Final revision:
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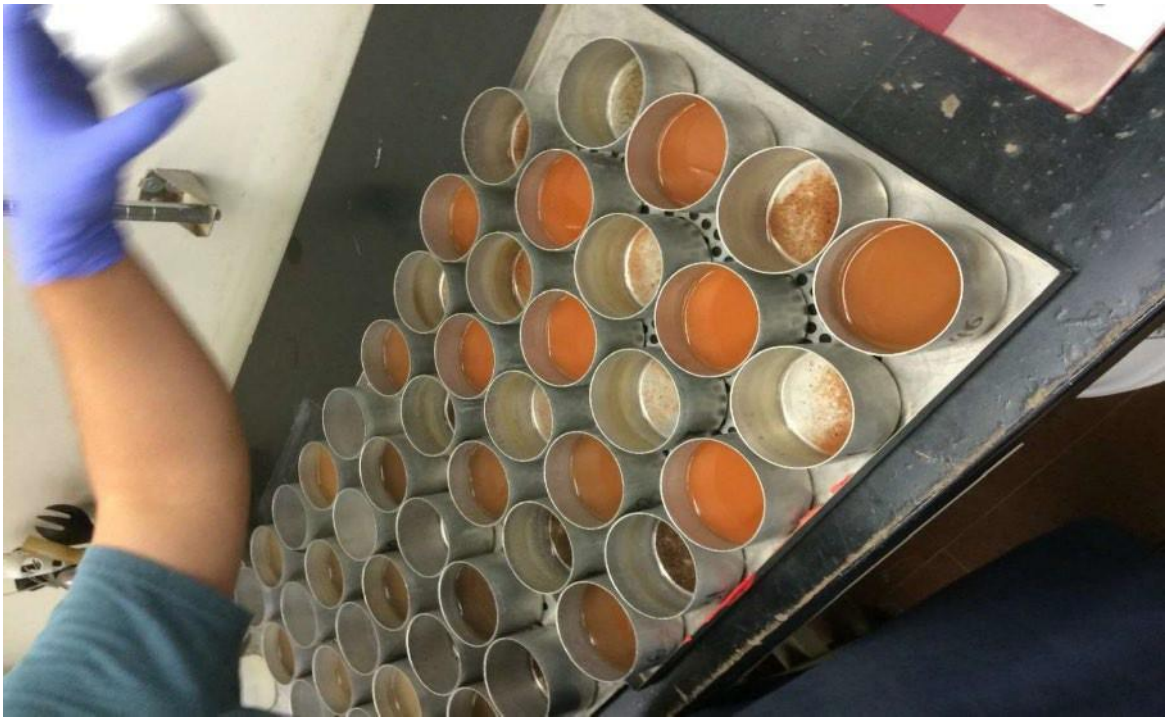

Rapid Soil Texture

Purpose and Justification:

The non-organic, solid material in soils is composed of a mixture of mineral particle sizes, the relative amounts of each determine the soil texture. Textural class affects many of the important physical, biological, and chemical processes in the soil, but is not easily altered by management practices because it changes little over time. Although soil texture itself is not a soil health indicator per se, knowledge of the textural class informs the interpretation of soil health indicators. The Rapid Soil Texture procedure involves dispersion of soil particles using sodium hexametaphosphate (a soap) followed by the 1) isolation of the sand fraction using a 0.053 mm sieve, and 2) separation of the silt and clay fractions by settling.

Background / Reference:

The rapid soil texture method is designed for processing large volumes of samples with accuracy comparable to more sophisticated tests. For original published procedure see:

Kettler, T.A., Doran, J.W., Gilbert, T.L. *Simplified Method for Soil Particle-Size Determination to Accompany Soil Quality Analysis*. Soil Sci. Soc. Am. J. 65:849-852 (2001).

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Scope/Objective:

Soap solution is used to disperse soil aggregates. Using a 0.053mm mesh sieve, sand is wet sieved from the soil sample, dried and weighed. The silt fraction is allowed to settle out of a water column in two hours and is removed, dried and weighed. Clay fraction is determined based on the difference from the original soil sample weight.

Note that that this procedure is designed to NOT remove Organic Matter (OM) with peroxide before testing. Mineral soils containing less than 5% OM will have the organic debris collected with the sand fraction on the 0.053mm sieve.

