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Weekly Newsletter
from Agresource Inc.
for turning waste into
opportunity

Whole Cycle Tuesday



"Nature does not hurry, yet everything is accomplished."
– Lao Tzu

Takeaway

Freeze-thaw cycles are a natural part of soil development and seasonal change, particularly in northern climates. A well-structured soil containing organic matter is generally better equipped to tolerate seasonal freeze-thaw cycles than a poorly structured soil with limited biological activity. The impact ultimately depends on soil texture, moisture, drainage, and organic matter content.

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The Impact of Freeze-Thaw Cycles on Soil

What Happens When Soil Freezes?

Soil is made up of mineral particles, organic matter, water, air, and living organisms. When temperatures drop below freezing, water within the soil's pore spaces begins to freeze. As water turns to ice, it expands, creating pressure within the soil. In certain conditions, water from deeper, unfrozen soil is drawn toward the freezing zone, forming layers of ice known as *ice lenses*. These ice lenses can expand and push soil upward, a process called frost heaving.

When temperatures rise, the ice melts and water returns to the soil's pore spaces. Repeated freezing and thawing can gradually rearrange soil particles, alter pore structure, and affect how water and air move through the soil.

How Freeze-Thaw Cycles Affect Soil Structure

Freeze-thaw cycles can have both beneficial and detrimental effects on soil structure, depending on soil texture, moisture content, and the frequency of temperature fluctuations.

Potential benefits: In some compacted or dense soils, freezing can create cracks and temporarily loosen the soil. This natural process, sometimes called frost action, may improve infiltration and create pathways for root development. These improvements are not always permanent.

Potential drawbacks: Repeated freezing and thawing can also weaken soil aggregates, particularly when soils are saturated. As aggregates break apart, fine particles may migrate and clog pore spaces, reducing infiltration and increasing the potential for surface crusting, compaction, and erosion. Fine-textured soils containing higher percentages of silt and clay are generally more susceptible to frost heaving than coarse, well-drained sandy soils.

The Role of Organic Matter

Organic matter plays an important role in helping soil withstand the physical stresses associated with freezing and thawing. Soils containing adequate organic matter generally have more stable aggregates, improved pore structure, and greater capacity to manage water. Organic matter also supports microbial activity and biological processes that help rebuild soil structure after winter. Compost contributes to these benefits by introducing stabilized organic material that helps bind soil particles together while improving water retention and drainage.

Building soils with stable structure, adequate organic matter, and good drainage helps create resilience.