W1382

What is Soil Texture Made of?

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Skill Level
Intermediate (6-8 graders)

Educational Standards Supported

Learner Outcomes
The learner will be able to:

- Define soil texture and describe how sand, silt and clay differ
- Classify soil using the USDA soil texture triangle and the texture-by-feel flowchart
- Explain why soil texture matters for water movement, nutrient holding and plant growth
- Apply observation and critical thinking skills to analyze soil samples in real-world contexts

Tag(s)
4-H Sciences
Plant Sciences

Time Needed
60 minutes

Materials Needed (per group)

- Less than 2 tbsp soil sample preferably with known textural class
- Spray or squeeze bottle with water
- Dropper for adding water
- Student Handout: Texture-by-feel flowchart (Reference Tool 1)
- USDA Soil Texture Triangle (Reference Tool 2)
- Optional – soil sample probes, small shovels or trowels for gathering your own soil sample to texturize

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Introduction to Content
Soil texture tells us how much sand, silt and clay are in the soil. Together, these three types of particles can be added to equal 100 percent of the soil. Each type is a different size—sand is the largest, silt is medium-sized, and clay is the smallest. The size of these particles affects how the soil feels and how it holds water and nutrients. Because there are many possible combinations of sand, silt and clay in nature, scientists group soils into textural classes or textural grades. In the United States, there are 12 texture classes. Scientists use a special tool called the soil texture triangle to figure out which class a soil belongs to. The United States Department of Agriculture (USDA) developed this system to help people understand and compare different types of soil.

Introduction to Methodology
Students will participate in a hands-on activity, discussion and reflection during this lesson.

Teacher Talk
Keep in mind this activity can get messy. Be prepared with water and towels.

Terms/Vocabulary/Concepts

Soil – The upper layer of earth in which plants grow, typically consisting of mineral and organic material

Soil texture – The proportion of sand, silt, and clay particles in the soil

Sand – The largest of three primary mineral particles ranging in size from 0.05 mm to 2.0 mm in diameter

Silt – Larger than clay, but smaller than sand, this soil particle is between 0.002 and 0.05 mm in diameter

Clay – The smallest soil particle; less than 0.002 mm in diameter

Erosion – The process where soil, rocks, and other minerals are worn away and moved from one place to another by natural forces such as wind, water or ice

Coarse and moderately coarse textures include sands, loamy sands and sandy loams:

- Drains well and allows water to soak in quickly but may not hold water well
- May be less likely to erode or wash away
- Does not hold nutrients well

Medium and moderately fine texture include loams, silt loams, silt, sandy clay loams, silty clay loams and clay loams:

- Drains moderately well and allows water to soak in at a medium rate
- Offers a balance of holding both nutrients and water

Fine textures include clays, sandy clays, silty clays:

- Soaks in water more slowly
- May be more likely to erode or wash away
- Typically can hold water and nutrients better than coarse or medium-textured soils

Setting the Stage/Opening Question

Say, “Hello, everyone! Today we are going to do something you may never have done before. We are going to be soil scientists.”

If possible, take the students outside.

Explain that they have one minute to look around and engage their senses. Say, “Remember the senses you have are seeing, hearing, smelling, touching, and what’s the last one? Can anyone help me?” **ANSWER – Taste**

Say, “Oh yes, taste. Well let’s not use that one. But the others – let’s engage your senses to what’s going on around you. Listen, watch, smell, and you can even touch. At the end of a minute, we will come back together and discuss.”

When the minute is over, ask students what they saw, heard, touched or smelled. If anyone says something about dirt, grass, the ground, etc., say, “YES! And that’s what we are going to learn about today. In this activity, you will have the opportunity to learn about soil texture through touch by using the texture-by-feel flowchart and soil texture triangle.”

Take students back to the classroom and break them into groups of two to three. Pass out Student Handout.

Experience

1. Have students place about a teaspoon of soil into the palm of their hands. Make sure there is extra soil that can be added in case the sample becomes too wet.

2. Add enough water, a few drops at a time, to the soil so that the entire amount becomes wet but not so much that the soil is dripping out of their hands. Different textures will need different amounts. Using a dropper can provide more control when adding water.

3. Let the students feel the soil in their hands for a few moments. See the section, "Strategies for Student Engagement" for questions to ask during this time.

4. Use the texture-by-feel flowchart on the next page to identify the soil texture class. This would be a good time to talk about the many years of experience professional soil scientists have and that they may not get the correct texture the first time (and that's okay!).

Be sure to ask the students the questions in the flowchart and incorporate their opinions into the identification process.

5. Once a texture class is decided, use the texture triangle to identify the possible percentages of sand, silt and clay in the soil sample. Be sure to have the students wash their hands or use hand sanitizer after the completion of the soil texture activity.

Pass out a copy of Figure 2 – Texture Triangle.

Say, "Use the texture triangle, and start by choosing a component: sand, silt or clay. In figure 1, clay is along the left side of the triangle, silt is along the right, and sand is at the bottom."

