Particle Size Distribution and Soil Texture

It is important to know the texture of each soil horizon because this is used in several parts of the contest.

Permeability: the most restrictive layer is what you consider for the permeability section. Usually, this is the bottom soil horizon.

Thickness of the rooting zone: only a USDA texture of Clay will limit roots. No other textures are root limiting. This means that Sandy Clay is NOT root limiting.

SHWT: sand and loamy sand are the only two textures in which you observe redox concentrations and stripping as indicators of SHWT.

Regrouped texture classes for land judging

Table 1. Soil texture determination.

Broad Textural Groups		Textural Names from USDA Textural Triangle
Sandy soils	Coarse-textured, very sandy soils	Sands Loamy sands
Loamy soils	Moderately coarse-textured soils	*Coarse sandy loam* Sandy loam Fine sandy loam
	Medium-textured soils	Very fine sandy loam Loam Silt loam Silt
	Moderately fine-textured soils	Clay loam Sandy clay loam Silty clay loam
Clayey soils	Fine-textured soils	Sandy clay Silty clay Clay

The USDA textural classes have been regrouped for land judging. This means when you read something about loamy soils, there are 10 USDA classes this would be referring to.

Let's back up

What is a soil particle?

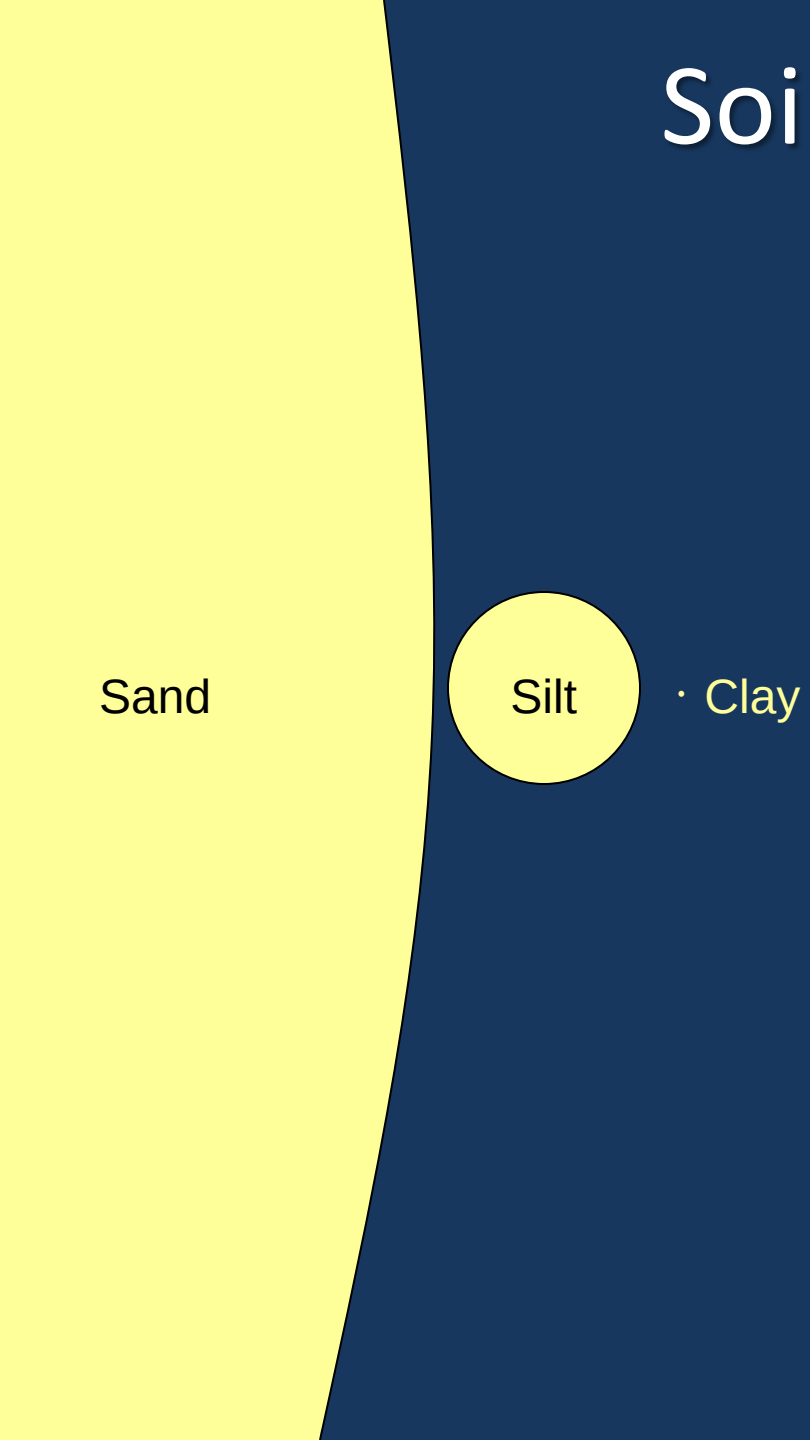
What is sand? What is silt? What is clay?

