

# Gross nitrogen transformation rates do not support previously described BNI capacities of selected *Brachiaria* genotypes

Eduardo Vazquez, Nikola Teutscherova, Mirjam Pulleman, Michael Dannenmann, Klaus Butterbach-Bahl, Paul Töchterle, Jacobo Arango  
CONTACT: [eduardo.vazquez@upm.es](mailto:eduardo.vazquez@upm.es)

## Introduction

Nitrification is one of the key processes leading to water contamination and greenhouse gas emissions ( $N_2O$ ) in pasture systems. As vast areas of tropical pastures are nitrogen (N) limited, grasses from the *Brachiaria* genus have adapted to reduce N losses and increase N use efficiency by releasing substances capable of biological nitrification inhibition (BNI) in the rhizosphere. Although the release of BNI compounds and its impact on  $N_2O$  emissions and net nitrification rates in soil have been studied, the impact of BNI on gross nitrogen transformation rates has not been addressed, despite its relevance to mechanistic understanding of this phenomena.

## Materials and Methods

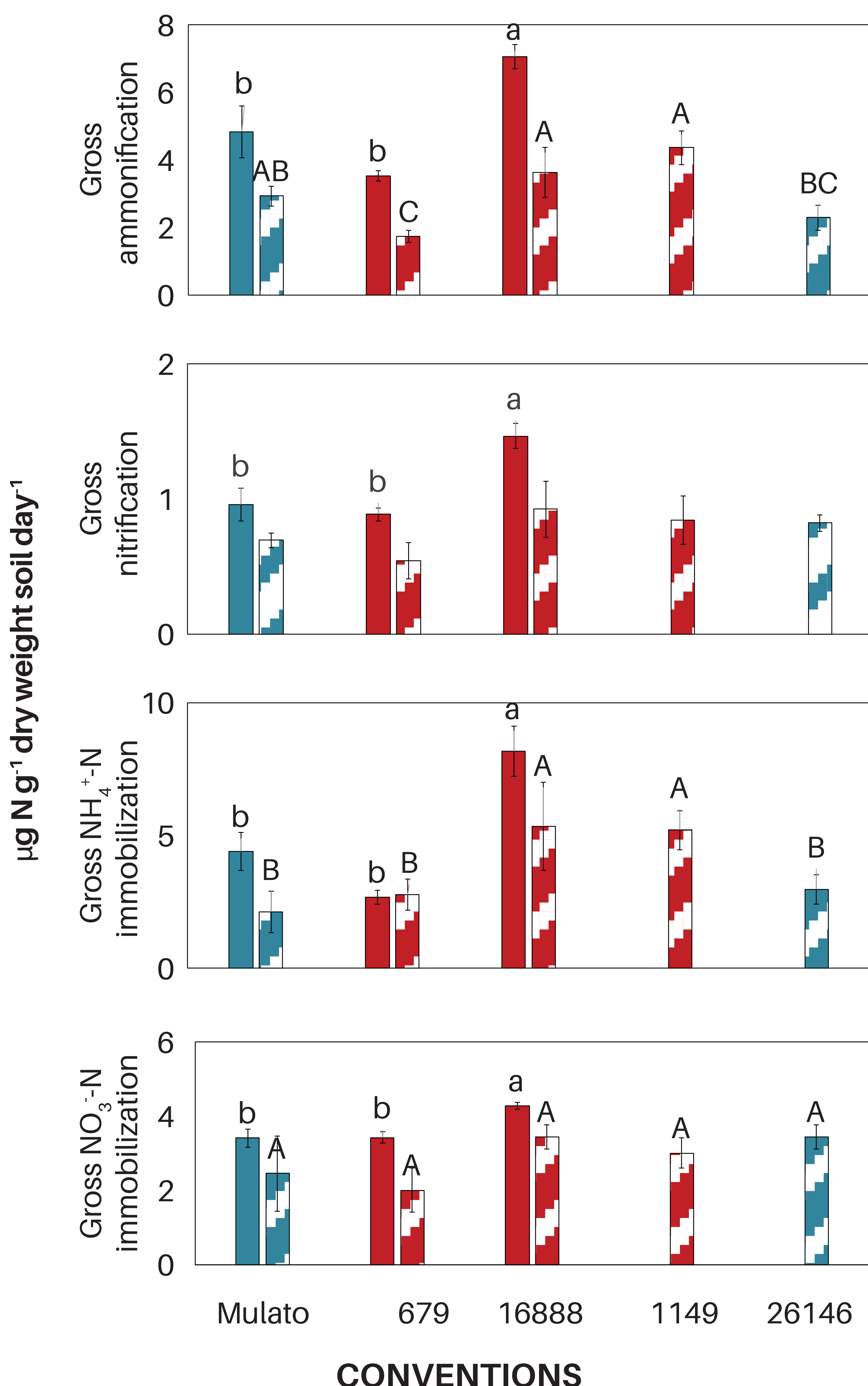
The  $^{15}N$  dilution technique and aerobic incubation were used to evaluate gross N transformation rates and potential nitrification rate (PNR), respectively, in 5 *Brachiaria* genotypes:

