Colorado Master Gardener[sm] Program
Colorado Gardener Certificate Training
Colorado State University Extension

GardenNotes #221

Soil Tests

Value of a Soil Test

On 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 since the nitrogen level constantly changes in response to soil organic matter additions, soil microorganism activity, temperature and moisture levels.

The research base for interpreting results is also lacking on landscape plants. For example, a test for a maple tree, native plants, or the gardener's favorite peony would simply be based on norms used for general agronomic crops. A research base to interpret needs for micronutrients is limited to specific agronomic and greenhouse crops.

A standard soil test will not identify the most 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 just neglect.

Typical Tests

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 2/3 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 on a new site, a soil test gives a useful base line on soil salts, phosphorus, potassium, and pH with *free lime* (or buffer index if acid).

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

In the neutral and alkaline soils of Colorado, repeat the test when dramatic changes were 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.

Taking a Soil Sample

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

The results of a test are no better than the sample sent to the lab. 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 reading.

Submit a sample for each yard area that receives different fertilizer and soil management treatments. For example, if the front and back lawn would be fertilized the same, the sample should include sub-samples taken from each and mixed together. Since garden areas are managed differently

from lawns, the garden would 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 lab. [Table 1]

Table 1. Example of sampling depth for soil test

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 5 or more sub-samples from a relatively small area in the home lawn, flower border or vegetable garden. Take 10-15 sub-samples for larger areas. Collect the sub-samples in a clean plastic pail; mix the soil thoroughly removing plant debris.

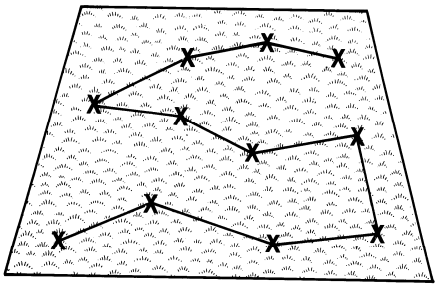

Figure 1. A proper soil sample is a composite of five to fifteen sub samples.

Place about one pint of the soil mix into the sample bag or box. Label the sample container (for example front lawn, vegetable garden, and flowerbed) and keep a record of the area represented by each sample taken. Send the samples to the soil-testing lab.

Many types of chemical solutions may be used to extract nutrients from soil in the laboratory. Processes used vary from laboratory to laboratory. Since climate and soil vary considerably in different parts of the country, select a local laboratory that processes for the alkaline calcareous soils of the mountain west. Future testing should be done with the same lab in order to make comparisons.

Soil tests are available from many local providers. For a list of labs, refer to CSU Extension fact sheet #0.520, *Selecting an Analytical Lab.*

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 labs. Because individual laboratories do not necessarily use the same soil test procedures, their ***availability indexes*** (the reported available nutrients) can, and frequently do, differ.

Labs 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 a soil test 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.

Basically, 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*.

Home Soil Test Kits

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

Also 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 required more expensive equipment. For details, refer to CMG GardenNotes #222, *Soil pH*.

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