You might think of sand as quartz and clay as kaolinite, and in fact, these are very common minerals, but the terms sand, silt, and clay specifically refer to particle size only.

A small shell fragment is therefore sand if > 0.2 mm in size. That shell is mostly $CaCO_3$, not quartz.

A sand particle is simply one that is larger than 0.2 mm. Particles greater than 2 mm are considered rock fragments and not part of particle size analysis.

Soil Particles



Sand: 2-0.2 mm

Silt: 0.2-0.06 mm

Clay: <0.06 mm

Particle Size Distribution (PSD)

- The proportions of sand, silt, and clay in a soil.
  - E.g. 92% sand, 5% silt, 3% clay.
- These proportions are based on the mineral portion only.
- Organic matter not considered when determining particle size proportions
- We determine PSD by allowing the particles to segregate themselves via settling in a water column.
- We classify the texture using the determined proportions.

Soil Texture

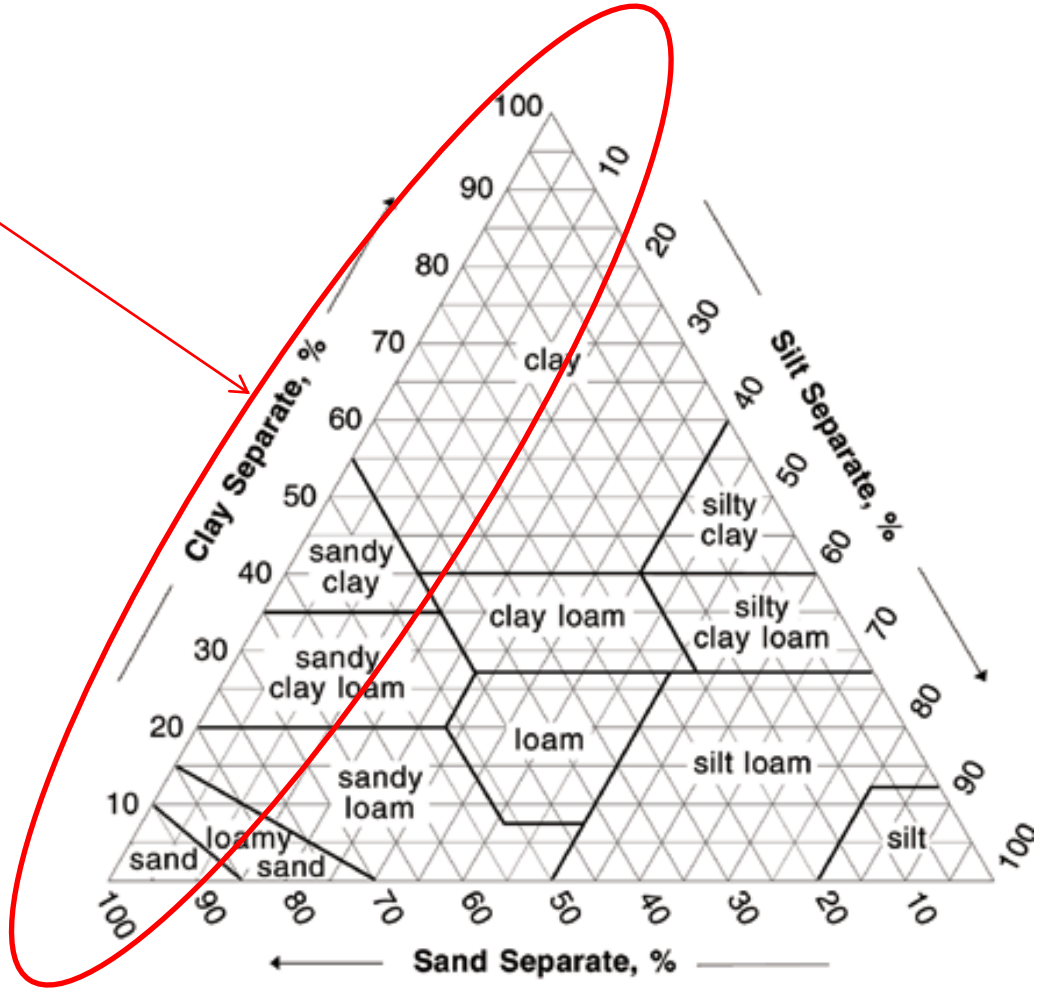
- This is a classification system meant communicate the proportions of sand, silt, and clay.
- Soils grouped in to classes with similarly behaving properties.
- For example, the sand class is small because adding just a little bit of silt or clay changes the way the soil behaves.

