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Determining Soil Texture by Feel

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What is soil texture?

Soil texture refers to the proportion of sand, silt, and clay in a soil. Texture influences almost every aspect of soil use, both in agricultural and engineering applications, and even how natural ecosystems function. Many scientists consider soil texture the most important soil property as it can influence soil/water relationships, gas exchange, and plant nutrition. Accurately determining soil texture in a lab requires time and money; therefore, it is often necessary to estimate soil texture in the field by feel, which can be very accurate if done correctly.

What gives soil its texture?

The three building blocks of soil—sand, silt, and clay—feel very different and lend different properties to a soil. Although the three types of soil particles are differentiated by their size (Table 1), which is a physical property, the relative amount of each of these components has a large influence on the physical, chemical, and biological properties of a soil. The pore spaces between soil particles are largely responsible for the amount of water a soil can hold. Finer soil textures have greater surface area, smaller soil pores, and slower water infiltration into the soil profile.

- **Sand** is the largest soil particle, measuring 0.05 to 2 mm in diameter, and can be seen by the naked eye. Sand feels gritty to the touch and holds very little water.
- **Silt** is the medium-sized component of soil, measuring 0.002 to 0.05 mm in diameter. Dry silt particles feel like flour or baby powder. When wet, silt will feel smooth. Silt only holds a moderate amount of water.
- **Clay** is the smallest particle in the soil, measuring less than 0.002 mm in diameter, and can only be seen with powerful microscopes. The largest clay particle is 25 times smaller than the largest silt particle and a thousand times smaller than the largest sand particle. Clay will feel sticky when wet and hard and brittle when dry. Clay can hold much more water than sand or silt. In most soils, clay content increases with depth.

