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Biomass of active microorganisms is not limited only by available carbon in the rhizosphere

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Microbial activity is generally limited by carbon (C) availability. The easily available substrate release by roots creates so called “hotspots” in the rhizosphere that drives microbial activity removing C limitation. We simulated a gradient of root exudates by glucose addition at different concentrations to stimulate the activation of microbial biomass (MB). Glucose was added at the rates lower than MB (5, 10, 25 and 50%) and at the rates similar or higher than MB (100, 150, 200, 250, 300 and 400%). During incubation CO_2 efflux was measured by conductometry, the size of active MB and specific growth rate were estimated by substrate-induced growth response method. We tested a hypothesis that glucose addition exceeding 100% MB is able to activate major fraction of soil microbial community.

Addition of glucose at concentrations higher than 5% decreased specific growth rate, demonstrating the shift of microbial community from r-strategy to K-strategy. The percentage of active MB grew up by the increase of glucose concentration. The treatment with glucose at 100% presented a dramatic shift in the activation of MB up to 14%. Contrary to our hypothesis, further increase in glucose rate caused moderate stimulation of active MB up to 22% of total MB. Furthermore, glucose addition above 200% did not increase the fraction of active biomass indicating glucose oversaturation and possible limitation by other nutrients. The results suggest that despite the fact that C is the most important limitation factor, limitless C supply is not able to activate MB up to 100%. Thus, if the rhizosphere is limited by nutrients, the fraction of active biomass remains at low level despite an excess of available C.