Effect of the application of differently produced biochar on CO_2 emissions from Sri Lankan soils

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Soil organic carbon (SOC) consist more than double the carbon stored in biosphere in terrestrial ecosystems. Agriculture has contributed to decrease in SOC and increase in atmospheric CO_2 and thereby to climate change. Increasing SOC stocks through biochar application has been suggested as a sustainable technology to mitigate climate change issues. We determined the effect of biochar amendment on CO_2 emissions and subsequent changes in SOC content in two predominant Sri Lankan soils. Four types of biochar were made from corn cob waste and rubberwood employing two simple pyrolysis technologies: top-lit up draft stove (BCTULD) and a retort (BCRetort) method. Soils from two great soil groups, RBE and RYP, were amended with biochar (2% w/w) and incubated for 370 days with no amendment controls. Cumulative CO_2 emissions by the end of 30, 180 and 370d were measured to assess short term and long-term effects. At the end of 30d, all biochar amended soils have released more CO_2 than the no amendment controls (14 to 24% in RBE and 9 to 33% in RYP). However, by the end of 370d, except in rubberwood amended RBE soil, all other biochar amended soils released significantly less CO_2 (3 to 34%) despite the fact the large quantity of organic C added into soil as biochar. The CO_2 release was greater from rubberwood biochar amended soils than from corn cob biochar amended soils. Stable isotope analysis revealed that application of biochar did not increase the decomposition of SOC and in some soils biochar could even suppress SOC decomposition. The SOC content at the end of the 370d incubation period was significantly higher in all biochar amended soils (2.69 % and 2.43% in RBE and RYP, respectively) when compared to unamended soils (1.83% and 1.24% in RBE and RYP, respectively). This study suggests that conversion of waste biomass into biochar and soil application could increase SOC stocks in degraded Sri Lankan soils while reducing the CO_2 emissions from these soils but the magnitude depends on the quality of the biochar.

Keywords: Biochar, Carbon mineralization, Corn cob, Rubberwood, Soil organic carbon