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Field Method for Determining Soil Texture

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Soil texture refers to the relative proportions of sand, silt and clay in a soil. These soil particles are defined in terms of size. Sands range from 2 to 0.05 millimeters; silts range from 0.05 to 0.002 millimeters; clay particles are less than 0.002 millimeters. To determine soil texture, one must estimate the amount of each of these three components in a sample.

There are 12 textural classes, as indicated on the diagram in Figure 1, that are used by the United States Department of Agriculture (USDA) and other agricultural soil scientists to describe soil texture. Further refinements of those terms in the diagram are used to describe the predominance of different sand sizes in the sand, loamy sand and sandy loam classes. Examples are: coarse sand; loamy fine sand; and very fine sandy loam.

For the purpose of 4-H and FFA studies and contests and general descriptions of soil texture, five textural classes are used: coarse; moderately coarse; medium; moderately fine; and fine. The general classes relate to the more detailed USDA classes as follows:

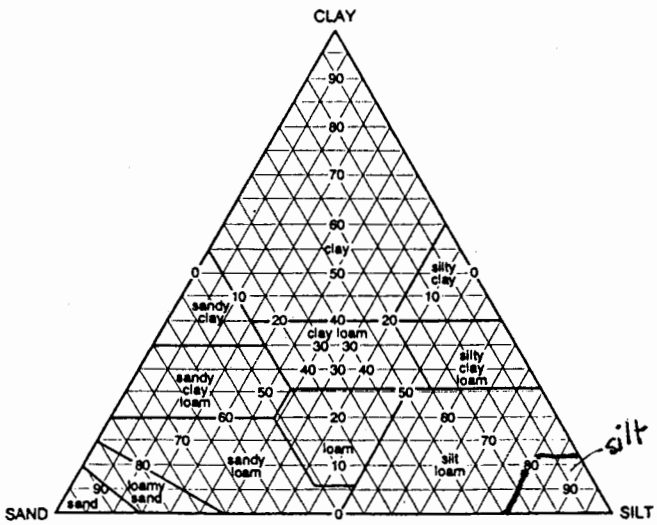

Figure 1. Official textural triangle. The scales of sand, silt and clay, along with the precise boundaries between soil textural classes, are used to determine the correct name for the texture of a soil sample.

Soil Textural Classes

General classes	Detailed classes
Coarse	very coarse sand, coarse sand, sand, fine sand, very fine sand, loamy coarse sand, loamy sand, loamy fine sand
Moderately coarse	sandy loam, fine sandy loam
Medium	very fine sandy loam, loam, silt loam, silt
Moderately fine	clay loam, sandy clay loam, silty clay loam
Fine	sandy clay, clay, silty clay

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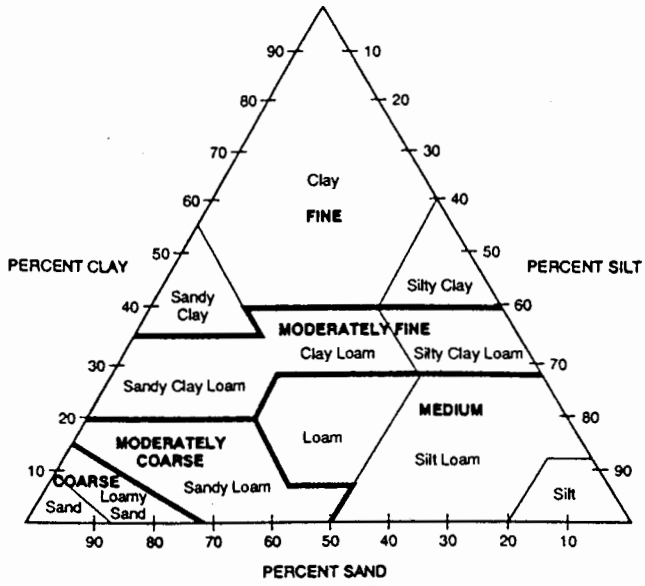

Figure 2. Generalized textural classes (note that very fine sandy loam is classed as medium texture).

Figure 3. Top - a soil "cast" or "mold. Bottom - the "cast" after a 12-inch drop.

Suggestions for Soil Texturing

To prepare a sample for texturing, place the equivalent of 1 heaping tablespoon of soil material in the palm of one hand. Use the other hand to crush large aggregates; remove rocks, roots and other debris from the sample; and apply water to the sample. Do not attempt to determine texture on dry soil material. Enough water should be added to the sample to make it very wet, but not soupy. To estimate the texture, rub the wet sample between the thumb and fingers while feeling the stickiness, grittiness, smoothness and other characteristics. Also determine how well the sample holds together.

Continue to rub the sample between the fingers until it becomes too dry to manipulate easily. This requires only a few minutes and is necessary for accurate texture estimation. While the sample is being rubbed, first estimate the clay content and then the silt and sand content.

For sandy soils, a "cast" or "mold" can be made by grasping the sample with the thumb and index and middle fingers. Then raise the cast about 10 to 12 inches in one hand and drop it into the palm of the other hand (as shown in Figure 3). The ability of the sample to retain its shape is related to its clay content. The higher the clay content, the more resistant the cast is to shattering.

For finer textures, force the soil material into a "ribbon" by applying pressure and sliding the material between the thumb and index finger (as shown in Figures 4-7). In general, the finer the texture the longer, thinner and stronger the "ribbon" will be before it breaks.

