

Understanding the Soil Triangle

Grade Level: 4-8

Lesson Overview

Students will use the soil triangle to find what types of soil they have and to find various geometric shapes found within the triangle.

Student Objectives

1. Use soil triangle to find type of soil from the percent of sand, silt, and clay found in the soil samples.
2. Students will work with soil textures to decide what their capacities are for plant growth.
3. Identify and locate geometric shapes and patterns within the soil triangle.

Materials

- ✓ Soil Triangle worksheet
- ✓ Geometric Shapes worksheet (an extension lesson)

Vocabulary

- **clay** - smallest of the three soil particles, when wet feels sticky, when dry, hard and brick-like.
- **nutrient**- substance that living things need to carry out their life processes.
- **sand**- very tiny rock fragments; largest and heaviest of soil particles; feels gritty.
- **silt** - medium-sized soil particles; feels like flour.
- **soil** - the outer portion of the earth's surface. Soil is the foundation of every living thing.
- **soil texture**- the way a soil feels.
- **soil texture triangle** - is used to determine soil textural class from the percentages of sand, silt, and clay in the soil.

Background Information

Texture is the “feel” of your soil. 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. Most soils are a combination of the three. The relative percentages of sand, silt, and clay are what give soil its texture.

The soil texture triangle is one of the tools that soil scientists use to visualize and understand the meaning of soil texture names. The textural triangle is a diagram which shows how each of these 12 textures is classified based on the percent of sand, silt, and clay in each. 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.

The 12 categories of soil texture are: clay, sandy clay, silty clay, sandy clay loam, clay loam, silty clay loam, sand, loamy sand, sandy loam, loam, silt loam, silt. Although a soil could be all sand, all clay, or all silt, that is rare. Instead most soils are a combination of the three.

The sides of the soil texture triangle are scaled for the percentages of sand, silt, and clay. Clay percentages are read from left to right across the triangle. Silt is read from the upper right to lower left. Sand is read from lower right towards the upper left portion of the triangle.

Texture is one of the most important properties of a soil, and it greatly affects crop production, land use, and management. Soil texture is directly related to nutrient retention and drainage capabilities.

Loam soils are best for plant growth because sand, silt, and clay together provide desirable characteristics. Three of these characteristics are water-holding capacity, permeability, and soil workability.

Qualities of Soil Textures

Soil texture	Holds Nutrients	Water Infiltrates	Water Holding	Aerated	Workable
Clay	Good	Poor	Good	Poor	Poor
Silt	Medium	Medium	Medium	Medium	Medium
Sand	Poor	Good	Poor	Good	Good
Loam	Medium	Medium	Medium	Medium	Medium

Procedure

1. As an interest approach, have students complete the What is Soil? lesson and/or a classroom soil slurry. If possible, show students sample of sand, silt, and clay for reference before beginning this lesson (sand, silt and clay samples can be purchased from <https://agclassroomstore.com/soil-samples-soil-texture/>).
2. Introduce the soil triangle to students.

3. Do the example problems with students and then have them work in pairs to complete the worksheet.
4. Students could also use the chart below to label the features of each of their soils.

Extension Activities

1. Geometric shapes within the soil triangle: Teacher will review geometric shapes with students. Students will search the soil triangle for all the following geometric shapes:
 - Hexagon
 - Pentagon
 - Trapezoid
 - Rhombus
 - Triangle

Provide more than one copy Geometric Shapes worksheet per student to allow students to search for each shape. Also note that no answer key is included in this lesson, because the answers will vary dependent on student grade level.

2. What is Soil? lesson which includes soil slurry (finding out the percentages of sand, silt, and clay from a soil sample).
3. Edible Soil Profile found in the Soil Logic Puzzle lesson as a hands-on culminating activity.

Additional Resources

- <https://youtu.be/AUhOBxVFcFk> Taking soil from garden and doing soil sample to find out what type of soil.
- <https://youtu.be/8nU26sXVNS4> Purdue University professor explaining soil texture and how to use the soil triangle.
- <https://youtu.be/cNx4czkFLbA> How to use the soil triangle with problems for students to do.

Standards

Illinois Mathematics Standards

4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two -dimensional figures. 1 - 3 2 - 6%.

4.G.2 Classify two -dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

4.G.3 Recognize a line of symmetry for a two -dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line -symmetric figures and draw lines of symmetry.

Illinois English Language Arts Standard

RST 1: Cite specific textual evidence to support analysis of science and technical texts.

The **M**ultidisciplinary **A**gricultural **I**ntegrated **C**urriculum (mAGic) was created in 2004 under the leadership of the Illinois State Board of Education (ISBE) and the Facilitating Coordination in Agricultural Education Project (FCAE). Funding was made available through the FCAE grant budget from the agricultural education line item of the ISBE budget. This revision, as printed, was developed in April 2021.



These mAGic lessons are designed to bring agriculture to life in your classroom. They address the Illinois Learning Standards in math, science, English language arts and social studies.