Strategies for Student Engagement

Questions that can be posed to students during this activity:

- How does the soil feel in your hands?
- Does it have a smell?
- Any ideas why the color is what it is?

Questions that can be posed after this activity, once a texture is determined:

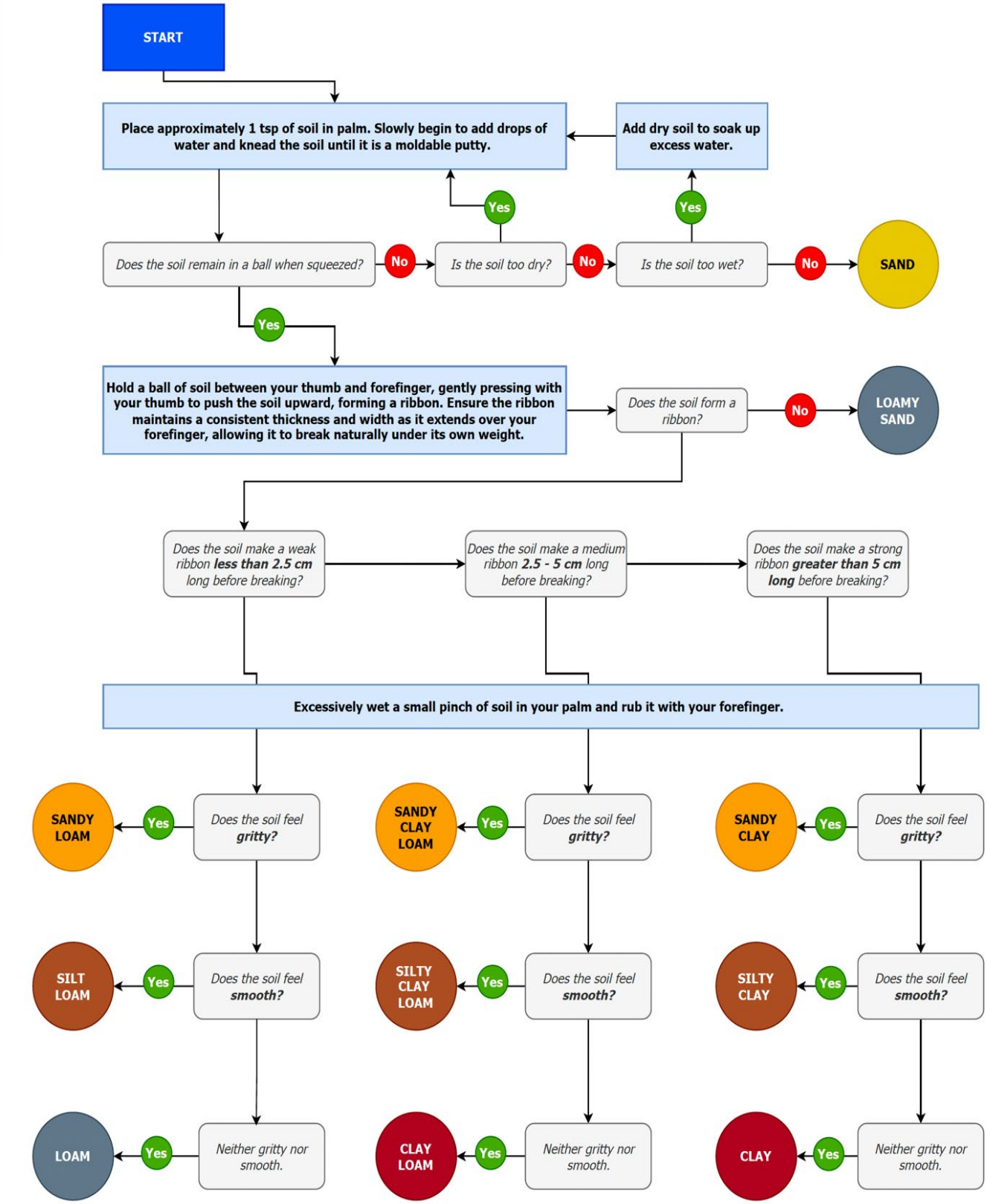
- How quickly might this soil texture soak up water?
- How well might this soil texture hold water?
- How well might his soil texture hold nutrients?
- Which plants might grow well in this soil texture?
- What special steps might need to be taken to keep plants happy in this soil texture with respect to water and fertilizing?

