Exercise 15

Aim: To study the texture of soil samples

Principle: Texture is one of the most important physical properties of soil. The soil texture is based upon division of the size of soil particles into three size fractions viz., **Sand** (2–0.05mm average particle diameter), **Silt** (0.05–0.002mm) and **Clay** (less then 0.002mm). If one of these fractions dominates the properties of a soil, the name of that fraction is included in the name of the texture. A soil which has all of these fractions in nearly equal proportion is called a **loam** soil.

The four terms—sand, silt, clay and loam— are combined in various ways to name 12 different textural classes. The 12 textural classes and the percentages of sand, silt and clay fractions that are included in each are shown in textural triangle (Fig. 15.1).

Texture affects several physicochemical properties of soil like density, capillary and non-capillary pore spaces, water holding capacity, aeration, temperature and also the root penetration.

Requirement: Oven/stove dried soil samples, balance, weights, mechanical sieve set and blotting sheets/old newspapers

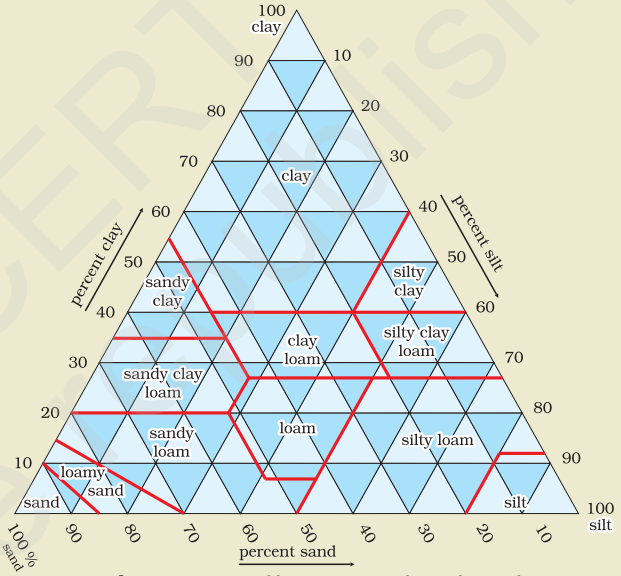

Fig.15.1 Soil Textural Triangle

Procedure

Three methods are suggested here. Any one of these may be followed.

Method I

(i) Collect about 300–500g of soil from two different locations. Label them as sample A and B.

(ii) Dry the samples in an oven, or stove or in sun to remove the soil moisture (capillary and bound water).

(iii) Select the 3 sieves of different mesh sizes (2mm, 0.05mm and 0.002mm). Arrange them in a collecting chamber as shown in Fig. 15.2.

(iv) Place 200g of the soil in the Ist sieve (sieve of 2mm mesh) and close the lid. To sieve the soil, shake the set manually for 5–10 minutes and collect the three soil fractions.

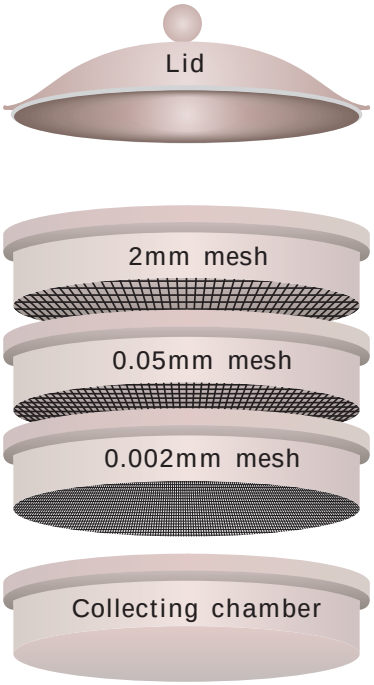

Fig.15.2 Sieve set

(v) Weigh the soil fractions viz-sand, silt and clay collected in the 3 compartments

Wt of soil sample taken – .....g

Wt of sand fraction – .....g

Wt of silt fraction – .....g

Wt of clay fraction – .....g

The weight of three fractions should be equal to the total weight of sample taken for analysis.

Observations

Calculate the percentages of the various soil fractions and tabulate:

Calculate the percentages of sand, silt and clay fractions.

Use the textural triangle now. Note that the three sides of the textural triangle represent 0 to 100% of sand, silt and clay respectively. Note that (i) the percentage lines for clay run paralled to the base line of sand, (ii) the precentage lines of silt run parallel to the clay side of the triangle and, (iii) perentage lines of sand run parallel to the silt silde of the triangle. In reading the textural triangle, any two particle fractions will locate the textural class at the point where these two intersect.

Soil sample	Percentage (%)			Texture class
	Sand	Silt	Clay	
A				
B				

Note for Teachers: The sieve sets contain a number and an abbreviation BSS/ASTM/ ISS on each sieve. In the given table (Table No. 15.1) the corresponding aperture size of the sieves is listed. For example, BSS 30 sieve aperture size will be 500 microns.

