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Project: Key drivers of N2O emissions under field conditions

BRIEF OVERVIEW OF RESEARCH PROJECT AND MAJOR ACCOMPLISHMENTS EXPECTED

Carlo Lammirato (CL) will participate, together with other members of the Yara-team, in ongoing and planned field experiments at Hanninghof, addressing the following general topics:

- reduced/oxidized fertilizer effects on N_2O emissions

- relationship between different splitting of N fertilization and N_2O emissions

- spatial and temporal variability of N_2O emission in such field experiments

- closer inspection of mechanisms of N_2O production/reduction in identified hot- and cool-spots (or particular fertilizer treatments), by short term incubations (Yara lab incubation or similar) combined with tracer studies of the sources of N_2O. Collaborative work is planned to compare the N_2O emissions measured in the field with emissions calculated by the DNDC model in order to evaluate the predictive capability of the model. Also a comparison with data calculated with the DayCent model will be considered. Acquiring experience with mathematical models would be very useful in order to improve the understanding of experimental data.

The lab incubation system at Yara is currently being modified to better simulate events such as fertilization and rainfall, which typically initiate periods of high N_2O emissions. In a later stage the system might be further developed in order to allow the collection of soil samples for molecular analyses during incubation. The incubation system will be used for an experiment aimed at assessing the effect of copper concentrations on $N_2O/(N_2O+N_2)$ ratios of denitrification products in copper deficient soils. The activity of N_2O reductase in soil can be a relevant N_2O sink; this enzyme is a metalloprotein requiring copper as cofactor for enzymatic activity, and a recent paper published by a NORA partner (UEA) also shows that copper upregulates the transcription of the gene encoding this protein in a typical soil microorganism (i.e. *Paracoccus dentitrificans*). Little is known about the copper requirements of denitrifyers in soil. The automated incubation system at Yara is well suited to test whether copper availability can be limiting for N_2O reduction in soils with a low copper content under denitrifying conditions.

Collaboration:

1) UGOT: i) source partitioning experiment with ^{15}N labeled N fertilizers (urea and calcium ammonium nitrate) aimed at better understanding N_2O origin and N_2O formation kinetics ii) training in micrometeorological methods

2) UMB: i) replication of experiments performed in the Yara automated incubation system in order to compare the results and include NO emission measurements ii) gaining experience with the field flux robot (alongside traditional chamber methods and automated chamber measurements)