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Abstract
Atmospheric nitrous oxide concentrations are increasing by 0.3% annually and a major source of this greenhouse gas is agriculture. Indirect emissions of nitrous oxide (e.g. from groundwater and surface water) account for about quarter of total nitrous oxide emissions. However, these indirect emissions are subject to uncertainty, mainly due to the range in reported emission factors. It's hypothesised in this study that cover cropping and implementing reduced (direct drill) cultivation in intensive arable systems will reduce dissolved nitrate concentration and subsequently indirect nitrous oxide emissions. To test the hypothesis, seven fields with a total area of 102 ha in the Wensum catchment in eastern England have been chosen for experimentation together with two fields (41 ha) under conventional cultivation (deep inversion ploughing) for comparison. Water samples from field under-drainage have been collected for nitrate and nitrous oxide measurement on a weekly basis from April 2013 for two years from both cultivation areas. A purge and trap preparation line connected to a Shimadzu GC-8A gas chromatograph fitted with an electron capture detector was used for dissolved nitrous oxide analysis. Results revealed that with an oilseed radish cover crop present, the mean concentration of nitrate, which is the predominant form of N, was significantly depleted from 13.9 mg N L-1 to 2.5 mg N L-1. However, slightly higher mean nitrous oxide concentrations under the cover crop of 2.61 μg N L-1 compared to bare fields of 2.23 μg N L-1 were observed. Different inversion intensity of soil tended to have no effect on nitrous oxide and nitrate concentrations. The predominant production mechanism for nitrous oxide was nitrification process and the significant reduction of nitrate was due to plant uptake rather than denitrification. It is concluded that although cover cropping might cause a slight increase of indirect nitrous oxide emission, it can be a highly effective mitigation measure in an agricultural area where high nitrate losses from fields into groundwater or surface water is excessively occurring.