PreSens
PRECISION SENSING

Scientific Paper:

Plant Soil (2022) 472, 565-575

Metabolic activity of *Hordeum vulgare*, *Brassica napus* and *Vicia faba* in Worm and Root type Biospore Sheaths

Lisa Petzoldt, Bärbel Kroschewski, Timo Kautz
Albrecht Daniel Thaer-Institute of Agri and Horticultural Science, Department of Crop Science, Humboldt Universität zu Berlin, Berlin, Germany

Abstract:

Aims Biopores offer favorable chemical, biological and physical properties for root growth in untilled soil layers. There they are considered as nutrient "hotspots" with preferential root growth. However, the literature lacks a quantification of metabolic activity due to nutrient acquisition of main crops while growing in the biopore sheath.
Methods A pot experiment was performed to map the metabolic activity of roots, as indicated by pH change. The roots of spring barley (*Hordeum vulgare* L.), spring oilseed rape (*Brassica napus* L.) and faba bean (*Vicia faba* L.) were growing through the biopore sheath influenced by an earthworm (*Lumbricus terrestris* L.) or a taproot (*Cichorium intybus* L.), in comparison to subsoil without a pore (bulk soil). pH sensitive planar optodes were applied in order to image a planar section of the sheath, while preserving an intact biopore sheath during the experiment.
Results Roots were first found in the field of view in worm biopore then root biopore and bulk soil. At time of the first measurement the pH value was highest in worm biopore sheath (LS-Mean±SEM: 7.16a±0.11), followed by root biopore sheath (6.99ab±0.12) and bulk soil (6.61b±0.12). In spring oilseed rape a significant alkalization (+0.80 Δ pH) was found over time in bulk soil. Faba bean significantly acidified the root biopore sheath (-0.73 Δ pH). Spring barley showed no significant pH changes.
Conclusions The results of the current study reveal a trend of faster root growth through biopores and a higher initial pH value in the biopore sheaths compared to the bulk soil. Biopores serve not only as an elongation path for roots, but their sheaths also provide an environment for root activity in the subsoil.

Keywords: biopore sheath, non-invasive imaging, pH planar optodes, metabolic activity, rhizosphere, root-soil interaction