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Changes in Soil Moisture, Microbial Biomass, Mineralization and Nitrification Explain Increases in N2O Emissions from a Spring Barley Crop Under Combined Reduced Tillage and Cover Crop Management

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This study investigated the effect of conventional tillage (CT), combined reduced tillage-cover crop (RT-CC), and reduced N application on crop yield and N2O emissions from spring barley. Reduced tillage plots were established for seven years, the final four incorporating a mustard cover crop. Higher N2O fluxes were from fertilized, RT-CC plots due to higher WFPS, soil nitrate, and soil carbon. Fluxes during the non-growing season were variable and the main source of cumulative emissions. Emission factors were in the range of IPCC default values. Low N fertilization reduced cumulative emissions, however during the wetter growing season this reduction was smaller than the reduction in barley production particular in the conventional tillage plots. Adopting RT-CC management for cereal crops may be problematic in reducing GHG emissions due to high N2O fluxes. Reducing N fertilizer in order to reduce N2O emissions is not feasible due to high inter-annual variation in crop yield. N2O flux in all plots was positively correlated with microbial biomass carbon, net nitrification and mineralization determined in the field. Increased emissions of N2O in the RT-CC plots are accounted for by increases in organic carbon in the soil and increases in mineralization.