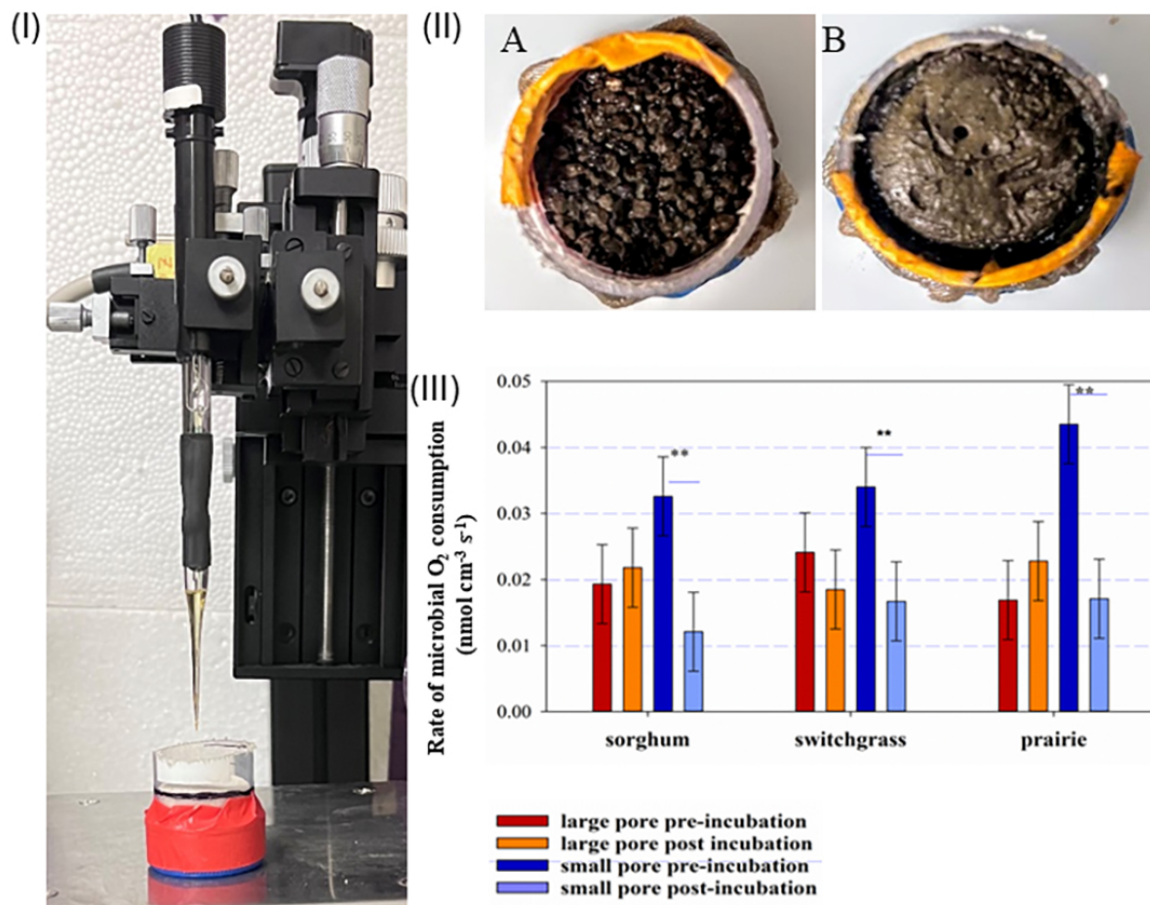




Microbial oxygen consumption is influenced by soil pore structure

June 12, 2025



(I) A micro-profiling system with an O₂ microsensor; (II) A: large pore soil material, B: small pore soil material; and (III) calculated rates of volumetric O₂ by microbes before and after 38 days incubation. Image by Poulamee Chakraborty, GLBRC, Michigan State University.

Since heterotrophic soil microbes use oxygen (O₂) as an electron acceptor, microscale O₂ availability influences microbial contributions to soil carbon and nitrogen cycles. The soil O₂ availability is determined by the O₂ diffusion from the atmosphere and microbial O₂ consumption in the soil. Pore structure is a well understood driver of O₂ diffusion. But does pore structure also affect microbial O₂ consumption?

To answer this question, researchers from the Great Lake Bioenergy Research Center at Michigan State University collected soil from three bioenergy cropping systems to create soil environments with two contrasting pore structures, i.e., large vs. small soil pores, of >30 µm and <10 µm diameters, respectively. They used O₂ microsensors to measure O₂ profiles and calculated microbial O₂ consumption using the finite difference method for solving Fick's Second Law of Diffusion at a steady state.

The researchers found that microbial O₂ consumption is indeed impacted by the pore structure. In the large-pore soil, O₂ consumption was stable while it rapidly decreased in the small-pore soil after 38 days of incubation. The study suggests that large-pore soil provides a better physical microenvironment for soil microbes while the O₂ limitation in small-pore soil might, in the long-term, contribute to changes in their

metabolism.

Dig deeper

Chakraborty, P., Guber, A., & Kravchenko, A. (2025). Microbial O₂ consumption as a function of pore structure in soils of sorghum, switchgrass, and prairie vegetation systems. *Vadose Zone Journal*, 24, e70001. <https://doi.org/10.1002/vzj2.70001>

Text © . The authors. CC BY-NC-ND 4.0. Except where otherwise noted, images are subject to copyright. Any reuse without express permission from the copyright owner is prohibited.