NOTE: ***For quarantined soils, see labeled procedures in italics at the bottom of each section.***

Materials and Equipment:

Analytical Balance
Aluminum drying cans
Aluminum trays
Falcon Tubes with 42ml, 3% Hexametaphosphate (soap) solution (HMP)
Shaker
20cm diameter 0.053mm sieve
20cm diameter Funnel
One-liter lidded containers
Catch basin
Drying oven at 105° C
Squeeze bottles with water

Additionally, for quarantine soils:
Two 5-gallon buckets
Bleach
Spray bottle with sterilization solution
Latex or nitrile gloves to protect hands
Large basin to bleach quarantine sieves

Sterilization solutions approved for use with Quarantined soil:
Bleach- 10% bleach solution within a labeled spray bottle must be left on contaminated equipment for 30 minutes before rinsing

Ethanol solution (70%) within a labeled spray bottle must be left on contaminated equipment for 30 minutes before rinsing.

Procedure:

1. Prepare Falcon tube racks with about 42ml of 3% HMP solution added to each tube. (Fill tubes from a HMP carboy - release the pinch clamp until liquid arrives at the 42ml mark on the centrifuge tube). Label lids of Falcon tubes within Falcon tube racks with sample IDs.
   Wear gloves (that are to be autoclaved after using) throughout entire test.

2. Fill out Soil Health Texture data sheet (Table 1 below) with Sample IDs. Insert a control sample in the last spot on the Falcon rack.

3. Use air dried soil for this test. Sieve about 2 tablespoons of soil past 2mm and record sample ID onto soil texture data sheet. Weigh and record 14g (+/- 0.5g) of soil and carefully add soil to the correct Falcon tube with soap solution and cap and shake vigorously to bring soil into suspension.
   Weigh soil in weigh boat placed on the scale. Sterilize with sterilization solution after using. Sterilize sieves used for sieving soil with sterilizing solution after soil is used. Discard any soil not used for test into autoclave bags and autoclave. Place a "Q" on each Quarantined texture lid.

4. If soil samples are encountered containing more than 5% organic matter, it can be advised to add less material (about 7g of air-dried soil) to the Falcon tube. Using the standard 42ml of soap solution then results in better dispersion of the soil particles. Highlight the data sheet with this divergence from standard protocol.

5. Place up to 3 racks onto a shaker for 2 hours at 150 rpm. Samples can be stored for several weeks before or after shaking.
   Place texture tubes in a plastic bin within the shaker. Sterilize shaker with sterilization solution after using.

6. On Texture data sheet (with sample IDs and weights) record IDs of pre-weighed aluminum cans into the sand can and silt can columns.

7. Once shaken, re-suspend soil (shake by hand until no soil is stuck to the sides or bottom of the Falcon tube) into solution before uncapping. Use a squeeze bottle to rinse ALL material onto the 20mm diameter 0.053mm sieve assembly (place sieve in funnel over 1000ml container (with screw lid removed) inside catch basin).
   Process all soil in the Texture test within a plastic bin that is to be disinfected after test is complete.

8. Rinse contents of Falcon tube (including inside the cap) onto the sieve assembly. Use less than 1000ml water to rinse tube and all soil particles (while wearing gloves, using fingers and water) through the mesh. When the contents of the Falcon tube rinse clean, collect sand grains and OM to a corner of the sieve. Flush the sand into the arranged SAND aluminum can. Decant OM. Place the 1000ml beaker containing the silt and clay on a stable table (in order based on rack position of tubes). Re-suspend all soil particles by emptying contents from labeled beaker to a temporary beaker and back into the labeled beaker. If using a lidded container instead of beaker, screw cap on and agitate until re-suspended. Allow a 2 hour settling period.
   Perform all procedures within a plastic bin that will be sterilized after use. Place beakers within a bin for the required settling time. Spray outside of water bottles with sterilization solution and let sit for the required time before rinsing.

9. At the end of the settling period, decant (and discard) the water and clay in beaker above the settled silt particles. Use caution when decanting the suspended clay from the silt layer at the bottom of the beaker. These silt particles at the bottom of the beaker are then rinsed into the SILT aluminum can.
   Decant quarantined water into buckets with a 10% final bleach concentration and let sit for a half hour before dumping down drain. Do decanting within a plastic bin that (along with the outside of the water bottles) will be sterilized with sterilization solution.

