Geophysical Research Abstracts
Vol. 17, EGU2015-12031-2, 2015
EGU General Assembly 2015

Soil carbon cycle of different saline and alkaline soils under cotton fields in Tarim River Basin

Xiaoning Zhao (1), Chengyi Zhao (2), Karl Stahr (1), Yakov Kuzyakov (3,4)

(1) Institute of Soil Science and Land Evaluation, University of Hohenheim, Emil-Wolff-Str. 27, 70593 Stuttgart, Germany(xiaoningzhao2012@gmail.com), (2) Key Laboratory of Oasis Ecology and Desert Environment, CAS, Urumqi 830011, China(zcy@ms.xjb.ac.cn), (3) Dept. of Soil Science of Temperate Ecosystems, and Dept. of Agricultural Soil Science, University of Göttingen, Büsgenweg 2, 37077 Göttingen, Germany (kuzyakov@gwdg.de), (4) Institute of Environmental Sciences, Kazan Federal University, Kazan, Russia

Calcium carbonate is the most common form of carbon (C) in semiarid and arid soils. Depending on pH and salinity changes, soils can act as sink or source of atmospheric CO_2 as well as contribute to C exchange between CO_2 and $CaCO_3$ leading to formation of pedogenic carbonates. However, the rates of these processes and the effects of environmental factors remains unknown. $14CO_2$ was used to assess carbonate recrystallization in 4 saline and alkaline soils (Aksu alkaline, Aksu saline, Yingbazar alkaline, Yingbazar saline) (EC = 0.32, 1.35, 1.72, 3.67 (1:20) mS cm-1, pH = 8.5, 8.2, 8.9, 7.9 respectively) and to trace the C exchange in the soils of the Tarim River basin depending on CO_2 concentrations in soils (0.02%, 0.04%, 0.2%, 0.4% and 4%). 14C was traced in soil water and air as well as in carbonates. The highest 14C in $14CO_2$ (95% of the 14C input) was observed in Aksu alkaline soil and the highest 14C incorporation in $CaCO_3$ (54%) was observed in Yingbazar saline soil. There were close negative linear relationships between initial CO_2 concentrations (0.04%, 0.4% and 4%) and the 14C in $Ca14CO_3$ and in $14CO_2$. The carbonate recrystallization rate increased with the CO_2 concentration and were depended on the recrystalliztion period. The average carbonate recrystallization rate was highest at 4% CO_2 concentration for Yingbazar saline soil (6.59×10-4 % per day) and the lowest at 0.04% CO_2 concentration for Aksu alkaline soil (0.03×10-4 % per day). The carbonate recrystallization rate linearly increased with the soil EC and with 0.04% and 0.4% CO_2 concentration , whereas the carbonate recrystallization rate decreased with pH. The highest CO_2 concentration of 4% can 10 to 100 times shorten the full carbonate recrystallization of the remaining primary carbonates compared to lower CO_2 concentrations 0.4% and 0.04% for complete (95%) recrystallization of soil carbonate. We conclude that microbial and root respiration affecting CO_2 concentration in soil is the most important factor of $CaCO_3$ recrystallization in alkaline and saline soils. Nevertheless, centuries and millennia are necessary for nearly complete $CaCO_3$ recrystallization and formation of pedogenic carbonates.

Keywords: $CaCO_3$ recrystallization, CO_2, $14CO_2$, saline, alkaline, pedogenic carbonate, Tarim River Basin