# Exercise 16

**Aim:** To determine the water-holding capacity of soils

**Principle:** Water holding capacity of the soil is the amount of water retained in the capillary spaces of the soil after the percolation of gravitational water into the deeper layers. Water holding capacity depends upon the capillary pore spaces in the soil. Sandy soil has very low water holding capacity, whereas clayey soils have very high water holding capacity.

**Requirement:** Soil samples from different sites (garden, road side, bank of river, paddy field etc.), Gooch crucible (china clay crucible with perforated bottom), filter-paper, pestle and mortar, petridish, beaker, glass rod, balance and blotting paper

## Procedure

(i) Dig a small pit about 10cm x 10cm x 10cm. Scoop 100–300 g of soil from the pit and collect it in a small polythene bag.

(ii) Remove the pebbles and large lumps from the soil sample.

(iii) Pass the soil through a coarse sieve to remove small lumps and dead decaying leaves and twigs.

(iv) Spread the soil into a thin layer on a sheet of blotting paper or old newspaper and sun dry it for 2–3 hours or dry it in a pan kept on stove. Alternatively dry the soil sample in oven at 108$^0$C for 1 hour.

(v) With the help of pestle and mortar grind the sample into fine powder.

(vi) Put a small disc of blotting paper at the base of the Gooch crucible. Weigh the crucible along with the blotting paper and note its weight.

(vii) Transfer the soil sample into the crucible. Tap the rim of the crucible gently several times with the help of glass rod so that soil is compactly filled and forms a uniform layer at the top. Add more soil if necessary.

(viii) Weigh the crucible along with soil sample and note its weight.

(ix) Fill the petridish with water and place two small glass rods in it parallel to and at a small distance from each other.

(x) Place the crucible on the two glass rods in such a manner that its bottom is in contact with water.

(xi) Leave the set up undisturbed till water appears at the upper surface of the soil. Wait till entire soil surface is wet.

(xii) Remove the crucible and allow all the gravitational water to flow out from the bottom. When no more water percolates, wipe the bottom dry with the blotting paper.

(xiii) Weigh the crucible and note its weight.

## Observation

Record your observation in the following table.
Calculate the % water holding capacity of the soil as follows.

Weight of crucible + blotting paper: A g

Weight of crucible + blotting paper + soil sample before experiment: B g

Weight of dry soil: B - A= Cg

Weight of crucible + blotting paper + wet soil sample after experiment: D g

Weight of wet soil after the experiment: D - A= Eg

Mass of water absorbed by soil: E - C= Ng

% Water holding capacity: $\frac{N}{C} \times 100$

**Tabulate your results as shown below**

| Sample No. | Wt. of Crucible + blotting paper (A) | Wt. of Crucible + blotting paper + soil sample (B) | Wt. of soil sample (B-A) = (C) | Wt. of crucible + blotting paper + wet soil (D) | Wt. of wet soil (D-A) = E | Amount of water absorbed (E-C) = N | % water holding capacity $\frac{N}{C} \times 100$ |
|---|---|---|---|---|---|---|---|
| A Garden soil | | | | | | | |
| B Road side soil | | | | | | | |
| C..... | | | | | | | |
| D..... | | | | | | | |

## Discussion

Compare % water holding capacity of soil collected from different habitat conditions. The variation in water holding capacity is due to varying proportion of sand, silt and clay in the soil of different habitats. Soil with very high proportion of sand have very low water holding capacity due to large pore spaces between the particles which enables the water to percolate freely into deeper layers leaving upper layers practically dry. In clay soil, due to very small size of the pore spaces (fine capillaries) the water is retained in the capillary spaces as capillary water. In these soil the water does not percolate freely. Soil with more or less equal proportion of sand, silt and clay (loam soil) combines the properties of sand and clay and therefore has optimum water holding capacity and optimum soil-air for root growth.

## Questions

1. What are heavy soil and light soil?
2. Give examples of a plant seen in heavy soil and light soil.
3. How does pore space determine the % water holding capacity of soil?
4. Why is clay soil often referred to as physiologically dry soil?
5. Which type of soil is suitable for cultivation of crop plants?
6. How can water-holding capacity of soil be improved?
7. Dead decomposed organic matter is usually added in the fields before the cultivation of crops. Apart from providing the mineral nutrients, what additional role does organic matter play in the cultivation of crop plants?