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Laboratory evaluation of a new approach to measure denitrification under N_2-depeleted atmosphere in situ using the ^{15}N gas flux method

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Direct determination of N_2 fluxes from soils is complicated by the huge N_2 background of the atmosphere. There are two principles to overcome this problem, i.e. adding highly enriched ^{15}N nitrate and monitoring ^{15}N labelled denitrification products (^{15}N gas flux method) or measuring denitrification gases during incubation of soils in absence of atmospheric N_2 using gas tight containers and artificial atmosphere. In the laboratory, both approaches have been combined to incubate soils under N_2-depeleted atmosphere to improve the detection limit of N_2 fluxes (Spott et al. 2006, Meyer et al. 2010, Lewicka-Szczebak et al. 2017). However, until now this approach was limited to lab conditions allowing extended incubation in fully closed systems and to control the incubation atmosphere.

Objectives of this study were to develop a procedure to conduct the ^{15}N gas flux method under N_2 depleted atmosphere suitable for field application. Moreover, we wanted to check this new approach with respect to stability and bias and optimize its practicability for future routine application in the field. Finally we aimed to compare its results with independent methods of N_2 flux quantification.

We established a testing system consisting of a 70-L container filled with soil were an aluminium cylinder (15 cm diameter, 35 cm long) was installed to mimic a typical field micro-plot suitable for conducting the ^{15}N gas flux method using closed chambers (Buchen et al. 2016). Soil and chamber atmospheres were replaced with an artificial N_2-depleted gas mixture and stability of N_2background concentration monitored by online GC analysis. Subsequently, several experiments with ^{15}N-labelled soil were conducted to check the performance under N_2 depleted atmosphere in comparison with incubation under ambient atmosphere. N_2 fluxes determined with both approaches will be shown

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