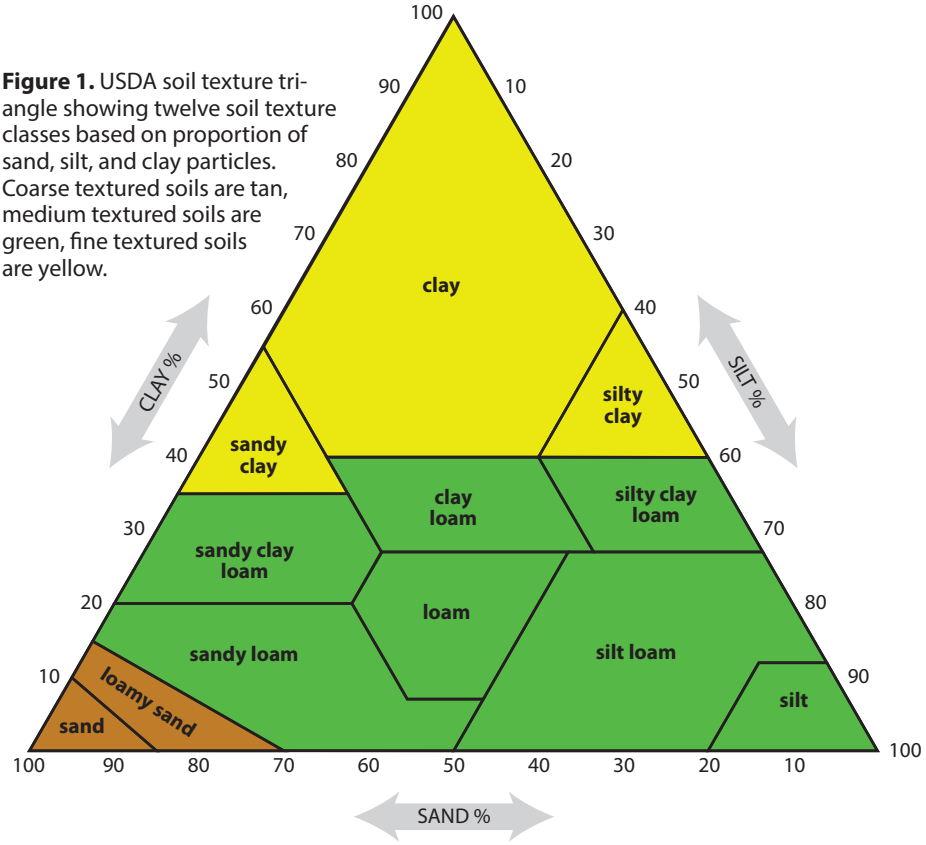


Figure 1. USDA soil texture triangle showing twelve soil texture classes based on proportion of sand, silt, and clay particles. Coarse textured soils are tan, medium textured soils are green, fine textured soils are yellow.

Table 1. Particle sizes for soil separates

Soil Separate	Diameter (mm)
Clay	<0.002
Silt	0.002 to 0.05
Sand	0.05 to 2.0
Very fine sand	0.05 to 0.10
Fine sand	0.10 to 0.25
Medium sand	0.25 to 0.5
Coarse sand	0.5 to 1.0
Very coarse sand	1.0 to 2.0

How are soil textures classified?

Soils are divided into three broad texture groups—coarse-textured soils, medium-textured soils, and fine-textured soils (Figure 1). A **coarse-textured** or sandy soil has 70 to 100 percent sand-sized particles. Because of the strong properties clay exhibits, a soil only needs to have 35 to 40 percent clay-sized particles to be considered **fine-textured** or clayey. Finally, the **medium-textured** soils or loams have a more even distribution between clay and sand particles.

The United States Department of Agriculture (USDA) soil texture triangle (Figure 1) is used to divide soils into 12 distinct classes based on their particle size distribution, or the relative amount of sand, silt, and clay in the soil. In the laboratory, we would first determine the

relative amount of sand, silt, and clay particles in a soil sample as a percent of the sample's weight, follow the arrows from each side to where they intersect, and identify what texture class the soil belongs to. For example, if we determined that a soil had 30 percent sand, 40 percent silt, and 30 percent clay, it would be called a *clay loam.* However, we can also estimate soil texture by feel fairly accurately with practice.

Using soil texture in the field

Once the soil texture is determined in the field, general characteristics of a soil can be predicted with reasonable accuracy, which helps identify proper management practices to use. A coarse-textured soil would have low water holding capacity, high water infiltration rates, high potential for leaching, low nutrient retention, and should respond well to supplemental irrigation. In contrast, fine-textured soils will remain wet longer than medium- or coarse-textured soils, have slow water infiltration rates, high potential for denitrification, and high nutrient retention. The medium-texture soils, such as loams, silt loams, or clay loams, have a good balance of sand silt, and clay. Medium-textured soils generally are very productive soils that allow for sufficient water infiltration without excessive drainage and have good water holding capacity and nutrient retention. Most soils can be used to produce crops or forage, if managed properly. Accurate determination of the soil texture allows for proper management practices to be used to maximize the potential soil productivity.

References

Thien, S.J. 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education. 8:54-55.

Photos by Edwin Ritchey

How do I estimate texture by feel?

Three simple steps along with the flow chart in Figure 2 will help you to determine soil texture by feel.

