Geophysical Research Abstracts
Vol. 15, EGU2013-12000, 2013
EGU General Assembly 2013

Reducing fertilizer-derived N_2O emission: Point injection vs. surface application of ammonium-N fertilizer at a loamy sand site

Marianna Deppe (1), Reinhard Well (1), Anette Giesemann (1), Martin Kücke (2), and Heinz Flessa (1)
(1) Thünen-Institute of Climate-Smart Agriculture, Braunschweig, Germany (marianna.deppe@ti.bund.de), (2) Institute for Crop and Soil Science, Julius Kühn-Institut, Braunschweig, Germany

N_2O emitted from soil originates either from denitrification of nitrate and/or nitrification of ammonium. N fertilization can have an important impact on N_2O emission rates. Injection of nitrate-free ammonium-N fertilizer, in Germany also known as CULTAN (Controlled Uptake Long-Term Ammonium Nutrition), results in fertilizer depots with ammonium concentrations of up to 10 mg N g^{-1} $soil^{-1}$. High concentrations of ammonium are known to inhibit nitrification. However, it has not yet been clarified how N_2O fluxes are affected by CULTAN. In a field experiment, two application methods of nitrogen fertilizer were used at a loamy sand site: Ammonium sulphate was applied either by point injection or by surface application. ^{15}N-ammonium sulphate was used to distinguish between N_2O originating from either fertilizer-N or soil-N. Unfertilized plots and plots fertilized with unlabeled ammonium sulphate served as control. N_2O emissions were measured using static chambers, nitrate and ammonium concentrations were determined in soil extracts. Stable isotope analysis of ^{15}N in N_2O, nitrate and ammonium was used to calculate the contribution of fertilizer N to N_2O emissions and the fertilizer turnover in soil. ^{15}N analysis clearly indicated that fertilizer derived N_2O fluxes were higher from surface application plots. For the period of the growing season, about 24% of the flux measured in surface application treatment and less than 10% from injection treatment plots originated from the fertilizer. In addition, a lab experiment was conducted to gain insight into processes leading to N_2O emission from fertilizer depots. One aim was to examine whether the ratio of N_2O to nitrate formation differs depending on the ammonium concentration. Loamy sand soil was incubated in microcosms continuously flushed with air under conditions favouring nitrification. ^{15}N-labeled nitrate was used to differentiate between nitrification and denitrification. Stable isotope analyses of ^{15}N were performed on N_2O in the gas phase and on ammonium and nitrate extracted from soil samples.