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Turnover of soil monosaccharides: Recycling versus Stabilization

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Soil organic matter (SOM) represents a mixture of differently degradable compounds. Each of these compounds are characterised by different dynamics due to different chemical recalcitrance, transformation or stabilisation processes in soil. Carbohydrates represent one of these compounds and contribute up to 25 % to the soil organic matter. Vascular plants are the main source of pentose sugars (Arabinose and Xylose), whereas hexoses (Galactose and Mannose) are primarily produced by microorganisms. Several studies suggest that the mean turnover times of the carbon in soil sugars are similar to the turnover dynamics of the bulk carbon in soil.

The aim of the study is to characterise the influence of stabilisation and turnover of soil carbohydrates. Soil samples are collected from (i) a continuous maize cropping experiment ("Höhere Landbauschule" Rotthalmünster, Bavaria) established 1979 on a Stagnic Luvisol and (ii) from a continuous wheat cropping, established 1969, as reference site. The effect of stabilisation is estimated by the comparison of turnover times of microbial and plant derived soil carbohydrates. As the dynamics of plant derived carbohydrate are solely influenced by stabilisation processes, whereas the dynamics of microbial derived carbohydrates are affected by recycling of organic carbon compounds derived by C3 plant substrate as well as stabilisation processes.

The compound specific isotopic analysis (CSIA) of soil carbohydrates was performed using a HPLC/o/IRMS system. The chromatographic and mass spectrometric subunits were coupled with a LC–Isolink interface. Soil sugars were extracted after mild hydrolysis using 4 M trifluoroacetic acid (TFA). Chromatographic separation of the sugars was achieved using a low strength 0.25 mM NaOH solution as mobile phase at a ?ow rate of 250 μL min^{-1} at 10 $^{\circ}$C.