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An incubation system to trace carbon fluxes in soil - First experimental

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Soils contain the largest carbon pool in terrestrial ecosystems and it is widely assumed that a considerable fraction of this pool might be mobilized by global warming. Numerous investigations have proven that soil respiration is a mixture of several source, like root rhizosphere and soil organic matter (SOM) degradation. However, little is still known about soil carbon dynamics and the influence of microbes on this process.

We developed an incubation system to perform multitracer experiments to quantify the contribution of microorganisms to carbon turnover from different carbon sources. A natural ^{13}C label was used to mark carbon sources. The old carbon in the SOM held a depleted ^{13}C3 signal and newly added C was enriched in ^{13}C4. Accordingly, in the experiment we quantified the relative respiration of carbon from added sugars and soil organic matter by microbial groups, with additional application of fungicide (cycloheximide). A root free arable soil was divided into three sets, all with depleted C3 soil, but varied in terms of the added material: one with C4 glucose, a second with C4 glucose combined with fungicide and the last one with water application only, as control. To characterize microbial communities and estimate microbial biomass we extract phospholipid fatty acids (PLFA). Furthermore, by measuring the isotopic ratio of the PLFA it was also possible to identify microorganisms that metabolised the traced material.

Preliminary results showed that the glucose application stimulated microbial growth in the beginning, but afterwards the microbial biomass decreased again over time. However, a change in the microbial community composition could not be observed, regardless to the kind of added material. Nevertheless, the respiration response slowed down after the fungicide application, and a second respiration pulse was induced by this application. This was probably due to reactivation of the fungi, after the effect of the fungicide expired.