Other techniques may be used in conjunction with these to help determine texture. Use the combination of practices which works best for you. There is no substitute for practicing these techniques on samples of known texture to become proficient at estimating soil texture in the field.

Verbal descriptions of soil textures are always inadequate, since it is primarily the individual's sense of "feel" that must be educated. However, the

following descriptions offer general guidelines about the characteristics of the five general soil textural classes.

Coarse: Coarse soil is sandy, loose and single-grained. The individual sand grains are easily seen and the feel is gritty. Squeezed when dry, aggregates readily fall apart into single-grained particles. Squeezed when moist, the soil will form a cast, but the cast will crumble when touched or when dropped from one hand into the palm of the other hand.

Moderately coarse: These soils contain large amounts of sand, but have enough silt and clay to form clods when dry and hold together when moist. Individual sand grains are readily seen and felt. Squeezed when dry, the aggregates will fall apart; but if squeezed when moist, a cast can be formed that will bear careful handling without breaking (as shown in Figure 4). A dropped cast shows more stability than with sands. Rubbed between the thumb and finger, the sample holds together and feels gritty, but will not "ribbon."

Figure 4. Moderately coarse texture. This soil has 60 percent sand, 30 percent silt and 10 percent clay. When textured by feel, it does not form a stable ribbon.

Medium: This soil has a relatively even mixture of different grades of sand and of silt and clay. It has a smooth, non-gritty feel and is slightly plastic. Squeezed when relatively moist, it will form a cast that can be handled quite freely without breaking. When squeezed between thumb and finger, it will not form a durable "ribbon," but will have a broken, almost "scaly" appearance (as shown in Figure 5) and will have a smooth, floury or doughy feel. When dry it may appear cloddy, but the lumps can be readily broken. When pulverized it feels soft and floury.

Figure 5. Medium texture. This soil has 15 percent sand, 65 percent silt and 20 percent clay. Note the scaly appearance and lack of strength in the ribbon.

Moderately Fine: These soils break into clods or lumps that are hard when dry. When the moist soil is pinched or pressed between thumb and finger, it will form a "ribbon" which will break readily, barely sustaining its own weight (as shown in Figure 6). It

Figure 6. Moderately fine texture. This soil has 14 percent sand, 55 percent silt and 31 percent clay. It forms a smooth, thick ribbon that readily breaks.

feels slightly slick and smooth. The moist soil will form a cast that will not easily break when handled or dropped. When the moist sample is kneaded in the hand, it does not crumble readily but tends to work into a heavy, compact mass.

Fine: These soils usually form very hard lumps or clods when dry, and are quite plastic and usually very sticky when wet. When the moist soil is pressed out between the thumb and fingers, it

Figure 7. Fine texture. This soil has 10 percent sand, 40 percent silt and 50 percent clay. Squeezed between thumb and index finger, it forms a thin ribbon that readily sustains its own weight.

generally will form a long, thin, flexible "ribbon" (as shown in Figure 7). Some of the more clayey samples will make a popping sound as they are kneaded during texturing.

Other Considerations

Kinds of Clay: Certain types of clay tend to be more sticky than others. To obtain maximum accuracy in field texture determinations, become familiar with the types and feel of the clay minerals present in the soils of the area being studied.

Organic Matter: In most cases, organic matter, which is especially prevalent in surface soil horizons, tends to cause errors in estimating the clay content of samples. Organic matter imparts a smooth, slick, non-sticky feel to a sample. In sandy-textured soils, organic matter leads to an overestimation of clay content, since it serves to bind the sand particles together. If the presence of organic matter is suspected (it often imparts a black color to the soil), make appropriate corrections when estimating clay content.

Amorphous Material: Soils formed from volcanic ash or pumice frequently contain large amounts of amorphous materials. These are rare in Texas. These materials cause difficulty in texturing since the particles contained in the sample continually break down as the sample is rubbed. Therefore, the estimated texture depends on how long and how hard a sample is rubbed. Amorphous materials impart a "greasy" feel to samples. Also, samples seem to become wetter the longer they are rubbed or or kneaded in the hand.

Excessive Salts: Large amounts of calcium carbonate, gypsum or other salts tend to cause problems in determining soil textures. Some salts lead to an underestimation of clay content, since they reduce the stickiness of the clays and dilute the volume of mineral matter. However, in some cases, the calcium carbonate crystals are clay-sized and cannot be distinguished by feel from other clay particles. This leads to an overestimation of clay content if the texture is to be determined on a calcium carbonate-free basis. Also, large amounts of sodium salts tend to give increased dispersion of the soil particles and, therefore, lead to a comparatively higher estimate of clay content. As indicated, salts can lead to either an underestimation or an overestimation of clay content. For maximum accuracy, become familiar with the particular salt present in a sample and its effect on texture estimation. Comparison of field determinations with laboratory analyses of representative samples is an excellent approach.

Coarse Fragments, Stones and Rocks: The 12 textural classes shown in Figure 1 are descriptive of soil particles smaller than 2 millimeters in size. Content of coarser fragments can be determined by professional soil scientists using appropriate modifiers of the USDA textural classes. The terms vary depending on the amount of coarser fragments present (e.g., gravelly clay loam or very stony silt loam).

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