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Does presence of large soil pores influence plant root decomposition and N2O emission from decomposing plant roots?

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Characteristics of soil pores are known to influence a number of soil processes associated with incorporated aboveground plant residues. Decomposition of plant leaves is faster when the leaves are surrounded by large (>30 μm) soil pores (Negassa et al., 2015). The amounts of N2O emitted from soil with incorporated leaves is also higher in the presence of such pores (Kravchenko et al., 2017). One of the mechanisms by which decomposing aboveground plant residues interact with soil pore characteristics is the sponge effect - greater water absorption by the residue from the surrounding soil, which is especially strong in the presence of large pores. However, incorporated aboveground plant residues are much less important for soil functioning than plant roots. Yet, it is not known whether the presence of large soil pores plays a similar role in affecting decomposition of dead plant roots and N2O emissions from them. Here we studied two contrasting soil materials: with dominance of (i) >30 μm pores and (ii) <10 μm pores. Young soybean plants were grown for one week in microcosms constructed from these materials. The plants were cut, air-dried and subjected to an X-ray computed micro-tomography (μCT) scanning at 5 μm resolution. Then, the microcosms were brought to two contrasting soil moisture conditions, namely 50% and 75% of water filled pore space (WFPS), incubated for 21 days, and subjected to the second μCT scanning. CO_2 and N2O measurements were collected from the microcosms on a regular basis during the incubations. Preliminary results indicate that at 50% WFPS, the condition similar to that used in our past experiments with incorporated plant leaves, greater N2O emissions were also observed in microcosms with the large pore than with the small pore dominance. This finding indicates that the effect of large pores on N2O emission related processes is ubiquitous, similarly affecting decomposing plant aboveground as well as belowground biomass. We will also present the results of pore effects on root decomposition, obtained from comparing root μCT images from before and after the incubation scans.

Kravchenko, A.N., Toosi, E.R., Guber, A.K., Ostrom, N.E., Yu, J., Azeem, K., Rivers, M.L., Robertson, G.P., 2017. Hotspots of soil N2O emission enhanced through water absorption by plant residue. Nature Geoscience 10, 496–500.

Negassa, W., Guber, A.K., Kravchenko, A.N., Marsh, T.L., Hildebrandt, B., Rivers, M.L., 2015. Properties of soil pore space regulate pathways of plant residue decomposition and community structure of associated bacteria. Plos One 10.