

Determination of infiltration rate by double ring infiltrometer method

Aim

To determine the infiltration rate

Materials required

1. Two Rings of 30 cm & 60 cm diameters
2. Hammer & Wooden board
3. Stop watch or timer
4. Hook or point guaze, spade, bucket, water

Introduction

Infiltration is the entry of fluid from one medium to another. In irrigation practice it is the term applied to the process of downward entry of water into the soil.

Infiltration rate is defined as the amount of water flowing into the soil profile per unit of soil surface per unit time. At the initial stage, when the soil is dry then the infiltration rate tends to be high but slowly it tends to decrease and becomes constant which can be called as basic intake rate or steady state infiltration rate.

The decrease in infiltration rate can be due to non – preventable decrease in matric solution gradients. The infiltration rate depends on the time of irrigation or rainfall initial soil wetness soil surface conditions hydraulic conductivity and soil profile. this method is used because of its accuracy and simplicity in measurement.

A double ring infiltrometer consists of 2 concentric metal rings. The rings are driven into ground and filled with water. The outer ring prevents the divergent flow of water. The drop in water level in the ring is useful in measuring the infiltration level.

Working principle

A double ring infiltrometer requires two rings: an inner and outer ring. The purpose is to create a one-dimensional flow of water from the inner ring, as the analysis of data is simplified.

If water is flowing in one-dimension at steady state condition, and a unit gradient is present in the underlying soil, the infiltration rate is approximately equal to the saturated hydraulic conductivity.

An inner ring is driven into the ground, and a second bigger ring around that to help control the flow of water through the first ring.

Water is supplied either with a constant or falling head condition, and the operator records how much water infiltrates from the inner ring into the soil over a given time period.

The ASTM standard method specifies inner and outer rings of 30 and 60 cm diameters, respectively.

Diagram sketch of double ring infiltrometer



Procedure

1. Characterize soil condition in terms of texture, surface condition, structure, initial moisture status etc.
2. Prepare a level testing area.
3. Place outer ring in place; place flat board on ring and drive ring into soil to a minimum depth of 10 cm.
4. Place inner ring in the center of outer ring; place flat board on ring and drive ring into the soil to a minimum of 10 cm. the bottom rim of both rings should be at the same level.
5. Seal any large gaps along edges of the ring with 'putty' made from moist, reworked soil rolled out to the thickness of a pencil (subsoil is best). Take care not to disturb the surface of the soil inside the ring.
6. Pour the water in the outer as well as inner ring until water level indicator mark. Remove the splash guard after pouring water. Avoid any soil disturbance while pouring water by placing a splash guard. Maintain the same water head in both the rings. Do not fill excess water beyond the point gauge.
7. Record the fall (recession) in water level in the inner cylinder as a function of time at fixed intervals. For instance, at 1, 3, 5, 10, 20, 30, 40, 60, 80, 100, 120 and thereafter on hourly basis till the water intake is constant.
8. Measurement of the water level in the inner ring should be made from a fixed reference point and should continue at the interval determined under a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of 5mm or less of drop between the highest and lowest readings of four consecutive readings.
9. Enter the infiltration data in the given format and calculate the infiltration rate.
10. Plot the infiltration rate and cumulative infiltration curve as a function of time. The drop occurs in the inner ring during the final period or the average stabilized rate, expressed as mm or hour, should represent the infiltration rate for the test location.
11. The drop that occurs in the inner ring during the final period or the average stabilized rate is expressed in mm/hour.

Observation:

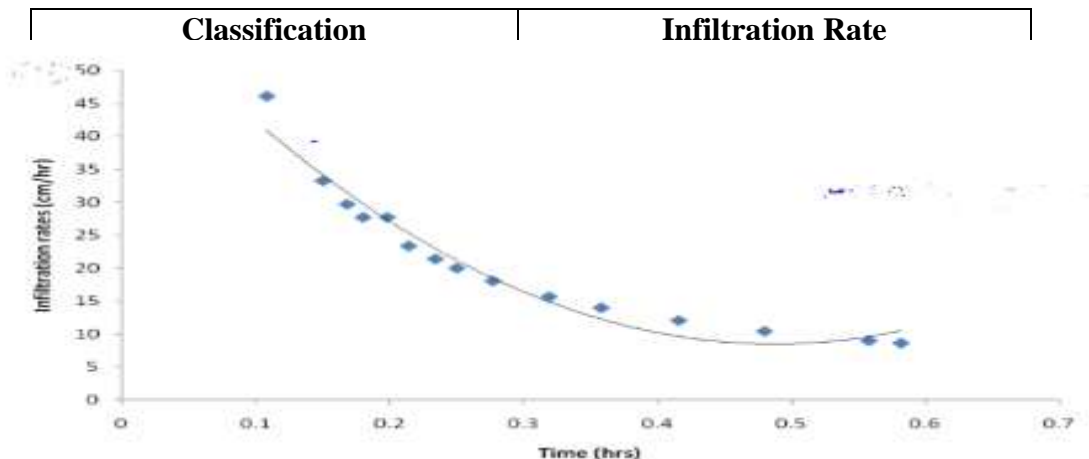
Location -

Test date –

Soil texture -

Time elapsed from previous rain –

Watch reading (hrs:min)	Time interval (min)	Cumulative time (min)	Water level before	Water level after	Infiltration (mm)	Infiltration rate (mm/min)	Infiltration rate (mm/hr)	Cumulative infiltration (mm)
2:05	0	(0+0) =0	100	0	0	100/0=0	0×60=0	(0+0) =0
2:07	2	(0+2) =2	100	93	(100-93) =7	7/2=3.5	3.5×60=210	(0+7) =7
2:10	3	(2+3) =5	94	89	(94-89) =5	5/3=1.6	1.6×60=96	(7+5) =12
2:15	5	(5+5) =10	88	80	(88-80) =8	8/5=1.6	1.6×60=96	(12+8) =20
2:25	10	(10+10) =20	79	70	(79-70) =9	9/10=0.90	0.90×60=54	(20+90) =29
2:35	10	(20+10) =30	69	60	(69-60) =9	9/10=0.90	0.90×60=54	(29+9) =38
2:45	10	(30+10) =40	59	48	(50-44) =6	6/10=0.60	0.60×60=36	(38+11) =49
3:05	20	(40+20) =60	47	38	(47-38) =9	9/20=0.45	0.45×60=27	(49+9) =58
3:25	20	(60+20) =80	37	30	(37-30) =7	7/20=0.35	0.35×60=21	(58+7) =65



Infiltration graph

Precautions

- Do not disturb the soil inside the rings
- Ensure that both the rings are placed at the same height.
- Do not let the rings get dry, pour water if needed.

Practical significance

Soil can be excellent temporary storage medium for water, depending on the type and condition of the soil. Proper management of the soil can help maximize infiltration and capture as much water as allowed by a specific soil type. If water infiltration is restricted or blocked, water does not enter the soil and it either ponds on the surface or runs off the

land. Thus, less water is stored in the soil profile for use by plants, Runoff can carry soil particles and surface applied fertilizers and pesticides off the field. These materials can end up in streams and lakes or in other places where they are not wanted. Soils that have reduced infiltration have an increase in the overall amount of runoff water. This excess water can contribute to local and regional loading of streams and rivers or results in accelerated soil erosion of fields.

Conclusion

Signature of Faculty In-charge