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Soil Health

Measuring Infiltration Rate in the Field

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Soil health, as defined by the USDA Natural Resources Conservation Service (NRCS), is the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans. There are a number of indicators that can be used in the field to assess the relative soil health of an area or to compare different management practices. Infiltration rate can help determine how quickly water can enter and move through the soil. A high infiltration rate may lead to loss of applied nutrients below the root zone and into natural water systems. A low infiltration rate may reduce aeration for proper root growth and lead to runoff and soil erosion. The steps below identify how infiltration rate can be measured in the field.

These steps can also be found in a video at:

https://www.youtube.com/watch?v=9KSdTFHA_E4

Step 1: Materials needed

The materials needed to measure infiltration rate can be found in Fig. 1. These include a metal ring, a sledge hammer, a wooden block, plastic wrap, water, pre-measured container or graduated cylinder, and a stopwatch. The metal ring can be made from a coffee can or pipe and should have a 6 inch diameter.

Fig. 1. Materials needed for measuring infiltration rate in the field.

Step 2: Installing the ring

Once a location has been identified, place the metal ring over the area to be measured and place the wooden block on top of the ring. Use the sledge hammer to drive the ring into the soil to a depth of around 3 inches (Fig. 2). A pre-drawn line on the outside of the ring can be used to identify when this depth has been reached.

Fig. 2. Installation of the ring using a sledge hammer and wooden block.

Step 3: Preparing the ring

If there is grass or organic matter above the soil surface, clip and gently remove this material (Fig. 3).

Fig. 3. Removing material from inside the infiltration ring.

Gently press along the inside of the ring to ensure the soil is in direct contact with the side of the ring. This will give more accurate results by preventing the water from using the slit formed by the ring to enter the soil. Cut a piece of plastic wrap that is large enough to cover the soil surface inside the ring and a few inches up the side of ring (Fig. 4).

Fig. 4. Placement of plastic wrap inside the infiltration ring.

Step 4: Adding water

The amount of water you add is dependent upon the diameter of your ring. You want enough water to provide a 1 inch depth of water. Table 1 provides the volume of water needed based on ring size. You can use a pre-measured container or a graduated cylinder to identify the volume required. Once the water has been added on top of the plastic wrap, slowly slide the plastic wrap, in one motion, out from under the water. Using the plastic wrap, rather than simply pouring the water, will ensure that the water is evenly distributed across the soil surface and reduce any impacts that might be caused by the falling water. Once the plastic wrap has been removed, start the stopwatch.

Table 1. Volume of water required based on ring size.

Ring diameter (inches)	Volume of water
4	206 ml or 7 oz.
5	322 ml or 11 oz.
6	463 ml or 16 oz.
7	631 ml or 21 oz.
8	824 ml or 28 oz.
9	1043 ml or 35 oz.

Step 5: Calculating infiltration rate

Record the time it takes for one inch of water to infiltrate into the soil, stop timing once the soil surface is glistening. If the soil inside the ring is uneven, then record the time once the about half of the soil surface is glistening. If it hasn't rained recently, you might need to follow the same procedure again and add another one inch of water because the first inch will likely have only moistened the soil enough to bring it to field capacity.

An infiltration rate of 1 to 2 inches per hour is considered ideal. If it takes longer there could be a restrictive layer, a high clay content, or compaction caused by tillage and/or traffic. If the rate is faster, you could be working with a sandy soil that contains larger pore spaces. It is also a good idea to dig up the ring and turn it over to see what the soil looks like. The causes of differences in infiltration rate can be identified by observing the soil (Fig. 5).

Fig. 5. Differences between a tilled (left) and untilled (right) soil can be observed by turning over the infiltration ring.

References and resources

USDA-NRCS. Soil quality test kit. Infiltration rate. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2_053873

USDA-NRCS. 2008. Soil quality indicators. Infiltration rate. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=stelprdb1237387

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