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ABSTRACT BOOK

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SIMP-SGI-SOGEI 2019

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



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Sorption of 3,4-Dimethylpyrazole phosphate (DMPP) in Soils amended with different chabazite zeolites

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The use of rocks containing more than 50% of zeolites (natural zeolites, ZTs) as a soil amendment is recognized as a valid method to increase soil properties. ZTs are usually used both at the natural state and/or in the pre-enriched form with specific cations (e.g., NH_4^+) to improve the plant N use efficiency (NUE) and soil physic-chemical properties. However, while it has been shown that ZTs at natural state can significantly reduce gaseous N losses and increase crop yield, NH_4^+ -enriched ZT has shown quick NO_3^- production and high gaseous N losses (Ferretti et al., 2017; Faccini et al., 2018). The use of nitrification inhibitors (NIs) could certainly mitigate these losses, constituting an exciting possibility to increase NUE when NH_4^+ -enriched ZTs are employed.

The purpose of this work is, therefore, the description of the adsorption characteristics of a synthetic NI (3,4-dimethylpyrazole phosphate, DMPP) on natural and NH_4^+ -enriched ZTs and different soil-ZTs mixtures. The introduction of new binding sites with the addition of zeolites may, in fact, influence the sorption of NI, which can reduce its availability to soil microbial biomass and therefore its inhibitory effect.

To this aim, we conducted a sorption experiment where different soil-zeolite textures, pure soil and zeolites, have been mixed with DMPP solutions at various concentrations (from 1 to 500 mg L⁻¹). Adsorption isotherms were built using the Langmuir model and other parameters, like organic carbon, cation exchange capacity, pH, and hydrophobicity degree, were measured during the experiment.

Results show that pure ZTs had a deficient capacity for DMPP sorption and thus decreased the possibility to retain DMPP once applied to the soil. The sorption capacity strongly positively correlated to soil organic C content, supporting that sorption was mainly driven by soil organic matter and hydrophobic interaction (reduced by ZTs addition) (Keiblinger et al., 2018). These outcomes indicate that the combined use of natural and NH_4^+ -enriched ZTs with DMPP may result in a good strategy for increasing nitrogen use efficiency since its inhibitory effect will likely not be influenced by sorption processes.

Ferretti G., Keiblinger M.K., Zimmermann M., Di Giuseppe D., Faccini B., Colombani N., Mentler A., Zechmeister-Boltenstern S., Coltorti M. & Mastrocicco M. (2017) - High resolution short-term investigation of soil CO_2 , N_2O , NO_x and NH_3 emissions after different chabazite zeolite amendments. *Appl. Soil Ecol.*, 119, 138-144.

Keiblinger M.K., Zehetner F., Mentler A. & Zechmeister-Boltenstern S. (2018) - Biochar application increases sorption of nitrification inhibitor 3,4-dimethylpyrazole phosphate in soil. *Environ. Sci. Pollut. Res.*, 25, 11173-11177.

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