Soil Textural Classes

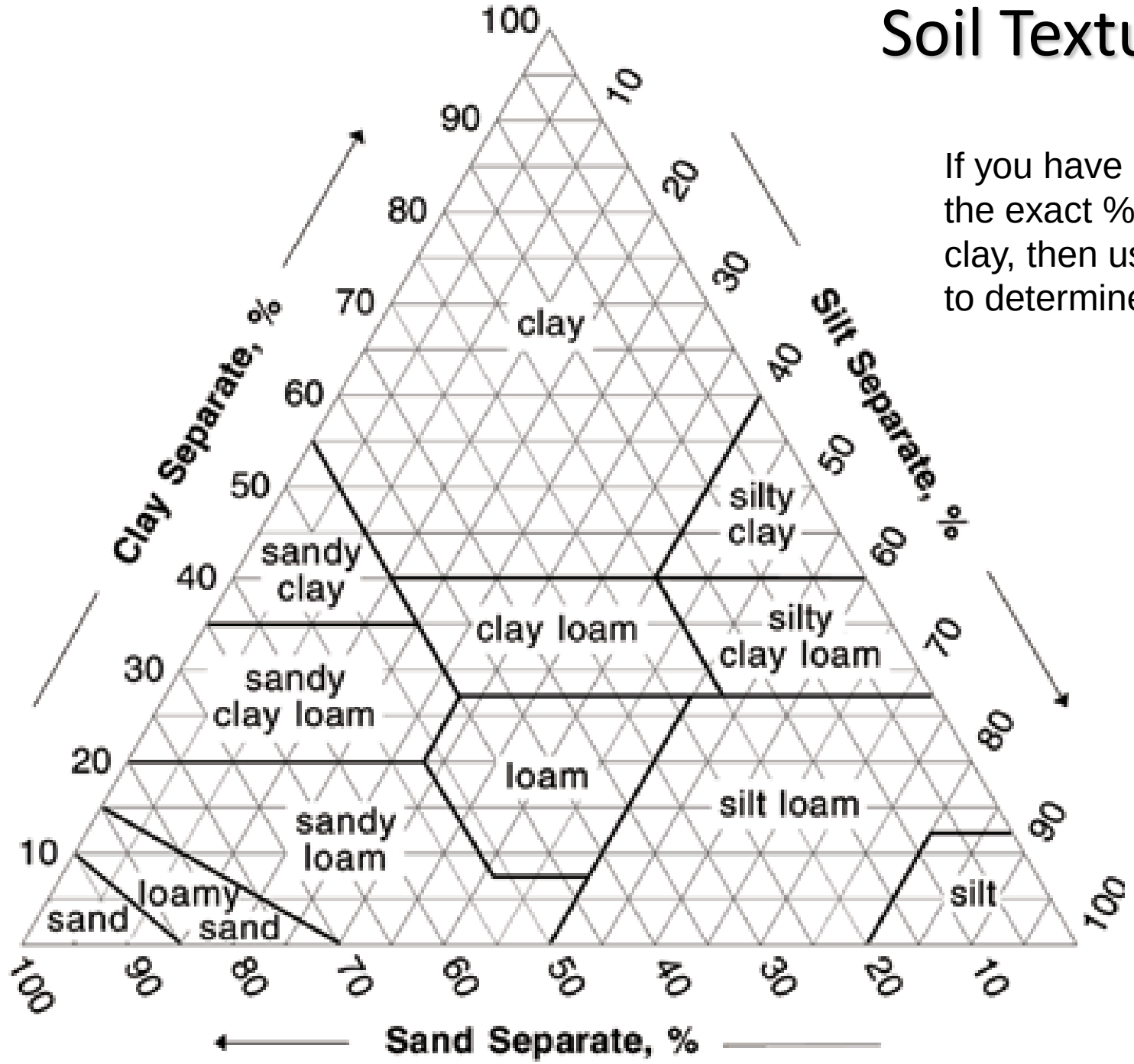
Florida Textures:

