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Compacted urban soils improved with composts have long-term benefits for tree growth

Adding compost to compacted urban soils can provide a lasting effect that aids tree growth, new research indicates. Urban soils improved with added organic material are less compacted after five years compared with soils that have not been treated with organic composts, the study suggests.

Urban soils are often compacted from the construction and repair of buildings, roads and pavements. Compacted soil is denser with limited air circulation and reduced water drainage. This makes it difficult for plant roots to penetrate.

To allow the development of vital green infrastructure in urban areas compacted soil can be improved by adding organic matter, such as compost, before planting trees. However, little research has been done on whether these improvements really have a lasting effect on soil quality.

This study examined the changes in the physical properties of reconstituted urban soil intended for tree planting over five years. The researchers compared three experimental soils: a 'control' sandy-loam soil with no added organic compost; the same soil with 40% by volume compost made of sewage sludge and woodchips (sw); and the soil with 40% by volume green-waste (e.g. grass clippings) compost (gw).

Twelve 600-litre containers were kept outside in natural conditions in north-west France from October 2004 to October 2009. All containers had a 29 cm bottom layer of the control soil, topped with an upper, 28 cm layer which consisted of either more control soil, the sw soil or the gw soil. The researchers took core samples from one of each type of experimental soil after 5, 12, 24 and 60 months.

The researchers assessed the ability of water to move through soil samples using a measure called Ksat values. Compacted soils, where drainage is impeded, have lower Ksat values. After five months Ksat values for the top layer of the control soil was 22 times smaller than both organically amended soils and after five years it was 9 times smaller.

To assess how much the soil had become compacted, the researchers calculated the soil weight per unit volume of soil. After five years, the values increased by 0.11 g/cm^3 for sw, 0.31 g/cm^3 for gw, and 0.27 g/cm^3 for the control, suggesting the sw treatment was the best at reducing soil compaction.

To determine whether the one application of organic matter would still be effective in maintaining a suitable structure for root growth after 10 years, the researchers modelled the water balance in the three experimental soils using weather information from the site and the water retention values they had recorded in the study. They found that between the fifth and tenth year, soils would be lacking oxygen as a result of water being unable to drain freely through the heavily compacted soil. For example, low-oxygen conditions would occur 329 days of the year in the lower layer (at depth 37cm).

This study demonstrated the long-term value of adding compost to urban soils and will help urban planners develop suitable soils for tree planting, the researchers conclude.

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