

Soil Health for Big and Little Farms; Part 1: Getting to Know Your Soil

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What is soil health and why should you care?

It's not just dirt! Soil is a living natural resource that provides nutrients, water, and support to your plants. The healthier your soil, the healthier your plants, and the healthier the animals that eat your plants, whether they are four-legged or two-legged!

Understanding your soil's physical, chemical, and biological makeup is not just a scientific endeavor, it's a pathway to a healthier, more productive farm or garden. It's a journey that can lead to stronger crops, healthier animals, and even more money in your pocket.

One teaspoon of healthy soil can contain one billion bacteria, several yards of fungal filaments, several thousand protozoa, and scores of nematodes. **Healthy soil** refers to soil's ability to support an ecosystem that creates healthy plants, animals and humans – the right mix of microbes and small animals (microbiota), the way water and air are retained, and the stability of the soil structure are all key elements of healthy soil.

How can you tell if your soil is healthy? In some ways, it involves a bit of detective work, including figuring out your soil's physical properties, the minerals present, and how they will nourish your crops as well as the presence of organic matter like leaves, mulch, fungi, and the soil microbiota who turn those things into soil. This guide will help you with the steps you can take as a soil detective.

What is your soil made of?

You can start to get to know your soil simply by observing it. The soil texture and structure are two of the first things to look at.

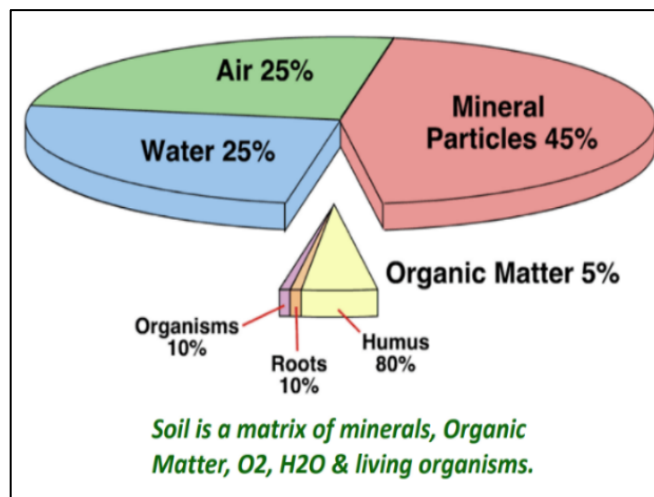


Figure 1: Soil Composition (General Ratios)

A lot of people don't realize that air and water make up half of most healthy soil. Mineral particles that make up the biggest portion of your soil are the home for all the good microbial life that make nutrients available to

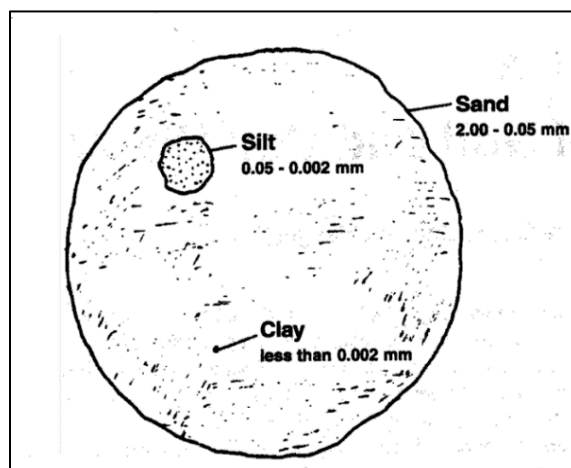


Figure 2: Different size soil particles

your plants. The mineral part of your soil is made up of some combination of sand (bigger particles), silt (much smaller), and clay (the tiniest particles).

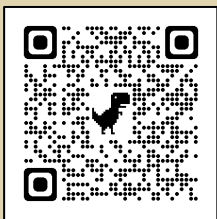
Soil structure refers to the way in which soil particles (sand, silt & clay) are grouped together to form what are called aggregates. Different types of soil structures are granular, platy, blocky, prismatic, and columnar. Soil structure can be improved by effective soil management.

Soil element composition percentage can vary depending on soil management. In well-structured soil, half the pores are filled with water and air, and the remaining half contains mineral and organic matter. The way these different soil elements are combined determines soil properties—texture, structure, porosity, chemistry, and color.

Soil Texture

Soil texture refers to the relative percentage of sand, silt, and clay particles that make up the mineral fraction of the soil. Soils are composed of different-sized particles (2.0 mm to <0.002 mm).

