Geophysical Research Abstracts
Vol. 20, EGU2018-18944, 2018
EGU General Assembly 2018

Dynamics in N availability and microbial properties following soil incorporation of conventional and novel biofertilizers

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In addition to the conventional organic inputs in the soil, numerous new materials have become available during the last decades following novel agricultural industries, applications and processes. For sustainable use of these organic materials, knowledge on their agricultural value and environmental risk is needed for farmers and policymakers. We conducted three incubation experiments using 14 conventional and novel organic fertilizers (OF) spanning a wide range of C:N ratio (6.5:1-60:1), consistency (liquid and solid) and sources (digestates, crop residues, phytoremediation plants and oil industry and food wastes). The objectives of the study were to quantify the N availability and to assess the impacts on microbial activity, biomass and community structure upon incorporation into the soil.

The organic fertilizers were anaerobic digestates of various feedstocks such as cattle manure only (AD_Man), AD from cattle slurry activated with crop residues (ActivatedAD), crop residues (AD_Crop), pig slurry-crop residue mixture (AD_SluCrop). Other OF include; composts from rice bran (RB), olive prunings (OliveWC), municipal wastes (MWC); Phytoremediation plant biomass (PhytoR), fresh crop residues of wheat (W-straw), sugar beet (SugarbtR), potato peels and Frass (left over after insects feed on wastes of mixed food, vegetable and chicken feed). A total of 347 PVC tubes (including unamended control in three replicates) were filled in with a sandy loam soil and an appropriate rate of each OF was added considering farmers practices. The impacts of each OF on potential carbon and nitrogen mineralization and the microbial parameters such as enzyme activities, microbial biomass C, community composition (through PLFA fingerprinting) were determined seven times during four to five-month incubation at a constant temperature and moisture content.

N availability significantly varied over time resulting in a high initial release (e.g., digestates), slow release over time (e.g., RB, sugarbtR, PhytoR, VEG and chickenfeed frass) and no net N release (MWC, OliveWC,Wstraw and mixed food waste frass). On the other hand, mixed food waste frass and W-Straw treatments resulted in higher dehydrogenase activity and microbial biomass carbon. Such and other findings and their implications for crop production and groundwater pollution will be presented during the conference.