# Soil Particle Size & Soil Texture

**Overview**

Students will learn about soil particle size, soil composition and may reach deeper into soil texture analysis.

**Background Information**

- Why is soil important?
  - Soil provides a foundation for life.
  - It gives a medium for plants to grow  plants are food for other living things
  - Soil itself is food
  - Habitat for living things- rodents, bugs, worms, microbes
  - Used in construction- roads, dams, buildings, foundations, etc.
  - Soil absorbs, holds, and filters water
- What is soil made of?
  - Soil is made up of water, air, minerals, organic matter, living things and soil particles.
- What are the three types of soil particles?
  - Soil particles vary in sizes which are put into three categories: sand, silt, and clay. Organic matter may also be present.
    - The smallest of these three is clay (less than 0.002 mm)
    - The middle of these three is silt (0.002-0.05mm)
    - The largest of these three is sand (0.05-2.0 mm)
    - Anything over 2.0 mm is called gravel or stone

***(if using the soil particle size demonstration now would be a good time to use that to show relative size)***

- Why is particle size important?
  - Particle size is important because it aids in the movement of water and air
    - The larger the particle, the more space there is between them (pore space). This leaves room for water and air to flow.
    - The smaller the particle, the less space there is which means there is not as much space for water and air to move.
    - Sandy soils tend to drain water whereas soils heavy in clay tend to hold on to water.
- Most soil found in nature is not comprised of just one type of soil particle, but is a mixture of sand, silt, and clay in different proportions.
  - The proportion of particle sizes is what gives soil its texture.
- What is soil texture?
  - ***soil texture*** is the classification of soil based on its physical texture. It indicates the relative content of varying particle sizes.
  - A ***loam*** texture is a soil with roughly equal proportions of sand, silt, and clay
- Why is soil texture important to understand?
  - Texture influences the ease with which soil can be worked- This is important to people who work with soil for a living (i.e. farmers, excavation companies, and contractors)
  - The amount of water and air it holds- this is important for plants that need those two things to grow
  - The rate at which water can enter and move through soil- this is important during rain events that may cause flooding if water cannot enter the soil
- How do soil scientists determine soil texture?

- The easiest is through a texture by feel guide which is a flow chart that guides you through identifying soil texture with just your hands and some water. This test is often the one done out in the field.
- Another way to determine soil texture is by separating the aggregates into their different sizes and measuring them.
    - One way to do this is to use a screen that separates soil particles by size.
    - Another way to do this is to suspend the particles in water and they will settle out by size (heavier ones sink faster).

**Supplies**

- Soil Samples
- Soil jars
- Blank note card or paper (not included)
- Pencil (not included)
- Calculator (not included)
- Ruler (not included)
- *Student Worksheet 1* (master copy included)
- *Student Worksheet 2* (master copy included)

