ENRICHED 15N-N2O TRACING REVEALS THE IMPORTANCE OF SOIL MOISTURE AND BULK DENSITY FOR N2O REDUCTION

KLEFOTH, ROLAND R.[1] (ROLAND.KLEFOTH@WUR.NL); CLOUGH, TIM J.[2]; OENEMA, OENE[3]; VAN GROENIGEN, JAN WILLEM[4]

[1]Wageningen University and Research Centre, Environmental Sciences, Soil Science Centre, The Netherlands
[2]Faculty of Agriculture and Life Sciences, Lincoln University, New Zealand
[3]Wageningen University and Research Centre, Alterra, The Netherlands
[4]Wageningen University, Soil Biology and Biological Soil Quality Group, The Netherlands

During denitrification or nitrifier-denitrification the greenhouse gas nitrous oxide (N2O) is an obligatory intermediate during the reduction of nitrate or nitrite to dinitrogen gas (N2). Topsoil fluxes of N2O can occur as a result of incomplete denitrification, and are strongly influenced by soil physical properties. However, quantitative insights into the relationship between N2O reduction and soil physical properties influencing this are still limited. Here we used artificially enriched 15N-N2O to measure N2O reduction in the soil profile as function of both soil bulk density and moisture content. Columns were repacked with a sieved sandy soil, using three moisture contents (60, 75 and 90% water-filled pore space; WFPS), to one of three bulk densities (1.02, 0.96 and 0.89 g cm-3). At the bottom of the columns, a silicon sheet, (permeable to N2O) was installed. The reservoir below the sheet simulated a subsoil from which N2O diffused upwards. After a pre-incubation phase of 9 days, 15N-N2O was injected into the reservoir every 12 hours and topsoil N2O emissions were subsequently measured for 20 days. Preliminary results indicate that 90% WFPS resulted in low and 60% WFPS in high N2O emission. However, the higher N2O flux at 60% WFPS was the result of an increased diffusion rate rather than enhanced production of N2O. At both high and low soil moisture contents, bulk density did not affect N2O emissions. However, at 75% WFPS, higher bulk density decreased N2O emissions by decreasing the diffusion rate and thereby increasing complete denitrification to N2. Our results show that N2O profile dynamics (diffusion characteristics and reduction of nitrous oxide) should be taken into account when linking soil characteristics to N2O emissions. A wet soil can either lead to higher or lower emissions when compared to a drier soil, depending on the situation in the subsoil.