



Reducing fertilizer-derived N₂O emission: Point injection vs. surface application of ammonium-N fertilizer at a loamy sand site

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N₂O emitted from soil originates either from denitrification of nitrate and/or nitrification of ammonium. N fertilization can have an important impact on N₂O 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 N₂O 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. ¹⁵N-ammonium sulphate was used to distinguish between N₂O originating from either fertilizer-N or soil-N. Unfertilized plots and plots fertilized with unlabeled ammonium sulphate served as control. N₂O emissions were measured using static chambers, nitrate and ammonium concentrations were determined in soil extracts. Stable isotope analysis of ¹⁵N in N₂O, nitrate and ammonium was used to calculate the contribution of fertilizer N to N₂O emissions and the fertilizer turnover in soil. ¹⁵N analysis clearly indicated that fertilizer derived N₂O 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 N₂O emission from fertilizer depots. One aim was to examine whether the ratio of N₂O to nitrate formation differs depending on the ammonium concentration. Loamy sand soil was incubated in microcosms continuously flushed with air under conditions favouring nitrification. ¹⁵N-labeled nitrate was used to differentiate between nitrification and denitrification. Stable isotope analyses of ¹⁵N were performed on N₂O in the gas phase and on ammonium and nitrate extracted from soil samples.