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Rhizosphere effect in soils under crops and trees

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Activity, concentration and diversity of microorganisms in plant – microbe - soil system depend on spatial distribution of so-called „hot spots“ governed by plant growth. The “hot spots” in rhizosphere are characterized by rhizosphere factors (Rf) expressed as a ratio of soil characteristics in rhizosphere to those in bulk soil. Our research was aimed to monitor development of the rhizosphere effect in time (under oats plants) and down the soil profile (under spruce trees).

The mean values of the rhizosphere factor in top soil varied from 0.9 (the water-soluble N pool) to 4.6 (dissolved organic C) under crops and from 1.1 (extractable DNA) to 2.3 (basal respiration) under spruce trees. The most labile/evanescent soil C and N pools had: i) maximal Rf values and ii) peaks in rhizosphere effect connected to the period of rapid root growth rate (tillering, booting, and earing stages). More conservative/sustainable pools of C and N in soil showed the peaks in Rf values during the intensive root turnover (milk and wax stages). Rhizosphere in deep soil had more pronounced “hot spot”/rhizosphere effect than in top one, with the most drastic differences between top and deep rhizosphere for basal respiration and soil organic matter (SOM) turnover rates. Rf for SOM turnover in the top soil was about 1.5, while that in the deep soil horizon was as high as 6. Thus, the two principle trends were revealed: i) among a number of pools and growth characteristics tested, the most prominent rhizosphere effect was found for labile soil C and N pools and basal respiration; ii) Rf values in deep soil horizons were higher than in top soil.

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