Appendix 1

Table 15.1 Mesh No. and the corresponding Aperture size

Sl. No.	BSS Mesh	ASTM Mesh	ISS Mesh	Aperture
1	4	5	480	4.75 mm
2	5	6	340	3.35 mm
3	6	7	280	2.80 mm
4	7	8	240	2.36 mm
5	8	10	200	2.00 mm
6	10	12	170	1.70 mm
7	12	14	140	1.40 mm
8	14	16	120	1.18 mm
9	16	18	100	1.00 mm
10	18	20	85	850 micron
11	22	25	70	710 micron
12	25	30	60	600 micron
13	30	35	50	500 micron
14	36	40	40	425 micron
15	44	45	35	355 micron
16	52	50	30	300 micron
17	60	60	25	250 micron
18	72	70	20	212 micron
19	85	80	18	180 micron
20	100	100	15	150 micron
21	120	120	12	125 micron
22	150	140	10	106 micron
23	170	170	9	90 micron
24	200	200	8	75 micron
25	240	230	6	63 micron
26	300	270	5	53 micron
27	350	325	4	45 micron
28	400	380	3	38 micron
29				25 micron

Method II

Texture by Feel

The texture of the soil sample can also be estimated by feeling it in the dry, moist and wet states. Sand is coarse and gritty, silt feels smooth like flour and clay is sticky and plastic. The smallest soil particles that one can see are coarse silt. Feel the known texture samples first, then feel the unknown ones and decide their textures.

Procedure

(i) Feel the dry soil first. Does it crumble easily or is it hard to break? Hard soil samples contain a moderate amount of clay.

(ii) Take in your palm a lump of soil sample about the size of a one-rupee coin and wet it to the consistency of modeling clay. Try to press it into a ribbon between the thumb and forefinger. An alternate test is to form a wire by rolling the wet soil until it is about 1/8" in diameter.

(iii) If a long wire or ribbon can be formed readily the soil is plastic and probably contains over 40% of clay. Its texture must therefore be clay/silty clay/or sandy clay. If a ribbon or wire can be formed easily but also breaks easily, the soil sample is probably a clay loam/silty clay loam/or sandy clay loam. A heavy loam/silt loam/or sandy loam sample may form ribbon or a wire if the moisture content is just right but these will be still weaker than the ribbons and wires formed by the clay loam samples.

(iv) Next determine whether sand or silt is dominant. If there is a gritty feel without the smooth floury touch of silt, choose a texture-name that includes the word 'sandy'. If the smooth floury feel predominates and there is not much gritty feel, choose one of the 'silty' texture names. Use the name without a prefix if neither smoothness nor grittiness predominates (simply clay or sand or silt). Often this can best be determined by adding more water until the soil is in a wet state.

If the soil is very sandy, you must choose between sandy loam, loamy sand and sand. In the moist state, sandy loam samples will have some tendency to stick together but loam sand and sand samples will not do so. Use the wet state to determine whether a sample is sand or loamy sand. After handling wet sand, your hands will be moist but clean loamy sand will make the hands slightly soiled.

Method III

Requirements: Soil samples, balance, weights, glass rod, standard sieves of 2mm and 0.5mm mesh size, blotting sheets/old newspapers, evaporating dish and water

Procedure

(i) Collect 200-300g of soil samples from different sites, and dry them as suggested previously to remove the moisture.

(ii) Sieve the sample through a 2mm sieve to remove stones, pebbles, roots etc.

(iii) Take 100-150 g of the sieved soil sample and further sieve it through a 0.05 mm sieve to separate the sand fraction (collected in the sieve) from silt and clay (collected on a blotting sheet). Weigh the amount of sand fraction and silt + clay fraction.

(iv) Take a large evaporating dish (a shallow clay plate, glass trough or a shallow iron plate) and record its weight.

(v) Add the clay and silt fraction to the dish and note the weight.

(vi) Add water to the dish leaving half an inch space empty at the top and stir the liquid thoroughly with a glass rod taking care that the contents do not spill out. Allow it to stand for several hours. Decant off the cloudy supernatant liquid (clay fraction). Repeat the process three to four times until the decanted liquid is quite clear.

(vii) Dry the silt left in the evaporating dish to dryness. Cool the dish and weigh it.

Observation

Record your observation in the following table:

	A	B
Weight of the soil sample taken		
Weight of sand fraction		
Weight of silt & clay fraction		
Weight of silt fraction		

Subtract the weight of silt fraction from the weight of silt + clay fraction. The difference will be the weight of clay decanted.

Calculate the % of sand, silt and clay fraction of the soil and express the texture.

Discussion

Correlate the texture with the plants growing in the area from which the soil sample has been collected. Discuss how the texture of soil can affect the root penetration, tillage, soil aeration, moisture content, water holding capacity and other aspects related to plant growth. In sandy soil the non-capillary pore spaces will be more and the capillary pore spaces will be less. The condition will be reverse in case of clay soil. The pore space in turn determines water holding capacity, percolation rate, aeration, root penetration and soil flora and fauna. Clay particles are anionic colloides and adsorb mineral nutrients and minimise their leaching.

Questions

1. Which type of soil is better for root-penetration and better aeration?
2. Among sandy and clay soil which one has higher water holding capacity? Explain.
3. If the clay content is high, will it affect soil fertility? Explain.
4. Which type soil has poor nutrient status and high leaching?
5. What kind of plants grow in smooth texture soil? Name two plants that grow in heavy-textured soil.