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Die Rhizosphäre: Ein Hotspot biogeochemischer Prozesse in Waldböden

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Titel
Root development controls hotspots localization and temperature sensitivity of enzyme activity in the rhizosphere

Abstract
The rhizosphere is a very important and dynamic hotspot of microbial activity in soil. Consequently, the enzyme activities in the rhizosphere are a footprint of complex plant-microbial interactions and may reflect functional response to climate changes.The temperature sensitivity of enzymes responsible for organic matter decomposition in soil is crucial for predicting the effects of global warming on the carbon cycle and sequestration. For the first time, we applied the in situ soil zymography for identification and localization of hotspots of phosphatase and chitinase activity in the rhizosphere of rice (Oryza sativa L.) under warming effect - (18 and 25 °C) after 14 and 30 days. Thus, we test the hypotheses that due to high inputs of easily degradable organic compounds from the roots canceling effect: strong reduction of temperature sensitvity (Q_{10}~1) of catalytic reactions will not accoure in the rhizosphere. Correspondingly, the Q_{10} values for reaction rates were always >1, at root-soil interface, with the average range of 1.3 –1.4 Independent of enzymes, canceling was never observed at vicinity of root. Thus, canceling effect is a substrate concentration dependence phenomenon. To our knowledge, this is the first study explored the canceling effect in the rhizosphere. Absence of canceling at root-soil interface for phosphates and chitinase revealed that warming will accelerate P and N mobilization in the rhizosphere. Altogether, for the first time we showed that extent of enzyme activity’s rhizosphere is constant, temporally however, there is a temporal heterogeneity of enzymatic hotspots localization in soil. Thus, increasing in temperature had a positive impact on overall enzyme activities, Rice growth and root development, conducted an enzyme specific impact on hotspots percentage and localization patterns. We conclude that absence of canceling at root-soil interface for tested enzymes revealed that warming will accelerate nutrient mobilization in the rhizosphere more than root free soil.