The Geopacks Infiltrometer

Introduction

The Infiltrometer is a simple device, which nevertheless can yield a wealth of important data about variables, which influence soil and substrate permeability. The Infiltrometer can be used to make detailed enquiries on any of the following topics:

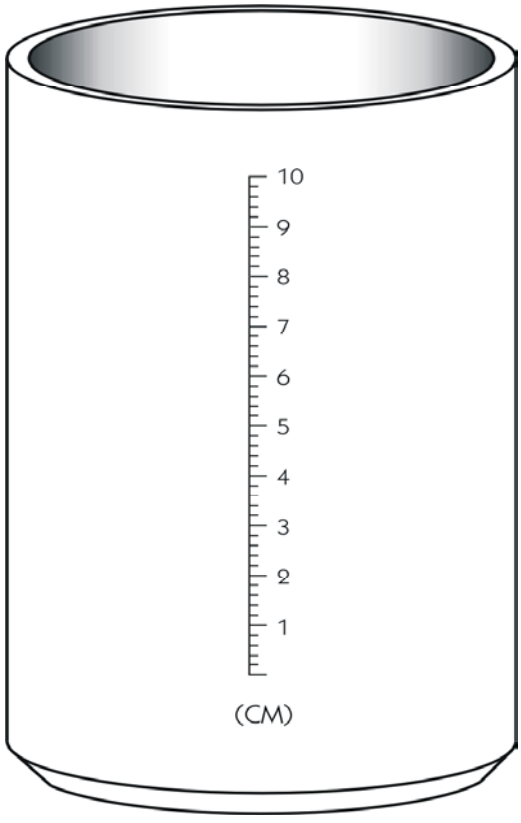
Measure infiltration rates in absolute terms on a ***variety of soils and substrates***

Measure infiltration rates in response to varying ***climatological conditions*** on the same soil or substrate

Measure infiltration rates in response to varying ***slope conditions***

Demonstrate the principal that water absorption by soil and substrate vary from surface to surface and from time to time

The device is therefore most suitable for geographical student projects from GCSE to A level and beyond (in the UK and equivalent levels in other countries for student-aged 16 years or more). It can also be used to demonstrate important principles to younger groups of students.



Using the Infiltrometer

What you will need for practical use of the Infiltrometer:

1 x Infiltrometer
1 x Stopwatch
1 x Clipboard and means of recording data
1 x Block of wood approximately 250 mm x 50 mm x 20 mm
1 x Mallet or Hammer
1 x Container of water (approximately 5 litres)

How to use the Infiltrometer

Carefully push the bevelled end of the cylinder into the surface you are testing to a depth of 40 mm; i.e. to the base of the graduated line on either side. This should be easy in soft materials like sand but much more difficult in compact materials like clay. If you cannot simply push the cylinder, place your wooden block across the top and gently tap with your hammer until the required depth is reached. It is important that the cylinder is upright and perpendicular.

Measuring Infiltration Rates

To measure variations in water infiltration rates over time, two recordings need to be taken:

First, the ***Total Elapsed Time (TET)*** from the beginning of the exercise to a point when the rate of infiltration becomes steady (see below).

Second, the time taken for a given volume of water to infiltrate the surface ***(Infiltration Rate or IR).***

Method:

- Start the experiment by choosing what is called a "Fall Unit" which is a volume of water within the infiltrometer. A suitable Fall Unit to begin with is 10 mm (1 cm). On highly porous surfaces, you may increase this to, say 20 mm. On impermeable surfaces you may need to reduce this to, say, 5 mm) - experience will guide you. Enter this and other details on a copy of the first data collection sheet provided there is an example on the following page.

- When you have chosen the Fall Unit, start the experiment by filling the cylinder to the 100-mm mark and simultaneously starting the timer.

- Record the time taken for the water level to fall by the chosen Fall Unit. Enter this figure on a copy of the second record sheet supplied - another example is provided.

- Quickly refill the cylinder to the 100-mm mark and record the time taken for the water level to fall by the Fall Unit. Enter the figure as before.

