NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Soil Studies: Soil Particle Sizes

Objective: Students will learn soil size classifications (clay, silt, sand) and their effects on soil composition.

Grade level: Elementary - Intermediate

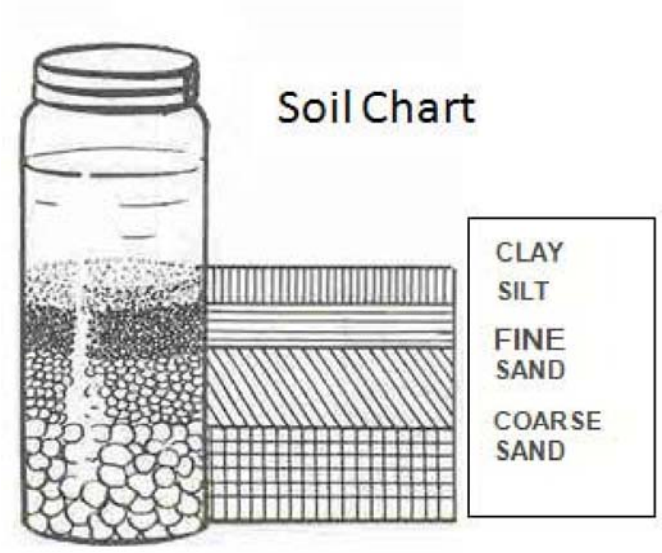
Time: First Activity - 30-45 minutes
Second Activity - 30-40 minutes

Season: Fall and spring

Materials: For each student - 1 jar and a card or a piece of heavy paper
For each group - 2 small tin cans (8-12 oz.) with one end open and the other end with many small holes in it
Marbles
Sand

Soil particles vary greatly in size, and soil scientists classify soil particles into sand, silt, and clay. Starting with the finest, clay particles are smaller than 0.002 mm in diameter. Some clay particles are so small that ordinary microscopes do not show them. Silt particles are from 0.002 to 0.05 mm in diameter. Sand ranges from 0.05 to 2.0 mm. Particles larger than 2.0 mm are called gravel or stones. Most soils contain a mixture of sand, silt and clay in different proportions.

The size of soil particles is important. The amount of open space between the particles influences how easily water moves through a soil and how much water the soil will hold. Too much clay, in proportion to silt and sand, causes a soil to take in water very slowly. Such a soil gives up its water to plants slowly. These soils are sticky when wet.



Loam and silt loam refer to soils that have a favorable proportion of sand, silt, and clay. A silt loam, for example, contains no more than 50% sand or more than 27% clay. The rest is silt.

First Activity Description

Have students collect some soil from their yards or from the school yard and fill a good sized jar about 1/2 to 2/3 full with it. When they get back to school fill the rest of the jar with water, replace the cover (tightly) and

shake it vigorously.

Put the jars on a table and have the students label theirs. Allow the jars to stand for a few days until all the particles settle out. Then hold a card or heavy piece of paper against the side of the jar and draw a diagram showing the different layers. Label each layer (clay, silt, sand). What percentages of each layer did you find? Which soils do you think would be better for plant growth? How do the Adirondack soils in your jar compare with the soils in the picture? Why is there a difference?

Size of soil particles is important for other reasons, too. It affects the ease of working the soil, what crops can be grown, and the efficiency of certain fertilizers.

Sandy soils that have no fine clay or silt particles filling the pore space cannot hold as much moisture since there is no surface area for the water to cling to and the pores are so large that the weight of the water causes much of it to run down and out of the soil. For this reason, medium and coarse sandy soils, low in clay are known as droughty soils. Crops cannot live long in them without very frequent rains.

When fine soil particles fill the large pore spaces, the soil can hold more water for plants because there is more surface area for water to cling to. And since the size of the pores is reduced, the weight of the water is less and it does not run out of the soil so readily.

Second Activity Description

Have the students work in groups for this. Fill two cans with marbles and add sand to one can, filling up the spaces between the marbles (tap the can gently on the table while doing this to be sure all the pore spaces are filled). Now add a specific amount of water (50ml, 100ml, etc.) to each can and let it percolate through the soil. Collect and measure the remaining water to compare it with the original amount. Also, time them from when the first drop comes out of the bottom of the can till the last comes out. Which soil held more water in it? Which took more time to empty out? Which do you think would be better for plant growth?