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Putting the pieces of the puzzle together: denitrification, what we know and what the gaps are

Laura Cardenas and the Laura M. Cardenas Team
North Wyke Research, Okehampton, Devon, EX20 2SB, UK. (laura.cardenas@bbsrc.ac.uk)

Denitrification and its products, NO, N2O and N2 are affected by physical, chemical and biological parameters in the soil. This process has been studied at the laboratory scale but only looking at a restricted number of parameters at any one time: mainly limited by the analytical techniques available. Soil temperature, soil nitrate and ammonium contents, carbon content and quality, water status coupled with O2 availability, texture and the microbial population are known to be the main controlling factors of denitrification affecting the magnitude of gaseous emissions from this process. Techniques that allow direct in situ measurements of the products of denitrification can be used to follow changes in real time, but these require verification of the process and additional measurements to understand the dynamics to help develop and validate models. Information from isotopic data as well as the use of selective inhibitors can be helpful, but may not provide all the information which is needed. To be able to predict the outcome of the process requires a better understanding of factors driving fluxes at a particular location and time and will need multidisciplinary experiments to evaluate all the parameters successfully.
Here we show results from a series of laboratory experiments, where gas measurements were carried out using a technique employing a He/O2 atmosphere. Confirmation of denitrifying activity and assessment of the accuracy of the measurements are reported. Various other measurements such as soil chemical parameters and microbial composition are discussed as well as modelling of the fluxes attempted. Gaps in our knowledge are identified and the need to extrapolate to the field scale is emphasised.