Determination of Infiltration Rate of Soils using Double Ring Infiltrometer – Study of Soil Characteristics of Kundapura, Udupi Dist.

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Abstract- *Infiltration is the process by which water on the ground surface enters the soil. Infiltration rate in soil science is a measure of the rate at which soil is able to absorb rainfall or irrigation. It is measured in inches per hour or millimeters per hour. Precipitation falling on the soil wets down and it starts penetrating into the soil. Water restores to the formal level the soil moisture deficiency excess moving down by the gravity force through percolation or seepage to build up the water table. The water is driven into the porous soil by force of gravity. First the water wets soil grains and then the extra water moves down due to gravitational force. The rate at which a soil absorbing the water in a given time is called infiltration rate and it depends on soil characteristics such as hydraulic conductivity, soil structure, vegetation cover. The main aim of this study is the determination of infiltration rate of soil and soil characteristic of Kundapura, Udupi District using Double ring infiltrometer. In this study tests are done by pouring water into the rings (of 30cm diameter and 60 cm diameter which is hammered in to the soil 10 cm and 30 cm respectively) until the depth is approximately 70-100 mm. At the same time, add water to the space between the two rings or the ring and the bund to the same depth. The water in the bund or within the two rings is to prevent a lateral spread of water from the infiltrometer. Recorded the clock time to measure the water level on the measuring rod and water in the ring refilled as water level on the measuring rod drops down. Same test done in the three places and same procedure is continued the drop in water level is the same over the same time interval. Taken readings frequently (e.g. every 1-2 minutes) at the beginning of the test, then extended the interval between readings as the time goes on (e.g. every 20-30 minutes).*

I. INTRODUCTION

A standard field-test method for determining infiltration rates by means of single- or double-ring infiltrometers is described and the construction, installation, and operation of the infiltrometers are discussed in detail. Saturated hydraulic conductivity is one of the most important soil hydrophysical characteristics. Its determination is needed for many different applications and it is a key parameter for solutions in soil physics, hydrogeology, environmental protection, soil and groundwater protection against pollution, soil reclamation, irrigation and drainage for agricultural and non-agricultural purposes, landfill foundation, sport surfaces, etc. It is also one of the main input parameters for models simulating transport of water and solutes through the soil profile. The double ring infiltrometer is a widely used method of infiltration test used in many applications; i.e. design of land drainage pipes, design of sports surfaces, golf courses, isolation layers of the communal waste, etc. The infiltrometer consists of two concentric metal rings which are driven into the soil, and of a perforated metal plate. The measurement is taken in the inner cylinder; the outer cylinder is used only as a tool to ensure that water from the inner cylinder will flow downwards and not laterally. The soil surface in the inner cylinder is covered by a perforated metal plate which is used in order to dissipate the force of the applied water, to distribute water uniformly inside the ring and to prevent disturbance of the soil surface

II. RESEARCH SIGNIFICANCE

The infiltration rate is the velocity or speed at which water enters into the soil. It is usually measured by the depth (in mm) of the water layer that can enter the soil in one hour. This test method describes a procedure for measuring the infiltration rate of water through in-place soils using a double-ring infiltrometer with a sealed inner ring. The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. This test method provides a direct measurement of infiltration rate

III. STUDY AREA

The Karnataka Coastal Region, which extends between the Western Ghats, edge of the Karnataka Plateau in the east and the Arabian Sea in the West, lies between 17° 42' 29" N to78° 17' 51" E

IV. MATERIALS AND METHODS

Two number of Cylindrical ring infiltrometer height 38cm,diameter of inner ring 30cm and outer ring 60cm,Wooden piece(to drive the cylinder inside the soil), Hammer (to dig the cylinder inside the soil without any disturbance in the soil surface), Metal plate, Long pipe, Stopwatch (to know the time interval in which infiltration has to be measured), Tape &scale (the amount of water penetrate inside the soil within a specific time interval), Cover & plastic sheet, Stationary use, Wash cloths.

