

Determination of Field capacity and Permanent Wilting Point by Pressure Plate Apparatus and Hygroscopic Coefficient

In our agricultural operations, mainly in scheduling irrigation we are interested to know the lower and the upper limit of available soil water (ASW). Lower limit of available soil water is known as permanent wilting point (PWP) or soil water potential, T_w of -15 bars; upper limit field capacity (F.C.) at which P_w is -1/3 bar. If we get soil moisture values from -1/3 to -15 bars, we can prepare the curve.

For irrigation we are interested in -1/3 and -15 bars. Though the water potential at field capacity may range from -0.1 to -0.5 bar in different types of soils, but the water content at -1/3 bar is generally taken as field capacity of the soil. Similarly, water content at -15 bar is considered as permanent wilting percentage. By determining the moisture content at -1/3 and -15 bar we get the values of field capacity and permanent wilting percentage in the laboratory. Besides the values of field capacity and permanent wilting point, pressure plate apparatus is a device to find moisture retention relationship of soil in laboratory.

Apparatus and Accessories:

1. Pressure Plate Apparatus
2. Compressed air source
3. Rings to hold soil: should be of 1 cm height and 4-6 cm diameter
4. Physical balance
5. 105 °C oven
6. Moisture boxes
7. 50 ml burette

Procedure:

1. Arrange the soil sample retaining rings evenly on the porous ceramic plate and fill them uniformly with processed air-dry soil. One sample retaining ring takes about 20 gm of dry soil. Segregation of particles of various sizes can be avoided by dumping of whole soil in a

ring rather than slow pouring. The capacity of a sample retaining ring should, therefore, be checked beforehand for the purpose.

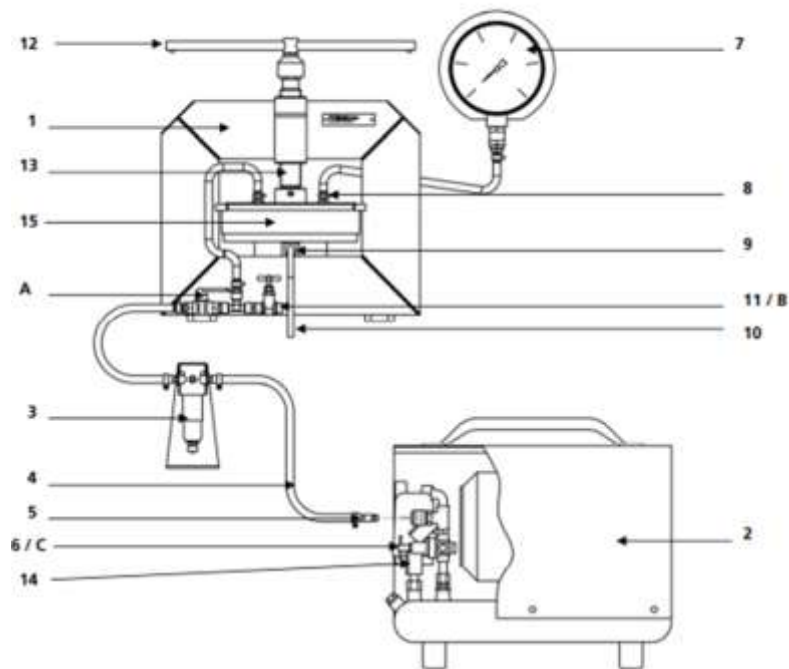
2. Fill the plate with distilled water and leave it for few hours for complete saturation of the plate and soil samples.
3. Drain off excess free water with pipette from around the soil samples.
4. Place triangular support on bottom of pressure chamber.
5. Place the porous plate with saturated samples on triangular support in the chamber and connect it to the lowest outlet port. The second plate is set on three plastic spacers which are placed on the first plate near the outer edge and located at about 120° from each other. Connection to this plate is made through middle outflow port. The third plate is similarly mounted and connection is made through the out let port on upper edge.
6. Connect the outflow tube to the burette and cover the pressure chamber with lid.
7. Tighten the clamping screws diagonally with 10-foot pound torque. Use torque wrench for uniform tightening.
8. Turn on about 2 psi air pressure in the pressure chamber. (Make sure that burette is also turned on before pressure is turned on). Immediately lot of air and water will rush out into the burette. Wait till air bubbles cease.
9. Gradually raise the pressure to desired level (1 atm = 14.7 psi one bar approximately). Now air bubbles will come very slowly at the rate of about 1 ml/minute. Faster air escape indicates leak and that must be corrected by resetting the apparatus.
10. Record water level in burette every morning and evening till the outflow of water stops completely. (Water level in burette should be noted immediately after escape of air bubble, which slowly forms at its surface).
11. Disconnect the burette and slowly release the pressure.
12. Open the lid of pressure vessel by unscrewing the clamping bolts.
13. Transfer the sample from one ring to weighed moisture box and record the wet weight of soil quickly without appreciable loss of moisture.

