Soil Particle Size

Directions, Datasheet, Lab, and Data Analysis

Supplies for the Field:

- Trowel
- Sandwich size baggies
- Dark sharpie
- Old towel
- Pencil
- Clipboard (or cardboard w/binder clip)
- Datasheet on page 2 (one copy for each site)
- Camera (cell phone)
- Backpack

Supplies for the Lab:

- Quart canning jar for each sample
- Sharpie
- Newspaper
- Hammer
- Water
- Water softener like Calgon
- Teaspoon
- Calculator (cell phone)
- Camera (cell phone)
- Ruler
- Watch or clock (cell phone)
- Completed field datasheets
- Data Analysis on page 4 (one copy for each site)
- 1 copy “Think About It” on pages 5-6
- Print or computer for directions on pages 1, 3, 7-8

You need to make 1 copy of your datasheet for each site you plan to visit. For example, if you are going to collect 5 samples from 5 different sites, print 5 copies. The blank ___ is for you to fill in Site 1, Site 2, Site 3, Site 4, Site 5, etc.

You need to make 1 copy of the data analysis sheets on page 4 and 5 for each site you plant to visit. For example, if you are going to collect 5 samples from 5 different sites, print 5 copies. The ___ is for you to fill in Site 1, Site 2, Site 3, Site 4, Site 5, etc.

Place all the supplies listed on the left hand column, Supplies for the Field, in your backpack. While in the field, you are only collecting the data. Wait until you return to your “lab” to analyze those data.

Remember to protect yourself while outside. Bring a hat, sunscreen, insect repellant, and water for you to drink, in addition to the supplies listed.

Be careful to identify the datasheet and the sample you collect, so you can determine the soil composition for each of your sites.

When you return, follow the directions on Soil Particle Size Data Analysis. At the very end of the data analysis sheets, you will find the soil triangle and the advantages and disadvantages of each soil type.

Field: Soil Particle Size Datasheet

(Make one copy for each site you plan to visit)

Site _____ (describe location with as many details as possible): _____

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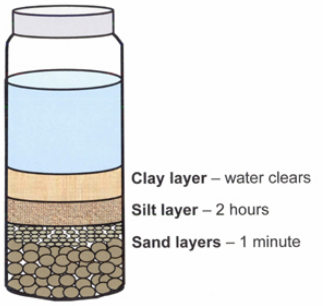
Date you collect the soil samples: _____

How to collect the sample:

1. Take a picture of your site. If possible, label "Site ____" on the image.
2. Scrape the organic matter away on the top of the soil with the trowel.
3. With the sharpie, label the baggie "Site 1" and today's date.
4. With the trowel, collect between 1½ and 2 cups of soil in the baggie.
5. Seal the baggie.
6. When you get back to your "lab," you will analyze these data.

Lab: Soil Particle Size Experiment:

1. Find a location for the jars where they will not be disturbed for 2-3 days to 2-3 weeks. Be sure that you can see a clock, or have access to a watch or timer on your cell phone. Leave the sharpie there.
2. Gather all the materials listed on page 1 in the right hand column labeled Supplies for the "Lab."
3. Lay out a sheet of newspaper for each sample and with your sharpie, identify the sample on the newspaper.
4. Match the label on the newspaper with the label on your soil sample baggie. Keep the baggie on the newspaper as a secondary precaution that you do not mix up the samples. Double check that the soil from Site 2 is in the Site 2 jar, Site 3 soils is in the Site 3 jar, etc.
5. If necessary, spread the soil on a newspaper to dry. Remove all twigs, rocks, trash, roots, etc. If your soil is dry, you can proceed to the next step.
6. After the soil has dried, use the hammer to crush lumps and clods. Continue until you have pulverized each of your soil samples.
7. You need 1-quart size canning jar for each soil sample you have collect. Use the sharpie to label each jar with the soil sample's location (i.e. Site 1, Site 2, etc.). Place each jar on the newspaper with the matching site soil.
8. Fill the jar 1/4 full of soil for your first site and add water until the jar is 3/4 full.
9. Add a teaspoon of Water softener like Calgon (or other water softener) to the soil sample.
10. Put on a tight fitting lid and shake hard for 10 to 15 minutes. You want the soil and water completely mixed.
11. FYI: Soil particles will settle out according to size. Sand will settle first because it is the heaviest particles, and it takes about 60 seconds for sand to settle at the bottom of the jar. Silt will take a couple of hours to settle. These particles are bigger and heavier than clay, but smaller and lighter than sand. Silt, is therefore, the second layer to settle on top of the sand. The clay particles are extremely small, and it will take several days for the clay particles to settle. The clay particles will be the top layer in your jar.



