Geophysical Research Abstracts
Vol. 15, EGU2013-1127, 2013
EGU General Assembly 2013

Carbon sequestration strategies for crop- and grasslands evaluated in long-term field experiments in Northern Europe

Thomas Kätterer (1), Martin Bolinder (2), Gunnar Börjesson (1), and Holger Kirchmann (1)

(1) Swedish University of Agricultural Sciences, Soil and Environment, Uppsala, Sweden (thomas.katterer@slu.se), (2) Department of Soils and Agrifood Engineering, Université Laval, Québec, Canada

Improved management of grass- and croplands is a win-win strategy resulting in both increased soil fertility and carbon sequestration. We quantified the effect of N fertilization, organic amendments and ley-arable rotations versus continuous annual cropping systems on soil carbon stocks by analyzing data from long-term field experiments in Nordic countries. Increasing net primary production was found to be the main driver for higher soil carbon storage. Mineral N fertilization increased soil carbon stocks by about 1-2 kg C ha-1 for each kg of N applied to cropland. Ley-arable rotations, being a combination of annual and perennial crops, are expected to have C stocks intermediate between continuous grass- and croplands. A summary of data from 15 long-term sites showed that on average 0.5 Mg ha-1 yr-1 (range 0.3 to 1.1; median 0.4 Mg ha-1 yr-1) more carbon was retained in soils in ley-arable compared to exclusively annual systems, depending on species composition, management, soil depth and the duration of the studies. We also quantified the effect of organic amendments on soil carbon stocks. Retention factors calculated for straw, manure, sawdust, peat, sewage sludge and composted household waste varied widely from about 15% for above-ground crop residues to about 90% for composted household waste. We also emphasize that increased soil carbon stocks not always lead to carbon sequestration of atmospheric CO_2 and discuss misunderstandings related to mitigation options earlier proposed for carbon sequestration such as organic farming, manure application, residue handling or application of biochar. Finally, the consequences of different land use and management are discussed, taking into account two critical boundaries – the limited area of agricultural land on Earth and requirements to produce sufficient food, fibres and energy for a growing population.