







# Does Dirt = Soil? Collecting Soil Samples

## Overview:



Students will understand how topsoil is formed, why a good balance of soil components is needed for healthy plants, and how they can add components to “balance” the soil prior to planting.

## Objectives:


At the end of the lesson students will be able to:

-  **Identify** the four main components of soil.
-  **Explain** why soil type varies by geographic location.
-  **Conduct**, as a team, an experiment to determine the type of soil in a specific area in the garden.
-  **Explain** why it is important to know what type of soil is in the garden where they will be planting.

## Preparation:

-  Prior to the lesson, prepare see through bags of soil components (i.e., sand, silt, clay, and organic material).
-  Label the N, S, E, W quadrants in the garden.

## Vocabulary:

-  dirt
-  soil

## Materials:



- Y Handout: “Soil Sample Gathering Protocol” (one for each group)
- Y A cylindrical jar with four layers of soil, labeled from bottom to top: sand, silt, clay, organic material
- Y Four see through bags of soil components:
  - 1 of organic matter
  - 1 of clay
  - 1 of silt
  - 1 of sand
- Y Beach ball
- Y Frisbee
- Y Dime
- Y Water proof container to hold beach ball, frisbee and dime when you pour water over them
- Y Watering can
- Y Four large jars (with a piece of masking tape on their sides for labeling)
- Y Four trowels
- Y Liquid dish detergent
- Y Tablespoon measure




## On the Board:




- Y Soil Sample Gathering Protocol
- Y Vocabulary
- Y Student Reflection Questions

## Suggested Snack:

- Y Seven Layer Dip: <http://www.fannetasticfood.com/recipes/healthier-seven-layer-dip/>

 parent rock  
 properties/  
 characteristics

 components  
 sand  
 clay  
 silt

 amend  
 soil formation  
 organic matter

## Learning Activities:

- I. Presentation: Soil Composition (15 min.)
  - A. In the garden, introduce the lesson by reviewing the four objectives.
  - B. Have students take notes in their journals about the different layers and characteristics. Students could also write down the questions you ask with their answers.
  - C. Ask students: Are dirt and soil the same thing? Why or why not?
    - *Dirt* often has negative connotations (something is “dirty” and therefore not desirable).
    - *Soil* is used to describe the medium where plants can grow successfully if it has the right combination of components.
  - D. Explain **soil formation**: When *parent rock* material is exposed to the atmosphere (e.g., wind and rain) and crumbles into small pieces, or when organic matter and/or minerals are deposited on the earth's surface, *soil formation* begins. The type of parent material and how the soil is formed will greatly influence the properties/characteristics of the soil.
  - E. Ask students: What four components do you think are in the soil in our garden?
    - Healthy soil contains organic matter and mineral matter (which includes: clay, silt, and sand).
    - Pass around the see through bags with each component. Ask them to explain the differences in physical characteristics of each component including the size, shape, and color of each.
  - F. Ask students: Which component do you think is the largest and weighs the most? (sand)
    - Demonstrate the relative sizes of each. Compare sand to a beach ball; silt to a frisbee; and clay to a dime.
  - G. With a watering can pour water onto each of these objects that you have placed in a container so students can see what happens:
    - With the sand granule/beach ball, the water runs off.
    - The silt granules/frisbee are rounded on the edges so the water will flow through them (but not as fast as through sand).
    - The clay granules/dime are thin, flat, and small and overlap to form a barrier so that water will pool on top.
  - H. Ask students: Is soil different in different parts of our city?
    - Why, or why not?
    - Is the soil at the beach the same as in our garden? Why? or Why not?

