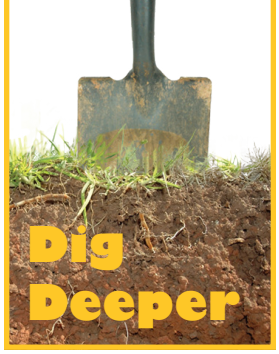
Soil Lessons

Soil Science Society of America

Soil Texture Analysis



Instructional Value

Soil Physical Properties

Grade Level: 2-5

Type of Lesson

Initial demonstration

Materials Needed

Quart jar with lid, large mouth
1-2 cups of soil
Water
Calgon/non-sudsing soap (optional)
Marking pen or whiteout

Time

Teacher prep time:
20 minutes to gather materials
Student class time:
30 minutes initially and then observation over a day or two

Student Learning Objectives

a. To explain the different sizes of soil particles.
b. To demonstrate that soil particles settle based on particle size
c. To understand how the soil texture triangle works

Keywords

Texture, sand, silt, clay, nutrients

Overview

Pick up a handful of soil and you can feel how fine or coarse it is. That feel comes from the size and relative proportion of mineral particles in the soil, and is known as soil texture. The particles that make up soil are categorized into three groups by size: sand, silt, and clay. Sand particles are the largest and clay particles the smallest. **(Fig.1)** The relative percentages of sand, silt, and clay are what gives soil its texture.

The soil texture triangle is used to determine the name of the soil texture. There are 12 soil textural classes. (Fig.2a) This triangle is used so terms like "clay" or "loam" always have the same meaning. Each texture corresponds to specific percentages of sand, silt, or clay.

Although a soil could be all sand, all clay, or all silt, that is rare. Instead most soils are a combination of the three. A clay loam texture soil, for example, has nearly equal parts of sand, slit, and clay (Fig.2b) and a soil with 15% clay, 20% silt, and 65% sand has a sandy loam texture. (Fig.2c)

When referring to loam one is only indicating that the soil has a given percentage of sand, silt, and clay; there is no mention of whether or not that soil has any organic matter in it or not. Knowing the texture helps us manage the soil.

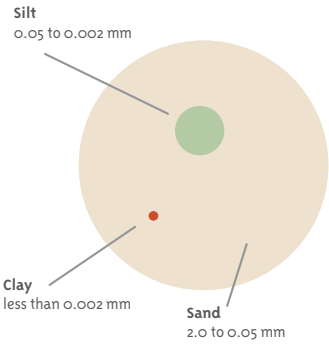


Fig. 1. Relative sizes of sand, silt and clay particles.

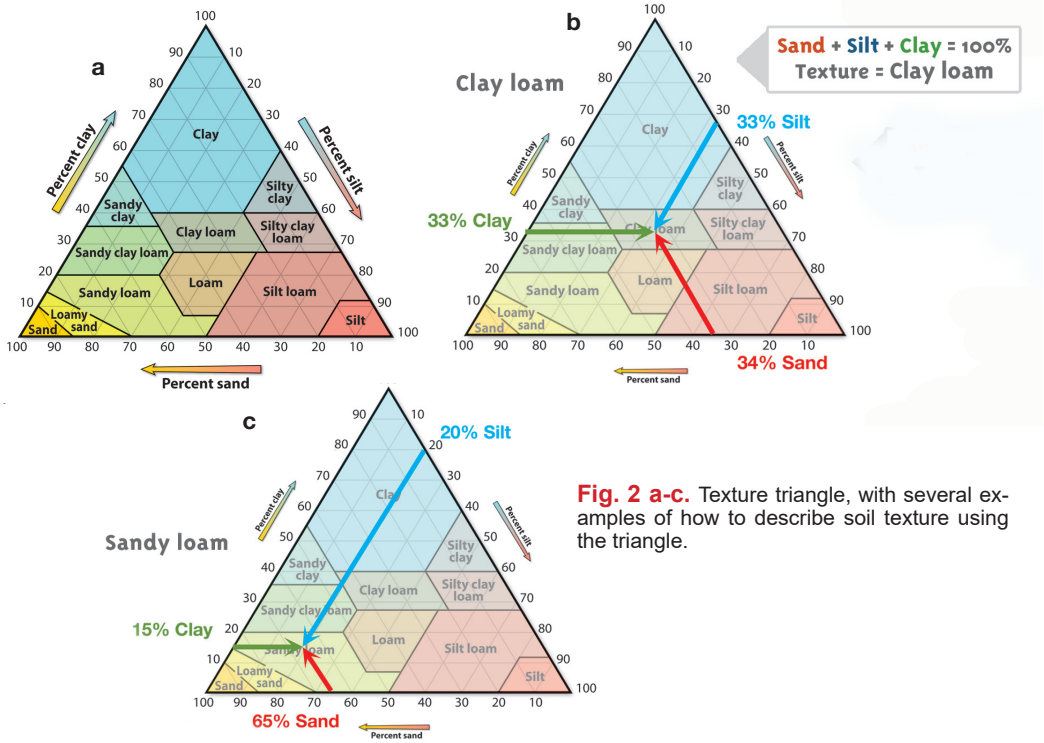
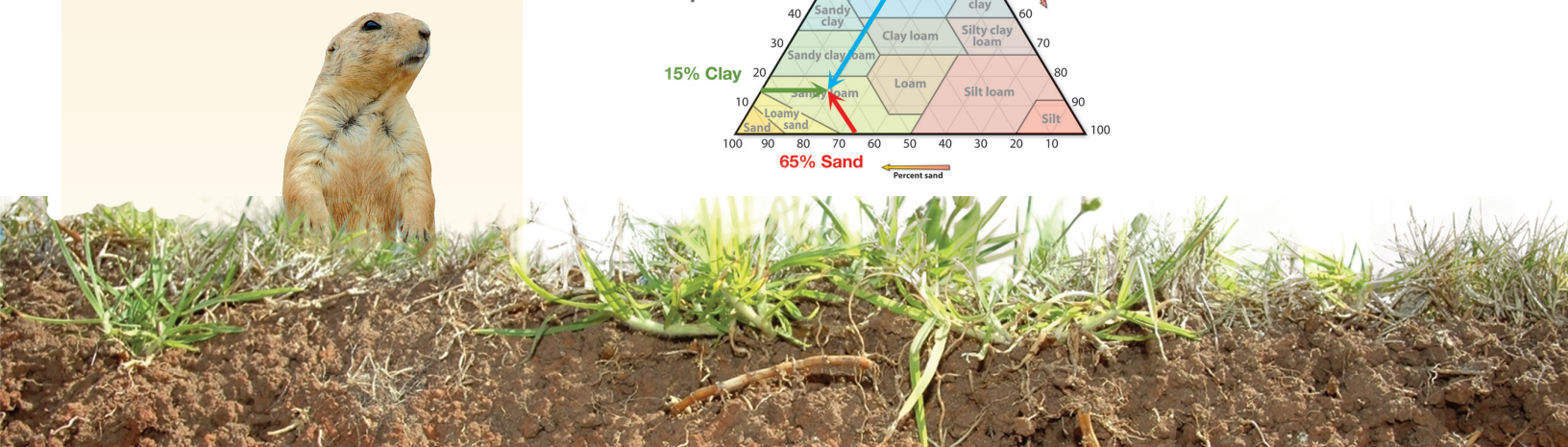