- Sand
- Loamy Sand
- Sandy Loam
- Sandy Clay Loam
- Clay

we just don't have much silt in FL



Soil Textural Classes



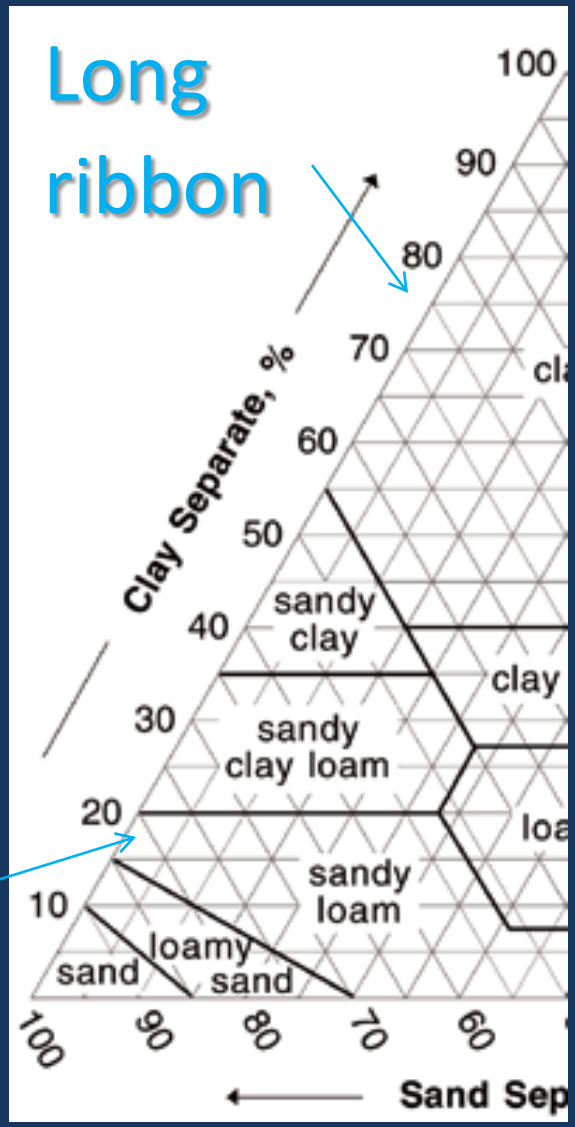
If you have lab data (e.g. the exact % Sand, silt, and clay, then use this triangle to determine the texture

But you are in a contest, not a lab!

- That's right. You have to do this with your hands.
- You are going to ball moist soil into your non-writing hand (don't get your paper dirty!)
- Use your thumb to work the soil into a ribbon.
- The longer the ribbon, the further down the clay axis you are progressing.
- When the ribbon breaks, you have your soil texture.

