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Effect of biochar application and soil temperature on characteristics of organic matter associated with aggregate-size and density fractions

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Potential increases in soil temperature due to climate change might result in intensified soil organic matter (SOM) decomposition and thus higher CO_2 emissions. Management options to increase and stabilize SOM include the application of biochar. However, the effects of biochar amendments under elevated soil temperatures on SOM dynamics are largely unknown. The objective of this study was to analyze the effect of biochar application and elevated soil temperature on the amount and composition of OM associated with fractions of different turnover kinetics. Samples were taken from four treatments of the Hohenheim Climate Change Experiment with the factors temperature (ambient or elevated by 2.5 °C in 4 cm depth, six years before sampling) and biochar (control and 30 t / ha Miscanthus pyrolysis biochar, one year before sampling) in two depths (0 - 5 and 5 - 15 cm). Basal respiration and microbial biomass C were analyzed within an incubation experiment. Aggregate size-fractions were separated by wet-sieving and the free light, occluded light (oLF), and heavy fractions were isolated by density fractionation. All fractions were analyzed for organic C and δ13C as well as by infrared spectroscopy. Preliminary data suggest that biochar significantly increased basal respiration and that the microbial biomass C was significantly affected by elevated temperature. No biochar-C was found in the microbial biomass. Biochar and elevated temperature had only minor effects on the organic C associated with aggregate-size classes, although biochar was incorporated into all fractions already after one year of application. Biochar application significantly increased the organic C associated with oLF. In most samples affected by biochar, the proportion of C=O groups was significantly increased. The results suggest that already after one year, biochar-mineral interactions were formed leading to an aggregate occlusion of applied biochar. At least in the short-term, the effect of biochar on the amount and composition of OM associated with different aggregate-size and density fractions seem to be independent from soil temperature.