Geophysical Research Abstracts
Vol. 16, EGU2014-6093-1, 2014
EGU General Assembly 2014

Enzyme dynamics in paddy soils of the rice district (NE Italy) under different cropping patterns

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The recent widespread interest on soil enzymes is due to the need to develop sensitive indicators of soil quality that reflect the effects of land management on soil and assist land managers in promoting long-term sustainability of terrestrial ecosystems. The activities of six important enzymes involved in C, N, P, and S cycling were investigated in a paddy soil from the Veneto region, Italy, in four different rotation systems (rice-rice-rice: R-R-R; soya-rice-rice: S-R-R; fallow-rice: F-R; pea-soya-rice: P-S-R) with three replications in April (after field preparation, field moist condition), June (after seedling, waterlogged soil condition), August (after tillering stage of rice, waterlogged soil condition) and October (after rice harvesting, drained soil condition) over the 2012 growing season. Our results demonstrated that enzyme activities varied with rotation systems and growth stages in paddy soil. Compared with field moist soil, drained soil condition resulted in a significant increase ($P < 0.05$) of β-glucosidase, arylsulfatase, alkaline and acid phosphatases, leucine aminopeptidase (except of fallow-rice), and chitinase activities in all rotations, while compared with drained soil, early waterlogging (in month of June) significantly decreased ($P<0.05$) β-glucosidase, alkaline and acid phosphatases, leucine aminopeptidase (except of pea-soya-rice), arylsulfatase, chitinases.

Soil organic-C was positively correlated with acid and alkaline phosphatases, and arylsulfatase while ß-glucosidase, chitinases and leucine aminopeptidase were not signi?cantly correlated to soil organic-C. Enzyme activities were always correlated among them.

Our results suggest that enzyme activity decreases in the different experimental conditions with the following order:

Drained soil > moist soil> late waterlogged>early waterlogged.

There was an inhibitory effect of waterlogging (except P-S-R rotation) for both alkaline and acid phosphatases due to high pH and redox conditions.

However, the response of enzymes to waterlogging differed with the chemical species and the cropping pattern. The best rotation system for chitinase, leucine aminopeptidase and β-glucosidase activity (C and N cycles) proved R-R-R, while for arylsulfatase, alkaline and acid phosphatases (P and S cycles) it was the S-R-R.

Key Words: enzyme activity, paddy soil, Crop Rotation System, Italy

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