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# MICROBIAL ACTIVITIES AND GHGs EMISSIONS FOLLOWING DIFFERENT FERTILIZATION ON MAIZE

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## Abstract

Several gases are produced in soil due to microbial activities; $CO_2$, $CH_4$ and $N_2O$ are considered the most important for their crucial role as GHGs. C and N availability are among the main factors affecting the production of gases in soil, along with water and $O_2$ availability, and temperature; then fertilization, amendment, watering, tillage and other agronomical practices can act on microbial population dynamics and metabolic adaptations, affecting the metabolic pathways releasing GHGs. The choice of good practices of crops management, in order to adequately direct the soil microbial activities, could be therefore the first way to control GHGs emissions and/or favour C sequestration in soil. In this work the effect of the addition to soil of different fertilizers was investigated on a maize-cropped field trial.

Treatments were maize for silage receiving farmyard manure (MS-F), slurry (MS-S) or urea (MS-U), and maize for grain receiving urea (MG-U), at 170 kg N $ha^{-1}$ entirely distributed just before tillage (30 cm depth) and sowing. Soil organic C, total N, ammonium and nitrate were analyzed; microbial populations and activities were characterized by analyzing total microbial biomass C and N, cultivable fungi, aerobic and anaerobic bacteria, and nitrifying and denitrifying activities. Emissions of $CO_2$, $CH_4$ and $N_2O$ were monitored and their yearly cumulative emissions calculated.

Manured plots (MS-F), where both the highest microbial biomass content and a high content of aerobic microorganisms were observed, induced the highest yearly $CO_2$ emission. MS-U plots produced the lowest $CO_2$ emissions and showed the lowest microbial biomass content, indicating that the absence of organic matter input prevents the growth and activity of microorganisms even in presence of N availability. Furthermore MS-U was the treatment revealing the lowest $N_2O$ emissions and even null cumulative $CH_4$ emissions. The highest $N_2O$ emission was observed in MG-U, and a high emission was also observed for MS-S immediately after fertilization. MG-U and MS-S were the plots where high activities were observed for both denitrifiers and nitrifiers. Due to the high content of methanogenic microorganisms in slurries, high $CH_4$ emission was produced in MS-S, even if the highest emission was found for MG-U, while in MS-F $CH_4$ seemed to be oxidized. The high emission in MG-U can be ascribed to the competition between ammonia and methane as substrate for the ammonium oxidizers that can be responsible of $CH_4$ decrease.