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Effects of agricultural tillage practise on green house gas balance of an arable soil in a long term field experiment

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Soils are an important part of the global carbon cycle. A large proportion of global carbon dioxide (CO2) emissions is released from soils, though carbon sequestration occurs. Nitrous oxide (N2O) emissions of soils are also believed to contribute significantly to the green house effect as well as the stratospheric ozone depletion. An important source of N2O emissions is denitrification of nitrate from nitrogen fertilized soils. Although it is desirable to minimize these emissions while maintaining high crop yields it is still poorly understood how green house gas emissions may be steered by agricultural management practise, i.e. tillage and fertilization systems .

In an ongoing long term field experiment at the research farm Scheyern, Bavaria, a arable field with one homogenous soil formation was transformed into plots in a randomized design 14 years ago. Since then, they are managed using conventional tillage (CT) and no tillage (NT) as well as low and high fertilization. A conventional crop rotation is maintained on the field. Starting 2007, CO2 and N2O emissions were monitored continuously for 2.5 years. Furthermore water content, temperature and redox potential were measured in-situ as they are major factors on microbial activity and denitrification. Soil was sampled from the Ap horizons of the plots about twice a month and extracts from these soil samples were analyzed for dissolved organic carbon (DOC), ammonium, nitrate/nitrite, and dissolved organic nitrogen (DON).

According to the results soil density and hydrology are clearly affected by tillage practise. DOC is more affected by tillage while concentration of nitrogen species is controlled mainly by fertilization. There are distinct differences in redox potential between CT and NT plots with CT plots having more anaerobic periods. CO2 and N2O emissions exhibit a clear seasonal pattern and are affected by both tillage system and fertilization