ENHANCEMENT OF SOIL MICROBIAL BIOMASS IN COTTON PRODUCTION SYSTEMS WITH CONSERVATION TILLAGE

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ABSTRACT

Microbial biomass plays a vital role in carbon and nutrient cycling and nutrient availability, and is considered a key indicator of soil quality. We measured microbial biomass in a long-term tillage experiment with cotton (Gossypium hirsutum L.) to determine changes due to soil management. The experiment was established in 1994, on a Decatur silt loam soil (clayey, kaolinitic, thermic, Rhodic Paleudult). We evaluated four conservation cotton production systems with a rye (Secale cereale L.) cover crop: strict no-tillage, shallow spring strip-tillage (6 inches deep, 12 inches wide), fall paratilling/no-tillage cotton planting, and fall in-row subsoiling/no-tillage cotton planting. A conventional tillage (fall chiseling and spring disking/cultivation) and strict no-tillage treatment, both without a cover crop, were also evaluated. Soil samples were collected during December 1999, March, June, and December 2000, at 0-1, 1-2.5, 2.5-5, and 5-10 inches increments and analyzed for microbial biomass using fumigation incubation methodology. A temporal variation in microbial biomass was detected with the highest rate observed during June. With the exception of conventional tillage, a sharp decrease in microbial biomass by depth was observed. Compared to conventional tillage, microbial biomass values for the upper layer (0-1 in), averaged over sampling dates, were 51, 94, and 135 % higher, respectively, for no-till without cover, spring strip tillage with cover, and no-tillage with cover (regardless of fall tillage). Fall deep tillage generally improved microbial biomass within 1-5 inches compared to other treatments. Microbial biomass measurement correlated well with the yield history

from these treatments. Thus, the combination of fall deep tillage, use of a rye cover crop, and no-tillage planting can improve both economic returns and soil quality in cotton production systems.