14. Dry the soil sample at 105 °C, find out dry weight of soil and calculate moisture in soil on dry weight basis.
15. Repeat the steps 6 to 14 seven times, applying the pressure of 4.9, 9.8, 14.7, 29.4, 73.5, 220.5 psi one after another at step 9.
16. Plot a desorption curve from the pressures and corresponding moisture data.

Important Note: For determination of Field Capacity by Pressure Plate Membrane Method, Pours Ceramic plate should be selected of -1/3 bars.

Hygroscopic coefficient:

Diagram sketch of Pressure plate



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|-------------------------|----------------|
| 1. Membrane apparatus | 8. Mouth piece |
| 2. Compressor | 9. Tube tulle |
| 3. Air filter | 10. Drain tube |
| 4. A high-pressure tube | 11. T-piece |
| 5. Mouth piece | 12. Handle |
| 6. Reduction valve | 13. Worm screw |
| 7. Manometer | 15. Casing |

Observations :

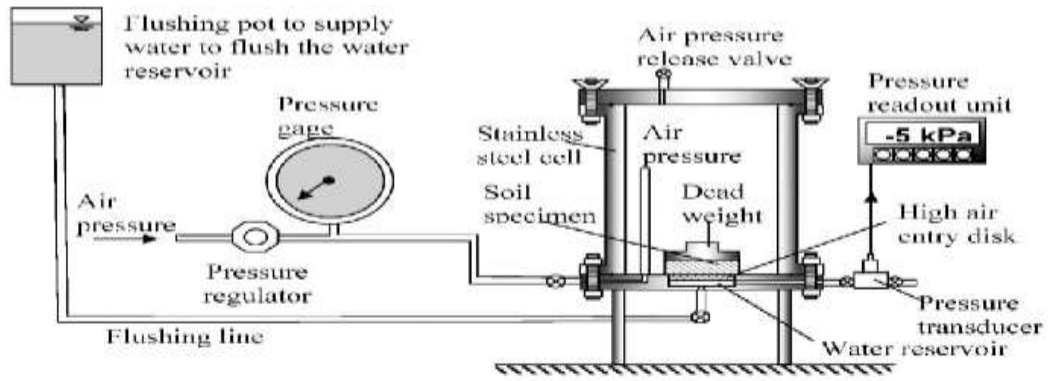
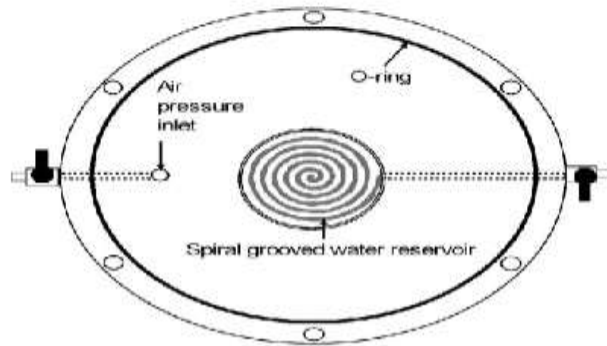


Fig. 1. Modified pressure plate apparatus for matric suction measurement

A)



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lars of soil sample

B) Description equilibrium

Sr. No.	Date	Time	Pressure (psi)	Plate No	Burette reading	Total out flow(ml)

Practical significance:

Conclusion:

Signature of Faculty In-charge