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# ABSTRACT BOOK

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



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## Effects of natural and NH<sub>4</sub>-enriched Zeolite on nitrogen leaching from a reclaimed agricultural soil of the Ferrara province (Italy)

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The impact of agriculture on water quality is a worldwide problem and a matter of concern for the European Union (EU) since the early nineties. Fertilizer-N inputs are generally inefficiently exploited by crops, resulting in widespread nitrogen (N) losses in the environment (Dawson et al. 2008). Agricultural systems characterized by low fertilizer use efficiency (FUE) are responsible for altering the equilibrium of natural ecosystems; in addition, high NO<sub>3</sub> and P levels in waters lead to eutrophication phenomena. Thus, in order to make modern agriculture a sustainable activity, fertilization reductions must be combined with FUE improvements. With the implementation of Nitrates Directive (91/676/EC) and the Water Framework Directive (2000/60/EC) the EU aimed at preventing the negative effects linked to the excess of NO<sub>3</sub> by promoting the use of good and innovative farming practices.

In this study we report an overview of the main outcomes of a three-years experimental cultivation carried out in a reclaimed agricultural field amended with different types of zeolites (rock containing > 50% of zeolites), under cereals cultivation (*Sorghum vulgare Pers*, *Zea mais* and *Triticum durum*). The experimental field was located in the Ferrara Province, declared as Nitrate Vulnerable Zone “NVZ” in 2006 after the implementation of the Nitrate Directive by the Emilia-Romagna Region in central-north of Italy. The aim of the experiment was to exploit the properties of zeolites for reducing the excessively high NO<sub>3</sub><sup>-</sup> content in the soil and in waters outflowing the sub-surface drainage system (SSDS) of the field and flushing into the surface water system, reducing concomitantly N inputs from chemical fertilizers (up to 50 %). Zeolites were tested both in their natural state and in an NH<sub>4</sub>-enriched form, obtained through an enrichment process with zootechnical effluents (pig slurry). NO<sub>3</sub><sup>-</sup> content in soils and in waters discharged through SSDS were periodically monitored during the experimentation and crop yield quantified. Results showed that, for three consecutive cultivation cycles, the overall NO<sub>3</sub><sup>-</sup> concentrations in soil (measured in H<sub>2</sub>O-extracts) was reduced by 45 % in the zeolite treated soils, while in SSDS waters the reduction reached the 64 %. Notwithstanding the lower N input from chemical fertilizers, crop yield was not negatively affected in the zeolite amended soils, with respect to the control. Zeolite addition probably influenced several pathways of N losses, allowing a better FUE by plants and a reduction of the overall NO<sub>3</sub><sup>-</sup> concentrations in the surface waters.

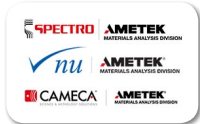
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