- Is soil the same here as 20 miles east of us?
  - Why is it important to know about the soil composition where you will be planting? (Because different kinds of plants grow well in different types of soil.)
- I. Have students make a statement in their garden journal about what a healthy soil sample would look like. Have them explain what would be in the thickest layer and why and continue to the thinnest layer. Have them include a sketch with justifications of layer thicknesses.
  - J. Hold up the cylindrical jar with four layers of soil components. Tell students that this is one example of what a good combination of soil components looks like. Starting from the bottom: 30% sand, then 40% silt, then 20% clay, and finally, 10% organic material at the top. Pass the jar around for all to see.
  - K. Tell students that to get this sample, we dug some soil out of a garden, added water and a little dish detergent (one tablespoon), shook the container up and down, and waited 24 hours for the components to settle into these four layers.
    - Ask students: Which component of soil is heaviest? (sand) The lightest? (organic matter)
    - Which ingredient has most air in it? (organic matter) Least air? (clay)
    - Which type of soil has the largest granules? (sand: 2mm-.0500mm)
    - Which has the smallest granules? (clay: less than .002 mm)
    - Which has medium-size granules? (silt: .0500-.002mm)
    - Which type of soil (i.e., which proportion of organic matter, clay, silt, and sand) will be best for planting most kinds of vegetables & why? (organic matter [10%], clay [20%], silt [40%], sand [30%]; This ensures that the water and nutrients in the soil reach all the way down to the plants' roots. This combination also helps to physically support the stems of plants as they grow).
2. Garden Activity: Collecting Soil Samples (15 min.)
- A. Review with the students where the north, south, east, and west quadrants are in the garden.
  - B. Divide the class into four groups. Give each group a jar and assign them to a quadrant. Have them label their jars with: team name, date, and garden quadrant.
  - C. Review the "Soil Sample Gathering Protocol" written on the board.
  - D. Have each group go to their quadrant to collect a soil sample.
  - E. Assist the students as they add dish detergent and water to their jars.
  - F. When they are finished, bring the class back together and tell students that at the next class they will examine and analyze the layers of the different soil components in their samples.

G. Conclude by telling students that understanding your soil type will help you know how to properly amend, plant, and water so that you have healthy, disease-resistant, and pest-resistant fruits and vegetables.

3. Snack: Serve Seven-Layer Dip with corn tortilla chips. (5 min.)
4. Have students answer the Reflection Questions in their garden journals. (5 min.)

### Student Reflection Questions:

1. Is there a difference between the terms “soil” and “dirt”? If yes, what is the difference?
2. Based on how your soil sample in your hands felt today, what do you think the composition will be when you measure the layers in the next lesson? (What percentage sand, what percentage silt, etc.?)

### Assessment Questions:

1. List the four main components of soil.
  - **organic matter, clay, silt, and sand**
2. Of these, which has the largest and heaviest grain?
  - **sand**

### Standards:

#### Next Generation Science Standards

- NGSS - CCC Cross Cutting Concept

#### Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

- NGSS-SEP Science and Engineering Practices

#### Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

- NGSS-DCI Disciplinary Core Idea

ESS3.A: Natural Resources Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

**Common Core State Standards**

Integration of Knowledge and Ideas:

- CCSS.ELA-LITERACY.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).



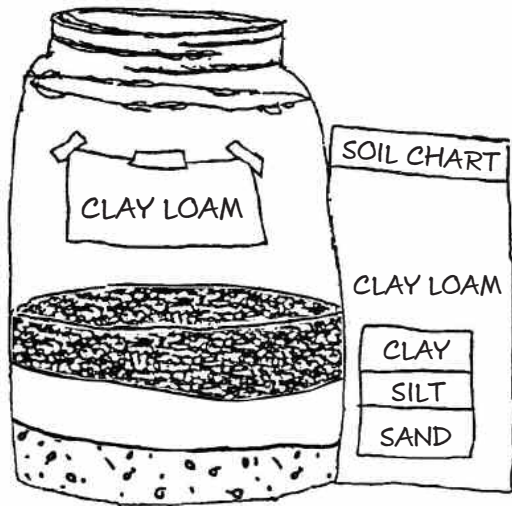
# Soil Sample Gathering Protocol

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1. Remove as much surface organic matter as possible before taking your soil sample by using something to scrape away loose material above your dig site.
2. After that, use your trowel to dig down about six-eight inches and put approximately one cup of soil into your jar.
3. Add approximately one tablespoon of beads or dish detergent to the jar (this will help the components separate into layers over the next 24 hours).
4. Fill the jar with water almost to the top.
5. Shake the jar vigorously for several minutes to get the soil moistened.
6. Write on the jar label: Team #, date sample taken, and garden location (N,S, E or W) where sample was obtained.
7. Bring the jar back into the classroom and let it stand undisturbed until you come back in 24 hours or more.

# 🍏 Clay, Silt, Sand Chart

(From: The Nitty-Gritty, p. 85)



## IDEAL COMPOSITION

10% Organic Matter
20% Clay
40% Silt
30% Sand

