



# tip sheet: **Soil for Gardening Basics**

## overview

Healthy soil is an important factor of a successful garden. If your crops are growing poorly, seem discolored, or your seeds aren't germinating, chances are you have problematic soil. This tip sheet is designed to explain the different ways to assess your soil's health.

## objectives

### *Participants will learn:*

- how to conduct a pH test
- how to conduct a soil texture test
- how to conduct a percolation test
- how to prepare for a soil test in order to assess soil health.

## resources

### *See below for full list:*

<http://nmsp.cals.cornell.edu/guidelines/factsheets.html>

## what is good garden soil?

Soil can be evaluated on fertility and texture. Fertility is a measurement of essential nutrients (primarily nitrogen, phosphorus and potassium, each of which have a major role in plant growth). Texture refers to the size and cohesiveness of soil particles: sand, silt and clay. In addition to understanding these characteristics, a good gardener should also test for soil toxins – which requires a soil test in a laboratory (most easily done via your local university cooperative extension).

## testing your soil

Whether testing your current soil or purchasing new soil for your garden beds you should evaluate your soil on a few basic characteristics. Each test is fully explained in the sections that follow.

## testing your soil (*continued*)

- A pH test, either by litmus paper, observation of soil profile or predominant flora (preexisting garden beds only), or with an electronic pH meter.
- A soil texture test, which is most easily done either as a squeeze test or jar test.
- A percolation test, or drainage test, to see how water drains through your soil.
- A soil test by your local land grant university cooperative extension. This will test both macro- and micro-nutrients, as well as toxins such as heavy metals. It is highly recommended when you bring in new soil from unknown sources, as well as after a season or two of gardening when deciding what you should use to amend your garden beds.

These tests can be done before, during or after you plant your crops – although generally, all tests should be done when the soil is 55 °F or just above. At this temperature, the soil is most like it is when you are growing your vegetables.

## soil pH

The pH of soil affects what nutrients are available to plants. A pH measurement is read between 0-14, with 0 as the most acidic and 14 the most basic, or alkaline. Vegetables do best in soil between pH 5.8 and pH 7.2, with some exceptions. Since pH represents the concentration of hydrogen ions in a watery solution, to test pH, you must make a solution (add water) of your soil, and test the solution (not the dry soil itself). Most pH kits will include directions as well as a key to read the results. To adjust your soil's pH, you'll add amendments – often granular products that, over time, dissolve in the soil. Looking up "adjusting soil pH" will lead you to a number of resources.

### **Resources:**

<http://www.dummies.com/how-to/content/how-to-adjust-soil-ph-for-your-garden.html>

## soil texture test

Soil texture is determined by the ratio of sand, silt and clay present in soil. This ratio determines how well soil holds (or loses) nutrients and moisture. You can do a quick-and-easy soil texture test in your hand, a more precise test (but just as easy) with a sealable jar and a soil triangle, or send your soil off to a lab to be tested. Regardless of the method you use, most vegetable growers are looking for one thing: loamy, or predominantly loamy, soil. Represented by the lower-middle section of a soil triangle, loamy soil drains well yet also retains nutrients easily.

## soil texture test (*continued*)

### **Resources:**

<http://www.finegardening.com/how-to/articles/hows-your-soil-texture.aspx>

<http://organicgardening.about.com/od/soil/a/easysoiltests.htm>

<http://edis.ifas.ufl.edu/hs1207>

[http://en.wikipedia.org/wiki/Soil\\_pH](http://en.wikipedia.org/wiki/Soil_pH)

<http://www.offthegridnews.com/2013/06/19/25-fruits-and-vegetables-to-grow-in-acidic-soil/>

[http://upload.wikimedia.org/wikipedia/commons/5/54/Soil\\_texture\\_chart.png](http://upload.wikimedia.org/wikipedia/commons/5/54/Soil_texture_chart.png)

<http://en.wikipedia.org/wiki/File:SoilTextureTriangle.jpg>

## various soil tests

With all soil tests, take your samples from about 2 in. below the surface, where the plant roots are. Here is how to do the various soil tests:

### **Hand Test**

**1. Take a soil sample of about 1.5 cm from your garden** (approximately a small fistful). Ideally do so after a day of light rain or a few hours after watering. If it hasn't rained or been watered recently, add a bit of water.

