



## Agrarforschung zum Klimawandel

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# Measures to reduce direct and indirect climate-impacting emissions caused by denitrification in agricultural soils

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Gaseous emissions from denitrification (nitric oxide, NO, nitrous oxide, N<sub>2</sub>O, and molecular nitrogen, N<sub>2</sub>) cause significant nitrogen losses and contribute to climate change. Denitrification in soils is highly variable on temporal and spatial scale due to its controlling factors such as climate, soil properties and management. Because of its variability, denitrification is difficult to measure in field studies. Therefore, there is still a knowledge gap on mitigation measures of N losses from denitrification in soils. While most studies focused on ammonia- (NH<sub>3</sub>) and N<sub>2</sub>O-emissions due to their impact on climate change, N<sub>2</sub> emissions can account for a large proportion of the gaseous nitrogen losses. However, due to the high atmospheric background, the quantification of N<sub>2</sub> emissions from fertilisation is challenging. Within the project "Measures to reduce direct and indirect climate-relevant emissions from denitrification in agricultural soils (MinDen)", a field experiment was set up in Brunswick to assess the impact of mineral and organic fertilisation in combination with different application techniques of the organic fertiliser on gaseous nitrogen losses from denitrification. <sup>15</sup>N labelled fertiliser and tracer solution was used to estimate nitrogen balance losses. The dominant and environmentally relevant nitrogen fluxes are determined by quantifying the amount of applied fertiliser, plant nitrogen uptake, soil mineral nitrogen content, in addition to NH<sub>3</sub>-, N<sub>2</sub>O- and N<sub>2</sub>-emissions as well as nitrogen leaching. N<sub>2</sub>O emissions are measured using the static chamber method. The N<sub>2</sub> setup is comparable, but the cover is flushed with H<sub>2</sub> and O<sub>2</sub> to decrease the N<sub>2</sub> content inside the cover.



fig. 95. Static chamber for N<sub>2</sub>O measurement

To account for a total nitrogen balance, the <sup>15</sup>N recovery rate not captured in soil and plant should equal to the amount of nitrogen lost in gaseous form (N<sub>2</sub>O, N<sub>2</sub> and NH<sub>3</sub>) or through nitrogen leaching. First results show that overall the N<sub>2</sub>O emissions in Brunswick are low, as expected, due to the sandy soil. The organic fertilised treatments had higher N<sub>2</sub>O emissions than the mineral fertilised treatments, while the control treatment without fertilizer showed the lowest N<sub>2</sub>O emissions. In addition, the mineral fertilizer resulted in higher nitrogen uptake in the maize plants compared with those under organic fertilization. The presentation aims to provide a brief overview of the project and to present preliminary findings on the impact of nitrogen fertilisation on gaseous N emissions, yield, and nitrogen uptake.