https://doi.org/10.3301/ABSGI.2019.05

Parma 16-19 settembre 2019

ABSTRACT BOOK

a cura della Società Geologica Italiana

Congresso
SIMP-SGI-SOGEI 2019

Il tempo del pianeta Terra e il tempo dell'uomo: Le geoscienze fra passato e futuro

PARMA 2020 la cultura batte il tempo | CAPITALE ITALIANA DELLA CULTURA

SIMP SOCIETÀ ITALIANA DI MINERALOGIA E PETROLOGIA

SOCIETÀ GEOLOGICA ITALIANA 1881 MENTE ET MALLEO

Società Geochimica Italiana So.Ge.I.

Effects of natural and NH_4-charged zeolite amendments and their combination with 3,4-dimethylpyrazole phosphate (DMPP) on soil gross ammonification and nitrification rates

Ferretti G.*[1], Galamini G.[1], Deltedesco E.[2], Gorfer M.[3], Faccini B.[1], Zechmeister-Boltenstern S.[2], Coltorti M.[1] & Keiblinger K.M.[2]

[1] Department of Physics and Earth Science, University of Ferrara.
[2] University of Natural Resources and Life Sciences Vienna (BOKU).
[3] Austrian Institute of Technology (AIT).

Corresponding email: frrgcm@unife.it

Keywords: gross N transformation rates, Nitrogen cycle, natural zeolites.

The use of zeolitites (rocks with > 50 wt% of zeolites) at natural (NZ) and NH_4-enriched state (CZ) as soil amendments is recognized as a valuable management practice to improve agricultural sustainability. Zeolites are known to influence the nitrogen (N) dynamics in soils because of their very high cation exchange capacity.

However, their influence on soil N transformation processes is mostly unknown, especially concerning their effects on gross rates of mineralization and nitrification. Recent studies demonstrated that NZ has limited influence on soil microbial biomass activity in the short-term period, while CZ is responsible for a priming effect on soil microbial biomass, which stimulates net NO_3^- production and NH_4^+ consumption. In this optic, the high NO_3^- concentrations induced by CZ suggests that the application together with a nitrification inhibitor (NI) would improve Nitrogen Use Efficiency (NUE) and reduce N losses.

With this work we aimed at unveiling the mechanisms for different N availability after zeolite amendments, by measuring gross N mineralization and nitrification rates in zeolite amended soils both with and without the addition of a NI.

Gross nitrification and mineralization rates were evaluated using the ^{15}N pool dilution technique in soils amended with NZ and CZ, with and without a commonly used synthetic nitrification inhibitor 3,4-dimethylpyrazole phosphate (DMPP).

The experiments were performed on a slightly alkaline soil with silty-clayey texture, amended with ten wt% of NZ and CZ in comparison to an unamended soil. Fertilizers were added at a ratio of 170 kg N ha^{-1}. At time 0 and after 24 h, we measured NH_4^+ and NO_3^- concentration and N isotopic signature. The total evolved N_2O during the incubation as well as total DNA and functional genes involved in the N cycle (*amoA*, *BamoA*, *nirS*, *nosZ*) through qPCR were also determined.

Results show that the addition of NZ to soil had no effects on NH_4^+ and NO_3^- production and consumption rates in this soil. On the other hand, CZ amended soil showed a significantly higher gross NH_4^+ production as well as high N_2O emissions. The latter were corroborated with a significantly lower content of *nosZ* and *nirS*. The lower expression of N_2O reductase genes likely resulted in higher N_2O emissions.

Concerning the DMPP, it generally lowered the NH_4^+ consumption, favoring the preservation of this pool. The efficiency of DMPP was not affected by the presence of zeolites at natural state but showed synergic effects with CZ. Additionally, DMPP application reduced by more than 90% the total amount of evolved N_2O in all the treatments. These results suggest that the addition of DMPP to soils can mitigate N_2O losses to a large degree, while the NUE for CZ amendments can be sharply improved via reduced gross nitrification and can thus reduce N losses to the water bodies.

SPONSOR

PLATINUM

GOLD

SILVER

BRONZE

PATROCINI

9 788894 022797