FACT SHEET

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Soil Texture

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Soil texture is an important soil characteristic which greatly influences field management decisions. The textural class of soil is determined by the percentage of sand, silt and clay. Soil texture is divided into classes (Soil Texture Triangle, Figure 3), and each class relates to whether the soil will be considered coarse, moderately coarse, medium, moderately fine or fine. For example, clay soil is referred to as fine-textured soil, whereas sandy soil is coarse-textured soil. Soil is often referred to as heavy (higher in clay) or lighter (higher in sand).

Soil texture is an inherent soil property that is typically unchangeable unless new soil is introduced. It's a product of soil-forming processes such as the underlying parent material and geological deposits. For instance, the retreat of glacier ice led to the pulverization of underlying bedrock material, breaking it into smaller pieces and transporting it with the glacial ice. This permanence underscores the need for careful soil management.

Sand: The largest soil particles, ranging from 0.05mm to 2mm. Sand is visible to the naked eye, will make the soil crumblier and feel gritty between your fingers.

Silt: Medium-sized soil particles, ranging from 0.002mm to 0.05mm. Silt is often carried by flood waters and feels very smooth or greasy when wet.

Clay: The smallest soil particles, anything smaller than 0.002mm. Clay particles are not visible to the naked eye and when wet, clay particles will stick together.

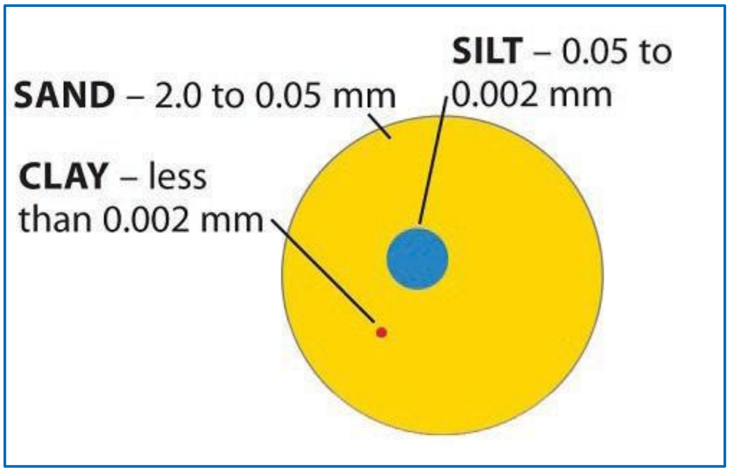


Figure 1. The relative size of sand, silt and clay particles.

WHAT IS SOIL TEXTURE?

Soil texture is the relative abundance of sand, silt and clay particles in soil. The following soil characteristics are impacted by soil texture:

Drainage: Soil texture plays a key role in the rate at which water drains through soil. Soil drainage depends on how large the soil pores are, how well they are connected and the moisture already in the soil. Water moves more freely through sandier soils than it does through clay soils. This is because clay particles are smaller and have smaller pore spaces between them, making it more difficult for water to percolate through. If the soil is not draining well during periods of excess moisture, plant roots will be deprived of oxygen, resulting in poor plant vigour. On the other hand, during periods of low moisture, plants growing on sandy soil may be deprived of water, and irrigation may be necessary.

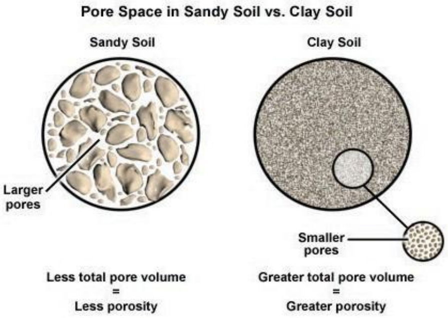


Figure 2. Pore space in sandy soil vs. clay soil.

Does clay or sand have more pores?

While sandy soils have larger pores, clay soils have a greater total pore space. These pores are very small and sometimes water and air cannot penetrate through.

Aeration: Aeration refers to the air space in the soil pores. Aeration and drainage are linked as they depend on the pore volume and pore size. Well-drained soils typically have good soil aeration, meaning that the soil contains air similar to atmospheric air, which is conducive to healthy root growth and, thus, a healthy crop. Typically, sandier soils have larger pore space and better aeration.

