilizers and soil amendments separately.

Samples are most easily collected using a soil tube or soil auger. A garden trowel, spade, bulb planter, or large knife also works. Discard any sod, surface vegetation or litter. Sampling depth is critical and varies for the type of test taken and for various labs. Follow sampling depth directions given by the laboratory. [Table 1]

Table 1. Example of Sampling Depth for Soil Tests

Crop	Sampling Depth
Garden (vegetable and flower)	0 through 6 inches
Lawns, new (prior to planting)	0 through 6 inches
Lawns, established	0 through 3 inches
Lead test	0 through ¾ inch

Each sample should be a composite of sub-samples collected from randomly selected spots within the chosen area. Take five or more subsamples from a relatively small area in the home lawn, flower border or vegetable garden. Take 10-15 subsamples for larger areas.

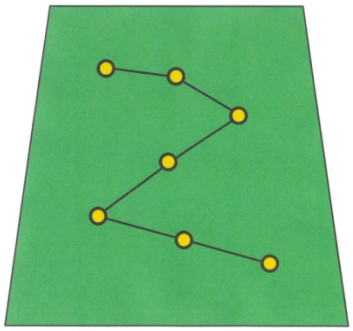

Figure 1. A proper soil sample is a composite of five to fifteen sub samples.

Collect the subsamples in a clean plastic pail, thoroughly mixing the subsamples together. Remove plant debris and break up clods. If possible, air-dry the soil by spreading it out on paper towel. (Do not oven-dry the sample.)

Place about two cups of the soil mix into the sample bag or box. Label the sample container (e.g., front lawn, vegetable garden, or flowerbed) and keep a record of the area represented by each sample taken. Send the samples to the soil-testing laboratory.

Climate and soil vary considerably in different parts of the country so it's important to select a local laboratory that processes for the alkaline calcareous soils of the mountain west. Future testing should be done with the same laboratory to make comparisons.

Soil tests are available from many local providers. For a list of laboratories, refer to CSU Extension fact sheet #0.520, *Selecting an Analytical Lab* available online at www.cmg.colostate.edu.

Soil Test Recommendations

In production agriculture, it is not uncommon for a grower or fertilizer dealer to split a sample and send it to different laboratories. Because individual laboratories do not necessarily use the same soil test procedures, their ***availability indexes*** (the reported available nutrients) can, and frequently do, differ.

Laboratories can also differ in the objectives behind their recommendations. For example, are maximum yields the primary objective? In this scenario, fertilizer application will be highest, with increased costs, and higher potential for leaching

of fertilizers into ground water. In another scenario, the crop's net return may be the primary objective, reducing production (fertilizer) costs, or minimizing potential for ground water pollution.

Fertilizer practices may also impact recommendations. For example, is the phosphate fertilizer recommendation based on an annual application or a single application to last several years? For new turf, it is a standard practice to bring the phosphorus to a higher level when the fertilizer can be cultivated through the soil profile before the sod is laid.

The recommendations resulting from a soil test need to be made by the laboratory doing the work, based on cropping information provided by the grower/gardener. For additional details on soil testing, refer to CSU Extension fact sheet #0.502, *Soil Test Explanation* available online at www.cmg.colostate.edu

Home Soil Test Kits

Home soil test kits have questionable value. The actual process used in some procedures is based on soil pH. Most home test kits were designed for acid soils, and have questionable accuracy on the alkaline soils of the west.

The accuracy in home soil test procedures may, at best, give a ballpark reading but not precise accuracy. For example, the calibration on a home soil pH kit will tell the gardener that the soil has a pH level between 7 and 8. How close to 7 or 8 makes a huge difference for the growth of some plants. More precise measurement requires more expensive equipment. For details, refer to *CMG GardenNotes* #222, **Soil pH**.

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Revised October 2015

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