Soil Texture

Soil texture is an important soil characteristic that drives crop production and field management. The textural class of a soil is determined by the percentage of sand, silt, and clay. Soils can be classified as one of four major textural classes: (1) sands; (2) silts; (3) loams; and (4) clays. In this fact sheet, we will discuss the importance of soil texture, different methods to determine soil texture, and the impact of texture on management decisions.

Importance of Soil Texture

A clay soil is referred to as a fine-textured soil whereas a sandy soil is a coarse textured soil. Numerous soil properties are influenced by texture including:

- Drainage
- Water holding capacity
- Aeration
- Susceptibility to erosion
- Organic matter content
- Cation exchange capacity (CEC)
- pH buffering capacity
- Soil tilth

Soil texture determines the rate at which water drains through a saturated soil; water moves more freely through sandy soils than it does through clayey soils. Once field capacity is reached, soil texture also influences how much water is available to the plant; clay soils have a greater water holding capacity than sandy soils. In addition, well drained soils typically have good soil aeration meaning that the soil contains air that is similar to atmospheric air, which is conducive to healthy root growth, and thus a healthy crop. Soils also differ in their susceptibility to erosion (erodibility) based on texture; a soil with a high percentage of silt and clay particles has a greater erodibility than a sandy soil under the same conditions. Differences in soil texture also impacts organic matter levels; organic matter breaks down faster in sandy soils than in fine-textured soils, given similar environmental conditions, tillage and fertility management, because of a higher amount of oxygen available for decomposition in the light-textured sandy soils. The cation exchange capacity of the soil increases with percent clay and organic matter (Agronomy Fact Sheet #22) and the pH buffering capacity of a soil (its ability to resist pH change upon lime addition), is also largely based on clay and organic matter content (Agronomy Fact Sheet #6). Soil tilth (how easily or difficult a field is tilled) is influenced by texture, soil moisture, aeration, and organic matter as well.

Soil Textural Classes

The combined portions of sand, silt, and clay in a soil determine its textural classification. Sand particles range in size from 0.05–2.0 mm, silt ranges from 0.002–0.05 mm, and the clay fraction is made up of particles less than 0.002 mm in diameter. Gravel or rocks greater than 2 mm in diameter are not considered when determining texture. Once the sand, silt, and clay percentages of a soil are known, the textural class can be read from the textural triangle (Figure 1). For example, a soil with 40% sand, 40% silt and 20% clay would be classified as a loam.

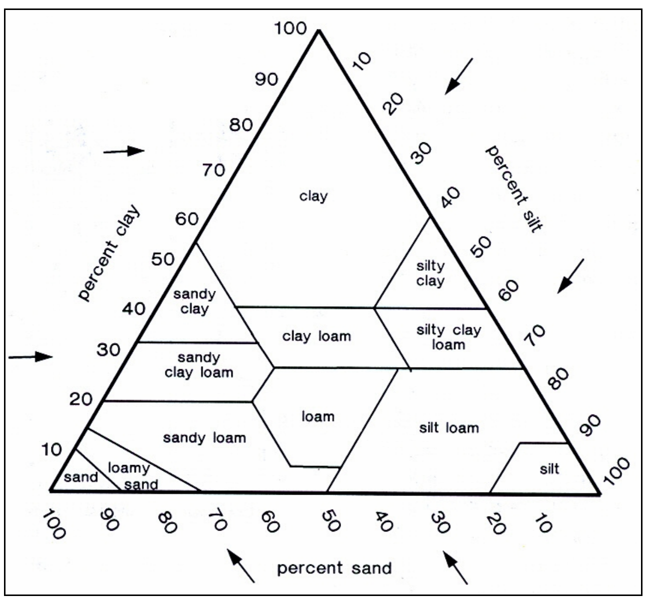

Figure 1: A soil textural triangle is used to determine soil textural class from the percentages of sand, silt, and clay in the soil.

Texture should not be confused with structure, which refers to how soil particles are aggregated together. It is possible to improve soil structure via best management practices such as reduced tillage. However, it is very impractical (expensive) and thus ill-advised to modify a soil's texture.

How to Determine Soil Texture

In the laboratory

The most accurate way involves submitting a sample to a soil testing laboratory for determination of the percentage of sand, silt, and clay by using either the pipette method (most accurate) or the hydrometer method (less accurate but quicker). The Cornell Nutrient Analysis Laboratory (CNAL) uses the pipette method. For more information contact:

Cornell Nutrient Analysis Laboratory
Phone: (607) 255-4540;
Email: soitest@cornell.edu
Website: www.css.cornell.edu/soiltest

In the field

Soil texture can be estimated in the field by observing its physical characteristics.

- A sandy soil feels gritty and falls apart easily if formed into a ball when moist.
- A loamy soil feels somewhat gritty, yet is easy to work; it has relatively even amounts of sand, silt, and clay; if formed into a ball when moist, it holds its shape, yet still breaks apart easily when squeezed.
- A silty soil breaks apart easily and has a floury appearance when dry. When moist, silty soils have a slick feel and form no ribbon when pinched between fingers and thumb.
- A clayey soil forms large, hard clods and cracks form on the surface. Clayey soils feel sticky and are bendable when moist. A ribbon can be formed when moist by pinching soil between fingers and thumb. A longer ribbon formed before it breaks indicates a higher amount of clay.

From a soil map

If the field location is known, a soil survey map can be used to determine the textural class of the soil. Maps are available through local Cornell Cooperative Extension (CCE) or Soil and Water Conservation District (SWCD) offices, or, for many New York counties, via the National Resources Conservation Service (NRCS) website (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx; once the area of interest is defined, surface texture information for each soil map unit can be generated by navigating to Soil Data Explorer/Soil Properties and Qualities/Soil Physical Properties/Surface Texture).

Soil Management Groups

New York soils are divided into five different mineral soil management groups (I through V) based on soil texture and parent material from which the soil was formed. Group I soils are medium- to fine-textured. Group II soils are moderately fine- to medium-textured. Group III soils range from medium-textured to moderately-coarse soils. Group IV has coarse- to medium-textured soils. Group V contains coarse- to very coarse-textured soils. Knowing the soil type of a specific field allows for more accurate fertility management. For example, the coarse-textured soils in group V are more susceptible to potassium deficiency than clay soils in group I. In addition, group I soil are generally more susceptible to runoff (moderately to poorly drained soils) and more likely to need tile drainage for early planting, optimum plant growth, and timely harvests (see also Agronomy Fact Sheet #19).

Additional Resources:

- Cornell University Agronomy Fact Sheet #6 (Lime Recommendations), #19 (Soil Management Groups), and #22 (Cation Exchange Capacity) http://nmsp.css.cornell.edu/publications/factsheets.asp

Disclaimer:

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.css.cornell.edu

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