PRACTICALS

1 Determination of soil moisture content by theromogravimetric method.

1.1 INTRODUCTION

The principal method of soil mosture determination in common use is where the water is removed by oven-dry method. Accuracy and reproducibility of water content measurements, assuming that weighing precision is consistent with desired precision of water content measurement, depend upon the drying technique and the care with which it is used.

1.2 OBJECTIVE

- *By doing this Practical the learner will be able to determine the soil moisture content.*

1.3 EQUIPMENTS REQUIRED

Sampling augers, aluminium moisture boxes, physical balance weighing up to 0.01 g and drying oven (105°C).

1.4 PROCEDURE AND CAUTION

Take a composite sample of soil not less than 100 g with the help of a smapling auger and put it in a moisture box. Cover it immediately with its lid. Cover the boxes with a cloth to avoid heating in the field due to insolation. Transport the smaples to the laboratory. Weight the smaple on a physical balance, correct to two decimal places in g (w_1). Dry the smaple in an oven to a constant weight at 105°C. This takes about 48 hours. As the boiling point of water is 100°C , 105° is the convenient temperature for oven drying. Weigh the dried sample (W^2). Calculate moisture percentage (P_w) on oven-dry weight basis by the formula

$$P_w = \frac{W_1 - W_2}{W_2} \times 100$$

1.5 OBSERVATION TO BE RECORDED & RESULTS

i) Weight of moist soil with boxes

ii Weight of dry soil with boxes

iii Weight of box

iv Weight of dry soil.

2. Determination of bulk density of soil

2.1 INTRODUCTION

Bulk density is the weight of oven-dry material per unit bulk volume. Bulk density of soil is closely correlated with porosity, and in turn, with the infiltration capacity and the degree of aeration.

2.2 OBJECTIVE

- *By doing this Practical the learner will be able to determine the bulk density of soil.*

2.3 EQUIPMENTS REQUIRED

Balance, Drying oven, aluminium moisture boxes, and core sampler.

2.4 PROCEDURE AND CAUTION

A flat soil surface is prepared at the desired depth in the field, and the core sampler is driven into the soil. Care should be taken to see that no compaction occurs during the process, so that a known volume of soil having field structure is obtained. The oven-dry weight of the sample is then determined. Bulk Density (B.D.) is expressed as grams per cubic centimeter.

The volume of soil is not always constant as some clays swell when wet and shrink when they are dried. So, to avoid the error that may come in measuring B.D., precaution is taken and the bulk density is measured at field capacity moisture content.

2.5 OBSERVATION TO BE RECORDED & RESULTS

a) Weight of the core smapler

b) Volume of the core sampler

   (i) height (ii) diameter

c) Weight of core sampler with moist soil

d) Weight of core sampler with dry soil.

3. Determination of field capacity

3.1 INTRODUCTION

Field capacity is the moisture content in percentage of a soil on oven-dry basis when it has been completely saturated and downward movement of excess water has practically ceased. Such a stage is reached generally in 48 to 72 hours after saturation.

3.2 OBJECTIVE

- *By doing this Practical the learner will be able to determine the field capacity of soil.*

3.3 MATERIALS/EQUIPMENT REQUIRED

Straw mulch or a black polythene sheet, spade, soil auger, moisture boxes, water, physical balance and drying oven.

3.4 PROCEDURE & CAUTION

Select a representative spot in the field. Ensure that water table is not within two meter from the layer of which field capacity is to be determined. Bund an area of about 2.5 sq. meters on all four sides and remove all weeds to avoid transpiration.

Pour water till the desired layers gets sufficiently wet. Spread straw mulch of at least 40 cm thickness on the surface to prevent evaporation. A polythene sheet can be conveniently used instead of a mulch. Take soil samples from different layers up to the root-zone depth with auger and determine the soil moisture content at every 12 to 24 hours interval till the values of two successive samples are nearly equal. Plot the moisture content versus time curve on a graph paper. The lowest influx value can be taken to represent the field capacity of the soil.

3.5 Observations to be recorded & results:

a) Weight of soil sample (wet) with box

b) Weight of dry soil with box

c) Weight of the box.

4. Determination of permanent wilting point

4.1 INTRODUCTION

Permanent wilting point is the moisture content in percentage of a oven-dried soil at which nearly all plants wilt and do not recover in a humid dark chamber unless water is added from an outside source.