Long ribbon

Short ribbon



Particle Size Estimated by Hand

- Sandy particles feel gritty
- Silty particles feel silky smoth
- Clay partcles feel sticky
- You can shape and form soil into ribbons
- Then length of the ribbon is controlled by the sand content (more sand = shorter ribbon)
- There is a flow-chart that can be followed to estimate the textural class of a soil sample

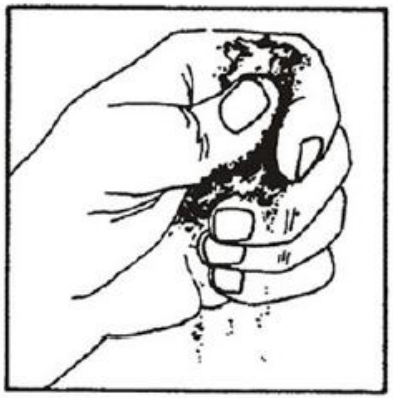
Simple way of texture by feel

Next slide is the correct way for all USDA textures

SANDY SOILS

Feels and sounds gritty. Ball usually breaks in your hand

No ribbon



LOAMY SOILS

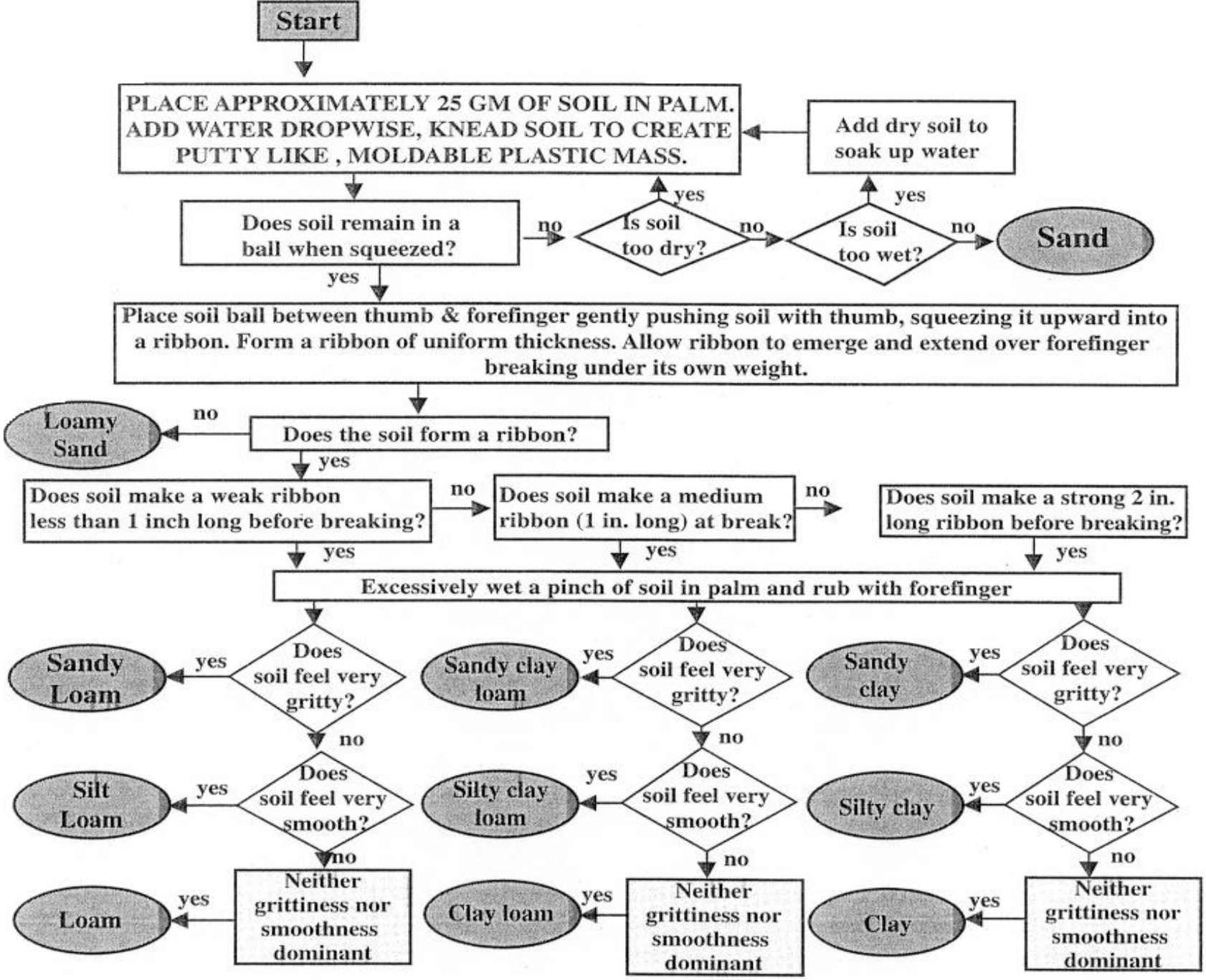
Usually smooth. Ball shows some finger marks and holds its shape.