Water Holding Capacity: Water holding capacity is the ability of soil to physically hold water. Low water holding capacity means water will be held less tightly, while high water holding capacity means water will be held longer. Finer-textured soils typically have a higher water-holding capacity compared to coarse-textured soils. Organic matter can also retain water, and higher amounts of organic matter in the soil often mean a higher water-holding capacity.

Cation Exchange Capacity (CEC): CEC is the sum of total exchangeable cations that soil can adsorb. Clay particles and soil organic matter have negatively charged surfaces that can bind to positively charged plant nutrients (cations). The higher the clay content in your soil, the higher the CEC, indicating how well nutrients are retained within the soil. Increasing organic matter also increases CEC.

Susceptibility to Erosion: Different soil particles have different erodibility (susceptibility to be impacted by erosive forces). Several factors affect erodibility, and texture is one of them. Silt soil is generally more erodible than sandy soil, and sandy soil is more erodible than clay soil. This is because larger particle sizes are harder to erode, but clays tend to aggregate more easily.

pH Buffering Capacity: Buffering capacity is the soil's ability to resist changes in pH and is largely tied to the soil's cation exchange capacity. Soil buffering capacity increases with the percent clay and organic matter content, so sandier soils have a lower ability to resist changes compared to clay soils.

Soil Tilth: Soil tilth is the physical condition of the soil in relation to growing conditions. Different soil textures have different limitations in terms of soil tilth. Sandier soil does not tend to aggregate as easily and can lead to a more single-grain structure, making it more difficult to retain nutrients and water. Clay soils may be more difficult to work on, resulting in cracking or crusting in dry conditions or becoming gummy and susceptible to compaction in wet conditions. Texture is only one factor that impacts tilth; it is also influenced by soil organic matter, soil moisture, aeration and management practices.

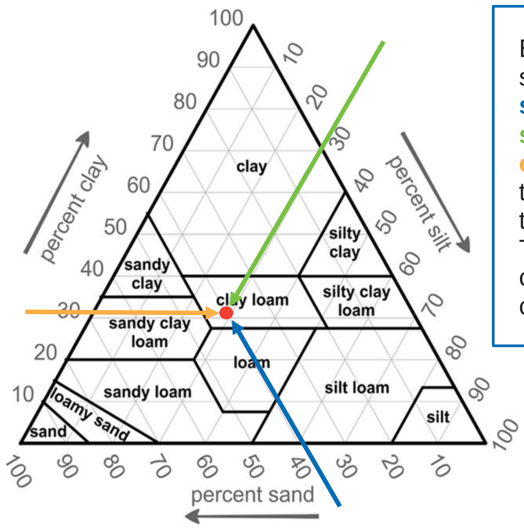
Considerations for Management

Soil texture is an inherent soil property that is not easily altered. It is important to understand your soil texture to adapt management practices. Some things that might be important to understand for management purposes include:

- Sandier soils often have lower soil organic matter and a limited capacity to retain nutrients. Applying nutrients from either an organic amendment or fertilizer source may be more prone to leaching and nutrient loss. Therefore, applying amendments at lower rates more frequently (split applications) may be more beneficial.
- Fine-textured soils are more prone to compaction. Therefore, heavy clay fields should be prioritized last after a heavy rain, as they take longer to dry due to their higher water-holding capacity.
- Certain crops perform better in different soil textures, which should be considered when planting. For example, deeper-rooted crops such as apples or grapes prefer soils with good drainage, which are often sandier.

HOW TO MEASURE SOIL TEXTURE?

Texture is grouped into different classes, shown by the soil texture triangle (Figure 3). Different sand, silt and clay proportions will place your soil into these classes. This diagram is useful if you know the soil sample's sand, silt and clay percentage; this can be determined at a soil lab. If you know your percentages, follow the direction of the lines for each different soil particle to determine the soil's textural class.



Example: Your soil has **40% sand**, **30% silt** and **30% clay**. Follow the arrows to the red dot. This soil is considered a clay loam.

Figure 3. Soil Texture Triangle with soil texture classes.

You can make field estimates if you don't know the exact percentage of soil particles in your soil sample. To estimate soil texture in the field, take a small amount of soil and remove any stones (anything above 2 mm); wet the soil so that it is wet enough that it sticks to your hand if your hand is inverted, but not so wet that water is dripping out of the sample (Figure 4). Rub the sample between your thumb and your forefinger (Figure 5). You should look for three things: (1) sand, which is identified by the grittiness of the sample; (2) silt, which is identified by the greasiness of the soil; and (3) clay, which is identified by the stickiness of the soil. Determine which of these is more dominant. Estimating the relative abundance of different soil particles takes practice, and the following flowcharts (Figure 7) can help determine soil texture.

