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Soil organic carbon, microbial respiration and their carbon isotope characteristics in alley cropping systems after 9 years of recultivation of quaternary deposits in eastern Germany

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The impact of the agroforestry system 'alley cropping' on soil quality of post lignite mine site was evaluated on the basis of organic carbon, microbial respiration and their carbon isotope signatures. Soils samples were taken at 0 to 3 cm, 3 to 10 cm and 10 to 30 cm depths under black locust and poplar, transition zone and in the middle of alley under rye. Soil microbial respiration at 0 to 3 cm soil depth across vegetation types was not significantly different, even though organic carbon was significantly higher under black locust and poplar. Soil organic carbon was highest at 0 to 3 cm soil depth under nitrogen-fixing black locust and reached 778 g C_{org} m^{-2}. Soil microbial respiration varied around 0.80 μg CO_2-C g^{-1}soil h^{-1} across vegetation types decreased with soil depth and was positively correlated with soil organic carbon. Compared to the deposits in 1997, soil organic carbon was more than doubled with high annual soil carbon sequestration rate averaged 151 g C_{org} m^{-2} yr^{-1}. The soil carbon isotope signature as reflected by the δ^{13} C value ranged between -18.9 and -16.5 per mill for the total carbon and between -25.1 and -24.7 per mill for the organic carbon (soil treated with phosphoric acid) and both increased with depth. The isotope signature of the soil microbial respiration ranged between that of the organic and total organic carbon and approached that of the total carbon with depth, indicating fractionation processes in these calcareous quaternary sediments particularly in deeper soil horizons. The soil

microbial respiration and the organic carbon content showed improved soil quality and carbon isotope signature labels reflected the recent organic matter input within 9 years of recultivation.