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A functional evaluation of four in situ collected or extracted DOM pools

Gerard Ros, Erwin Temminghoff, Ellis Hoffland, and Willem Van Riemsdijk
Wageningen University, Soil Chemistry Group, The Nethelands, gerard.ros@wur.nl

Dissolved Organic Matter (DOM) is considered to be the most dynamic and bio-available fraction of C and the primary source of mineralisable nutrients in soils. Numerous devices and extraction procedures have been used to estimate its size, varying from in situ collection of soil solution to extraction of field-moist or dried soil with salt solutions. However, the size, molecular characteristics, and function of DOM strongly depend on the sampling technique (Zsolnay, 2003; Ros et al., 2009). The main question of this work is: how can one best sample DOM in order to understand its function as nutrient source?
We compared four existing sampling techniques for their ability to extract bio-available DOM: (1) DOM collected by centrifugal drainage, (2) DOM collected by Rhizon soil solution collectors, (3) DOM collected by a 0.01M CaCl2 extraction of field-moist or (4) dried soil. In particular, we investigate how these DOM pools change during 100 days after or without incorporation of crop residues. We used 15N labeled ryegrass clippings to test whether the source and function of the DOM pools differ. We incubated the soil-crop mixture for 140 days at 20°C, frequently analyzing DOC, DON, inorganic N, and their isotopic signature.
Sampling techniques significantly affected the amount, origin and characteristics of DOM. Extraction techniques released more organic N from soil than techniques collecting soil water due to their influence on sorption equilibria. Most important factor increasing DOM seemed to be soil drying prior to extraction; its concentration increased with more than 100%. The isotopic signature suggests that most of it originates from soil organic matter and not from the biomass. Use of centrifugation caused also an additional release of DOM compared to Rhizon samplers. In spite of these quantitative differences, all collected DOM pools seem to have a similar role in N mineralization processes; the 15N enrichment was similar for extracted (dried, field-moist) and centrifugated DOM. Our results also suggested that DOM do not directly regulate the rate of ammonification and nitrification in soil, because the enrichment of DON was lower than the enrichment of inorganic N during main part of the incubation, and even developed in an opposite direction.
The fate of DOM is significantly affected by the methodology to collect DOM. Extraction of soil only provides a comparative estimate of in situ DOM. All four sampling procedures collect a recalcitrant and less bio-available DON pool rather than a pool actively involved in N mineralization.

Zsolnay, A. 2003. Dissolved organic matter: artefacts, definitions, and functions. Geoderma 113, 187-209.
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