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Substrate availability and microbial growth in soil amended with glucose, root exudates and maize straw

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Kinetic parameters of substrate-induced respiration and substrate availability estimated by the Wright-Hobbie approach were monitored during decomposition of three substrates: glucose, root exudates and maize straw residues. Adding small amounts of easily available substrates (glucose or root exudates) increased the specific growth rates of soil microorganisms for 1-4 days. This increase showing transitions from K to r strategies was confirmed by a decrease in the affinity of microorganisms to the easily available substrates. For these treatments the amount of C extracted by 0.05 M K_2SO_4 was identical with the amount of easily available C estimated by the Wright-Hobbie approach. However, the amount of easily available C after maize straw addition was overestimated by K_2SO_4-extraction by a factor of up to 2.

Applying 8 mg*g^{-1} of plant residues, in contrast, lowered specific growth rates and increased the affinity of microorganisms to substrate. In this case, the shift in kinetic properties of the soil microbial community to K strategy was accompanied by an increase in the growing fraction of microbial biomass (as estimated from kinetics of substrate induced respiration). The generation time of the growing fraction of microbial biomass in soil was 1.8 to 2.8 h, which was about 100 to 1000 times shorter than that of the whole microbial community.

Adding N to the soil together with plant residues prolonged the mineralization peak, decreased specific growth rates and increased the amount of easily available C in the

soil. This indicates more efficient decomposition of maize residues by K-selected microorganisms after removal of N limitation.