**2. Make a fist around the soil, then release.** Now knock the soil gently with your thumb. If the soil:

- falls apart immediately after you release your fist, it is likely too sandy.
- holds together even after you knock it with your thumb, it is likely has too much clay.
- holds together when you release your fist, then breaks up a bit when you knock it with your thumb, it is likely to have a good mix of clay and sand, and fall closest to ideal soil conditions.

### **Jar Test**

#### **Materials:**

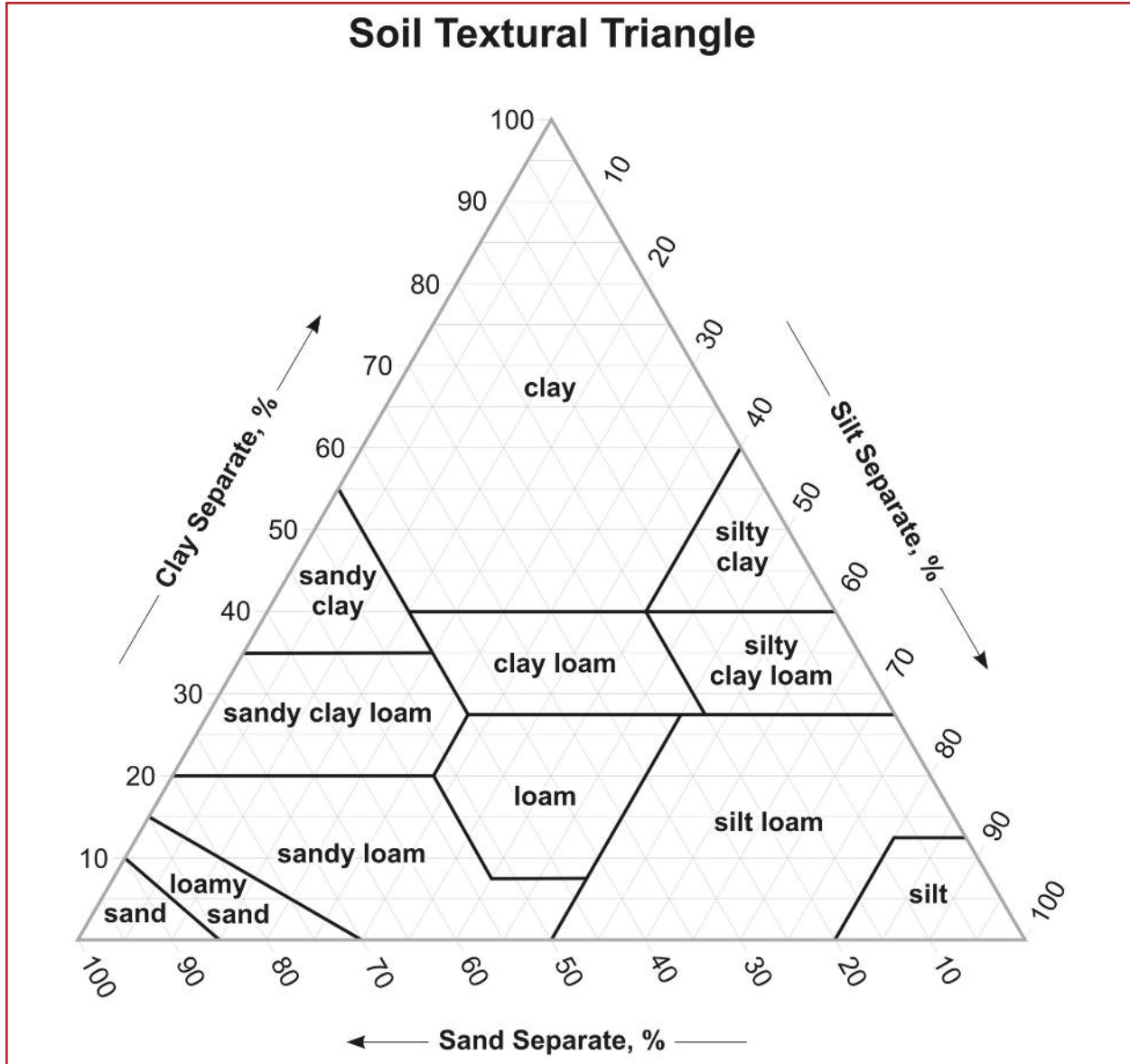
- Shovel or trowel
- Access to water and a hose
- Ruler
- Calculator
- A straight-sided jar with a tight-fitting lid
- Powdered dishwashing detergent
- USDA soil texture triangle (included below)