Soil mAGic project update writers/reviewers: Rhodora Collins – Dekalb County; Suzi Myers – Kane County; Connie Niemann – Montgomery County; Debbie Ruff – Livingston County; Jennifer Waters – Sangamon County; and Dawn Weinberg – Hancock County.

Name _____

Soil Triangle Worksheet

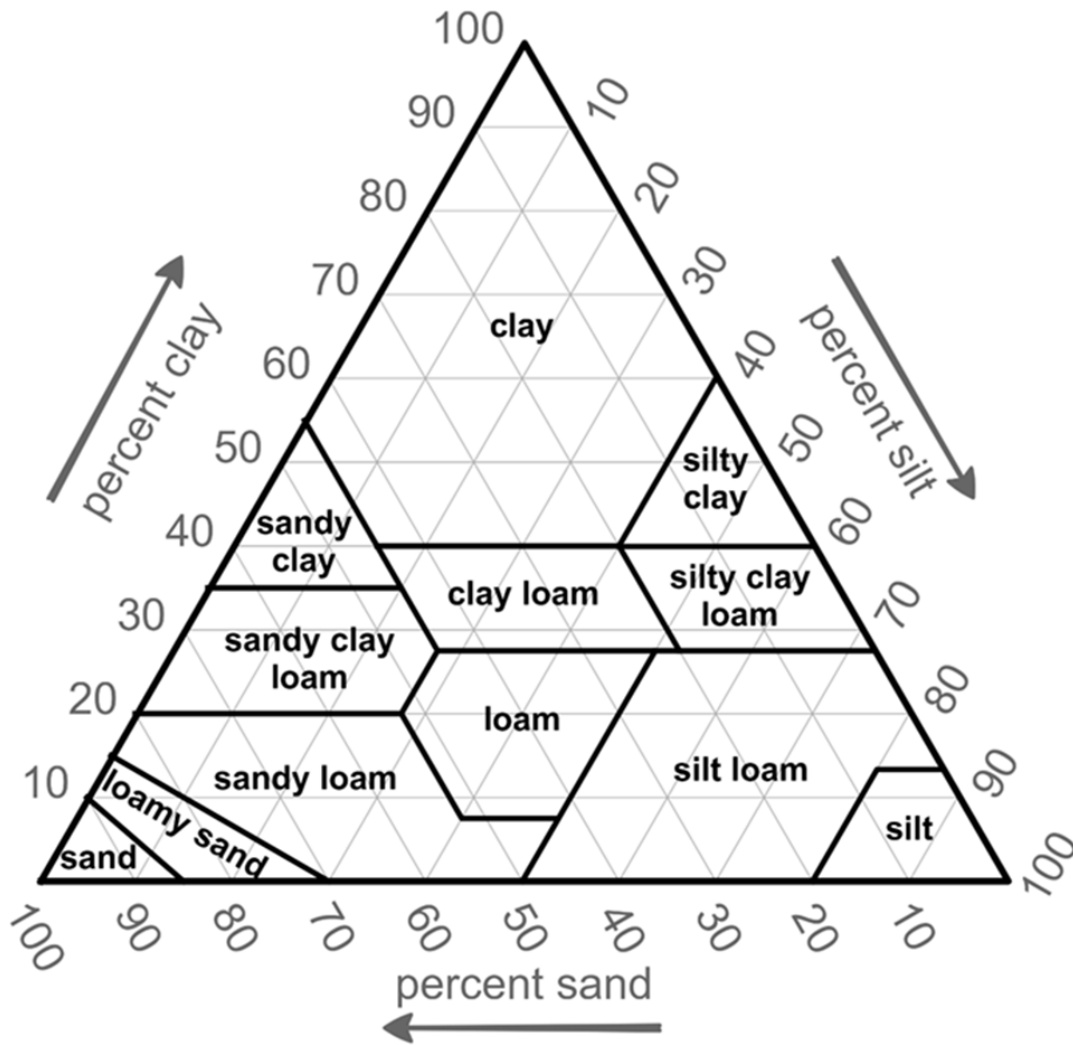


Image source <https://doi.org/10.1371/journal.pone.0131299.g001>

Complete the table by using the soil triangle. If a % is missing, do the calculations and add to chart. (Remember, the sand, silt and clay percentages must equal 100%.)

% of sand	% of Silt	% of clay	Soil type
75	10	15	
27	52		
64		6	
	10	40	
42		37	
	35	50	
36	34		
10		42	
80	15		
20		10	