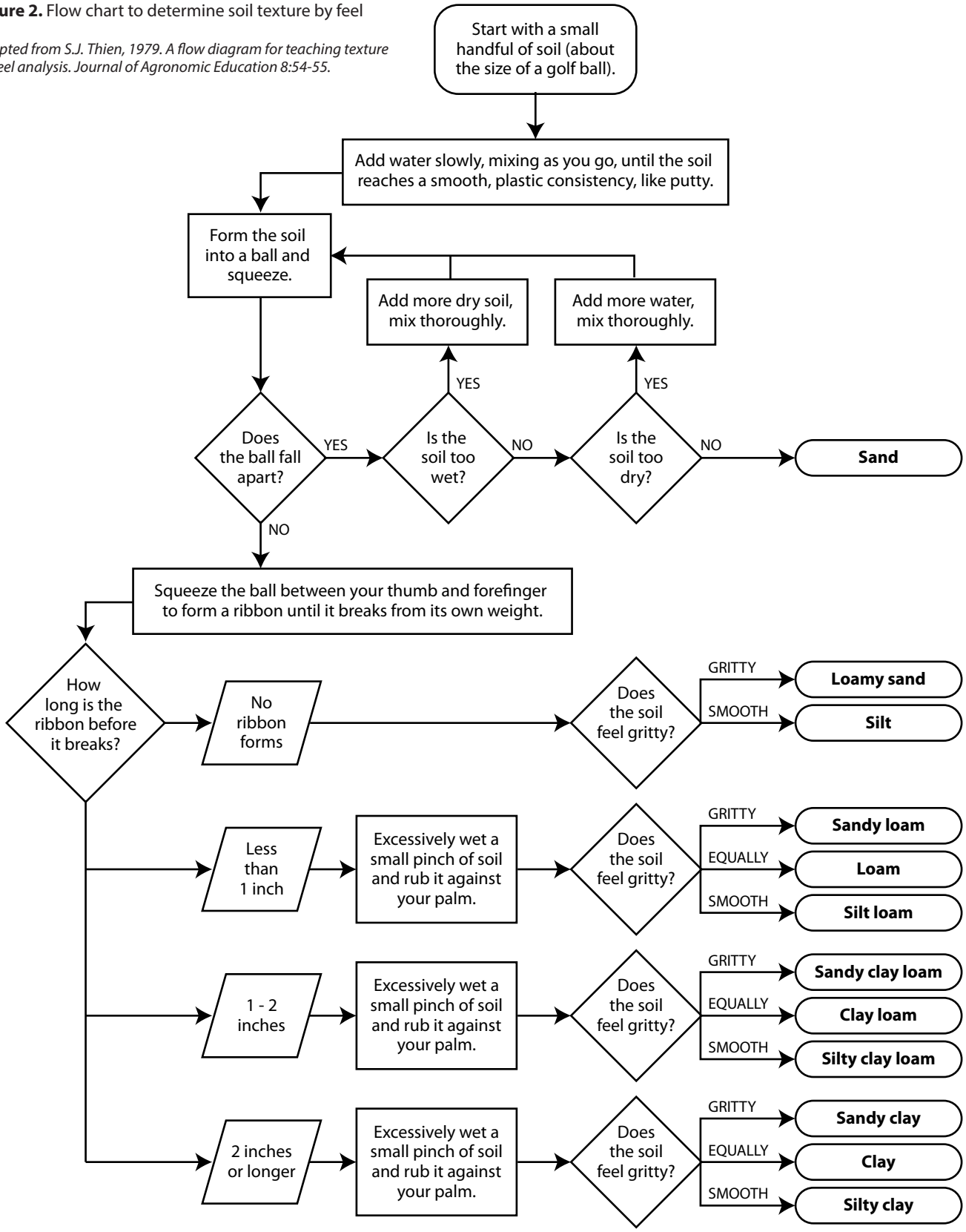
Step 1: Start with a small handful of soil, about the size of a golf ball, and slowly add water a drop at a time, mixing as you go, until you have a ball of soil that has the consistency of putty. Gently squeeze the ball to determine if it will stay together in a ball or fall apart.

Step 2: If the ball of soil stays intact, gently press the ball between your thumb and index finger, trying to work it out to form a ribbon. If you can form a ribbon, measure how long the ribbon is before it falls apart.

Step 3: After completing the ribbon test, add water to a pinch of soil in the palm of your hand until you have a muddy puddle. Rub the mud puddle against your palm and determine if it feels gritty, smooth, or equally gritty and smooth.

Figure 2. Flow chart to determine soil texture by feel

Adapted from S.J. Thien, 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education 8:54-55.



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