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Consecutive Biochar Application Alters Thermal Stability of Soil Organic Matter in Cropland of North China

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Biochar amendment may alter the quantity and stability of soil organic matter (SOM), which could be quantified using thermogravimetry (TG) and differential scanning calorimetry (DSC) techniques. The present study was to evaluate the thermal stability of SOM after 8-yr consecutive biochar application in the North China. The experiment consisted of four treatments: control (CK), biochar rate at 4.5 t ha^{-1} yr^{-1} (B4.5), biochar rate at 9.0 t ha^{-1} yr^{-1} (B9.0), and crop straw return (SR). Soil samples were collected from the 0-10 cm layer. The results showed that the derivatives of thermogravimetry curves (DTG) and DSC curves had three peaks, near 100, 400 and 500˚C for both the bulk soils. The percentage of thermal labile SOM (weight loss in 200–400˚C accounting for that in 200–550˚C, $\%Exo_1$) followed the order of SR $>$ CK $>$ B4.5 $>$ B9.0. Across the treatments, the TG-T_{50}(the temperature leading to half of SOM loss) showed the trend of B9.0 $>$ B4.5 $>$ CK $>$ SR. Moreover, a negative correlation between $\%Exo_1$ and TG-T_{50} existed (r= -0.975; P $<$0.05). The energy densities (ED) of SOM (energy release per unit SOM) followed the order of B9.0 $>$ B4.5 $>$ SR $>$ CK. We concluded that biochar amendment increased the thermal stability of SOM.