Two rings of 30cm diameter and 60 cm diameter which is hammered in to the soil 10 cm and 30 cm respectively, and the water is poured in to these ring until the depth is approximately 70-100 mm. water is also added to the space between the two rings or the ring and the bund to the same depth. The water in the bund or within the two rings is to prevent a lateral spread of water from the infiltrometer. Recorded the clock time to measure the water level on the measuring rod and water in the ring refilled as water level on the measuring rod drops down. After 1-2 minutes, recorded the drop in water level in the inner ring on the measuring rod and added water to bring the level back to approximately the original level at the beginning of the test. Maintained the water level outside the ring similar to that inside. Same test done in the three places and same procedure is continued the drop in water level is the same over the same time interval. Taken readings frequently (e.g. every 1-2 minutes) at the beginning of the test, then extended the interval between readings as the time goes on (e.g. every 20-30 minutes).

V. RESULT AND DISCUSSION

This test method describes a procedure for measuring the infiltration rate of water through in-place soils using a double-ring infiltrometer with a sealed inner ring. Rate of infiltration studied by passing the water at different time of interval and measured depth of water infiltered.

Table: 1 Showing the Time interval, depth of infiltrated and rate of infiltration of Moodalakatte

Time Interval	Depth of water Infiltered	Rate of Infiltration	Cumulative value
2	5-4.2=0.80	0.4	0.40
2	2.6-2.1=0.50	0.25	1.45
2	4.2-3.9=0.30	0.15	2.45
2	2.5-2.1=0.40	0.20	3.35
2	2.95-2.70=0.25	0.125	4.0
2	3.0-2.80=0.20	0.10	4.625
2	3.80-3.60=0.20	0.10	5.225
2	2.6-2.35=0.25	0.125	5.85
2	3.4-3.10=0.30	0.15	6.40
2	2.4-2.15=0.25	0.125	6.875
2	3.2-2.95=0.25	0.125	7.40
2	2.35-1.95=0.40	0.20	7.90
2	1.7-1.4=0.30	0.15	8.45

Runoff = Precipitation – Infiltration = 4316 – 3.625
= 4312.375mm

The infiltration rate of the area we got as 3.162 mm/s.

Type of the soil: clay soil.

Table: 2 Showing the Time interval , depth of infiltrated and rate of infiltration of Maravanthe

Time Interval	Depth of water Infiltered	Rate of Infiltration	Cumulative value
4	10-7.9=2.10	0.525	0.525
4	10.9-10=0.9	0.225	2.00
4	4.5-3.5=1.0	0.25	3.075
4	5.90-5.00=0.90	0.225	4.125
4	7.4-6.5=0.90	0.225	5.05
4	3.50-2.90=0.60	0.150	5.95
4	5.50-4.85=0.65	0.162	6.737
4	2.40-1.90=0.50	0.125	7.50

Runoff of Maravante:

Runoff = Precipitation – Infiltration
= 4316 – 3.125
= 4332.875mm
The infiltration rate of the area 3.162 mm/s.
Therefore type of the soil: clay soil

Table: 3 Showing the Time interval , depth of infiltrated and rate of infiltration of Near Check Dam area

Time Interval	Depth of water Infiltered	Rate of Infiltration	Cumulative value
4	5.0	1.25	1.25
4	3.0	0.75	5.825
4	5.70	1.425	9.625
4	4.20	1.05	15.59
4	2.95	0.73	19.84
4	5.80	1.45	23.61
4	4.40	1.10	29.80
4	3.20	0.80	34.38

Runoff of Near Check dam:
Runoff = Precipitation – Infiltration
= 4316 – 15.20
= 4300.80mm
The infiltration rate of the area 15.15 mm/h.
Therefore type of soil: loam soil.

Analysis:

Soil characteristics of Kundapura

Particle size various in the study area as mentioned in the below table studies says that area is largely consist of sandy soil, next to this sediments size found in study area is clayey particles. Large amount of nutrient found in the study area is

Table: 4 Particle size distribution of surface soil found in the study area

Particle size distribution (ranges) in surface soils of Kundapura	Sand (%)	Silt (%)	Clay (%)
	54.56 – 71.12	6.44 – 15.00	20.36 – 30.44

VI. CONCLUSIONS

Double-ring infiltrometers is equipment used conduct the field test to determine the rate of infiltration. it has many merits but this method is hard t undertake The studies in these three places of Kundapura says how the rate of infiltration various from place to place depends upon the types soil and soil properties.

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