4.2 OBJECTIVE

- *By doing this Practical the learner will be able to determine the permanent wilting point of soil.*

4.3 EQUIPMENTS REQUIRED

Five 600 g capacity cans with lids, sunflower seeds, glass tube (5 cm x 0.5 cm), sealing wax, moisture boxes, physical balance, drying oven, bell jars, water trays and soil sampler.

4.4 PROCEDURE AND CAUTION

Fill uniformly five cans having a drain hole at the bottom with about 500 g of airdry soil in each. Sow about 4 seeds of sunflower in each and allow them to germinate. After emergence, thin the plants to two, allow them to pass through the two holes in the lid and place the lid. Avoid heating of the cans due to insolation, by placing them in moist Sowdust. Grow them for about six weeks, watering then as and when necessary. By this stage, the plants would have developed at least about three pairs of leaves.

Insert a glass tube in the soil for aeration and plug it with cotton wool. Seal the soil surface with wax. Also close the drainage hole and seal it. At this stage, water the plants for the last time and plug all the space between the soil surface and the holes in the lid of the can be plugged with cotton wool to control evaporation. Allow the plants to wilt.

As soon as both the plants show signs of loss of turgor, transfer them to a drak humid chamber. The cans with plants can be kept in a small water tray and covered with a bell jar to create a high humidity chamber. The bell jar should be covered with a black polythene piece.

Leave the plants overnight to gain favourable water balance by allowing them to extract moisture from the soil. If they gain turgidity, expose them to the atmosphere for a couple of hours and transfer them back to the humid chamber. Repeat the

process till the plants do not recover in the dark humid chamber.

At this stage, remove the lid and cut the plants. Take a duplicate soil sample. Determine the moisture content of the soil sample. This value will represent the value of the permanent wilting point of the soil.

4.5 Observation to be recorded & results

a) Weight soil sample with box

b) Weight oven-dry soil sample and box

c) weight of box.

5. Use of tensiometer for determination of soil moisture tension

5.1 INTRODUCTION

Various measures of water in the soil may be made but the most relevant to understanding plant growth is soil moisture tension, which is a measure of the energy required to exact water from the soil.

5.2 OBJECTIVE

- *By doing this Practical the learner will be able to determine the soil moisture tension .*

5.3 EQUIPMENTS REQUIRED

Tensiometer, sampling auger and deaerated water

5.4 PROCEDURE & CAUTION

For installing, a vertical hole equal to the cup diameter i.e. augered in the soil. The tensiometer is placed in the hole and soil is pressed in the hole to ensure a good contact with the cup after setting the tensiometer. After installation, tensiometers are filled with deaerated water. The tensiometer is placed in the field and reading is taken daily in the morning.

5.5 OBSERVATIONS TO BE RECORDED & RESULTS

Daily reading of the tensiometer is taken and when the desired tension i.e. reached, irrigation is applied.

5.6 REPORT PREPARATION

A. CALCULATION OF AVAILABLE MOISTURE IN SOIL :

Available moisture = FC - PWP/100 x BD x Depth of soil

FC = soil moistur percentage at field capacity field capacity

PWD = soil moisture percentage at field capacity

PWP = soil moisture percentage at permanent wilting point

BD = Bulk density of soil.

Determination of soil mosture percentage, field capacity, permanent wilting point and bulk density of the soil has been discussed.

Example : FC = 21.1 per cent

PWP = 8.3 per cent

BD = 1.15 g/cc

Available moisture per meter depth of soil $= \frac{21.1 - 8.3}{100} \times 1.15 \times 100$ cm

$= \frac{12.8 \times 1.15 \times 100}{100} = 14.7$ cm

Available moisture in the soil is 14.7 cm per meter depth of soil.

B. CALCULATION OF NET DEPTH OF IRRIGATION WATER

Net depth $= \frac{FC - M}{100} \times BD \times E$

When M = soil moisture percentage before irrigation

FC = Soil moisture percentage at FC

BD = Bulk density

E = Effective root zone depth

Example : Wheat field at the time of irrigation contains 12.5 per cent moisture. FC value of this soil is 22.5 per cent. Effective root zone depth of wheat is 60 cm

Bulk density of the soil is 1.20 g/cc

Therefore, net depth of irrigation

$= \frac{22.5-12.5}{100} \times 1.20 \times 60$ cm = 7.2 cm

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