The ratios of particles that make up your soil can't be changed much by management but it's good to understand because it determines water infiltration rate, water storage, and the movement and availability of air, water and nutrients in a soil. You can watch the videos below to learn about how to determine your soil texture by feel method or mason jar test. These two tests are very fun to do with family members or fellow gardener.



[Feel method](#)



[Mason Jar Test](#)

Soil Testing

An understanding of your soil's physical, chemical, and biological properties is essential for effective farm management and soil fertility decisions. Healthy soil can increase active and diverse microbial population, increase agricultural productivity, improve farmer livelihood, and build climate resilience.

The combination of soil structure and soil texture determines things like nutrient retention and how air and water are stored in your soil.

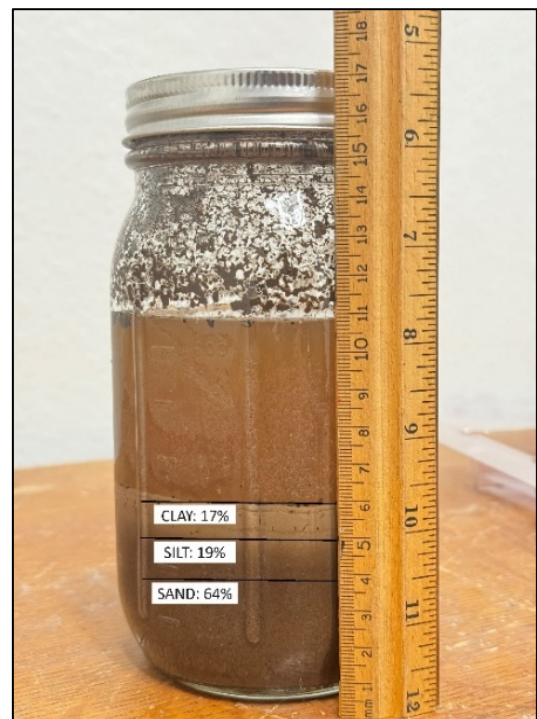


Figure 3: Mason Jar Test

If you are planning to start any farming practice, it is a good idea to have your soil tested to get baseline information about your soil. This will help you plan the right soil amendment and fertilizer program to maintain or enhance soil fertility. It is helpful to sample your soils every year (for farmers) or 3-4 years (for gardeners) to observe changes in soil fertility over time.

Generally, there are two different approaches to testing the soils: do-it-yourself (DIY) soil testing with a home test kit, and soil testing via laboratory analysis.

Do It Yourself (DIY) Soil Test

Some soil properties, like texture, can be assessed right at the comfort of your farm without having to sample and send the soil samples to the laboratory. Soil textural analysis is important to get information about the physical components of soils, i.e., sand, silt, and clay.



Figure 4: Home soil test kit

There are many soil testing kits or probes in the market (online and garden centers) that can measure your soil pH, and nutrient levels such as Nitrogen (N), Phosphorus (P), and Potassium (K). While such tests are quick and inexpensive, their accuracy varies

depending on both the user and the product.

The results from home test kits are generally not as accurate as lab results. In the long run, paying for a professional soil test can be the most cost-effective way to improve the soil in your farm or garden. Accurate soil information will help you save money on

unnecessary fertilizers and amendments by identifying the exact need.

Soil Sampling for Lab Analysis

To get the most accurate result, proper protocol should be followed when collecting your soil sample and sending it to the lab. Good News!! These sampling protocols are fun and easy to follow.

Most soil labs have a protocol they would like you to use for sampling, and they may also provide you with shipping containers, so it is best to contact the lab before sending the sample and ask about these things. In general, you will follow the steps below for soil sampling.

If your garden or small farm has multiple areas that are different from one another (based on DIY assessment and SoilWeb), one sample from each area (Figure 4) should be sent out to the lab.

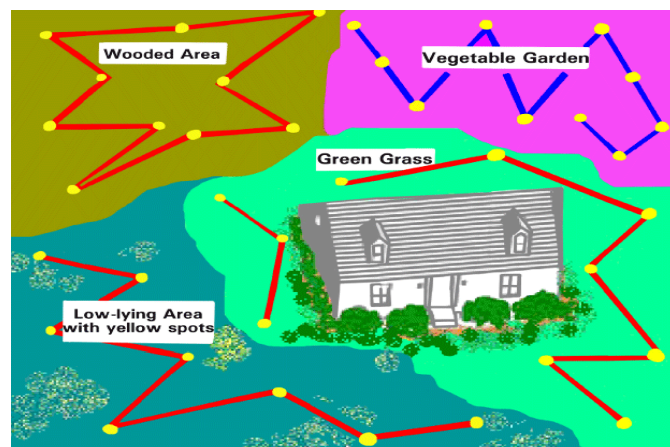


Figure 5: Choosing where to sample. Photo Courtesy: University of Georgia Extension. Circular 896

