Geophysical Research Abstracts, Vol. 8, 01871, 2006
SRef-ID:

Carbon mineralization and stabilization in soils in response to different crop rotations and tillage treatments

M. Tatzber (1), M. Stemmer (2), G. Haberhauer (3), H. Spiegel (2) , C. Katzlberger (2), M. H. Gerzabek (1)

(1) Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Recources and Applied Life Sciences, Peter Jordan Strasse 82, 1190 Vienna(2) Austrian Agency for Health and Food Safety, Agricultural Inspection Service and ResearchCentre, Vienna, Spargelfeldstraße 191, 1226 Vienna, Austria(3) ARC Seibersdorf research GmbH, Dept. of Environmental Research, A-2444 Seibersdorf, AustriaContact: michael.tatzber@boku.ac.at, Tel.: 0043 1 47654 3132

The knowledge of the size and turnover rate of various labile, active and recalcitrant soil organic matter pools and the C–fluxes between these pools is essential to understand C stabilization in soils and to improve existing C balance models. The main objective of our endeavour is to gain an advanced insight into the dynamics of slowly converted soil organic matter pools in agricultural soils as driven by different soil management and crop systems. The long–term ^{14}C–turnover field experiment, established in 1967 in Fuchsenbigl (Lower Austria), offers the unique possibility to follow the fate of radiocarbon labelled C under different crop management systems which are spring wheat, crop rotation and bare follow over a period of more than 35 years. In 1988 a soil tillage long–term field experiment was additionally established close to the ^{14}C field experiment with a randomised block design and three replicates each. The treatments in this second experiment are: Conventional tillage (plow), reduced tillage (soil is mixed but not turned over) and minimum tillage (rotavator). Soil-samples were taken in April 2004 at soil depths from 0 – 10, 10 – 20 and 20 – 30 cm at the soil tillage long–term field experiment, the ^{14}C–experiment was sampled from 0 – 20 cm. The preliminary analytical approach includes measurements of the bulk soil density, C_{org} and ^{14}C–contents and FTIR-spectroscopy to characterize C stocks and humic substances in the soils. Additionally we performed photometric measurements of the

extracts to obtain data about their degree of condensation ("E_4/E_6") and the ratio of fulvic to humic acids. In a first step FTIR-measurements were performed on both, the enriched humin fraction and samples of extracted and purified humic acids. The ^{14}C – measurements showed higher amounts of remaining ^{14}C for farmyard additions (7.47 – 9.74 %) than for straw treatments ^{14}C (5.03 – 6.58 %). Crop rotation and spring wheat did not differ with respect to the stability of the ^{14}C pool, in both treatments more carbon remained than in the permanent bare fallow. The measurements of E_4/E_6 showed slightly higher values for the 0 – 10 cm layer compared with the two deeper layers of the minimum tilled soils; the ratio of fulvic to humic acids seemed to increase slightly with increasing depth. As expected these effects were decidedly weaker in case of reduced tillage and vanished in the samples from the conventional tillage. The crop systems showed almost no significant differences in their E_4/E_6 – values but the fulvic acids to humic acids ratio was higher in the samples of the permanent bare fallow. Referring to the FTIR – measurements, significances between the 0 – 10 cm – layer and the layer from 20 – 30 cm (of minimum tillaged samples) appeared in connection of the bands deriving of aromates, aliphates, amides and carbonyles. It generally seems that humic acids become more aliphatic with an increasing depth (which should correspond to the age) whereas the humin fraction seems to show a depletion of its aliphatic groups. Also the humin fraction has (referred to the band area in $A*cm^{-1}$ per mg) less aliphatic characteristics from the outset than the "younger" humic acids. One reason for this phenomenon could be the wellknown decrease of aliphatic properties with increasing age of humic substances.