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Research Article

MEASUREMENT OF INFILTRATION ON DIFFERENT LAND COVERS

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Abstract- The field experiment was conducted on the farm of Krishi Vighyan Kendra, near the College of Agricultural Engineering and Technology Jalgoan (Ja) for "Measurement of Infiltration on Different Land Covers". The measure of infiltration of water into the soil is an important in dication concerning: the efficiency of irrigation and drainage optimizing the availability of the water for plant improving the yield of the crop and minimizing the erosion. Infiltration is an important parameter in irrigation planning. Study was undertaken to measure the infiltration on different land covers. Infiltration was measured by double ring infiltrometer and developed the infiltration equations, also determined the different properties of soil on cultivated land cover and bared land covers. It was found that for cultivated land cover, the average infiltration rate was 6.06 cm/hr and 4.34 cm/hr for bared land cover. The average moisture content, bulk density and field capacity was found to be 16.49%, 1.71 gm/cc and 26.23% respectively for cultivated land cover. Also the average moisture content, bulk density and field capacity was found to be 11.7%, 1.59 gm/cc and 29.55% respectively for bared land cover.

Keywords- Infiltrometer, Moisture content, Bulk density, Field capacity.

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Introduction

India has a naturally available abundant water resource. Infiltration is one of the most important components in irrigation. Water infiltration is driving force influencing crop growth, soil erosion and chemical leaching process. The water is driven into the porous soil by force of gravity and capillary attraction. The rate at which a given soil can absorb water at given time is called infiltration rate and it depends on soil characteristics such as soil texture, hydraulic conductivity, soil structure, vegetation cover etc. the infiltration plays an important role in generation of runoff volume, if infiltration rate of given soil is less than intensity of rainfall then it results in either accumulation of water on soil surface or in runoff. There are two general approaches to determine capacity of soil infiltration rate. That is first analysis of hydrograph of runoff from natural rainfall in plots and watersheds. Secondly, use of infiltrometer with artificial application of water to enclosed sample areas, concerning hydrograph analysis [2]. The major factor affect infiltration of water in to soil are initial moisture content condition of soil surface, hydraulic conductivity of soil profile, texture, porosity, organic matter, vegetative cover, duration of irrigation or rainfall and viscosity of water. Infiltration rates are generally lower than soil of light texture.

MaterialsandMethods

Materials

Double ring infiltrometer, bucket, oven, electrical weight balance, mechanical shaker, scale, stopwatch, wooden hammer, screw auger etc

Experimental Site

The site for conducting the experiment was selected at Krishi Vigyan Kendra, Jalgaon (Ja) near the College of Agricultural Engineering and Technology, Jalgoan (Ja). Which is affiliated to Dr. Panjabrao Deshmukh Krishi Vidyapeeth,

Akola (M.S Two land covers were selected for study *viz.*

1. Cultivated land
2. Bared land

Location

The study was confined in the Jalgaon (Ja), District Buldana, which is situated in Vidarbha region of Maharashtra. The Buldana district is situated in between latitude 210 3.1164 N-S and altitude 760 32.0784 E-W and altitude 309 m above the sea level.

Climate

The climate of area hot and dry subtropical. The summer is two dry and hot. The winter is to cold and rainy season start from the first week of June and continues up to September with maximum rainfall in July. The average annual rainfall is about 750 mm. The average minimum and maximum temperature varies between 70c to 170c and 400cand 460c respectively. May is driest and January is coolest month.

Experimental Setup

The experimental was conducted on the form of Krishi Vigyan Kendra, Jalgaon (Ja) near the College of Agricultural Engineering and Technology, Jalgoan (Ja),

district Buldana. Water infiltration was measured with a double-ring in tiltrometer with a 15-cm head maintained during the measurement. The diameter of the inner and outside rings were 30 and 60 cm, respectively. Readings of water level were taken at 0,5,10,15,20,30,45,60,90, and 120 minutes [8]. Actual cumulative intake of water was recorded for each time interval throughout the 2-hour period. Infiltration data for the last 30 minutes of the 2-hour period were used to calculate equilibrium infiltration rate. Double ring infiltrometer was used for measurement infiltration because of its reliability and accuracy. One hook gauge for measurement of water level, stop watch and water container. One of the two cylinder, one was used to form buffer pond in order to avoid the lateral movement of water. The cylinder were installed 10 cm deep in soil care was taken to maintain the same instruction depth in all the experiments. The cylinders were installed in the field by means of a mild steel plate and hammer. Gentle hammering was done to avoid the soil in getting distributed from their natural condition. The depth of water in all the experiment was kept equal, [12]. Water level in cylinder was recorded with help of point gauge and stop watch. The point gauge was used to record the water level at the cylinder. The water level in cylinder was brought to initial level often a regular interval of one hour.

