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Effect of different agronomic practises on greenhouse gas emissions, especially N2O and nutrient cycling

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In order to achieve a reduction of greenhouse gas emissions, management practises need to be adapted by implementing sustainable land use. At first, reliable field data are required to assess the effect of different farming practises on greenhouse gas budgets. The conducted field experiment covers and compares two main aspects of agricultural management, namely an organic farming system and an integrated farming system, implementing additionally the effects of diverse tillage systems and fertilisation practises. Furthermore, the analysis of the alterable biological, physical and chemical soil properties enables a link between the impact of different management systems on greenhouse gas emissions and the monitored cycle of matter, especially the nitrogen cycle.
Measurements were carried out on long-term field trials at the Research Farm Scheyern located in a Tertiary hilly landscape approximately 40 km north of Munich (South Germany). The long-term field trials of the organic and integrated farming system were started in 1992. Since then, parcels in a field (each around 0,2-0,4 ha) with a particular interior plot set-up have been conducted. So the 20 years impacts of different tillage and fertilisation practises on soil properties including trace gases were examined.
Fluxes of CH4, N2O and CO_2 are monitored since 2007 for the integrated farming system trial and since 2012 for the organic farming system trial using an automated system which consists of chambers (per point: 4 chambers, each covering 0,4 m2 area) with a motor-driven lid, an automated gas sampling unit, an on-line gas chromatographic analysis system, and a control and data logging unit (Flessa et al. 2002). Each chamber is sampled 3-4 times in 24 hours.
The main outcomes are the analysis of temporal and spatial dynamics of greenhouse gas fluxes as influenced by management practice events (fertilisation and tillage) and weather effects (drying-rewetting, freezing-thawing, intense rainfall and dry periods) in both established systems and the creation of an impact study comparing the minimum tillage system with the conventional tillage system. Physical, chemical and biological soil properties (i.a. texture, mineral nitrogen and soil organic carbon) were monitored to aggregate the parameters and processes influencing the greenhouse gas fluxes. Moreover, to understand processes leading the greenhouse gas emissions, additional experiments under laboratory conditions (e.g. soil potential for trace gas formation) are included. Furthermore, with the comparison of the similar long-term field experiments (organic vs. integrated) more relevant data are ascertained to assess and calculate the global warming potential of different management and tillage systems.