



The eco-innovation of K-Chabazite zeolite application in high nitrate vulnerable soils: a mapping assessment

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Farmers' cultivation choices, mainly related to the use of agricultural inputs, affect the natural ecosystem and has an impact on larger scale. In particular the on-land application of swine manure by pigs livestock affects the water quality of waterways and in certain area can compromise the long term sustainability of the agro-ecosystems. The Volano-Burana basin (Ferrara Province, Italy) is a high vulnerable area (under the Directive Nitrate 91/676/CEE) characterized by waterways surrounding terrains with high concentration of croplands that year by year are managed by farmers with slurry and fertilizers application on the soil.

A 6 ha agricultural field within this basin has been involved as a case study for the implementation of ZeoLIFE project experimental activities, which consist in the introduction of volcanic rocks called zeolite, by an innovative integrated cycle, that combines zeolite with pig slurry, and put it into soil.

The zeolite used for the project, K-Chabazite zeolite, holds a high cation exchange capacity (up to 2.2 meq/g) and reversible hydration. The granulated waste quarries zeolite, enriched in ammonium by a treatment with pig slurry and added to agricultural land, have a high fertilization capacity and a slow-realise of nutrients (K, NH₄) and water, allowing the solubilisation of tricalcium phosphate, making the P available for plants. Added to agricultural soil it has allowed an increase in yield up to 20% and simultaneously reduce of the amount of fertilizer and irrigation water up to 50%, with a resulting decrease in the nitrate concentration in pore-waters and superficial waters issued from the field in the water system.

Starting from project's results, an agro-ecological model of charged zeolite application has been provided taking into account the economic and normative constraints and the main characteristics of the Burana-Volano Basin to identify and promote the best pathways to spread this eco-innovation process and practice.

This analysis has been set at regional scale through a GIS mapping framework to focus on the priority areas where the interventions on soil are suitable to preserve environmental functions and land quality, taking into account the environmental policy addresses and the Regional Rural Development Program.