Optional experience addition:

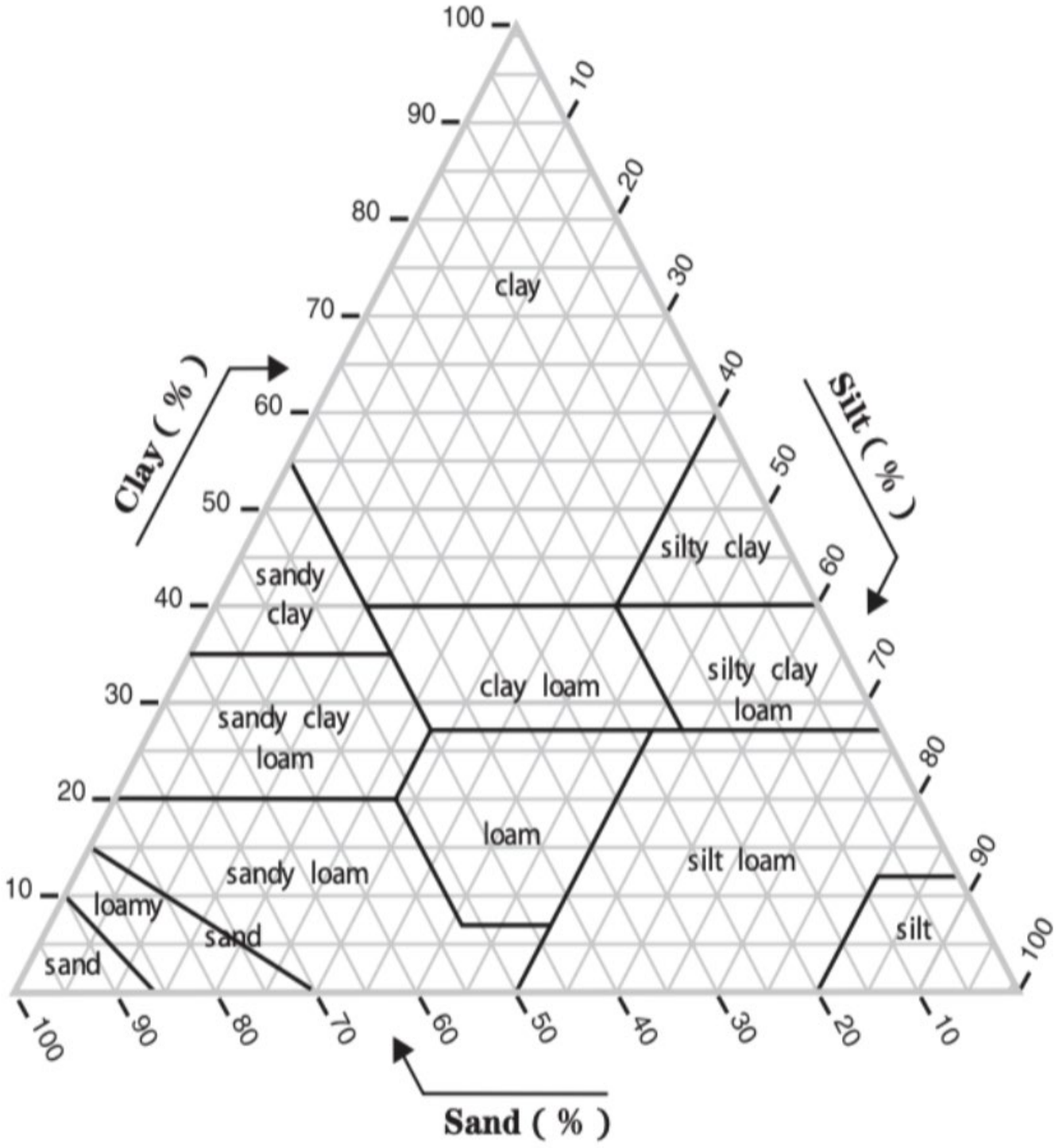
Students take their own sample. Using a soil probe, small shovel or trowel, have the students take their own soil sample. Be aware this is considered destructive sampling because there will be holes left behind in the ground. Depending on where the students are when conducting the activity, permission may be needed to take the soil from the ground. After taking the samples, the holes should be refilled to the best of your ability. This also has the potential to add about 30 extra minutes depending on the number of students and how many tools are available. This addition can significantly alter the amount of time the lesson takes, extending beyond the estimated 60-minute time.

STUDENT HANDOUT

Names:



Reference Tool 1 - Flowchart to determine soil texture by hand-feel method. Modified from NRCS (2022) and S.J. Thien 1979.



Reference Tool 2 – Texture Triangle

Share
Ask the students if there are any differences in opinions on the determination of soil texture class.

Process
If time permits, the students can go through the process again with a different soil to see who can get the closest to the correct texture class.

Ask about their interpretations of the way the soil feels and how that influenced their decisions throughout the process.

Be sure to remind the students that professional soil scientists have many years of training, so it's okay if they don't get the correct texture.

Apply
Provide printouts or links to the flowchart and texture triangle and students can practice this at home with soil from their gardens and backyards.

References

Natural Resources Conservation Service (2022). National agronomy manual (Title 190, 5th ed.). U.S. Department of Agriculture. https://www.nrcs.usda.gov/sites/default/files/2022-10/National-Agronomy-Manual.pdf

Natural Resources Conservation Service (2022, November). Soil texture by feel method. U.S. Department of Agriculture. https://www.nrcs.usda.gov/sites/default/files/2022-11/texture-by-feel.pdf

Thien, S. J. (1979). A flow diagram for teaching texture-by-feel analysis. Journal of Agronomic education, 8(1), 54-55.

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