10. After all aluminum cans have been filled with sand and silt fractions from each sample, dry in oven at 105°C until samples reach constant weight.

11. When samples have dried to constant weight, record the weight of the dry aluminum sand can with sand on the Soil Texture data sheet. Record the weight of the dry aluminum silt can containing silt on the Soil Texture data sheet.
    Be sure to thoroughly disinfect weighing station & area around it afterwards with sterilization solution.

12. Clean, rinse and store aluminum cans upside down in numerical order on the metal trays.
    Place all soil in autoclave bags and autoclave as soon as possible. Disinfect cans in sterilization solution for the required time and then rinse.

Data Note 1. Moisture Correction Factor (MCF- used to convert air dried soil weight to oven dried soil weight (105C) basis):

1. Place about 10g of air-dried soil sample material into an aluminum drying can.
2. Record the weight of aluminum can and air-dried soil.
3. Oven dry at 105C to constant weight.
4. Record the weight of aluminum can and 105C soil.
5. Calculate moisture correction factor (MCF) used in Table 1 column P.

MCF = ((can + air dried soil wt) – (can + 105C soil wt)) / ((can + 105C soil wt) – (can wt))
Units are in g water per g air dried soil

The moisture correction factor (MCF) is used in column F on the Soil Texture data sheet (Table 1 below).

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Table 1. Soil Texture datasheet

DATE:

Soil Texture Data 2022

rack-position rack-position

	A	B	C	D	E	F		A	B	C	D	E	F
	texture tube ID	air dry soil wt.	sand can ID	silt can ID	dry wt. sand can	dry wt. silt can	Theta M MCF	texture tube ID	air dry soil wt.	sand can ID	silt can ID	dry wt. sand can	dry wt. silt can	Theta M MCF
1								1						
2								2						
3								3						
4								4						
5								5						

Where:

All units are in grams.

In column B and column C, replace the recorded ID of the aluminum can in each row in the lab data sheet with the can weight in the EXCEL worksheet.

Column F (Theta M MCF) is the Moisture Correction Factor, used to convert air dried soil weight to oven dried soil weight (105C) basis. See Data Note 1 above.

Excel worksheet calculations:

Sand % = (D - B) / ((A / (1+F)) * 100

Silt % = (E - C) / ((A / (1+F)) * 100

Clay % = 100 - (Sand % - Silt %)

Sand % = **(**oven dry sand weight**) / ((**air dry sample weight / **(** 1+ MCF**))** x 100

Silt % = **(**oven dry silt weight**) / ((**air dry sample weight / **(** 1+ MCF**))** x 100

Clay % = 100 - **(**Sand % **+** Silt %**)**

Quality Control/ Standards:

Each year the Quality Control (QC) standard soil (Lima silt loam, 0- 6" depth, air dried to constant weight, sieved past 2mm) is run in a set of 25 replicated samples to determine the reproducibility of the test. From Table 1 above a datasheet is created where sample number 25 in each set of samples is this standard. If this standard result falls outside the expected range, the entire data set is rejected and is re-run.

Table 2 below lists the descriptive statistics from the 2018 QC standard soil.

Table 2. Lima silt loam soil descriptive statistics for the Rapid Soil Texture test

REP	%sand	%silt	%clay
1	26.6	47.3	26
2	27.2	46.5	26.3
3	25.8	47.8	26.4
4	25.5	48	26.5
5	25.7	48.6	25.7
6	25.8	48.8	25.4
7	26.4	51.3	22.4
8	26.4	52.7	20.9
9	28.7	50.2	21.1
10	27.4	50.8	21.7
11	26.6	50.4	23
12	27	52	20.9
13	27.7	49.6	22.7
14	27.3	50.2	22.5
15	27.8	50.6	21.6
16	27.5	48.4	24.1
17	27.3	51.1	21.7
18	28	52.7	19.3
19	29	50.5	20.5
20	30.3	50.4	19.2
21	28.6	51.2	20.2
22	27.2	51.9	20.8
23	27.6	51.4	21
24	28.6	51.3	20.1
25	27.7	52.4	19.8

	%sand	%silt
Mean	**27.3**	**50.2**
Minimum	25.5	46.5
Maximum	30.3	52.7
Standard Deviation	1.1	1.7
Mean MINUS 2 SD	**25.1**	**46.8**
Mean PLUS 2 SD	**29.6**	**53.7**