Effect of biochar addition on the chemical and isotopic evolution of nitrate retained and leached from soil after manure fertilization: Lysimeter experiments

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Increase of soil fertilization produces an increase of N export to the hydrosphere. The amount of nitrate that reaches the aquifers is controlled by processes affecting N-cycle species within the soil. The most relevant processes are nitrification, denitrification, plant uptake, mineralization, and immobilization. Biochar is reported to reduce nitrous oxide (N_2O) emisions and nitrate (NO_3^-) leaching. This work studies the fate of N compounds in soil after manure (pig slurry) application in a lysimeter study, comparing a soil with and withoud added biochar. The N and O isotopic composition of dissolved nitrate (δ^{15}N-NO_3^- and δ^{18}O-NO_3^-) and the N isotopic composition of ammonium was studied coupled with the evolution of N-compounds retained in soil (soil extracts) and leached from the soils. Results showed an increase in the δ^{15}N-NO_3^- in both the leached and the soil extracts towards values similar to the δ^{15}N-NH_4^+ from the applied manure. The highest δ^{15}N-NO_3^- values were measured after 100 days of manure application, and thereafter, values decreased towards the initial δ^{15}N-NO_3^- of the soil before manure application. No clear trend was observed in the evolution of the δ^{18}O-NO_3^-. Preliminary resuts showed no significant differences in the evolution of the N and O isotopic composition of dissolved nitrate as a result of biochar treatment.