- Repeat the procedure, recording the time taken for each Fall Unit to be achieved until the time taken for each Fall Unit to be absorbed becomes constant. This may take several hours depending on the surface, sub-surface and degree of saturation.

- Finally, record the total elapsed time from the start of the experiment to the end (i.e. from the start to the time when the Fall Unit absorption rate (i.e. the Infiltration Rate becomes constant).

Processing the Data

Now we can calculate the Infiltration Rates for this particular site:

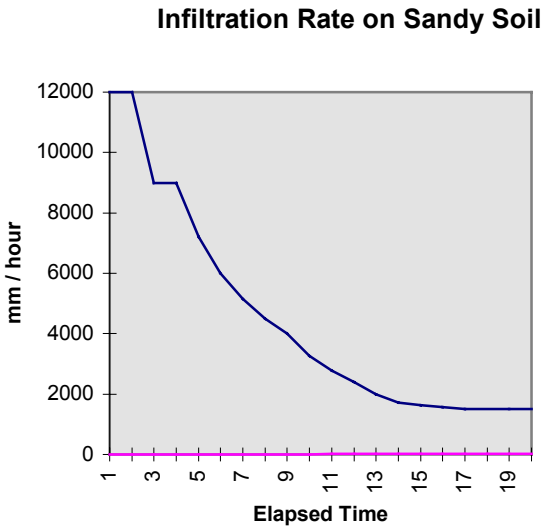
Infiltrate Rate (IR) in mm sec^{-1} = Fall in Water level (in mm) / Time Taken to fall this amount (in seconds)

Or:

Infiltration Rate (IR) in mm $hour^{-1}$ = (Fall in Water level (in mm) / Time Taken to fall this amount (in seconds)) x 3.6 x 10^3

Enter these values in the column marked for either IR in mm sec^{-1} or mm $hour^{-1}$ or both. These are your infiltration rates.

Presenting the data



This is a simple chart showing how the infiltration rate for a Sandy Soil changes from the beginning of the experiment to the point where on four successive readings the rate becomes steady. The data from which this chart was constructed is shown on the following pages. Of course, there are a number of different ways of representing your data.

DATA COLLECTION SHEET

Name:	**Julie Williams**
Group:	**Geopacks**
Project:	**Infiltrate**
Date:	**May 2002**
Site:	**Wimbledon Common South Side**
Grid Ref:	**Bare Earth**
Subsurface	**Terrace Gravel**
Position:	**5 degree slope**
Aspect:	**Tree canopy**

Fall Unit (mm):	**10**

	Hrs	**Min**	**Sec**
Finish Time	**13**	**9**	**28**
Start Time	**13**	**5**	**0**
Total Elapsed Time (TET)		**4**	**28**

DATA COLLECTION SHEET

Name:	

Group:	

Project:	
Date:	
Site:	
Grid Ref:	
Subsurface	
Position:	

Aspect:	

Fall Unit (mm):	

	Hrs	**Min**	**Sec**
Finish Time			
Start Time			
Total Elapsed Time (TET)			

Geopacks Infiltrometer

DATA COLLECTION SHEET

Time Slot	Fall Unit	Fall Time	IR mm/sec)	IR (mm/hour)
1	10	3	3.3	12000
2	10	3	3.3	12000
3	10	4	2.5	9000
4	10	4	2.5	9000
5	10	5	2.0	7200
6	10	6	1.7	6000
7	10	7	1.4	5142
8	10	8	1.3	4500
9	10	9	1.1	4000
10	10	11	0.9	3272
11	10	13	0.8	2769
12	10	15	0.7	2400
13	10	18	0.6	2000
14	10	21	0.5	1714
15	10	22	0.5	1636
16	10	23	0.4	1565
17	10	24	0.4	1500
18	10	24	0.4	1500
19	10	24	0.4	1500
20	10	24	0.4	1500
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Geopacks Infiltrometer

DATA COLLECTION SHEET

Time Slot	Fall Unit	Fall Time	IR (mm/sec)	IR (mm/hour)
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