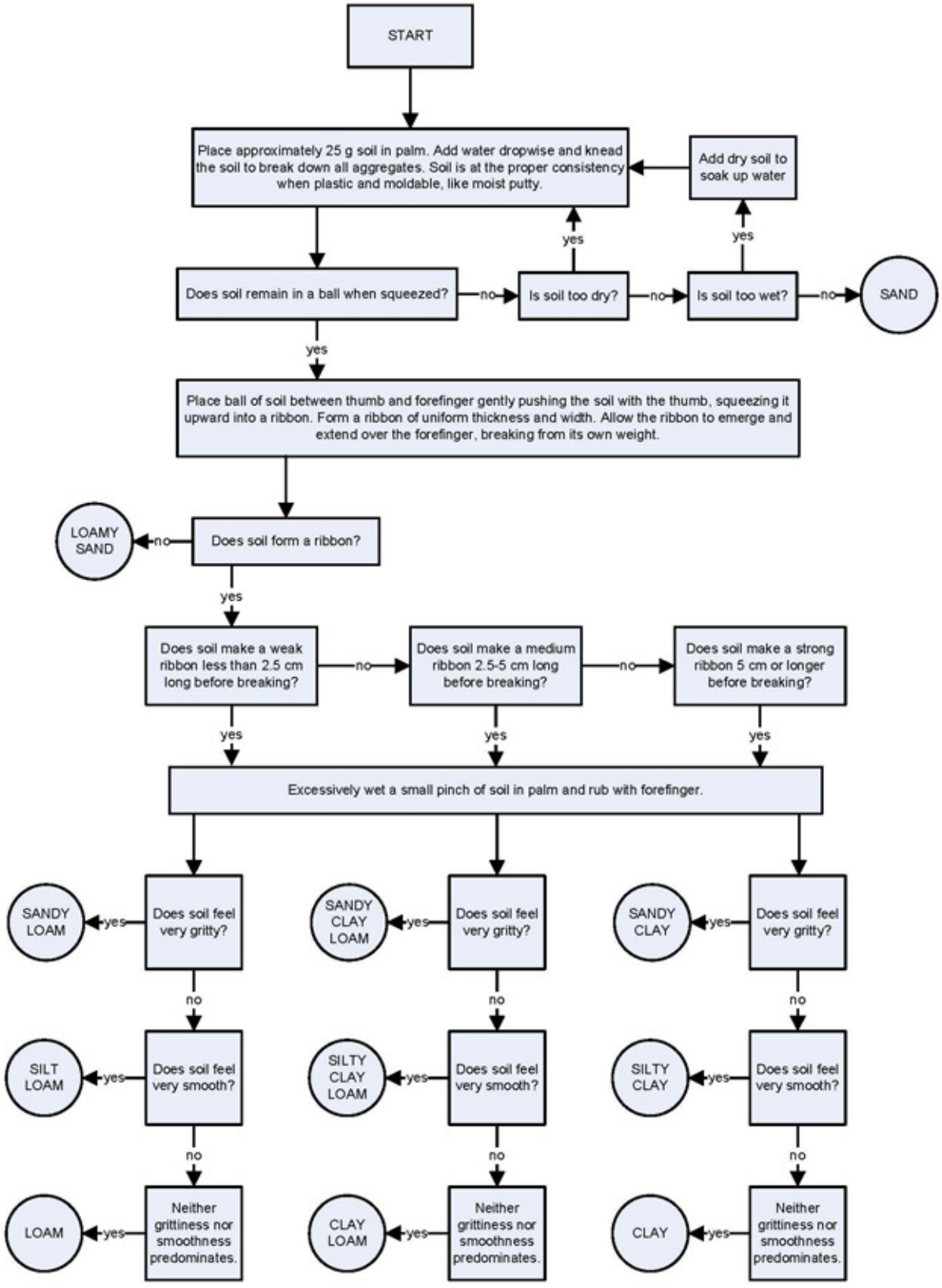
**Directions**

The activity can be done in small groups or individually

1. Use the soil samples provided and follow the *Guide to Texture by Feel* flow chart for each sample. You can have students fill out the chart as they are working through each sample. When they are done they may compare answers and discuss how they could tell the difference between the samples. You may also ask them to bring in their own soil samples that they can test.
2. Give each student/group a jar (eventually each group/students will use each color)
    - You can create your own soil samples by filling a straight sided jar halfway with soil and then fill the rest with water.
3. Have the students take the jar and shake it gently until all the soil is loose and mixed into the water
    - As a side note, you can mention this is what happens when it rains hard or there is a weather event. The soil is eroded or stirred up in bodies of water (rivers, lakes, etc.)
    - Sediment is the number one pollutant in Elkhart County
    - A good comparison is that it looks like chocolate milk.
4. Allow the jars to sit until the soil settles (depending on soil type some may take up to a few hours). You may want to leave the jars overnight.
5. Once it is settled, have the students answer the questions on the ***Texture by Suspension*** and discuss observations.
    - You can use this calculator online: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167

# Guide to Texture by Feel

Modified from S.J. Thien. 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education.




Sand feels gritty

Silt feels like flour

Clay is very sticky

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**Fill out this chart for each sample.**

| Sample | What does it feel like? | Texture Name |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Questions to ponder:

What were the differences between the samples? What did they feel like?

How do your answers compare to that of your classmate?

Do you think this test is very accurate? Why or why not?

What other tests can we do to determine soil texture?

