



Soil Characteristics

WHY IS THIS IMPORTANT?

Soil can make or break a good garden or landscape. What the roots of plants have surrounding them can affect their nutrition and overall health. Plants need water, mineral nutrients and air. If one is missing or in such abundance, it affects plant growth.

The *physical composition* of soil is a fundamental aspect of soil health. Getting a basic soil profile helps you proceed with many gardening practices. You will know whether what you are reading applies to your particular soil makeup. It helps you to make informed decisions later.

The *chemical base* of your soil provides the

foundation for nutrient uptake for your plants. For instance, a soil which is neutral or alkaline will not adequately support plants, such as rhododendron or blueberries, that require nutrients available only in acidic soils. You may need to adjust pH or organic matter to grow certain plants.

Soil is not just dirt. The physical and chemical components of soil may vary from site to site in a garden and from garden to garden in a neighborhood.

ACTIVITIES

1. What's the physical composition of my soil? (soil sedimentation test)

MATERIALS:

POINTED SHOVEL
BUCKET
ZIP-LOCK BAG
PINT-SIZED GLASS JAR WITH TIGHT FITTING LID
KITCHEN TIMER, WATCH OR ELECTRONIC TIMER
POWDER DISHWASHER DETERGENT
RULER
MASKING TAPE

1. To get a good overview of the entire site, take soil from many places in the garden. Dig a hole 6-8 inches deep and place a slice of soil into the bucket. Do this in about 10 locations within

your study area. Mix them all together. Measure one cup of mixed soil for this first activity; save another cup of it in a zip lock bag for the next activity (pH)

2. Get rid of any stones, roots, grass or debris. Dry out the soil for easy removal.
3. Apply masking tape vertically to jar, to mark layer levels later.
4. Add one cup of soil to a glass, pint-sized jar with a tight lid. The narrower the jar, the easier it will be to measure the layers later.
5. Fill the jar containing soil with water to about $\frac{2}{3}$ to $\frac{3}{4}$ to the top. Screw the top on the jar, shake well to put the soil into a suspension with the water.
6. Add one teaspoon of powder dishwasher detergent to the mix. Shake the jar again.
7. Set the jar on a flat surface and start the timer to one minute.
8. Mark on the masking tape the point where soil particles have dropped in one minute. This will be the *sand* component.
9. Reset the timer to 2 hours.
10. Mark on the masking tape the point where the soil particles have dropped in 2 hours. This second layer is the *silt* component.

11. The next layer needs several days to settle out (Check it in two or three days. If the layer stays the same after checking on two separate days, it has probably settled as much as it is going to.) Mark on the masking tape this layer as the *clay* component.

12. Each layer is a percentage of the entire mass of dropped soil particles. Divide each layer height by the total settled soil. Multiply by 100 to find the percentage of sand, silt and clay.



13. Any dark colored material floating in suspension in the water is *organic matter*. Estimate how much of this you have.

14. Repeat this if you are testing more than one garden or landscape study area.

ESTIMATED TIME: 20 MINUTES OF COLLECTING, OBSERVING AND RECORDING. MOSTLY 2-3 DAYS OF WAITING TIME.

It may be difficult to see the layers in the jar. If that happens, try it again using a jar with a narrower diameter, such as an olive jar.

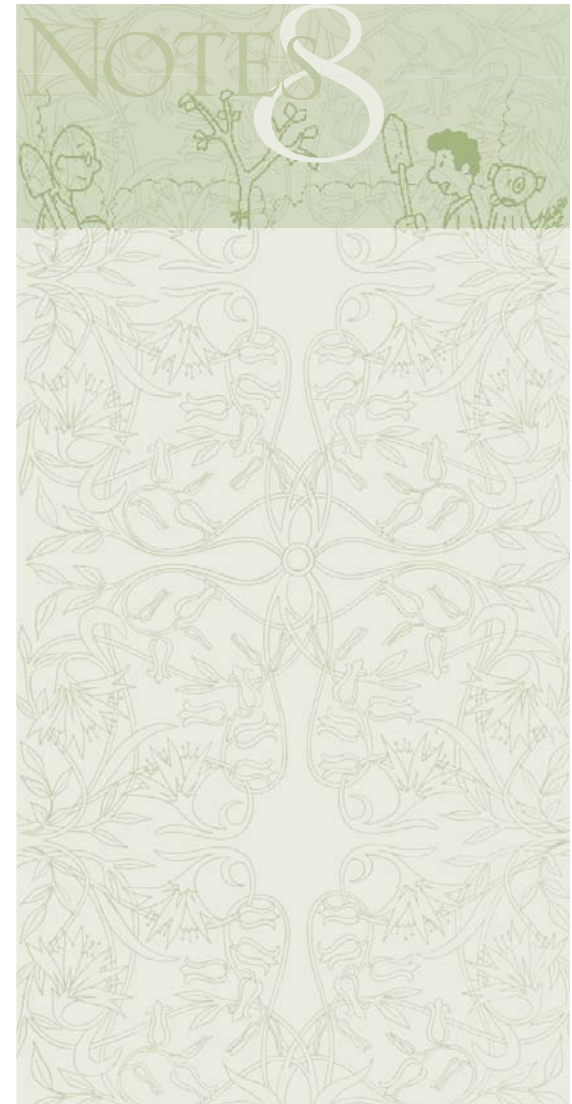
The percentage of three main soil components: sand, silt and clay should add up to 100%. You are measuring each layer as a part of the soil that settles to the bottom, not the water layer. In a few cases, even after several days, the clay particles will not all settle in the jar, forcing you to estimate.

