













Physical soil properties – Exercise P04

SOIL COMPACTION - INFILTRATION TEST¹

Reference posters n. 4, 7a, 8a, 8b

<p>RELEVANCE</p>	<p>Infiltration rate is a measure of how fast water moves through the soil. A slow infiltration rate may indicate soil compaction and either lead to ponding (level fields) or surface erosion (sloping fields). By contrast, high infiltration rates may lead to nutrient leaching, reducing their availability for plant uptake.</p>	
<p>MATERIALS</p>	 <p>Stopwatch</p>  <p>Mallet</p>  <p>Soil cylinder (approx. diameter 15.24 cm)</p>  <p>Block of wood</p>	 <p>Plastic foil</p>
<p>PROCEDURE</p>	<p>1) Clear the sampling area of surface residue. Using the mallet and the block of wood, drive the metal/plastic ring down into not saturated soil, to a depth of 10 cm</p>	 <p>© S.Pioli</p>
	<p>2) Protect the soil surface inside the ring with a sheet of plastic wrap to completely cover the soil and ring. It is advisable to make a trench around the cylinder, 5 to 10 cm apart, and place water in it, before adding the water inside the cylinder. This avoids lateral flow of water into the soil, especially in compacted soils²</p>	 <p>© S.Pioli</p>
	<p>3) Pour 444 mL (2.54 cm) of water into the ring</p>	 <p>© S.Pioli</p>
	<p>4) Remove the plastic wrap by gently pulling it out, leaving the water in the ring</p>	 <p>© S.Pioli</p>
	<p>5) Using the stopwatch record the time (in minutes) it takes for the water to infiltrate into the soil. Stop timing when the surface is just glistening. Repeat the test to get a better estimate of infiltration rate</p>	 <p>© S.Pioli</p>

CALCULATION	1) Calculate the fraction of an hour: Fraction of an hour = minutes/60	
	2) Calculate the infiltration rate: Infiltration rate = 1 inch/ fraction of an hour	
	3) Compare the calculated infiltration rate with the following table according to your soil texture ³	
	Infiltration rate (cm/hour)	Soil Texture
	>3	Sand
	2-3	Sandy loam
	1-2	Loam
	0.5-1	Clay loam
	0.1-0.5	Clay
4) Evaluate your soil's condition according to the examples at the end of the page		
ADVANTAGES OF THE METHOD	Standard method that can be repeated over time and space. Different soils can be compared	
LIMITATION OF THE METHOD	Requires specific tools. Can be difficult to be applied on heavily compacted soils. It lacks precision. Soil moisture conditions should be similar at different sampling sites, preferably near field capacity	
QUESTIONS TO BE ADDRESSED	What are the soil physical attributes that affect the observed infiltration rates? Have you observed differences between soil types? How do you think infiltration can be improved?	

EVALUATION EXAMPLES		
POOR	MODERATE	GOOD
Measured infiltration rates differ greatly from the reference values (see table 1). Infiltration class is very rapid (>50 cm/hour) or impermeable (< 0.0038 cm/hour)	Measured infiltration rates differ slightly from the reference values (see table 1). Infiltration class is rapid (15 - 50 cm/hour) or very slow (0.0038 - 0.15 cm/hour)	Infiltration rates varies within the ranges of the reference values (see table 1). Infiltration class is moderately rapid (5-15 cm/hour), moderate (1.5-5 cm/hour), or moderately slow (0.5-1.5 cm/hour)

1 https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050956.pdf

2 <https://pubs.usgs.gov/wsp/1544f/report.pdf>

3 <https://www.fao.org/3/s8684e/s8684e0a.htm>