Tropentag, September 20-22, 2017, Bonn

"Future Agriculture:
Socio-ecological transitions and bio-cultural shifts"

δ15n Leaf Signature in *Brachiaria humidicola* Reflects the Potential Biological Nitrification Inhibition (BNI)

Hannes Karwat[1], Konrad Egenolf[1], Jacobo Arango[2], Jonathan Núñez[2], Danilo Moreta[2], Idupulapati Rao[2], Frank Rasche[1], Georg Cadisch[1]

[1] *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*

[2] *International Center for Tropical Agriculture (CIAT), Colombia*

Abstract

The tropical forage grass *Brachiaria humidicola* (Bh) reduces soil microbial nitrification by biological nitrification inhibition (BNI) and consequently reduces formation of nitrate (NO_3) in soils. NO_3 leaching and nitrous oxide (N_2O) emission might therefore be reduced by BNI. Intraspecific contrasting BNI potentials in Bh have been observed but screening methods for field plots need to be further developed to identify high BNI Bh candidates.

Nitrification discriminates against the stable isotope ^{15}N and leads to a ^{15}N enriched ammonium (NH_4^+) and a ^{15}N depleted NO_3 pool. It was hypothesised that high BNI Bh genotypes would mainly feed on NH_4^+ and lower$\delta^{15}N$ values in leaves are expected whereas low BNI (and high nitrification) should cause respective higher $\delta^{15}N$ leaf signatures under the assumption that NO_3 has been leached out of the rooting zone.

Contrasting BNI genotypes were grown in the Llanos of Colombia for 3 years. Plots were split and either fertilised (+N) or not (-N) with 70 kg N ha^{-1}. Soil was collected and incubated for potential nitrification determination. Leaves were collected from both split plots of two high BNI (CIAT 679 and CIAT 16888) and one low BNI (CIAT 26146) Bh hybrid frequently after fertilisation and ^{15}N was measured with an IRMS. As reference NO_3 in shoots were measured simultaneously and NO_3 in topsoil determined at 8 DAF.

A strong correlation (p = 0.006, R^2=0.38) was observed between means of $\delta^{15}N$ leaf values and soil NO_3 at 8 DAF. High BNI Bh showed respective lower $\delta^{15}N$ signatures and less NO_3 in stems compared to the low BNI Bh at 11 DAF. Soil incubation indicated lower nitrification for high BNI genotypes compared to the low BNI Bh.

It could be demonstrated that $\delta^{15}N$ leaf signatures and BNI are strongly linked. However it needs to be considered that the leaf $\delta^{15}N$ might also be influenced by other factors such as N fractionation under high N availability or uptake of both N forms from soil N min pools with different $\delta^{15}N$ values. It was concluded that the technique has the potential to screen for contrasting BNI genotypes within Bh.

Keywords: Isotope Discrimination, N assimilation, N Uptake, Nitrate Leaching, Soil Incubation

Contact Address: Hannes Karwat, University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Garbenstr.13, 70599 Stuttgart, Germany, e-mail: hannes.karwat@posteo.de