Soil Triangle Worksheet ANSWER KEY

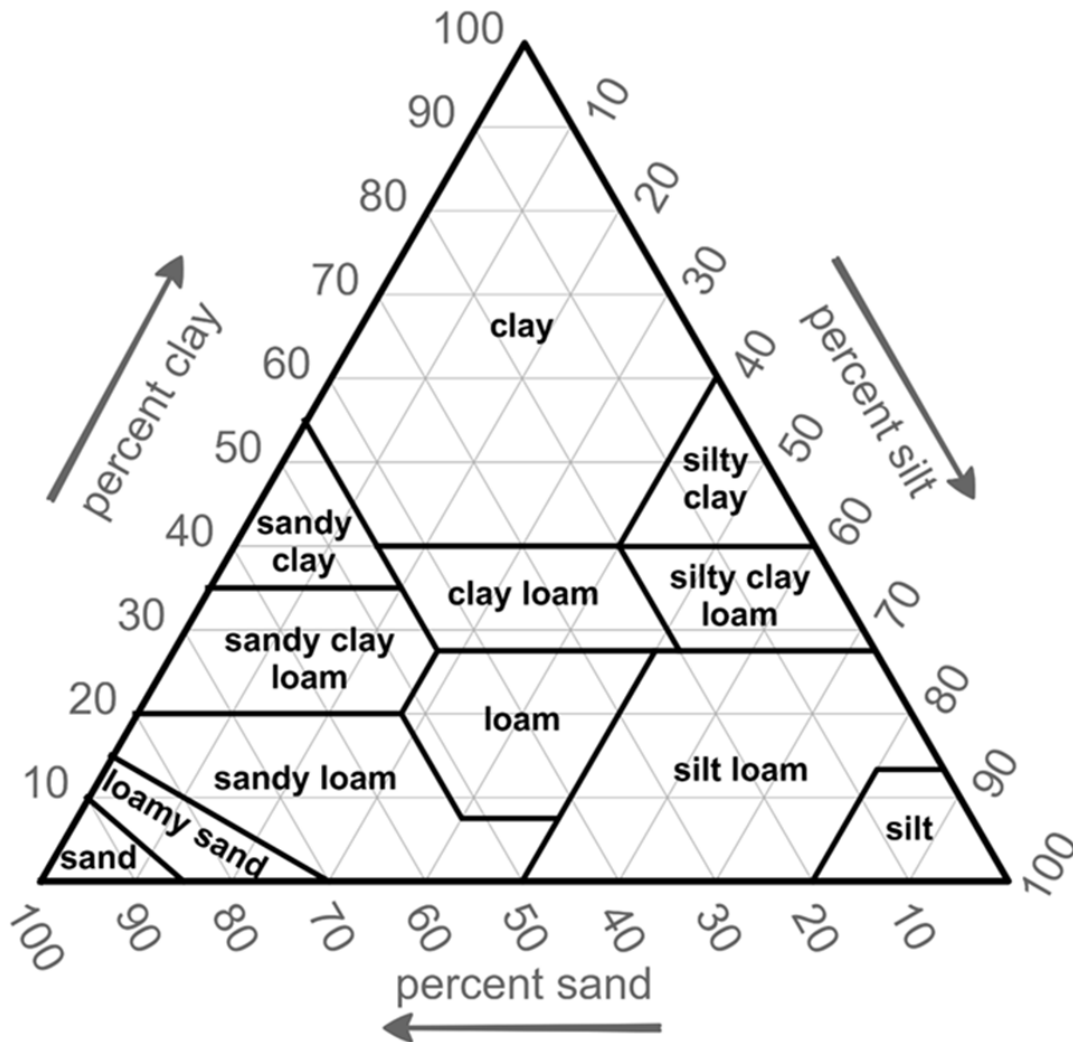


Image source <https://doi.org/10.1371/journal.pone.0131299.g001>

Complete the table by using the soil triangle. If a % is missing, do the calculations and add to chart. (Remember, the sand, silt and clay percentages must equal 100%.)

% of Sand	% of Silt	% of Clay	Soil Texture
75	10	15	Sandy loam
27	52	21	Silt loam
64	30	6	Sandy loam
50	10	40	Sandy clay
42	21	37	Silt loam
15	35	50	Clay
36	34	30	Clay loam
10	48	42	Silty clay
80	15	5	Loamy sand
20	70	10	Silty loam

Name _____

Geometric Shapes in the Soil Triangle Worksheet

How many of these shapes can you find in the soil triangle?

Fill in the blanks below with the correct number. Count carefully so you don't miss any.

Good luck!

I found _____ triangles in the soil triangle.

Did you find a pattern? _____

What was it? _____

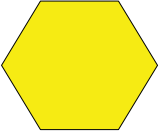
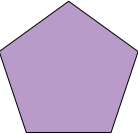

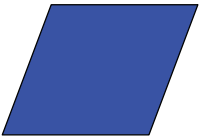

I found _____ rhombuses in the soil triangle.

I found _____ trapezoids in the soil triangle.

I found _____ pentagons in the soil triangle.

I found _____ hexagons in the soil triangle.

Why are there no circles or squares on the soil triangle? _____

Figure	Name	Description
	Hexagon	This is a polygon with six sides. A hexagon is both equilateral (all sides of equal length), and equiangular (all interior angles of equal measure).
	Pentagon	This is a polygon with five sides and five angles
	Trapezoid	This figure has four sides and exactly one pair of opposite sides parallel. The trapezoid is isosceles; the two sides that aren't parallel are the same length.
	Rhombus	This figure has four sides of equal length. Opposite sides are parallel.
	Triangle	This isosceles triangle is another regular polygon. It is both equilateral and equiangular.