Figure 4. Soil wetness for determining texture. The soil should stick to your fingers when inverted but not drip with water.

Figure 5. Pressing soil between the thumb and forefinger to form a ribbon.

Figure 6. Soil wire for determining soil texture.

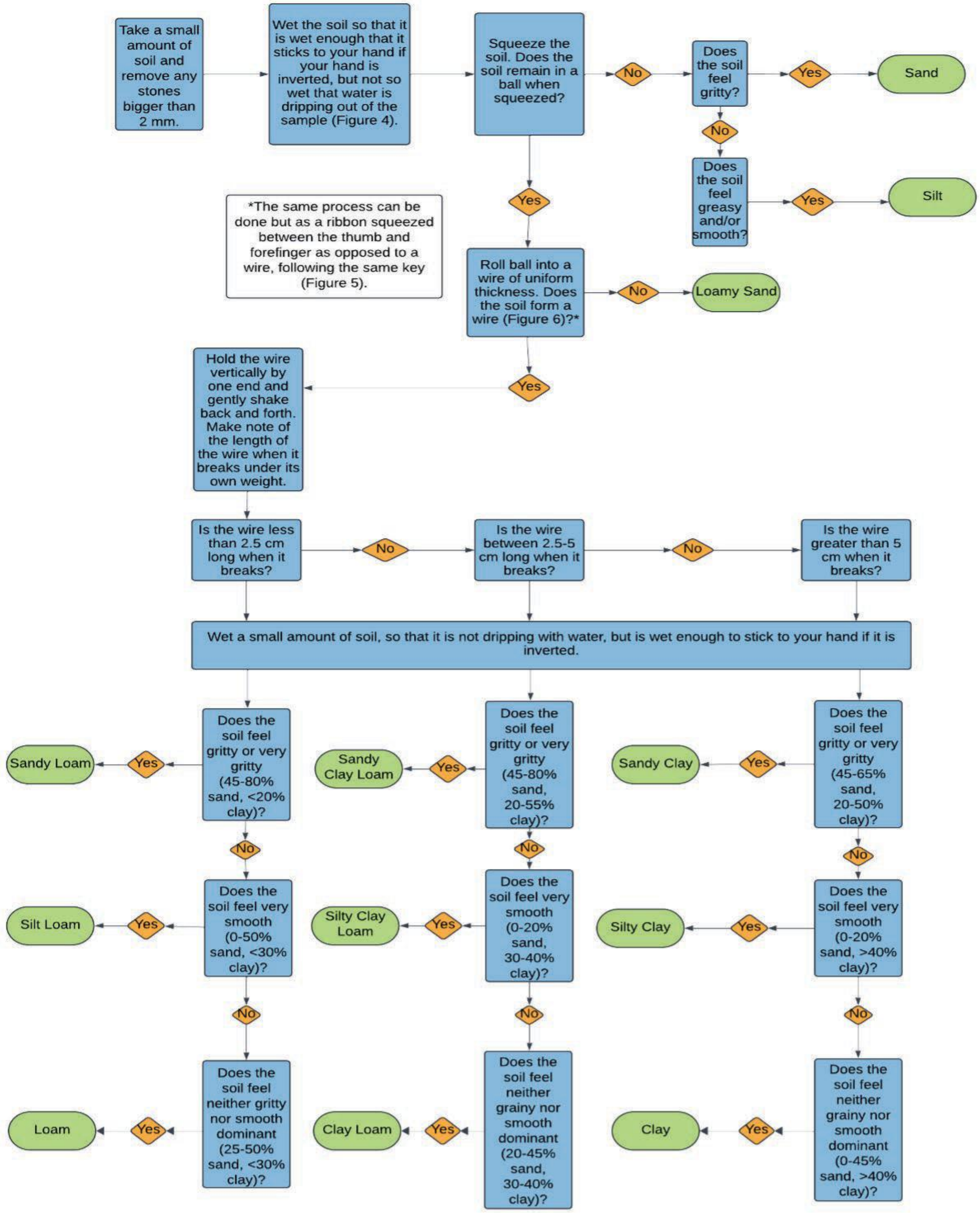


Figure 7. Flow charts for determining soil texture. Adapted from Thien, 1979

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