Organic matter floats on top of the water; it is harder to quantify because the organic matter has many more air pockets and is looser than the mineral soil sediment. Make note of the organic matter in some way. You can easily add it every year.

The soil here is approximately 45% sand, 4% silt and 51% clay. Organic matter is negligible.



SOIL SEDIMENTATION LAYERS



2. What is the chemical base (pH) of my soil?

MATERIALS:

GLASS JAR WITH TIGHT FITTING LID

SOIL SAVED IN ZIP-LOCK BAG FROM FIRST ACTIVITY

Testing for chemicals can be performed by a lab with proper equipment. Bring the soil you collected in the first activity to a lab for a pH test. Most county Cooperative Extension offices and some garden centers have the equipment and expertise to perform a pH test for you.

ESTIMATED TIME: WAITING TIME AT LAB WILL VARY.

While soil test kits are sold in garden centers, gardeners often struggle with getting an accurate reading from them.

In this activity we are only looking at the soil's pH reading. It is a measure of acidity or alkalinity. You will not need a more complete analysis at this time.

Avoid extremely wet soil conditions unless absolutely necessary. If the sample is wet, spread the sample in a thin layer on an aluminum pie pan, clean wrapping paper or waxed paper, and allow to dry out at room temperature.

3. Visual Observations

(1) Soil Appearance

MATERIALS:

LONG HANDLED, POINTED SHOVEL

Dig a pit approximately two feet deep in order to examine the soil horizons, or layers, especially if the site has recently had construction activity.

Soil layers that are noticeably lighter in color than lower layers indicate that subsoil has been spread on top of the original grade. Conversely, the absence of a rich brown, organic layer at the top may indicate that the topsoil has been removed.

ESTIMATED TIME: 30 MINUTES

(2) Soluble Salt

Look (particularly near walks and parking areas in early spring) for white powder that has precipitated from the soil surface. De-icing salts linger and can cause damage to plants.

There are other sources for soluble salts, but it is difficult see them; more extensive lab tests at a time after the site assessment might reveal those.

ESTIMATED TIME: 5 MINUTES

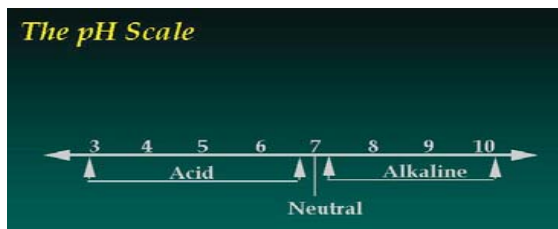
USING WHAT YOU FOUND IN THIS STEP

The percentages of sand, silt and clay indicates which component is most dominant. A soil that has a high percentage of sand is *sandy*; a high silt is *silty*; and high clay is *clayey*. Relatively equal proportions is a balanced *garden loam*. Sandy soils drain well, but hold nutrients poorly; clayey soils drain badly, but retain nutrients well. Both silty and clayey soils pack down too much, making roots develop poorly. To read about different soil types, see any of the books on soils in For Further Reading.

Soil is what it is and only in extreme cases is it bad. You may garden or landscape with whatever soil you have and make choices accordingly.; for instance, if you have a soil high in clay, you may choose plants that tolerate clayey soils. Or you may amend your soil, knowing that it could become expensive or time consuming to amend large areas in your garden.

Annually add organic matter to your soil *Organic matter*, an important component of healthy soils, breaks down continuously and needs to be replenished. See "Using Organic Matter in the Garden" in For Further Reading.

The results of a pH test indicate on a scale of 0-14 if your soil is acidic, neutral, or alkaline.



Most plants prefer a soil pH between 6 and 7; acid-loving plants, like rhododendron, azalea, holly and blueberry, prefer 4.5 - 5.8 pH.

Don't try to change the soil pH at this point. When you begin a planting project, you can make necessary changes and do a more complete analysis (for nutrients). Lime to reduce the acidity should only be added if recommended by the testing lab.

A top soil layer with high organic matter is necessary to grow lawn or other shallow rooted plants. Add topsoil to lawn areas if yours is missing. For deeper rooted plants (trees, shrubs, perennials, vegetables, fruit) incorporate organic matter into the top 1-3 feet of soil.

Where you have found evidence of soluble salts, flush salted planting areas near driveway, sidewalks or roads with water in the spring. Use plant friendly de-icing salts, sand or plain kitty

litter. For plantings near roadsides, choose salt tolerant plants or install a burlap fence to shield against splashing road salt. A few examples of salt tolerant plants are Mugo pine, candy tuft, Vanhoutte's spirea and garden snowberry. A few plants that do not tolerate soluble salts are sugar maple, white pine and European red elder.

FOR FURTHER READING

Building Soils for Better Crops, 2nd Edition, Fred Magdoff and Harold van Es. Sustainable Agriculture Publications, Waldorf, Md. 2000.

Cornell website on soils resources for home gardeners www.gardening.cornell.edu/soils/index.html

Secrets to Great Soil (Storey's Gardening Skills Illustrated), by Elizabeth Stell, Workman Pub Co, New York, 1998.

Several articles on salt-tolerant plants, www.gardening.cornell.edu/woodies/factsheets.html

Soil Biology Primer, by Soil and Water Conservation Society, www.swcs.org (order form)

Start with the soil: The Organic Gardener's Guide to Improving Soil for Higher Yields, More Beautiful Flowers, and a Healthy, Easy-Care Garden, by Grace Gershuny, Rodale Press, Emmaus, Pa., 1995

Using Organic Matter in the Garden, by C.P.Mazza, S.J.Cunningham and E.Z.Harrison, www.gardening.cornell.edu/factsheets/orgmatter/index.html

