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Biological Nitrification Inhibition (BNI) in Tropical Pasture and its Influence on the Recovery of Applied Nitrogen Fertiliser by Subsequent Maize Crop in the Llanos of Colombia

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Abstract

Biological Nitrification Inhibition (BNI) by the tropical pasture grass *Brachiaria humidicola* (Bh) suppresses the microbial conversion of relatively immobile ammonium (NH_4^+) to very mobile nitrate (NO_3) in soils. BNI is expected to reduce nitrogen (N) losses by NO_3 leaching and nitrous oxide (N_2O) emission. Smallholder farmers could benefit from BNI of improved Bh pastures by obtaining higher yields of a subsequent crop. CIAT researchers had demonstrated that within 3 years, Bh pastures had suppressed soil nitrification. It was hypothesised by us that the residual BNI effect of Bh enhances the N use efficiency of a subsequent maize crop since tissue turnover of Bh biomass could lead to passive release of BNI compounds and consequently preserve N in the form of NH_4^+. A field trial was established in Colombia to determine the effects of BNI from a long-term Bh pasture after its conversion to maize cropping in terms of grain yield and N uptake of maize. Maize was also grown in an area of degraded Bh pasture (low BNI) and also in a long-term maize mono cropping field (non-BNI control). Four N fertiliser levels were used to study the influence on N losses and its influence on maize grain yield. ^{15}N traced N fertiliser in microplots was used for determination of the N recovery. Dicyandiamide application served as synthetic nitrification inhibition control. Soil incubation method was used to test differences in rate of nitrification among the three field sites. Results showed superior yields in the preceding Bh field sites. Reduced nitrification rate observed in soil indicated that the BNI effect was present even after conversion of Bh pasture to maize cropping. Fertiliser N recovery by maize on BNI soil from pasture sites was only higher under low rate of N fertiliser application but not under higher rate of N application. It can be concluded that Bh has a huge potential to reduce N fertiliser amounts and N losses due to BNI and boost yields of subsequent crops in low input pasture-crop rotations by enhancing plant N supply. New research tools are necessary to measure BNI in plants and soil.

Keywords: Biological nitrification inhibition, *Brachiaria humidicola*, forage grasses, maize yield, nitrogen use efficiency, residual effect

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