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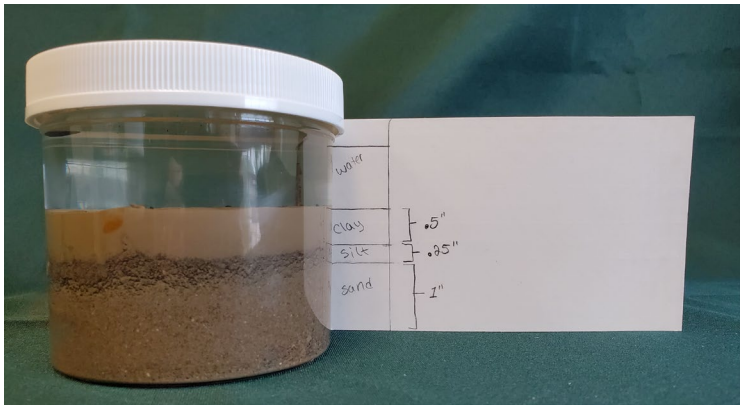
# Texture by Suspension




**Observation Questions**

1. What happened to the soil?

2. How many layers of soil do you observe?

3. What is in each layer? How do you know?

4. Which soil component (sand, silt, or clay) is the heaviest? The lightest?

5. Which soil component (sand, silt, or clay) is the largest? The smallest?

6. Would water move fast or slow through your soil sample? Why or why not?

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**Calculate the percentage of each particle type using the directions below.**

- Using a blank note card, mark the height of each layer and label
- Use a ruler to measure the total height of each layer
- Take this number and divide it by the total height of all the layers.
- Convert this number to a percentage by multiplying by 100.
- Repeat this for the other layers.
- *Note- not all layers may be present*

- Using the numbers from your calculations, determine what the approximate soil texture would be according to the soil texture triangle.

- Repeat the above for each soil sample

Sample: _____

| Layer | Height | Percentage |
|---|---|---|
| Sand | | |
| Silt | | |
| Clay | | |
| **Total** | | 100% |

**Calculate the soil texture using *Figure 1***

Texture: _____

Sample Color: _____

| Layer | Height | Percentage |
|---|---|---|
| Sand | | |
| Silt | | |
| Clay | | |
| **Total** | | 100% |

Texture: _____

Sample: _____

| Layer | Height | Percentage |
|---|---|---|
| Sand | | |
| Silt | | |
| Clay | | |
| **Total** | | 100% |

Texture: _____

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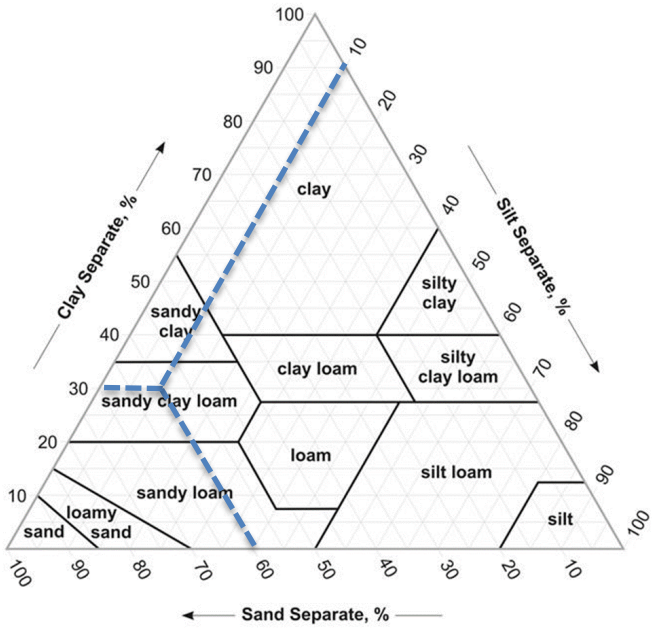
Sample: _____

| Layer | Height | Percentage |
|---|---|---|
| Sand | | |
| Silt | | |
| Clay | | |
| **Total** | | 100% |

Texture: _____

What are the differences in texture? Why do you think that is? Would other locations have different textures?

How did your answers to this compare to the *Texture by Feel* results? Is this method more accurate? When would it be more appropriate to use *Texture by Feel*?




