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Organic amendments derived from a pharmaceutical by-product: benefits and risks

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The application of organic amendments to soils, such as sewage sludge, anaerobic digestate and compost is considered a tool for improving soil fertility and enhancing C stocks. The addition of these different organic materials allows a good supply of nutrients for plants but also contributes to C sequestration, affects the microbial activity and the transformation of soil organic matter (SOM). Moreover, the addition of organic amendment has gained importance as a source of CO_2 emissions and then as a cause of the "Global Warming". Therefore, it is important to investigate the factors controlling the SOM mineralization in order to improve the soil C sequestration and decreasing at the same time CO_2 emissions. Moreover, the quality of organic matter added to the soil will play an important role in these dynamics.
Based on these considerations, the aim of the present work was to investigate the effect of the application to an arable soil of different organic materials derived from a pharmaceutical by-product which results from the fermentative biomass after the separation of the lipopolypeptidic antibiotic produced.
A microcosm soil experiment was carried out using three different materials: a sewage sludge derived from the stabilization process of the by-product, a digestate obtained from the anaerobic treatment of the by-product and a compost produced by the aerobic treatment of the same digestate.
To achieve this aim, the short-term variations of CO_2 emissions, enzymatic soil activities (Dehydrogenase total activity and Fluoresceine diacetate hydrolysis), SOM quantity and quality were studied. In addition, process-related residues of antibiotic and decanoic acid (a precursor added during the fermentation) were analyzed on the organic materials to assess their possible presence.
Through these analyses it was possible to state that the application to the soil of sewage sludge and anaerobic digestate may have a strong influence on the short-term variations of the parameters evaluated, particularly on enzymatic soil activities and on CO_2 emissions.
Whereas, results obtained from compost amended soils showed that its addition to the soil affects lower the enzymatic soil activities and CO_2 emissions than the other materials.
Determinations of antibiotic and decanoic acid residues showed that only small traces of them were recognizable in the sewage sludge and in the anaerobic digestate. Compost showed concentrations of these compounds lower than the method sensibility and then, based on these results, further analysis on the amended soil were considered negligible.