Infiltration Test

Soil infiltration refers to the soil's ability to allow water movement into and through the soil profile. It allows the soil to temporarily store water, making it available for uptake by plants and soil organisms. Infiltration raters are a measure of how fast water enters the soil and are typically expressed in inches per hour. For initial in-field assessments, however, it is more practical to express infiltration time in the number of minutes it takes soil to absorb each inch of water applied to the soil surface.

https://www.nrcs.usda.gov/sites/default/files/2022-10/Soil%20Infiltration.pdf

Materials needed to measure infiltration:

- Infiltration ring
- Rubber mallet
- Gallon-sized plastic ziptop storage bag
- 444mL of 15 ounces of water (approximately one 16.9 ounce water bottle with one drink taken from it)
- Stopwatch, timer, or cell phone time

Considerations:

If the soil is saturated, infiltration will not occur. Wait for one or two days to allow for some drying. Make sure the sampling area is free of residue and weeds or that vegetation is trimmed to the soil surface before inserting the ring.

Directions:

1. Use rubber mallet to pound infiltration ring a few inches into the ground.
2. Firm the soil – With the enclosed ring in place, use your finger to gently firm the soil surface only around the inside edges of the ring to prevent extra seepage. Minimize disturbance to the rest of the soil surface inside the ring.
3. Line ring with ziptop bag – Line the soil surface inside the ring with the plastic bag to completely cover the soil and ring. This procedure prevents disturbance to the soil surface when adding water.
4. Add water - Pour 444mL or 15 ounces of water (1" of water) into the ring lined with the plastic bag.
5. Remove wrap and record time –
    a. Remove the plastic wrap by gently pulling it out, leaving the water in the ring. Note the time/start the stopwatch.
    b. Record the amount of time (in minutes) it takes for the 1" of water to infiltrate the soil. Stop timing when the surface is just glistening.
    c. If the soil surface is uneven inside the ring, the time until half of the surface is exposed and just glistening.
    d. Enter the amount of time in minutes on a notepad.
6. Repeat infiltration test – In the same ring, perform Steps 2, 3, and 4 with a second inch of water. On a notepad, enter the number of minutes elapsed for the second infiltration measurement. If soil moisture is at or near field capacity, the second test is not necessary. (The moisture content of the soil will affect the rate of infiltration; therefore, two infiltration tests are usually performed (if the soil is dry). The first inch of water wets the soil, and the second inch gives a better estimate of the infiltration rate of the soil.)
7. Interpretation – Use the table to determine class. Inch/hr=(1/minutes)*60

Infiltration rate (minutes per inch)	Infiltration rate (inches per hour)	Infiltration class
< 3	> 20	Very rapid
3 to 10	6 to 20	Rapid
10 to 30	2 to 6	Moderately rapid
30 to 100	0.6 to 2	Moderate
100 to 300	0.2 to 0.6	Moderately slow
300 to 1,000	0.06 to 0.2	Slow
1,000 to 40,000	0.0015 to 0.06	Very slow
> 40,000	< 0.0015	Impermeable

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Wet Aggregate Stability/Soil Structure Retention

For a soil to be healthy, it must have good structure. Soil is made up of a combination of primary particles – sand, silt and clay – that can be bound together into aggregates. These aggregates are clumps of soil that range from the micro level (less than 0.25mm in diameter) to the macro level (greater than 0.25mm in diameter) and can resemble various shapes: granular, blocky, etc. These varied shapes allow for healthy soil to have pore spaces for air and water, needed for healthy plant growth.

Soil aggregates are formed through physical, chemical, and biological activity. Soil management influences aggregate size, shape, and stability. Plant roots also play a role in aggregate formation by secreting organic compounds called root exudates. These help bind soil together near the root zone.

Benefits of good soil aggregation include improved water infiltration, improved water retention, increased air exchange, increased resistance to wind and water erosion, greater organic matter accumulation, and increased habitat for soil life. Wet aggregate stability suggests how well a soil can resist raindrop impact and water erosion, while size distribution of dry aggregates can be used to predict resistance to abrasion and wind erosion.

Sources: https://www.nrcs.usda.gov/sites/default/files/2022-10/nrcs142p2_051276.pdf

Materials needed to observe wet aggregate stability:

- Two sink strainers
- Two small bowls or cups filled with water
- Flat surface or board

Considerations:

Start with two similar soils that have different long term management. For example: in the grass under a fencerow or near a hedgerow vs crop field or in a compacted area or a problem area in your field vs where you have the best yields.

Directions:

1. Place an even amount of surface soil, crumbled to pea size, from each management system in sink strainers.
2. Immerse or lower strainers in small bowls or cups of water.
3. Leave strainer of soil in bowl of water until each one is fully saturated. If necessary, add extra water from the top to ensure both are fully saturated.
4. Turn the strainers upside down onto a flat surface, pickup hood or tailgate, back of shovel, or a board.

Figure A shows a soil with good aggregate stability (left) and one with poor stability (right). A soil with good aggregate stability will retain its structure and have a “brownie” appearance; one with poor aggregate stability will have a “pudding” appearance. Tilt the board to observe the soil and water movement (erosion) with the poorer soil.

Figure A (photo credit: Mike Kucera, NRCS Nebraska)

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