

Types by Texture

Soil Isn't a Dirty Word

Objectives

Students will be able to determine soil types by texturing several soil samples.

Materials

- Soil samples of sand, silt, and clay loam (included with video package)
- Soil samples brought in by students from home, about 1 cup)
- 1 quart jar
- ruler
- alum (*optional*)
- small bowls
- spoons
- water
- bucket
- Particle Size and Textural Triangle transparencies
- newspaper

Time

Activity 1: 20 minutes, with 3 short follow-ups
Activity 2: 45 minutes

Getting Started

Gather materials, make necessary copies and transparencies. Soil samples of sand, silt, clay, and loam can be obtained from Utah Agriculture in the Classroom. One of each sample is included with this Educators Guide. Soil samples can be used over and over if allowed to dry after each use. In each subsequent use the samples can be moistened to a paste and textured as explained. If you would like students to see what the soils look like dry, expose the sample to air, dry thoroughly. Then using a mortar and pestle (a wooden dowel or carriage bolt and plastic bowl will work) pulverize the sample to its "original" dry, loose state.

Procedures

Activity 1 - Dirt Shake

1. Divide the students into groups of three or four.
2. Provide each group with a soil sample or instruct each group to use one of the samples brought from home.
Caution! This activity will not work with most potting soil. Potting soil is made up of mostly organic matter. This activity is designed to determine soil texture. By evaluating soil (mineral) particle size.
3. Place 1-inch of soil into a 1 quart jar. Add water until the jar is 2/3 - 3/4 full. Add one teaspoon of alum (*optional* water softener, found on the spice aisle of most grocery stores, it does help the soil settle faster, but is not necessary) Be sure the lid is tight. (You may use 3 or 4 inches of soil if you would like to see "larger" layers. This may facilitate measuring. Be sure to record the depth you start with so you can accurately estimate percentages.)
4. Shake the jar vigorously until all the particles have been sufficiently wet and separated by the water, about 2 minutes.
5. Set the jar down and allow the soil to settle. (See page 23)
6. After 1 minute measure the amount of soil on the bottom of the jar. Record this information
7. Allow the sample to settle for 3 to 4 hours, then measure again and record the level of the silt. This is your second layer. This would be a good time to explain that soil pieces,



which students saw in a previous activity, are comprised of different size particles. Use the background information and Particle Size transparency.

8. The rest of the soil (or clay particles) may take the next couple of days to a week to settle depending on the amount of clay in the sample. But because you know that each sample started with 1 inch you can determine the amount of clay because you know the amount of organic matter that is floating on top (this may be difficult to measure), sand, and silt.
9. Convert the measurements into percentages. Students may need help with this. If you used 1 inch of soil and the first layer measured 1/2 an inch, that would be equal to 50% sand, a 1/4 inch measured in the second layer would be 25% silt, and the remainder would be 25% clay, to make 100%. If the sample has 5% organic matter, you may only have 20% clay. If you started with 4 inches of soil and 2 inches settled out as sand, 50% of that sample would be sand, 1-inch of silt would be 25%, 1-inch of clay would be evaluated as 25% clay.
10. Determine the soil type by using the Texture Triangle transparency.

Discussion

1. Why do the larger particles settle out first?
2. What is the stuff floating in the jar?
3. How does each person's sample compare?

Activity 2 - Soil Textures By Feel

Classroom management note for Activity 2: Divide the class into groups of four. Invite each group, **one at a time**, back to the table where the soil samples are set up in the bowls on newspaper. Cover the entire surface with newspaper. Place a bucket of water on the table for rinsing hands between texturing samples. Have paper towels available for the final rinse and dry. The bucket of water should be placed in the middle of the table so muddy hands will not have a chance of being hung out over the floor. Before students rinse their hands, as much of the sample as possible should be returned to the sample bowl. Hands must be rinsed between samples so as not to confuse the sampler, and mix up the sample for the following students. While each group is working at the texture sampling area, provide the other students with some other type of "at your desk" activity. You may want to have them work on a crossword or word search puzzle provided in the back of this guide. The teacher should try to remain with the texturing group as much as possible to guide them through the activity and clarify questions the students may have.

1. Place at least three different soil types into four bowls. (a sand, silt, and clay, loam).
2. Introduce the soil "Textural Triangle." Show the students there are different names for different types of soil. It will be the task of your students to determine the texture of the supplied soil samples.



3. Explain to the students that each sample is different and explain how the different particles feel by reading the background information. Ask them to determine the type of soil in each sample.
4. Moisten soils to the consistency of “pasty” mud. Do not get them too wet and soupy.
5. Each student should place a teaspoon of the “mud” into the palm of his or her hand.
6. Instruct students to rub some of the soil between their index fingers and thumbs feeling for the presence of sand, silt, and clay.
7. As they continue to feel the sample, ask them evaluate how much sand, silt, or clay is present. Do they think it mostly sand or silt or clay? Is it half sand or silt or clay? Students should feel a mixture and then try to determine the relative amounts of sand, silt and clay. Students should record their analysis of the soil: sandy, silty, or clayey or an evenly mixed type of loam.
8. After all students have sampled the soils discuss with them what their analysis should have been. You may want to show them how to use the “Textural Triangle” and together determine the soil types.

