OUTDOORS ❀ GRADES 4-6 ❀ FALL, SPRING ❀ PROJECT

The Nitty-Gritty

DESCRIPTION

Through a simple process, students separate soil into its three major components: sand, silt, and clay.

sand (beach ball size)

OBJECTIVE

To explore the composition of garden soil and determine its quality.

TEACHER BACKGROUND

Soil is composed of a blend of various-sized particles. The proportion of sand to silt to clay is one factor that determines the quality of the soil. Sand, silt, and clay may seem to be uniformly categorized as small particles, but there is a great difference in the size of each of them, and this difference affects soil quality. If a particle of sand were the size of a beach ball, then silt would be roughly the size (and shape) of a Frisbee, and clay would be roughly the size and shape of a dime (see illustration, right).

silt (Frisbee size)

clay (dime size)

Gardeners describe soil types in many ways: heavy, light, sandy, clay, loam, rich loam, and so on. Scientists and horticulturists classify soil types by the proportion of sand, silt, and clay particles they contain, based on the sizes of mineral particles. The texture of the soil is determined by the blend of these various sized particles. Classifying the soils in our garden will give us some indication of the problems we are likely to encounter in working with them: *Soil that has too much clay is hard to work* and *Soil that has too much sand dries out fast*. Through the years, it is possible to change the texture of soil by adding amendments such as sand and compost to balance the proportions.

MATERIALS

- 1 glass quart jar with a lid per group of 5
- 1 piece of masking tape per group
- 1 trowel per group
- markers
- soil samples gathered by student groups during activity
- water
- 1 Clay, Silt, Sand Chart (blackline master) per group, page 379

CLASS DISCUSSION

What have we learned about how soils are made? *(They are made when materials break down.)* Are all soils the same? *(no)* Why would some be different from others? *(They are made from different types of materials, during different weathering processes, and in different climates.)* Do you think all soils are good for growing food? *(no)* What might make some soils better than others? *(good drainage, ability to hold nutrients, easy to dig, lots of living things)* In this activity, we are going to do a simple demonstration to determine the parts of soil. We will find out if it will be hard or easy to dig and if it holds water.

ACTION

1. Divide the class into groups of five. Give each group their materials.
2. Fill each quart jar about $^2/_3$ full of water.
3. Demonstrate how to take a soil sample. First dig a few inches (2 to 7 cm) below the surface. Then carefully scoop up soil for the sample.
4. Help each group select a different location in the garden or schoolyard to take soil samples.
5. Instruct each group to add soil to their jar until it is almost full, then put the lid on the jar.
6. Have groups label the jar lids with the group name and soil location.
7. Have students shake each jar vigorously. Let the soil settle. Have each group observe their jar. What do they see happening? *(In a short time, the heaviest sand particles sink to the bottom and the sand layer becomes visible, but the silt and clay particles will take hours to settle.)*
8. Place the jars in a location where they may be easily observed. Be sure no one lifts the jars to observe them.
9. In 24 hours the soil will be completely layered. Have each group describe the layers. Which layer is on the bottom? *(one with the heaviest, biggest particles)* Is that the same for each group? Which layer is the thickest? *(Answers may vary.)* How do you think the thickest layer will affect your soil for gardening?
10. Each group can use the Clay, Silt, Sand Chart, page 379, to determine their soil name. Then have them mark off the layers on a piece of paper held up to the jar, as shown on the chart, and compare each one to the chart. If the particles divide into about 40% sand, 40% silt, and 20% clay, the soil is called **loam** – a very good kind of soil to have. If the soil falls into other classifications, you could add sand or organic matter to change its classification.

WRAP UP

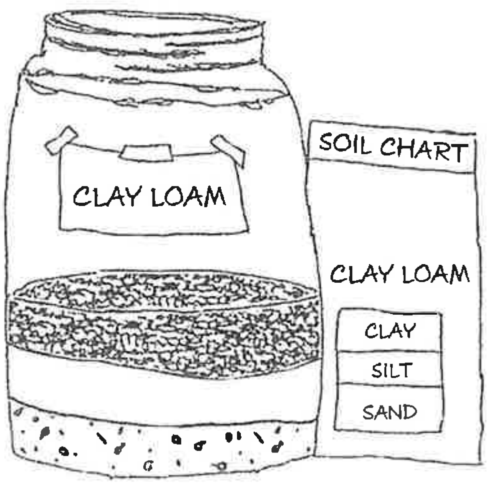
Were all of the soils the same? How did they differ? What are the three different particles in soil? Which is the biggest? Which is the smallest? What do you predict will make your soil better for gardening? Why? Which soil sample will be easiest to dig? Which will not let water drain?

