Nitrogen and carbon pools and ^{15}N natural abundance in a zeolitite-treated agricultural soil

G. FERRETTI[1*], B. FACCINI[1], L. VITTORI ANTISARI[2], D. DI GIUSEPPE[1] AND M. COLTORTI[1]

[1]University of Ferrara, Dept. of Physics ad Earth Sciences, Ferrara, Italy. (* correspondence: frrgcm@unife.it)
[2]University of Bologna, Alma Master Studiorum, Dept. Of Agricultural Sciences, Bologna, Italy.

Nitrogen (N) and carbon (C) pools and ^{15}N natural abundance in the soil-plant system were investigated in a reclaimed agricultural soil amended with both natural (NZ) and NH_4-enriched (NEZ) Italian Chabazite zeolitites over an eleven-months monitoring period. Zeolitite were mixed in the top soil layer in November 2012 in quantities ranging from 5 kg m^{-2} to 15 kg m^{-2}. *Sorghum vulgare Pers*. was sowed during the experimentation and different fertilization reductions (up to 50%) with respect to untreated soil (CNTR) were applied in zeolitite treatments. pH, Cation Exchange Capacity (CEC), Total N (TN), Fixed (Fix) and Exchangeable (Exch) N-NH_4, N-NO_3, Microbial Biomass N (Nmic) and C (Cmic), Total Organic C (TOC), Total Extractable C (TEC), C contained into Humic Acids (HA) and Fulvic Acids (FA) in the soil, as well as C-N content of plants and yield were measured in the various parcels. In addition, $\delta^{15}N$ in soil TN and Fix pools and in the different sorghum organs was measured. Results show that zeolitite introduction mainly affected N pools while the majority of C pools were not significantly affected. The dynamics of Fix N-NH_4^+ pool reserve and its $\delta^{15}N$ turnover suggest an active role in plant nutrition and a partial substitution by N from chemical fertilizers. N-NO_3^- content was significantly lower in soils treated with NZ, suggesting a lesser N availability to nitrifying bacteria. The initial lower Cmic and the change in microbial C/N ratio in the treated parcels suggest that zeolitite introduction affected microbial biomass. Probably, a change of population through a fungal prevalence occurred as evidenced by the higher microbial C/N ratio in the treated soils. Plants and TN $\delta^{15}N$ indicate that N contained into NEZ remained in the soil system until the growing season to be successively undermined by the crops. The low $\delta^{15}N$ and the similar N content of plants grown in NZ treatments suggests a possible higher fertilization efficiency. TOC was significantly higher in the rhizosphere of all zeolitite treatments but the causes of this enrichment require further investigation. Zeolitite addition also brought to an increase in soil CEC and yield; the latter was similar or higher with respect to the CNTR, notwithstanding the applied fertilization reduction.