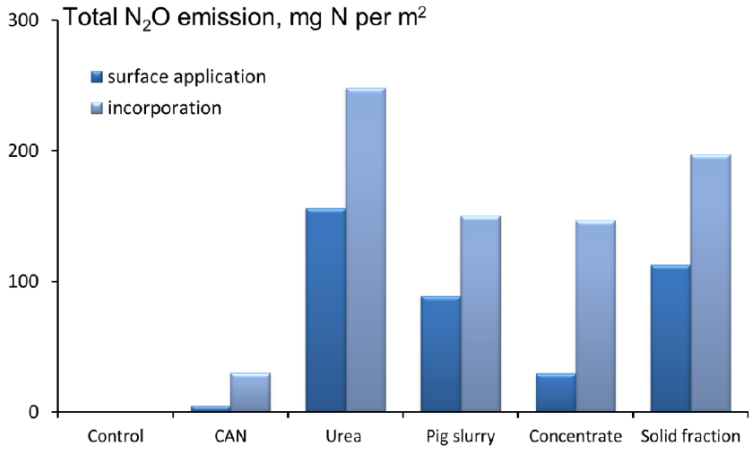
Nitrous oxide emission after application of mineral concentrates

INTERREG IVB

The Biorefine project aims to provide innovative strategies for the recycling of inorganic chemicals from agro- and bio-industry waste streams. The project is financed via Interreg IVB
http://www.biorefine.eu/

Introduction Manure processing can be used to increase nutrient use efficiency of manure. Reverse osmosis of the liquid fraction from separated slurry produces an end-product called mineral concentrate, which has similar properties as a liquid fertilizer. A series of experiments was carried out to test the risk of nitrous oxide (N_2O) emission from mineral concentrates. Mineral concentrates contain organic C, and denitrification and N_2O emission may increase when applied to a nitrate containing soil under wet conditions. Moreover, application of mineral concentrate may result in a high ammonia concentration in the soil, which may increase N_2O emission. In incubation studies we compared the N_2O emissions from mineral concentrate, untreated pig slurry and the solid fraction with the emissions from mineral fertilisers.

Methods Experiments were carried out with arable and grassland soils at 20 °C. N_2O emission from manures and fertilizers applied with different techniques to sandy soil from an arable field was measured. At 12 times during 28 days, incubation pots were closed during 1 hour and the build-up of N_2O in the headspace was measured. An experiment with intact grass sod columns from sandy, clay and peat soils was carried out to quantify N_2O emission from manure and fertilizers at different application techniques and soil types. Pig slurry and concentrate were applied in slits of a few cm depth, mineral N was surface applied. At 8 times during 14 days N_2O emission was measured.



Total N_2O emission during 28 days from calcium ammonium nitrate (CAN), urea, untreated pig slurry, mineral concentrate and the solid fraction from separated slurry (averages of four farms) applied to arable sandy soil.

Total N applied was 170 kg N per ha (= 17 g/m^2), emission was circa 0 – 0.4 g/m^2

Results The figure shows that after surface application of CAN the emission of N_2O was negligible, from concentrate it was higher, but much lower than from urea or from pig slurry and its solid fraction. Incorporation strongly increased emission from all N sources. Thus, reducing NH_3 emission by incorporation increases the risk of N_2O emission. Averaged over all experiments, N_2O emission from mineral concentrate was approximately 1.5-fold higher than from untreated pig slurry. No clear explanation can be given for this difference. Differences in N_2O emission will be related to the form and content of N, pH, presence of organic matter and other factors that influence the microbial processes of nitrification and denitrification. The results of measuring NH_3 emission in this experiment are presented in another flyer.

Further reading

G.L. Velthof & E. Hummelink (2011) Alterra Report 2180. [*link*],
G.L. Velthof et al. (2012) Proc. 716, Int. Fert. Soc., Leek, UK.

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