Getting Ready to Send Soil Samples to a Testing Lab: What You'll Need

- Soil auger, core tool, garden spade, or clean shovel
- Gloves
- 1-2 Clean plastic buckets (1 or 5-gallon buckets work!)
- 1-gallon freezer Ziploc bag
- Sharpie pen to label your sample
- Information sheet (Chain of custody), supplied by the lab

Factors such as soil type, topography, crops grown, and past management should be considered for zoning different soil sampling areas. For example, you will send separate samples for your vegetable garden, perennial beds, lawn area, and forage crops. Grab the soil cores from 15-20 locations from each area and mix them thoroughly.

In the case of crop fields, zone soil sampling is preferred, collecting one sample for every 40 acres. Your one composite sample for 40 acres would represent about 43500 tons of soil in the top 8 inches

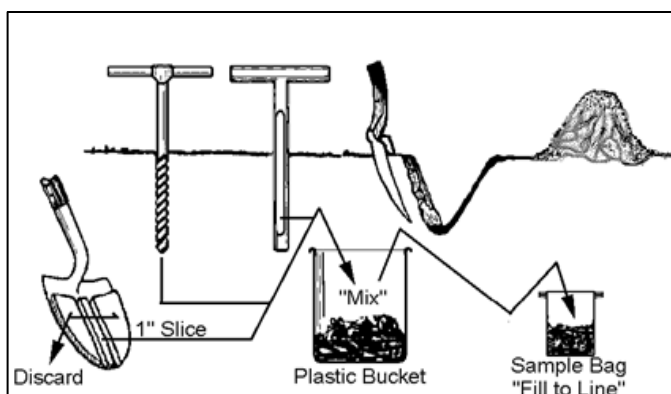


Figure 6: Different soil sampling tools.

of soil, so collecting samples from different areas and mixing them well is very important to get representative results.

Soil Sampling Protocol

- Choose your sampling sites by walking in a zigzag pattern or forming a W-shape over your field or garden. Avoid edges or unusual areas such as previous fence lines, storage areas for manure, former parking areas, and so on.
- Remove the surface residue/debris from soil surface of sampling location.
- Use a soil auger to grab the soil core up to depth of 6-8 inches. In case of spade, make a 6-8 inch deep V-shape cut in the soil and remove an inch-thick slices of soil from top to bottom of the cut from each side. Place samples in your plastic bucket. (Trying to replicate the probe)
- Once you have grabbed samples for each location in your plastic bucket, break the soil clods and mix the soil thoroughly. Remove any debris or stones present.
- Your lab will tell you how much sample they need for testing and how to label your sample. Put your mixed sample in the labelled Ziploc bag.
- Ideally ship the sample on the same day. Avoid sampling on Thursdays or Fridays to avoid weekend shipping delays.

If you aren't able to ship the sample within 24 hours, it is best to air-dry the soil before sending in the sample.

Choosing a lab

You can choose any lab in your area or ship your sample, some of the CDFA recommended labs can be accessed through the link or QR code below. Each lab has a basic package with important parameters to establish a baseline information about your soils. Packages are usually less expensive as compared to asking each parameter separately for the analysis. If you know that your soil has a specific problem (heavy metal toxicity, salinity), you can always list that analysis if not included in the package. You can also ask for the soil amendment recommendations from the lab if applicable, most labs would provide this service free of cost along with the analysis.

[CDFA recommended soils test labs \(ca.gov\)](https://www.cdфа.gov/soils-test-labs)



What to analyze?

The soil labs have different analysis packages in their catalog that you can choose from. For the start, use the simple package that can provide you with the most important baseline information for your soils. Soil should be analyzed for the percent of organic matter, primary nutrients (Nitrogen, Phosphorus, Potassium) and secondary nutrients (Calcium, Magnesium, Sulfur) essential for plant growth. Plants also require micro-nutrients in relatively low amounts compared to primary and secondary nutrients. Soil should be tested for chemical properties such as pH, cation exchange capacity and base saturation. Chemical properties are used to predict the nutrient

availability and retention in the soils. It is recommended to sample the soils during the same time every year, typically fall. Available nitrogen essential for field crop should be sampled at the start of the growing season.

What's Next

You've taken a look at your soil, you've gathered your soil samples, and the test results are in. What do they mean? See our next Fact Sheet, "**Soil Health for Big and Little Farms Part 2: Understanding Your Soil Test Results**" for information about reading and interpreting soil test results.