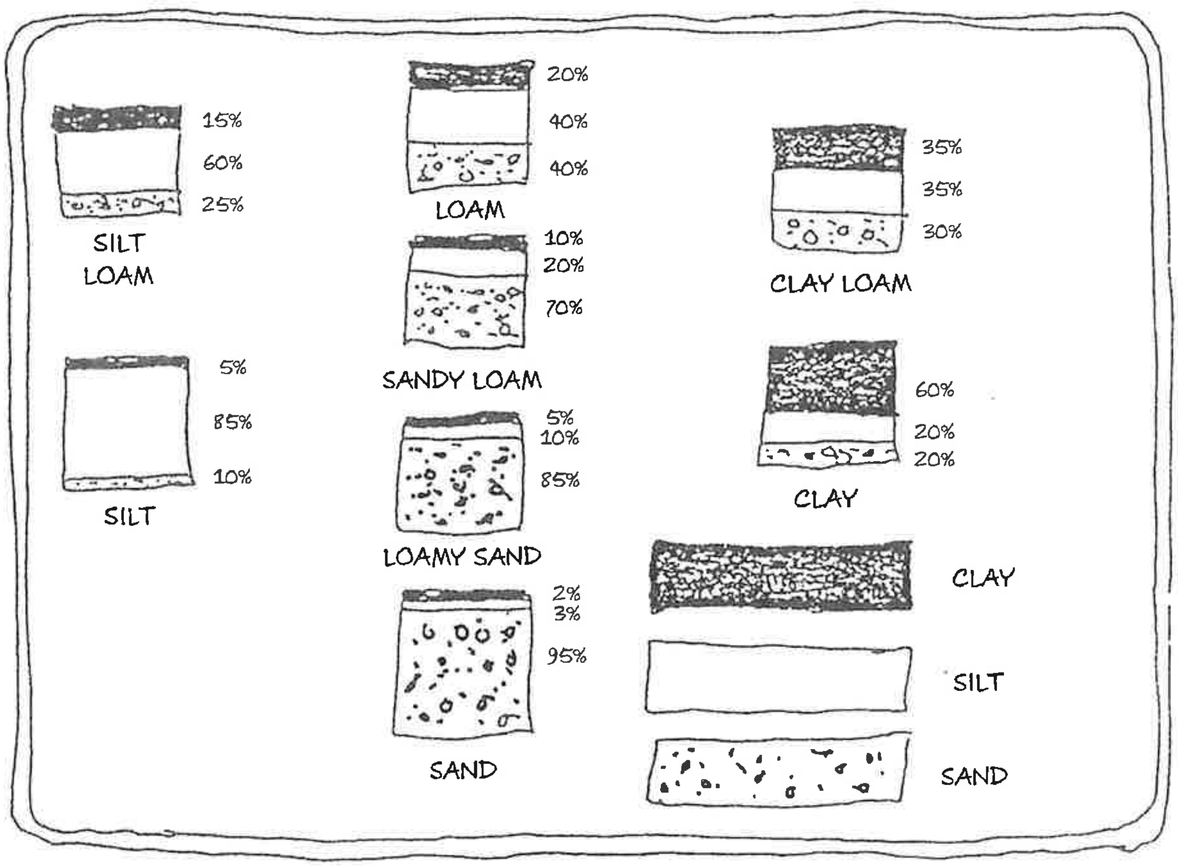
DIGGING DEEPER

Keep a soil history from year to year for comparison.

Clay, Silt, Sand Chart

(From: The Nitty-Gritty, page 83)





Differences in Soil

2nd Grade

Objective:

- Students can analyze data obtained from testing different soils to determine which soils have the properties best suited for growing certain plants (2-PS1-2)

Guiding Questions:

- How can we describe different types of soil?
- How do the properties of soil relate to whether plants can grow well?

Time: 30 min

Materials: soil samples, plastic spoons, large clear jars (one per class), scratch paper, soil worksheets, water spray bottles

Activities:

What is soil?