Has short thick ribbon.

CLAYEY SOILS

Feels smooth and sticky. Ball shows finger marks. Holds shape.

Long thin ribbon.


Start
PLACE APPROXIMATELY 25 GM OF SOIL IN PALM. ADD WATER DROPWISE, KNEAD SOIL TO CREATE PUTTY LIKE , MOLDABLE PLASTIC MASS.
Add dry soil to soak up water
Does soil remain in a ball when squeezed?
no
Is soil too dry?
yes
no
Is soil too wet?
yes
no
Sand
yes
Place soil ball between thumb & forefinger gently pushing soil with thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness. Allow ribbon to emerge and extend over forefinger breaking under its own weight.
Loamy Sand
no
Does the soil form a ribbon?
yes
Does soil make a weak ribbon less than 1 inch long before breaking?
no
Does soil make a medium ribbon (1 in. long) at break?
no
Does soil make a strong 2 in. long ribbon before breaking?
yes
yes
yes
Excessively wet a pinch of soil in palm and rub with forefinger
Sandy Loam
yes
Does soil feel very gritty?
Sandy clay loam
yes
Does soil feel very gritty?
Sandy clay
yes
Does soil feel very gritty?
no
no
no
Silt Loam
yes
Does soil feel very smooth?
Silty clay loam
yes
Does soil feel very smooth?
Silty clay
yes
Does soil feel very smooth?
no
no
no
Loam
yes
Neither grittiness nor smoothness dominant
Clay loam
yes
Neither grittiness nor smoothness dominant
Clay
yes
Neither grittiness nor smoothness dominant

Particle Size Estimated by Hand

Permeability

Permeability refers to the rate of water or air movement through the most restrictive layer in the soil, including bedrock, if present. This may be considered as internal drainage. Permeability can be estimated from texture, compaction, and arrangement of soil particles (structure). Figure 3 illustrates the common ways particles may be arranged to form soil structure. This secondary grouping of particles may affect the soil's internal drainage by either providing a pathway for water to drain (such as around the outside of granules) or by retarding water movement (such as with platy structure or where structure is absent and the soil is massive).

Rapid. *Soils are generally not finer than sands to fine sandy loam throughout the profile, with little if any defined structure other than being structureless (i.e., single-grained) (very little restriction to movement of water and air). Organic soil material (e.g., muck or peat) is generally rapidly permeable, unless compaction or some other soil feature gives cause to think otherwise.*

Moderate. *These soils generally include medium-textured loamy soils, light silty clay loam (i.e., on the coarser-textured side of the silty clay loam category), light clay loam, or light sandy clay loam with prismatic to granular or blocky structure, and have no severely restrictive layers. Weakly cemented sandy material is also included.*

Slow. Soils generally would be on the fine side of the loamy group, such as heavy silty clay loam to heavy sandy clay loam. Such soils would be structureless (massive) or have platy structure, weakly expressed blocky structure, or weakly expressed prismatic structure. Strongly cemented sandy material is included here, as is impermeable or slowly permeable bedrock.

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So you can see that the rapid, moderate, and slow permeability categories don't currently line up directly with the broad textural groups of sanndy, loamy, and clayey.

I'm actually looking to change this and have it line up. New manual in fall 2014.