Determination of moisture content of soil

Soil auger was used to collect the samples for measurement of moisture content. The soil samples were taken always from 20 cm depth in all the observations. The soil auger was driven in to soil up to the depth of 20 cm and sample were collected in moisture box was weight was already known. Now the sample along with moisture box was weighed on a balance and kept in an electric oven at 1050C for 24 hour. The dried samples were again weighed and the moisture content on dry weight basic was calculated [14].

Determination of bulk density of soil

The predicted important variable like bulk density. Incorporation of limited data on water retention, mostly, field capacity and permanent wilting point was also reported to improve accuracy of clay mineralogy. [18]. Bulk density of soil was out by core cutter. The cutter was used to take the undisturbed soil sample. The cylinder of core sampler has cutting edged was driven into soil and an un compacted core obtained within tube. The samples were carefully trimmed at both ends of core cylinders. They were dried in an oven at 1050C for 24 hour until all the moisture was given off and the sample weight again. The volume of soil core cylinder was measure [14].

Determination of field capacity

Field capacity was determine by ponding water on the soil surface in an area of about 1 sq. m and permitted it to drain for one day with surface evaporation prevented. Evaporation was prevented by spreading a polythene sheet on the ground surface. After one day soil samples were collected with an auger from 20 cm depth. The moisture content was determined by oven dry method [12].

Results

Infiltration under cultivated land cover and curve fitting

The infiltration depth at the selected time interval was measured. Infiltration rate was calculated using the actual infiltration depth and time period. Average infiltration rate and accumulated are given in [Table-1].

Table-1 *Measured cumulative infiltration, measured infiltration rate and predicted cumulative infiltration in cultivated land by double ring infiltrometer*

SN	Time (min)	Infiltration depth cm	Average rate infiltration cm/hr	Accumulated infiltration cm.	Predicted infiltration
1	5	1.7	20.4	1.7	1.6
2	10	0.4	12.6	2.1	2.11
3	15	0.3	9.6	2.4	2.53
4	20	0.6	9	3	1.9
5	25	0.2	7.68	3.2	3.2
6	30	0.3	7	3.5	3.5
7	35	0.5	6.85	4	3.8
8	40	0.2	6.3	4.2	4.1
9	45	0.2	5.8	4.4	4.4
10	50	0.2	5.52	4.6	4.6
11	55	0.3	5.34	4.9	4.9
12	60	0.3	5.2	5.2	5.1
13	65	0.2	4.98	5.4	5.3
14	70	0.1	4.71	5.5	5.6
15	75	0.1	4.48	5.6	5.8
16	80	0.2	4.35	5.8	6
17	85	0.2	4.23	6	6.21
18	90	0.1	4.23	6.2	6.4
19	95	0.1	4.133	6.3	6.7
20	100	0.1	3.97	6.4	6.9
21	105	0.1	3.84	6.5	7.1
22	110	0.1	3.71	6.6	7.3
23	115	0.1	3.6	6.7	7.4
24	120	0.1	3.49	6.8	7.6
25	125	0.1	3.4	6.9	7.8
26	130	0.1	3.31	7	8
Total			157.72		

Average infiltration rate = 6.60 cm/hr.

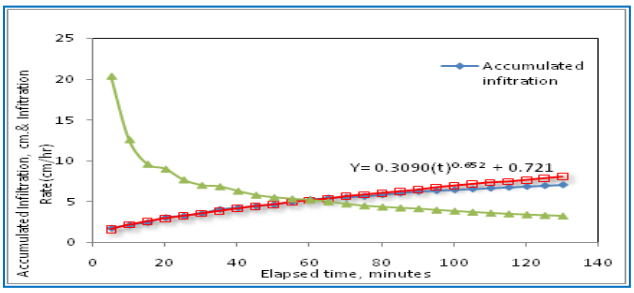

Fig-1 Plots of Accumulated infiltration and average infiltration rate against elapsed time of the cultivated land.

Infiltration under bared land cover and curve fitting

The infiltration depth at the selected time interval was measured. Infiltration rate was calculated using the actual infiltration depth and time period. The average infiltration rate and accumulated infiltration rate is shown graphically in [Fig-2]. From the graph, it is seen that the infiltration rate decreased during the experiment.