high-BNI (strong inhibition of nitrification)	low-BNI (low inhibition of nitrification)
CIAT-679    CIAT-16888 Bh08-1149	Mulato hybrid CIAT-26146

Two experimental plots were established:

**Palmira** - established 14 years ago, neutral soil pH, Vertisol  
**La Libertad** - established 5 years ago, acid soil pH, Oxisol

## Results



Potential nitrification rate*	Mulato hybrid	CIAT 679	CIAT 16888	Bh08 1149	CIAT 26146
Palmira	1.87±0.73a	0.04±0.02b	1.58±0.58a	-	-
La Libertad	6.96±3.23A	0.27±0.05B	0.17±0.16B	0.35±0.18B	2.44±0.92A

\*µg NO<sub>3</sub><sup>-</sup>-N g<sup>-1</sup> soil day<sup>-1</sup>

- » The PNR in Palmira was lower in CIAT-679 (high-BNI) than in Mulato (low-BNI). In La Libertad, both low-BNI (Mulato and CIAT-26146) showed a higher PNR than the three high-BNI genotypes.
- » Gross nitrification did not differ between high- BNI and low-BNI genotypes in La Libertad, but was higher under CIAT-16888 (high-BNI) compared to Mulato (low-BNI) in Palmira plots.
- » In Palmira, the high-BNI CIAT 16888 soil exhibited the highest gross ammonification rates and immobilization of both ammonium and nitrate, when compared to other genotypes.
- » In La Libertad, CIAT-16888 and Bh08 1149 (both high-BNI) showed higher ammonium immobilization rates than both low-BNI genotypes (Mulato and CIAT-26146).
- » The PNR confirmed the previously described BNI status of each *Brachiaria* genotype, but, unlike expected, the gross nitrification was not suppressed by the high BNI genotypes.

## Conclusions

Our results suggest, for the first time, that **BNI capacity** (defined by the suppression of PNR) may not be only due to a suppression of the gross nitrification rates but also to **higher N immobilization rates**, which could equally explain lower net nitrification rates and  $N_2O$  emission previously described in the fields under high-BNI genotypes. The N immobilization could lead to temporal N storage and reduce N availability to leaching or gaseous losses.

## Acknowledgements

This study was conducted within the framework of the LivestockPlus project as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit [ccafs.cgiar.org/donors](http://ccafs.cgiar.org/donors). The views expressed in this document cannot be taken to reflect the official opinions of these organisations. This work was conducted as part of the CGIAR Research Program on Livestock, and is supported by contributors to the CGIAR Trust Fund. CGIAR is a global research partnership for a food-secure future. Its science is carried out by 15 Research Centers in close collaboration with hundreds of partners across the globe. [www.cgiar.org](http://www.cgiar.org). This work was conducted also with funds of the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan.

This poster is licensed for use under the Creative Commons Attribution 4.0 International license (CC BY 4.0) 2019-09. Design: JL Urrea (CIAT)