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Testing Your Soil
Why and How to Take a Soil-Test Sample

Why have a soil tested?
Does my soil have problems?
Does my crop need fertilizer?
What kind of fertilizer should I use?
How much should I apply?

A soil analysis can help farmers and gardeners answer these questions. A ***basic soil analysis*** provides information on two important soil characteristics:

- **Soil pH** is a measurement on a scale from acid (low pH) to alkaline (high pH). Most soils are on the acid side of the pH spectrum. Good soils for crop production are often moderately acid, but some soils in Hawaii are acidic to the extent that crops grow poorly. Soil tests indicate pH problems and allow recommendations for correcting them.
- **Available nutrient** levels in the soil determine how good crop growth will be. Testing for phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) helps determine the need for soil amendments (phosphate, and lime or dolomite) and the right fertilizer formulations for the crop to be grown.

In addition to the basic information on pH and levels of major nutrients, ***specialized soil analyses*** can help to investigate other factors that may limit crop growth:

- **Soil salinity** can build up in coastal areas and in soils irrigated with brackish water or to which too much fertilizer has been applied.
- **Nitrogen** (N) is required in large quantities by most crops, and adding N is a basic part of most fertilizer programs. In special circumstances, N can be analyzed as total N, ammoniacal N (NH_4-N), or nitrate N (NO_3-N), but this is not usually done because N does not remain in the root zone for very long.
- **Organic carbon** (C) analysis, like N analysis, is useful only in special circumstances. Most soils benefit from additions of organic matter.
- **Aluminum** (Al) in soils can be toxic to plants if pH is low and the Al is too available to them. Knowing the soil's pH and classification is the first step in predicting Al problems, and tests for "extractable" Al can then be done if necessary.
- **Micronutrient** levels in the soil may be analyzed when crop symptoms suggest problems. Micronutrients often measured include boron (B), copper (Cu), manganese (Mn), and zinc (Zn).

These specialized soil tests usually are not called for unless crop growth problems have been observed or there are other reasons to suspect that they are needed.

Taking a good soil sample

Soil tests are done on a sample that is only a tiny fraction of a field or garden plot. Soil treatment recommendations assume that data from the analysis of that tiny fraction represent the entire area to be treated. Therefore, care must be taken to ensure that the soil sample truly represents the field or plot.

If differences can be seen in the soil from various parts of the overall area to be sampled, each distinct subarea should be sampled separately. Differences in soil color or texture are obvious reasons for taking separate samples. Other reasons include differences in land slope, soil drainage, crop management history (different soil amendments or fertilizers), variations currently observed in crop growth, or variations in the natural vegetation.

Each soil sample analyzed should be a combination of 5 to 10 subsamples taken from the soil area of interest. The subsamples should each be about the same

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amount of soil, and they should be mixed together thoroughly as they are collected. The final sample taken from this mixture is called a composite sample.

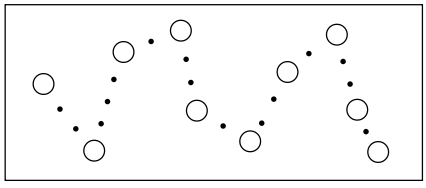
How large an area to sample? For home gardens, one sample that is representative of the garden plot is usually sufficient. For orchards or farms, even if no distinctly different soil types are noticeable, large areas should be subdivided into sample areas of 2–5 acres and sampled separately.

What equipment do I need?

- **map** the area sampled if you are taking more than one sample. Mark each sampled area on the map with a label that you will also write on the sample bag.
- **spade** or shovel (for specialized soil tests, tools should preferably be made of steel, because tools made of brass, bronze, or galvanized metal may contaminate samples with copper or zinc)
- **plastic bucket** or large plastic bag for collecting and mixing subsamples
- **plastic bag** to contain about 2 cups (1 pint) of the final, composite soil sample (thin plastic bags that can "breathe," such as sandwich bags, are better than thick plastic bags for storing soil; brown paper bags can contaminate samples to be tested for boron)
- **waterproof marker** to label the plastic bag to identify the sample

Collecting the soil sample

For each distinct soil area you are sampling, take 5 to 10 subsamples and mix them together to obtain the final sample. Take the subsamples by selecting spots in a pattern that ensures a balanced representation of the whole area sampled. Don't sample spots that look atypical of the area being sampled.



