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Microbial activity and soil quality in alley cropping systems after 9 years of re-cultivation of quaternary deposits in eastern Germany

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The beneficial effect of alley cropping in diversification of agricultural products, substitution of fossil resources, self- and decentralized energy supply and environmental and resource protection has made it increasingly more attractive over the last decades. In 1997 an experimental field was established to evaluate the potential of alley cropping in restoration of post lignite mine soils. However, the impact of such systems on soil quality and sensitive microbial properties is unclear. Therefore the aim of this study was to evaluate the development of soil quality of very young soils under alley cropping system in East Germany on the basis of accumulation of organic matter and nitrogen, pH values and in particular microbial indicators that are sensitive to changes in environmental conditions. Microbial biomass in the 3 cm top soil under trees increased to 321 μg Cmic g-1soil and was 41 % and 32 % higher than in adjacent transition zone and rye field respectively. Microbial basal respiration (BAS) was higher in the transition zone than in the tree (0.75 μg CO2-C g-1soil h-1) and rye field (0.72 μgCO2-Cg-1soil h-1). The microbial quotient (Cmic:Corg) of the top 3 cm soil varied between 42 (rye) and 20 mg Cmic g-1 Corg (tree) . Microbial indicators were more doubled between 0 to 3 cm than in 3 to 10 and 10 to 30 cm soil depth. The pH value in the soils varied around 8.0 and increased with soil depth. Both organic carbon (Corg) and total nitrogen (Nt) accumulation were high at the first 3 cm soil depth under tree. Humus values reached up to 17 mg Corg g-1 which was 168 % higher than in soil under transition zone and 192 % higher than under rye field. Soil Nt content under trees was 1.4 mg g-1, particularly high under N2-fixing black locust at 0 to 3 cm soil depth and 408 % and 345 % higher than under the transition zone and rye field. With

reference to 10 to 30 cm soil depth under the trees, 4.18 mg Corg g-1 soil and 0.44 mg Nt g-1 soil accumulated in the top 3 cm soil over the 9 year period. The microbial indicators responded more sensitive. From 1997 to 2006, the values increased from 3.5 to 7 mg Corg g-1 soil and 0.2 to 0.4 mg Nt g-1 soil for 30 cm soil depth indicating an accumulation of 3.5 mg g-1 Corg and 0.2 mg g-1 Nt in the mine soil over 9 year period in the alley cropping systems.