It concluded that an increase in initial moisture content in the tested sediments correlated with a decrease in infiltration rate. They stated that this is probably due to the unavailability of the smallest interstitial spaces for the percolation of water after the initial supply is received. In fine textured materials part of the rate reduction is due to the swelling of clay and the resultant choking of the small pores [11,13].

Infiltration was measured at suitable interval of 5 minutes up to 130 minutes and plotted the graph of accumulated infiltration verses elapsed time, then developed equation which was suggested by [4]. The following equation was developed for cultivated land cover.

$$Y = 0.62(t)^{0.380} + 0.50$$

Table-2 *Measured cumulative infiltration, measured infiltration rate and predicted cumulative infiltration in bared land by double ring infiltrometer.*

Sr.No.	Time (min)	Infiltration depth cm	Average rate infiltration cm/hr	Accumulated infiltration cm.	Predicted infiltration
1	5	1.5	18	1.5	1.68
2	10	0.4	11.4	1.9	1.98
3	15	0.3	8.8	2.2	2.23
4	20	0.2	7.2	2.4	2.43
5	25	0.2	6.24	2.6	2.6
6	30	0.2	5.6	2.8	2.75
7	35	0.2	4.97	2.9	2.89
8	40	0.1	4.5	3	3.01
9	45	0.1	4.1	3.1	3.13
10	50	0.1	3.84	3.2	3.2
11	55	0.1	3.6	3.3	3.34
12	60	0.1	3.3	3.3	3.4
13	65	0.1	3.1	3.4	3.5
14	70	0.1	3	3.5	3.6
15	75	0.1	2.88	3.6	3.69
16	80	0.1	2.77	3.7	3.77
17	85	0.1	2.68	3.8	3.85
18	90	0.1	2.6	3.9	3.92
19	95	0.1	2.52	4	3.99
20	100	0.1	2.46	4.1	3.06
21	105	0.1	2.4	4.2	4.13
22	110	0.1	2.45	4.3	4.26
23	115	0.1	2.29	4.4	4.32
24	120	0.1	2.25	4.5	3.38
25	125	0.0	0.0	4.5	4.38
26	130	0.0	0.0	4.5	4.44
Total			112.95		

Average infiltration rate = 4.34 cm/hr.

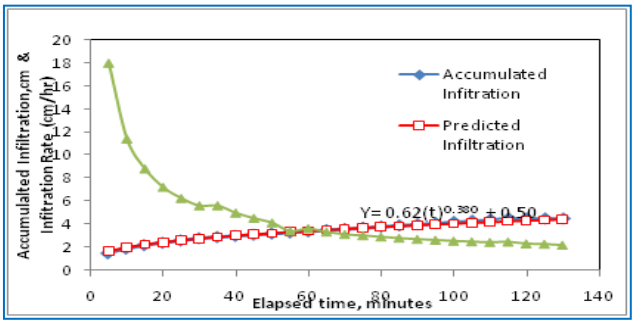

Fig-2 Plots of Accumulated infiltration and average infiltration rate against elapsed time of the Bared land.

Determination of soil properties

Soil properties i.e. moisture content, bulk density, and field capacity etc. was found out by standard procedure. It is given in [Table-3].

Table-3 *Properties of soil*

Sr.No.	Properties of soil					
	Moisture content, %		Bulk density gm/cc		Field capacity,%	
1	16.16	13.33	1.72	1.54	25	30.43
2	13.33	10.11	1.67	1.6	26.05	27.65
3	20	11.66	1.74	1.63	27.65	31
Avg.	16.49	11.7	1.71	1.59	26.23	29.55

Conclusion

Infiltration is an important parameter in irrigation planning. In this study measure the infiltration on different land, covers by using double ring infiltrometer were obtained infiltration equation. On the basis of equation were determined the different properties of soil on cultivated land cover and bared land covers.

Based on the results obtained from the study, the following conclusions are drawn.

1. The average infiltration rate for cultivated land cover was 6.06 cm/hr and 4.34 cm/hr for bared land cover.
2. Measured and predicted values were nearly same and curved were nearly fitted with each other.
3. The average moisture content, bulk density and field capacity was found out to be 16.49%, 1.71 gm/cc, 26.23 % respectively, for cultivated land cover. The average moisture content, bulk density, and field capacity was found out to be 11.7%, 1.59 gm/cc, 29.55% respectively, for bared land cover.

Conflict of Interest: None declared

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