Collect soil samples in a zig-zag pattern

Use clean tools to sample soil, a clean container to mix it, and clean bags to store it. Small amounts of contaminants, especially fertilizer or lime, can distort the analysis results.

How deep to sample?

- the top 4 inches for lawns, turf, established pasture, and "no-till" fields
- the top 8 inches for conventionally tilled fields and garden plots
- the top 8 inches plus a separate sample for the 8–24 inch zone for tree crops

The sampling method:

1. Clear surface litter and plant growth from the sample spot. Dig a hole about as wide as your spade and as deep as the layer you are sampling.
2. With the spade tip placed one inch outside the edge of the hole, cut down to remove a slice of one side of the hole wall.
3. Keeping that slice on the blade of the spade, use a trowel, knife, or stick to cut away the sides of the slice, leaving a center section about 1 inch wide. This 1 x 1 inch vertical section of the soil is your subsample.
4. Place the subsamples in the plastic container, mix them together well, and remove about 2 cups (1 pint) of this mixture. This is your composite sample, to send to the laboratory for analysis.

Getting the sample analyzed

The Agricultural Diagnostic Service Center (ADSC) of the College of Tropical Agriculture and Human Resources (CTAHR) at the University of Hawaii at Manoa provides residents of Hawaii with a reasonably priced soil and plant-tissue testing service. Samples for analysis by ADSC can be taken to county offices of the CTAHR Cooperative Extension Service (CES), or they can be mailed directly to ADSC at 1910 East-West Road—Room 134, Honolulu, HI 96822.

Soil samples sent to ADSC should be accompanied by the ADSC soil information form (p. 4). Complete information helps ADSC provide more accurate recom-

mendations. Helpful information about your soil sample includes:

- an estimation of the soil texture, either "heavy" (which applies to many of Hawaii's soils), "light" (soils derived from volcanic ash on the Big Island), or a'a (irregular pieces of lava)
- a description of the plot or field (slope, presence of rocks, drainage problems)
- the kind of plants presently growing at the site (natural vegetation or crops)
- whatever is known about past use of the site or management of the soil
- the crop or crops to be grown

An analysis fee schedule and extra copies of the soil sample information form can be obtained from the ADSC or at CES county offices.

Plan to submit soil samples well in advance of when you wish to prepare your soil to plant. It may take several weeks before the laboratory results become available. If liming is recommended for your soil, the effects of the amendment will not be realized for a month or more after incorporating the lime.

Soil analysis results from the ADSC will be sent to you in the mail. The test values will be given, as well as an interpretation of them. For example, available nutrient levels will be rated as very low, low, sufficient, high, very high, or extremely high. Based on these interpretations and on the nutritional requirements of the crop you wish to grow, the form will also provide specific recommendations for soil amendments and fertilizer formulations, as well as the amounts of these to apply.

The analysis results form also asks for feedback on how your crop grew after you followed ADSC fertilizer recommendations. This information helps ADSC to fine-tune future recommendations.

The bottom line

Applying too much or the wrong kinds of fertilizer can harm your crop and be a costly waste of money. Perhaps more important, it can affect our coastal waters and drinking water by washing into streams or leaching into the groundwater.

Failing to correct soil problems or apply enough of the right types of fertilizer to your crops can result in poor yields and wasted effort.

The CTAHR Agricultural Diagnostic Service Center is dedicated to helping you make the right decisions about amending and fertilizing your soil. We hope that our recommendations will enable you to make your soil more productive while protecting Hawaii's environment.

Prepared by N. V. Hue[1], R. Uchida[2], and M. C. Ho[2]
[1]Department of Agronomy and Soil Science and [2]Agricultural Diagnostic Service Center