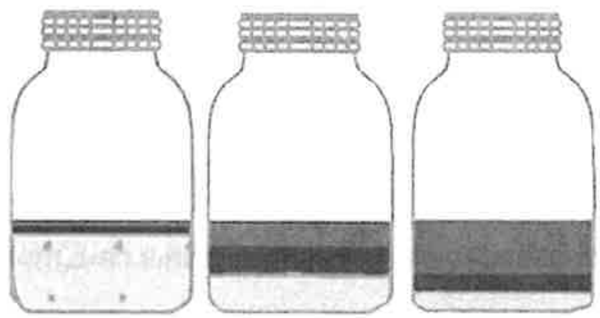
- Ask students "What is soil?" Write some defining words on the board. What do they know about soil? What is it made of? Why is it important?
- Show examples of sand, silt and clay – let students feel each. How would you describe how each feels? What are the differences between these types of soil? (size of particle)
- Sand is the largest particles (how does it feel?), silt is medium-sized (silky or floury), clay is the smallest (feels sticky, hard to squeeze)
- Soil is a combination of sand, silt, clay, and organic material (from living things - twigs, dead leaves, etc.). Organic material puts nutrients back into the soil, which plants need. (Nutrients from decomposition)

Soil Exploration

- In groups of 2, each pair is given a spoon and scratch paper and sent to different parts of the garden. Have students dig a small soil sample and put it on the paper. Have them examine it and sort it into different groups of living things – things that were alive (grass, twig, root), bigger rocks, small rocks, etc. Have students circle and tally the things they found in the soil on the soil worksheet.
- Take another sample of soil from the same location and estimate what components are in the soil using the "ribbon test". Students add water to the soil until it makes a moist ball. (Helpers can spray water into students' soil) Rub the soil together between their fingers. If the soil makes a nice, long ribbon, it has a lot of **clay** in it. If it crumbles in your hand, then it has a lot of **sand**. If it is somewhere in between it probably has a good mix – **loam**. Have students circle what soil type they think they have on the worksheet.

Soil Shake

- Let's look at another way to see what type of soil is in the garden. Fill a jar halfway with soil from a garden bed. Add water until the jar is almost full. Shake until any clumps are broken down (students can help do this). Leave the jar to settle for several hours in the classroom. The teacher can help the students classify the soil type at the end of the day or the next day as everything settles.



The Perfect Soil?

- Particular plants grow best in particular soils. In general garden plants prefer loam (a mix of all particles) and lots of organic matter. But some grow best in sandy conditions and others are adapted to clay soils. Small particles like clay can pack very close together, so water moves through it very slowly and you can often see water puddles on top of clay soil for days. What characteristics do you expect of a plant that can do well in clay soil? (Roots do not easily rot from too much water, do well in lots of water). Large particles like sand pack more loosely so water drains through it very quickly. What characteristics do you expect of a plant that can do well in sandy soil? (Does not need much water)
- Let's see what happens when a particular garden plant is placed in sandy soil, loamy soil, and high clay soil. Show the plants in the garden bed – students can check in on them the next time they come to the garden with their class to see how well they are growing in each type of soil. Is there a type of soil where the plant is growing better? Worse? Why do you think that is?

Lesson plan adapted from:

- https://growing-minds.org/documents/soil-exploration-lesson-plan.pdf/
- https://kidsgardening.wpengine.com/wp-content/uploads/2016/10/KG_lessonplans-soiltextureandcomposition.pdf

Name: ______________________________

What is soil?

Soil is a mix of **sand**, **silt**, **clay** and **organic material**.

- ______________ is the smallest sized particles.
- ______________ is the medium-sized particles.
- ______________ is the largest sized particles.
- Organic material is material from ______________.

What did you find in your soil sample?

Circle the things you found and count them using tally marks.

big rocks (bigger than a nickel)	small rocks (smaller than a nickel)
leaves or leaf bits	twigs
roots	living organisms (pill bugs, spiders, etc.)

other (describe): ______________________________

____

Date: ______________________________

Ribbon test

Using the ribbon test we think our soil sample is mostly:
(circle one)

Clay **Loam** **Sand**

Draw a picture of the results of your class jar test below:

Jar test

Using the jar test we think the garden soil sample is mostly:
(circle one)

Clay **Loam** **Sand**