Geophysical Research Abstracts
Vol. 13, EGU2011-13117, 2011
EGU General Assembly 2011
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Soil CO2 efflux for a sandy silt and a loamy clay under different tillage systems

Gerlinde Trümper and Andreas Klik

BOKU Wien - University of Natural Resources and Life Sciences, Institute of Hydraulics and Rural Water Management, Vienna, Austria (gerlinde.truemper@boku.ac.at)

Agricultural soils are an important source for atmospheric carbon dioxide. Adapted management strategies, especially reduced or no-tillage systems, are supposed to diminish this effect or even convert soils into a carbon sink. So less intensive or even no soil tillage treatment may result in slower mineralization of soil organic carbon and enhanced carbon sequestration.

In order to assess the carbon dioxide emissions due to soil respiration for three different tillage systems a study of three years duration has been performed. The following three tillage systems were compared: (1) Conventional tillage (CT) with plough with and without cover crop during winter period, (2) Reduced tillage (RT) with cultivator with cover crop during winter period, and (3) No-Till (NT) with cover crop during winter period.

The results for two agricultural fields in Lower Austria will be presented. Both fields are part of long-term tillage treatment experiments performed by the agricultural school Tulln. As both sites are situated very close to each other climatic conditions are similar. However, the soil conditions are completely different (sandy silt vs. loamy clay). In intervals of one to two weeks soil CO2 efflux was measured using a portable soil respiration system consisting of a soil respiration chamber attached to an infrared gas analyser. Additionally, concurrent soil temperature and soil water content were measured and soil samples were taken for chemical and microbiological analyses.

The results of the study show a high spatial heterogeneity of soil respiration data even within one plot. Nevertheless, the level of soil CO2 efflux was similar for CT and RT, but usually higher than for NT. Minimum values occurred under cold and dry, maximum values under hot and moist conditions. Focussing on the soil texture higher fluxes were observed for the sandy silt than for the loamy clay.