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# Impact of "Biological Nitrification Inhibition" on N Recovery Efficiency, N Leaching and $N_2O$ Emissions Using the Example of *Brachiaria humidicola*

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**Abstract**

Biological Nitrification Inhibition (BNI) has been reported for several plant species. Amongst these the tropical forage grass *Brachiaria humidicola* has gained major attention due to its high BNI-activity. An increased N-recovery efficiency (reduced N-leaching) and reduced $N_2O$-emissions are proposed for *B. humidicola* based pastures. Breeding programs targeting on BNI-activity currently lack indicators suitable for large scale field evaluation. A promising approach could be the link between the plant $^{15}N$-signature and its N-nutrition (ammonium versus nitrate). As both pools usually possess different isotopic signatures, the nutritional contribution of each N-pool should be reflected in the plant, thus indicating the magnitude of nitrification inhibition (BNI-activity). Objectives of the present study are the evaluation of selected *B. humidicola*-hybrids regarding their BNI-activity; the assessment of BNI's impact on N recovery efficiency, N-leaching and $N_2O$-emissions; and a correlation analysis on the relation between the plant's BNI-activity and its $^{15}N$-signature.

The study was designed as a two phased greenhouse trial. In a first phase the plant *15*N-signatures were analysed and assessed in relation to the $^{15}N$ background signal of soil and fertiliser. In a second phase the fertilisation regime was switched to $^{15}N$-labeled ammonium sulfate. This enabled tracing of N-fluxes, estimation of the hybrid's BNI-activity (via the nitrification rates) and determination of overall N recovery efficiency. N-leaching and $N_2O$-emissions were assessed in relation to the estimated BNI-activity.

Plants were cultivated in PVC-tubes (Ø12cm * 100cm) on a ferralitic substrate. Nitrification rates and nitrate dislocation were derived on the basis of soil nitrate levels determined by regular sampling of soil solution through suction tubes installed at different depths within the soil column. Anion exchange resin bags were installed at the bottom of the column to quantify cumulative N-leaching. $N_2O$-emissions were quantified after irrigation inducing reducing conditions.

**Keywords:** *Brachiaria*, denitrification, N use efficiency, $N_2O$ emissions, nitrification, nitrification inhibition

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