1. Determine the percent sand of your sample and find that number on the bottom of the triangle. Note that the numbers read from right to left, not left to right.
2. Follow that line to the one that corresponds with the percentage of clay.
3. Lastly, where those lines intersect is the percentage of clay.
4. Whichever area the point lands is the soil texture

**Example 1**

Percentage: 60% sand, 30% clay, and 10% silt

Texture: Sandy Clay Loam

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# Soil Texture Triangle

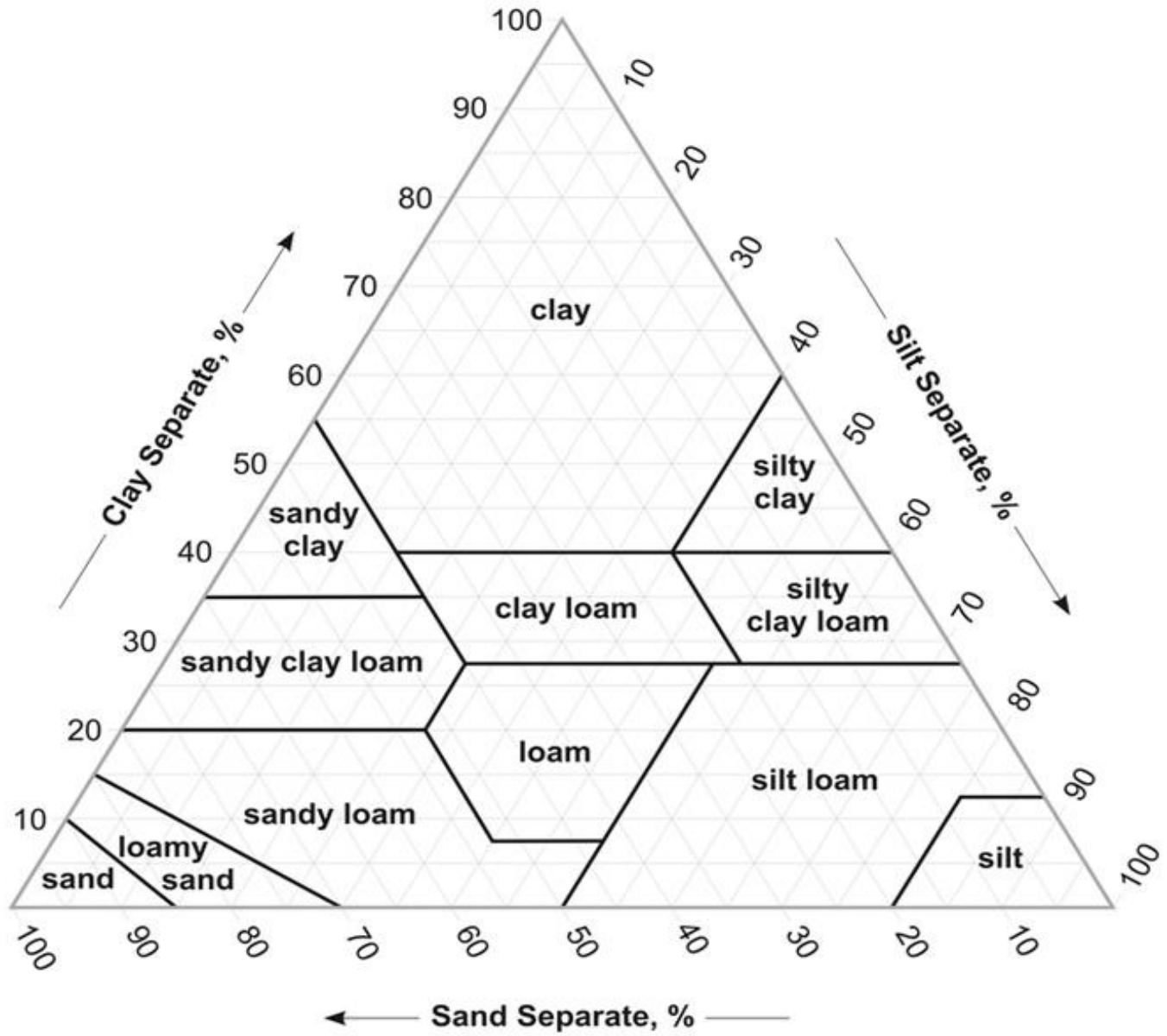


**Figure 1**

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# Soil Sample Key

**A.** Sandy Clay Loam
**B.** Clay Loam
**C.** Sandy Loam
**D.** Course Sand
**E.** Loam
**F.** Fine Sand
**G.** Silty Clay Loam

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