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Interaction of biochar and organic residues from sugarcane industry in soil chemical attributes and greenhouse gases emissions.

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Researchers have highlighted the importance of providing soil quality in agricultural systems, besides mitigating greenhouse gases (GHG) emissions to the atmosphere and increasing soil carbon sequestration. Therefore, several studies have demonstrated the effectiveness of biochar as a soil conditioner, both in relation to increased C sequestration and improvements in soil chemical, physical and biological attributes, resulting in better conditions for plant growth. The aim of this study was to assess the impact of applying biochar produced from sugarcane straw to soils in relation to changes in soil chemical attributes and mitigation of greenhouse gases emissions into the atmosphere. To do so, we conducted a laboratory incubation under controlled environmental conditions (ie temperature and humidity) with and without the application of filter cake and vinasse (ie organic residues from sugarcane industry) and rates of biochar application (0, 10, 20 and 50 $Mg\,ha^{-1}$). The fluxes of CO_2, N_2O and CH_4 of each incubation unity were measured periodically (in days 1, 2, 5, 9, 13, 16, 20, 24, 28, 30, 47, 60, 91, 105, 123, 130, 138 and 150). Each treatment consisted of eight replicates with destructive samples evaluated at 30, 60, 90 and 150 days after incubation to characterize the chemical attributes of the incubated soil, besides GHG (CO_2, N_2O and CH_4) emissions. In general, there was an increase in carbon dioxide (CO_2) fluxes over time due to the application of filter cake and vinasse and increasing dose of biochar. Regarding nitrous oxide (N_2O) emissions, there was an increase of 82.35% with the application of vinasse and filter cake compared to the control treatment. However, different doses of biochar (10, 20 and 50 $Mg\,ha^{-1}$) reduced N_2O emissions by 29, 38.7 and 70.9%, respectively. The methane (CH_4) flux was negligible in all treatments. We observed improvements in soil chemical attributes, such as higher pH, a substantial increase in the soil CEC, reduced exchangeable Al^{3+} and higher available P regarding the condition of the original soil.