http://mea.com.au/upload/TextureTest.jpg

12. As soon as you set down the jar, time 60 seconds. You will need to see a clock, watch, or get your cell phone ready to time. Be sure that your sharpie is handy.
13. Put down the jar, time for 60 seconds, and at the end of 60 seconds, draw a line on the particles that have settled to the bottom of the jar. Label that layer as "Sand."
14. Repeat steps 8-13 for each of your soil sample sites. Do one site at a time, so that everything you do is the same for each sample.
15. Set the timer on your cell phone for 2 hours. After 2 hours, mark on the jar the depth of the silt with your sharpie.
16. When the water clears, mark on the jar the clay level. This typically takes 1 to 3 days, but some soils may take weeks.

Soil Particle Size Data Analysis

(Make one copy for each sample you collected)

Site _____:

- Measure the thickness of the clay (top layer), silt (middle layer), and sand (bottom layer) in centimeters (cm):
    - Thickness of sand deposit _____cm
    - Thickness of silt deposit _____cm
    - Thickness of clay deposit _____cm
    - Thickness of total deposit _____cm (not water, just soil layers)

- Calculate percentages of clay, silt, and sand:
    - Formula: [clay thickness] / total thickness] x 100 = percent clay
      Your calculations:

      [/] x 100 = _____ % clay

    - Formula: [silt thickness] / total thickness] = percent silt
      Your calculations:

      [/] x 100 = _____ % silt

    - Formula [sand thickness] / [total thickness] = percent sand
      Your calculations:

      [/] x 100 = _____ % sand

Attach image of site here:

Think About It:

Take a picture of the jars from each of your sites, with the measured sand, silt, and clay measurements showing.

As you were sampling at each site, did you notice that it was easier for the trowel to dig in some spots than others were. Why?

_____

_____

_____

Using the images above and your datasheet, does each site you selected have uniform percentage of sand to silt to clay? YES ☐ NO ☐

Compare each of your sites and examine the details you described (i.e. how far from the river, in a cultivated field, next to a garden path, etc.). Can you see any patterns of why the percentages of clay, silt and sand would be the same or why they would be different? For example, if you collected by a stream or river, would you expect the soil to be sandier or more clayey. Why?

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Using the information about the disadvantages of each soil type (on the next page), what are the disadvantages of your soil types at each of your locations?

_____

_____

_____

Using the information about the advantages of each soil type (on the next page), what are the advantages of your soil types at each of your locations?

_____

_____

_____

What are the things that you can do to improve your soil to help your plants better thrive?

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What did you learn?

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Soil Types: Disadvantages, Advantages, and Improving

Disadvantages

- **Clay**
  - One of the disadvantages of clay is that it stays wet long after rain.
  - Clay becomes compacted very easily when wet.
  - When the soil does finally dry out, the surface becomes like concrete, and cracks. This poses problems for sowing and planting out.
- **Sand**
  - Sandy soils do not hold water. Sand is composed of silica, usually quartz crystals, and it has little ability to hold on to water.
  - Sandy soils do not hold nutrients. Sand is composed of silica, usually quartz crystals, and these have relatively no ability to hold onto nutrients.
- **Silt**
  - Silt soils come about halfway between clay and sandy soils.
  - Like clay, it can have a tendency to become compact. This sometimes causes drainage problems when used by itself.

Advantages:

- **Clay**
  - It retains moisture. In raised beds, this is useful, as they dry out quicker than conventional beds. Plants growing in clay that deal with dry conditions do better than plants in other soils.
  - You do not have to use as much water.
  - Clay is usually very rich in nutrients too, which reduced need for fertilizing.
- **Sand**
  - A sandy soil is lighter weight than clay or silt.
  - It does not compact like clay or silt.
  - It is easy to dig in or amend with compost.
  - It drains.
  - Transplanted plants seem to establish a little bit faster in sandy soils as well, since it is easier for their roots to get a foothold in this looser type of soil.
  - Sandy soils also tend to warm up a little faster in the spring when compared to clay soils.
- **Silt**
  - Silt soils come about halfway between clay and sandy soils so silt soils help clay and sand to mix well.
  - Silt soil is very fine and also holds moisture,
  - Most moisture-loving plants, like colored flowers, vines and grasses, grow well in this smooth and slippery soil.