Fig. 2 a-c. Texture triangle, with several examples of how to describe soil texture using the triangle.



Adapted from experiments developed by Ted Sammis, New Mexico State University, and the University of California, www.ucanr.edu

Method

A simple method to estimate the percent sand silt and clay in a soil and determine it texture.

1. Gather a quart jar with a lid and a large mouth.

2. Gather soil. If the soil has a covering of organic matter (compost, plants) scrape that off digging the soil. Remove roots.

3. Fill the jar half full of soil. Wet the soil to a mud consistency and tap the jar to settle the soil.

4. Mark the level of soil on the jar with a marking pen or whiteout.

5. If you have Calgon/non-sudsing soap, put a full teaspoon in the jar.

6. Add water to the top of the jar and shake the soil water mix till the soil is all mixed up in the water

7. Put the jar on a table and let the soil settle out for 40 seconds, mark the level of soil on the jar. This is sand portion in the soil.

8. Wait 6 hours and mark the level of the soil in the jar. The difference between the bottom mark, which is the sand, and the second mark up is the silt portion of the soil. The total sand plus silt is the distance from the bottom of the jar to the second mark.

9. Calculate the percent sand, silt and clay by measuring the depth of the soil by measuring the distance from the bottom to the first mark up in inches which is the sand fraction, the distance from the first mark up to the second mark up which is the silt fraction and the distance from the bottom to the third mark up from the bottom which is the sand plus silt plus clay fraction.

Sometimes, when all the sand silt and clay has settled, the height of the soil is higher than when you marked the jar after making a mud solution. This can only be determined by letting the jar sit for several days. If you have the time to do this, a more accurate calculation of % sand silt and clay can be determined based on this new measured total height.

10. The percent sand is the depth of the sand divided by the depth of the total soil

11. The percent silt is the depth of the silt divided by the depth of the total soil

12. The percent clay is 100 minus the percent sand plus silt. Or use the following formula …

Calculate the percentage of each soil texture using these formulas:

$$\% \text{ SAND} = \frac{\text{Sand Depth}}{\text{Total Depth}} \times 100$$

$$\% \text{ SILT} = \frac{\text{Silt Depth}}{\text{Total Depth}} \times 100$$

$$\% \text{ CLAY} = \frac{\text{Clay Depth}}{\text{Total Depth}} \times 100$$

13. Record data in box. (insert box)

14. Locate the number that represents the percentage of sand in the soil sample along the bottom of the soil texture triangle. At each number, two lines enter the triangle; hold a ruler, pencil or finger along the left line.

15. Find the number that represents the percentage of silt in the soil along the right side of the texture triangle. Follow with a finger or a lay a ruler or pencil down on the diagonal line that emerges from the silt percentage number.

16. Find the point where the two lines intersect. Follow the line that emerges to the left of the intersection point back to the left side of the triangle, where it reaches the percentage of clay, and make sure that the percent clay on the chart is the same as the percentage calculated from the soil sample.

17. Read the textural class that the point of intersection falls into. For example, a soil sample that is 40 percent sand, 40 percent silt and 20 percent clay is a loam, whereas a sample that is 10 percent sand, 45 percent silt and 45 percent clay is a silty clay.