EUROSOIL 2008

Book of Abstracts

Winfried H. Blum, Martin H. Gerzabek
and Manfred Vodrazka (Eds.)

University of of Natural Resources and Applied Life Sciences (BOKU)
Vienna, Austria, August 2008-08-04

ISBN: 978-3-902382-05-4

potential for SOC storage has to be taken into account when land use change effects on SOC are assessed.

S01.J.05

Impact of tillage on carbon and nitrogen storage of two Haplic Luvisols

A. Jacobs[1], *R. Rauber*[2], *B. Ludwig*[1];
[1]*University of Kassel, Dep. of Environmental Chemistry, Witzenhausen, Germany,* [2]*University of Göttingen, Institute of Agronomy, Göttingen, Germany.*

The effects of reduced tillage systems (minimum tillage = MT) on soil organic carbon (Corg) and N sequestration are not completely understood. Thus, the objectives were to investigate the impact of a MT system (to 5-8cm) on water-stable aggregates and particulate organic matter (POM) and on storage of Corg and N in two loamy Haplic Luvisols in contrast to conventional tillage (CT) (to 25cm). Surface soils (0-5cm) and subsoils (5-20cm) of two experimental fields near Göttingen, Germany, were investigated. Both sites (Garte-Süd and Hohes Feld) received both tillage treatments since 37 and 40 years, respectively. In the bulk soil of both fields Corg, N, microbial carbon (Cmic), and microbial N (Nmic) concentrations were elevated under MT in both depths. Likewise, water-stable macroaggregates (>0.25mm) were on average 2.6 times more abundant under MT than under CT but differences in the subsoil were generally not significant. For surface soil under MT, all aggregate size classes <1mm showed about 48% and 56% increased Corg concentrations at Garte-Süd and Hohes Feld, respectively. For greater macroaggregates (1-2, 2-10mm), however, differences were inconsistent but elevations of N contents were regular over all size classes reaching 72% and 64%, respectively. In the surface soil, tillage system did neither affect the yields of free POM and occluded POM nor their Corg and N contents. Moreover, more Corg and N (125-238%) was associated under MT within the mineral fractions investigated. To sum up, similar to no-tillage, a long-term MT treatment of soil enhanced the stability of macroaggregates and thus was able to physically protect and to store more organic matter (OM) in the surface soil in contrast to CT. The increased storage of Corg and N did not occur as POM but as mineral-associated OM.

S01.J.06

Nitrogen retention and plant uptake on a highly weathered central Amazonian Ferralsol amended with compost and charcoal

C. Steiner[1], *B. Glaser*[2], *W. G. Teixeira*[3], *J. Lehmann*[4], *W. E. H. Blum*[5], *W. Zech*[6];
[1]*Biorefining and Carbon Cycling Program, University of Georgia, Athens, GA, United States,* [2]*Department of Soil Physics, University of Bayreuth, Bayreuth, Germany,* [3]*Embrapa Amazonia Ocidental, Manaus, Brazil,* [4]*Department of Crop and Soil Sciences, Cornell University, Ithaca, NY, United States,* [5]*Institute of Soil Research, University of Natural Resources and Applied Life Sciences, Vienna, Austria,* [6]*Institute of Soil Science and Soil Geography, University of Bayreuth, Bayreuth, Germany.*

Inspired by the sustained fertility of anthropogenic Terra Preta soils in the central Amazon Basin, we studied the effect of charcoal as soil amendment. The use of charcoal as recalcitrant soil amendment can have important implications for sustainable land use in the humid tropics and the earth's carbon budget. Leaching losses of nitrogen (N) are a major limitation of crop production on strongly weathered soils and under heavy rainfalls, as in the humid tropics. We established a field trial in the central Amazon Basin (near Manaus, Brazil), in order to study the influence of charcoal and compost on the retention of N. Fifteen months after organic matter admixing (0 - 0.1 m soil depth), we added ^{15}N labelled ammonium sulphate (27.5 kg N ha^{-1} $(NH_4)_2SO_4$ at 10 atom% excess). The tracer was measured in the top soil (0 - 0.1 m) and plant samples were taken at two successive sorghum (*Sorghum bicolor* L. Moench) harvests. The N recovery in biomass was significantly higher when the soil contained compost (14.7 % of applied N) in comparison to only mineral fertilized plots (5.7 %), due to a significantly higher crop production during the first growth period. After the second harvest, the N-retention in the soil was significantly higher in the charcoal amended plots (15.6 %) in comparison to only mineral fertilized plots (9.7 %). The total N recovery in soil, crop residues and grains was significantly ($P < 0.05$) higher in compost (16.5%), charcoal (18.1%) and charcoal plus compost treatments (17.4%), in comparison to only mineral fertilized plots (10.9%). Organic amendments increased the retention of applied fertilizer N. One process within this retention was found to be the recycling of N taken up by the crop.

S01.K.01

Soil structure dynamics and carbon sequestration

U. Franko, *K. Kuka;*
UFZ, Halle, Germany.

Soil structure has a strong impact on SOM turnover. The recently developed CIPS model demonstrates this very successful. The partition of the total pore space into micro, meso- and macropores and the subsequent distribution of specific microbial activity to these classes proofed to be very useful to understand long term dynamics without sophistic assumptions like an inert pool. The CIPS model has recently been integrated in the CANDY model in order to perform more complex scenario simulations.

It is well known that SOM has an impact on soil structure. A new submodel in CANDY has been developed in order to simulate these effects also. In this context we consider as structural indicators field capacity (FCAP), permanent wilting point (PWP) and total pore volume (PV) because these are used to control the soil water dynamics in the CANDY model and also as proxies to identify the pore space classes in CIPS. The main driver of soil structure changes is PV depending on the ratio of bulk density to particle density which are both dependent on SOM. FCAP and PWP can be calculated using a pedotransfer function if PV is known. Particle density is calculated using the approach of RÜHLMANN ET AL. (2006) depending on SOM content. Bulk density is modelled following the concepts of SCHAAF(1998) (tillage and recompaction) and RÜCKNAGEL(2007) (compaction from machinery). The resulting model handles soil structure no longer as a constant parameter but a soil state variable depending on management, climate and SOM.

The integrated CANDY&CIPS model simulates not only the dynamics of SOM pools but also their ages that are varying between 10 to 3000 years if SOM is in steady state.

S01.K.02

Micro-scale modelling of carbon turnover driven by microbial succession at a biogeochemical interface

J. Ingwersen, *C. Poll, T. Streck, E. Kandeler;*
Institute of Soil Science and Land Evaluation, Stuttgart, Germany.

The detritusphere is a very thin but microbiological highly active zone in soil. To trace the fate of litter carbon in the detritusphere we developed a new 1D dynamic mechanistic model. In a microcosm experiment soil cores were incubated with ^{13}C labelled rye residues ($\delta^{13}C$=299‰), which were placed on the surface. Microcosms were sampled after 3, 7, 14, 28, 56 and 84 days and soil cores were separated into layers of increasing distance to the litter. Gradients in soil organic carbon, dissolved organic carbon, microbial biomass and activity were detected over a distance of 3 mm from the litter layer. The newly developed 1D model simulates both the total carbon and the ^{13}C carbon pools and fluxes, so that it was possible to include the ^{13}C data in model optimisation. The special feature of the model