Discussion

1. What is the name of a soil that contains a mixture of sand, silt, and clay?
2. How does sand, silt, and clay, feel?

Background

Remember that soils are made of tiny pieces of rock or minerals. But not all of the particles are the same size. Gravel particles are greater than 2.00 mm, **sand** is classified between 2.00 and 0.05 mm, **silt** is a particle that is between 0.05 and 0.002 mm, and **clay** is any mineral particle less than 0.002 mm. Students should have seen the different particle sizes in the “What’s in Soil” activity. To determine a type of soil, particles are analyzed. Most soils are a mixture of sand, silt, and clay and are said to be **loams**. If the sample has more sand it is a “sandy loam,” more silt a “silty loam,” more clay a “clay loam.” Depending on the amounts of sand, silt, and clay, the soil type may be further classified as a “sandy clay loam,” “silty clay loam,” “silty clay,” etc.

Activity 1 is a “hydrology test” that, with the use of water, simply separates the soil particles. Sand is the largest particle in a soil sample (gravel is not small enough to be considered soil) and is a heavier, denser, particle and will settle out in the water within 1 minute. Silt (the next largest particle) will settle out in 3 to 4 hours and clay will take a few days or as long as a week to completely settle. Scientist will shake soil samples in water for 24 hours. This is to ensure that “tightly” bound clay particles are thoroughly separated, but for the classroom experiment the 2 minute shake will work. Organic matter will be the “debris” floating on top of the water, if the sample was dry. This usually is a very small amount that can’t be measured. Measuring the sand, silt, and then surmising what the clay will be will

Dirt: Secrets in the Soil



help to determine the type of soil in the jar. For example, if the sample measures 1/2 inch after settling for 1 minute, the sample is 50 percent sand and is considered a sandy type (probably sandy loam) soil.

Within 2 days the students should be able to see the different layers easily. The layers may be easy to see or difficult depending on the color of the minerals in a given soil sample. Soil color is determined by the minerals in the soil, not the texture. Red soil can be sandy or made of clay.

When texturing soil samples by hand students should follow this criteria. **Sand feels gritty. Silt feels smooth, soft, somewhat slick, like the smooth silkiness of baby powder. Clay feels sticky, and often stains the fingers.** Soil samples containing a lot of clay will also be able to be pressed together through the thumb and forefinger to create a “ribbon” of soil. Clay soils stick together. Most of us have worked with potters clay. Potters clay is not quite as sticky, but a truly clay soil will hold together in a similar fashion. You cannot determine soil texture by color or where it is found in the soil profile. The touch method and hydrology tests determine soil texture.

Vocabulary

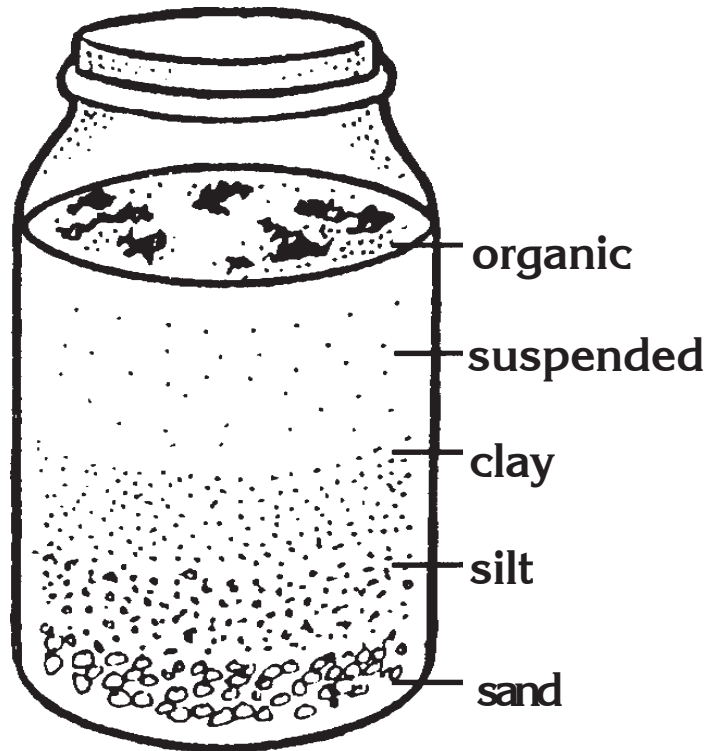
sand: soil particle that is classified between 2.00 and 0.05 mm

silt: a soil particle that is between 0.05 and 0.002 mm

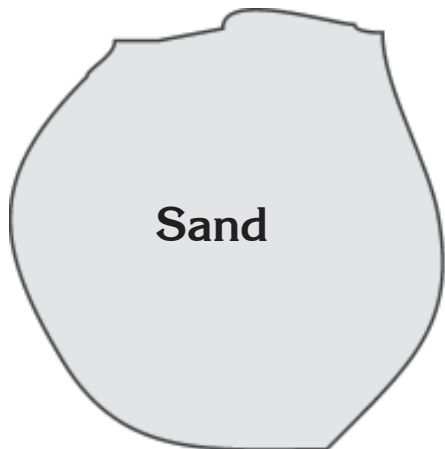
clay: any soil mineral particle less than 0.002 mm.

loam: a mixture of sand, silt, and clay. (See the Textural Triangle)

Dirt Shake



Particle Size



Relative particle sizes of sand, silt, and clay. Remember silt and clay cannot be seen with the naked eye.

Silt



Clay



Soil Textural Triangle

To find the texture of your soil, read percentages of sand, silt, and clay in the direction of the arrows at the sides. For example, a soil with 20% clay and 40% each of sand and silt is a loam.

