

NITROGEN FERTILIZATION AND TILLAGE INFLUENCE ON SELECTED SOIL MICROBIOLOGICAL PROPERTIES

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ABSTRACT

Soil microbes play a key role in plant nutrient availability and act as a nutrient source (N) upon their decomposition. The quantity of soil biomass and conversion of biomass N into plant-available inorganic N may be affected by soil management and fertilization practices. Increased knowledge of physical environment interactions with biological and chemical transformation affecting indigenous soil and fertilizer N is essential to a better understanding of N use efficiency by crops. Long-term tillage and N fertilization studies evaluated no-till (NT), minimum till (MT), and conventional till (CT) systems under N rates of 0, 20 and 60 kg N ha⁻¹ for effects on soil microbial biomass C (SMBC) and N (SMBN) and mineralizable C and N in a long-term corn-cotton rotation. The Victoria clay (fine, hyperthermic, montmorillonitic Pellusterts) was sampled at three soil depths and at cotton planting, flowering and harvest. Because of crop residue accumulation and limited incorporation, microbial biomass C was greatest under MT followed by NT and CT. Generally, SMBC decreased with soil depth for all tillage systems. As the growing season progressed the NT consistently maintained the higher SMBC compared to the CT system. A decrease in labile C substrate quality and availability tended to decrease SMBC and SMBN through the season. Mineralizable N was higher in NT than in CT only in the surface layer regardless of N fertility rates. In all tillage systems and N fertility rates mineralizable N decreased with soil depth. Nitrogen fertilization caused increases in mineralizable N in all tillage systems but non significant increases in mineralizable C. Inorganic N averaged over N rates was some 35% higher in NT soil compared to CT at planting and 26% higher at harvest. Generally, reduced tillage such as NT and MT affected soil microbial properties in surface soils and thereby, influenced plant availability dynamics of N.