16. Carbon in urban soils: three amendments to enhance sequestration

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Abstract:
Properties of urban, brownfield and contaminated soils can be wide ranging due to diverse anthropogenic influences during development. Underpinning the green infrastructure of cities many of these soils could be well below saturation level, and there could be opportunities to sequester more carbon with careful management. Achieving this through the application of organic materials, such as greenwaste compost, may have the additional effect of improving soil physical condition, although other materials that are more recalcitrant could offer longer-term carbon storage benefits.

Experimental manipulation of an urban soil was carried out using composted greenwaste, 'oversized compost' (a woody material left over after composting of greenwaste), and biochar. In the first of two experiments, two 100 cm deep trenches were excavated in an undisturbed urban soil in the centre of St Helens, Merseyside, UK; formally a heavily industrialized town. Soil amendments were applied immediately above the exposed excavated profiles as a 15 cm mulch layer. Rhizon porewater samplers were placed in the soil profile below each amendment and the control, with no surface amendment, at 20, 50 and 75 cm. After two months equilibration porewater was collected from vacuum tubes and analyzed for DOC using a Shimadzu TOC-VE instrument. In the second experiment each soil amendment was mixed with the soil excavated from the trenches in the ratio 30% amendment to 70% soil, and placed in PVC cylinders (50 cm height, 20 cm diameter). Free drainage was ensured before the cylinders were placed outside and allowed to equilibrate for 2 months. Rhizon porewater samplers were drilled into the cylinders at 20 cm soil depth and samples were collected and analyzed as above.

Leaching of DOC from each of the mulch amendments to the soil at 20 cm depth was evident two months after the start of the experiment, with a 2 to 3 fold increase due to greenwaste compost and oversize materials. Biochar increased DOC more slowly, with a more noticeable effect after 4 months. Oversize had the greatest effect at lower soil depths, with evidence of DOC leaching to 75 cm, probably associated with increased throughflow of water. This paper reports the detailed ongoing findings of these experiments and evaluates the feasibility of enhancing carbon storage in this way.

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