## various soil tests (*continued*)

### Jar Test (con't)

1. Take your soil sample by removing the top 2 inches of soil, then digging down about 6 inches (usually the length of a gardening trowel).
2. Remove any large rocks, twigs, etc. and spread the soil sample out on a clean, flat surface to dry (a cookie sheet works well).
3. Once dry, sift the soil once more in a colander or sieve to remove roots or small rocks.
4. Put the soil into a straight-sided jar (you can't measure percentages as easily with a curved jar) with a tight-fitting lid.
5. Add a Tablespoon of dishwashing detergent.
6. Fill the jar to the top with water and shake well for three minutes to combine the soap, water and soil particles.
7. Place your jar on a flat surface and leave it alone for a day or two.
  - a. Sand is the heaviest, coarsest particle and will settle after about one minute.
  - b. Silt takes about an hour.
  - c. Clay, the lightest particle in the mix, can take between one and two days to truly settle out. It will settle on the top and likely be the lightest, and most finely texture, of the three layers.
8. To measure the percentages of each, use your ruler to determine the height of all three layers. This represents 100% of your sample.
9. Now measure each layer separately and divide by the amount of the total sample. For example, if a total sample is 1-  $\frac{3}{4}$ " and the sand layer measures 1", divide 1 by 1.75 and learn that 0.57, or 57% of your soil sample is sand.
10. Once you've derived the various percentages, use the soil texture triangle to locate the nexus of the three percentages

various soil tests (continued)



Soil texture triangle from [nrcs.usda.gov](http://nrcs.usda.gov)  
Suggested illustration: jar soil test results

## various soil tests *(continued)*

### **Percolation Test**

1. The simplest test of all: dig a hole and time it to see how well it drains.
2. This test will tell you if your soil is too compacted or drains too well.
3. Too much water in your soil and your plant roots will suffocate and drown.
4. If your soil drains too easily, nutrients will be stripped away too quickly.

### **Soil Test**

#### ***Materials:***

- pH test kit

1. The most basic soil test done by your land grant university's cooperative extension will tell you the levels of your macronutrients, percentage organic matter, pH, and soil texture.
2. Since you can test pH and soil texture fairly easily on your own, the other soil tests you might ask a laboratory to run include checking for high levels toxins (such as heavy metals) and micronutrient tests.
3. Often the soil test will have shorthand opinions for action, such as fertilizer recommendations. Your best bet is to follow the instructions on the website, then follow up with the lab using either their local tip sheet or contacting an extension agent.

#### ***Resources:***

##### **How to read a soil test:**

[http://extension.unh.edu/resources/representation/Resource000496\\_Rep518.pdf](http://extension.unh.edu/resources/representation/Resource000496_Rep518.pdf)

[http://www.hort.cornell.edu/expo/proceedings/2013/Berries/  
Berries%20Understanding%20Your%20Soil%20test.pdf](http://www.hort.cornell.edu/expo/proceedings/2013/Berries/Berries%20Understanding%20Your%20Soil%20test.pdf)

##### **Plant nutrition:**

<http://antoine.frostburg.edu/chem/senese/101/acidbase/faq/what-is-pH.shtml>

[http://en.wikipedia.org/wiki/Plant\\_nutrition](http://en.wikipedia.org/wiki/Plant_nutrition)