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Tracking earthworm-microbe interactions and GHG emissions in green sugarcane production

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Many vital soil processes such as nutrient cycling, mineralization and decomposition are microbially-mediated, but can also be influenced by soil fauna. Recent advances in green sugarcane production allow us to propose the hypothesis that organic matter input (straw) and earthworms are priming forces that activate specific microbial communities involved in nutrient cycling, mineralization, decomposition and greenhouse gas (GHG) emission. Next Generation Sequencing (Illumina MiSeq) shotgun of DNA and RNA from soil samples will be correlated with environmental data (soil physical-chemical and biochemical analysis) in a factorial greenhouse experiment (began in March 2014) including a one year cycle of sugarcane installed in 24 experimental units filled with a podzolic dark red Oxisoil in the presence and absence of: 1) earthworms (*Pontoscolex corethrurus*), 2) sugarcane straw and 3) fertilizers. GHG emission (N_2O, CH_4 and CO_2) from soil are being measured throughout the experiment. We hypothesize that earthworms will impact microbial diversity and that there will be significant changes in both microbial pools and activity due to the three factors. Partial results show statistically significant differences (Tukey HSD $p<0.05$) between treatments. Straw addition increased plant height, which was also observed in straw+earthworms compared to the treatment with only fertilizers. Regarding GHG emissions, for N_2O and CO_2, straw may be the driving factor (although earthworms were also important), and the full treatment (earthworms+straw+fertilizers) had higher emissions than the three factors separately. Also the interaction between the three factors increased N_2O concentrations inside the soil compared with the other treatments. For CH_4 earthworms alone caused the highest emission rates, being significantly higher than with only fertilizer applied ($p = 0.0106303$). DNA recovered from soil samples reached an average of 36.62 ng/µl with a quality of 1.92 (NanoDrop).

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