Improving the Soils:

- **Clay**
  - Test soil pH, and adjust as necessary. Clay soils are rich in nutrients, but if the soil is too acidic or too alkaline, those nutrients will not be available to the plants.
  - Add organic matter. This helps improve drainage and lighten heavy soil.

- Build raised beds.
- Mulch beds over the winter.
- Plant a cover crop.

- **Sand**
  - Incorporate organic matter by adding compost to the garden soil. Good organic matter to add include compost, straw, shredded wood bark, etc. These will help your soil retain more water and fertilizer as well as providing additional nutrients as these organic bits decompose. For most sandy soil, it may be better to use a slightly coarser material for your amendments because they break down so quickly in well-drained soils, especially if local rains are heavy.
  - It is essential to mulch sandy soils in order to get plants established. Because sandy soils have so much more air space than other types of soil, water evaporates from the surface of the soil at a much faster rate than clay soils.
  - The key to success in sandy soil is less frequent deeper watering, using slow release fertilizers to reduce the amount of fertilizer run off and environmental pollution, and adding as much organic matter as possible to the soil to help hold water, nutrients, and keep plant roots in place.

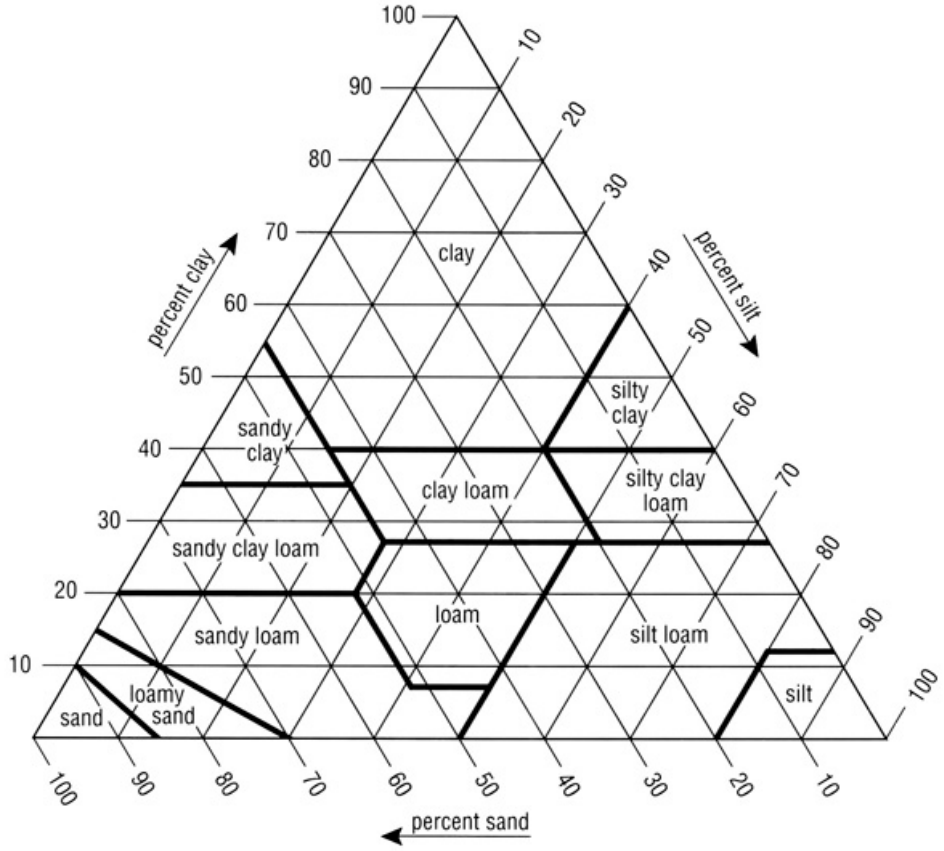

Image from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/wv/soils/?cid=nrcs142p2_054253