Geophysical Research Abstracts
Vol. 18, EGU2016-15081, 2016
EGU General Assembly 2016

Response of hydrolytic enzyme activities and nitrogen mineralization to fertilizer and organic matter application in subtropical paddy soils

Mohammed Abdul Kader (2), Sabina Yeasmin (3), Masuda Akter (1), and Steven Sleutel (1)

(1) Ghent University, Department of Soil Management and Soil Care, Gent, Belgium (steven.sleutel@UGent.be), (2) Department of Soil Science, Bangladesh Agricultural University , (3) Faculty of Agriculture and Environment, The university of Sidney

Driving controllers of nitrogen (N) mineralization in paddy soils, especially under anaerobic soil conditions, remain elusive. The influence of exogenous organic matter (OM) and fertilizer application on the activities of five relevant enzymes (β-glucosaminidase, β-glucosidase, L-glutaminase, urease and arylamidase) was measured in two long-term field experiments. One 18-years field experiment was established on a weathered terrace soil with a rice-wheat crop rotation at the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) having five OM treatments combined with two mineral N fertilizer levels. Another 30-years experiment was established on a young floodplain soil with rice-rice crop rotation at the Bangladesh Agricultural University (BAU) having eight mineral fertilizer treatments combined with organic manure.

At BSMRAU, N fertilizer and OM amendments significantly increased all enzyme activities, suggesting them to be primarily determined by substrate availability. At BAU, non-responsiveness of β-glucosidase activity suggested little effect of the studied fertilizer and OM amendments on general soil microbial activity. Notwithstanding probably equal microbial demand for N, β-glucosaminidase and L-glutaminase activities differed significantly among the treatments (P>0.05) and followed strikingly opposite trends and correlations with soil organic N mineralization. So enzymatic pathways to acquire N differed by treatment at BAU, indicating differences in soil N quality and bio-availability. L-glutaminase activity was significantly positively correlated to the aerobic and anaerobic N mineralization rates at both field experiments. Combined with negative correlations between β-glucosaminidase activity and N mineralization rates, it appears that terminal amino acid NH2 hydrolysis was a rate-limiting step for soil N mineralization at BAU.
Future investigations with joint quantification of polyphenol accumulation and binding of N, alongside an array of extracellular enzymes including oxidases and peroxidases for (poly)phenols and hydrolases for N-compounds, would enable verifying the hypothesized binding and stabilization of N onto accumulating polyphenols at BAU site under SOM accumulating management.