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Research Article

Dynamics of soil biological fertility as influenced by organic and inorganic inputs under soybean in vertisol

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Summary

The integrated use of crop residues, biofertilizer and inorganic fertilizers in vertisol improved fertilizer use efficiency and nutrient turnover through augmentation of biological activity specially enzyme activity which is a step toward sustainable agricultural production. Highest soil microbial biomass C (340.25 µg Cg^{-1} soil) and biomass N (30.15 µg N g^{-1} soil) were recorded in Bradyrhizobium + 100% RDF *i.e.* 30 kg N + 75 kg P_2O_5 ha^{-1} treatment followed by incorporation of wheat straw @ 4 t ha^{-1} + 100% RDF. Incorporation of wheat straw and sugarcane trash along with chemical fertilizer significantly increased SMBC and SMBN content over their alone application. There was significant influence of crop residues and biofertilizer on soil enzyme activity *i.e.* dehydrogenase activity over control. Incorporation of wheat straw @ 4 t ha^{-1} + 100% RDF significantly increased soil dehydrogenase activity as compared to all other treatments. Bacterial and actinomycetes population were found maximum *i.e.* 29.6 CFU g^{-1}x 10^{7} and 25.0 CFU g^{-1}x 10^{6}, respectively in seed treatment with Bradyrhizobium + 100% RDF, whereas, fungal population was found to increase (21.4 6 CFU g^{-1}x 10^{4}) with the incorporation of wheat straw @ 4 t ha^{-1} + 100% RDF followed by sugarcane trash with 100% RDF. Seed inoculation with Bradyrhizobium with 100% RDF recorded highest grain yield (24.59 ha^{-1}) and was followed by wheat straw + 100% RDF. SMBC, SMBN, dehydrogenase activity and soil biota were significantly correlated with soybean yield.

Key words : Soil microbial biomass carbon and nitrogen, Soil microbial population, Dehydrogenase activity, Integrated nutrient management,Vertisol

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Introduction

The living soil is a central part of soil fertility because the activity of soil organisms rendered available the elements in plant residues and organic debris entering the soil. Part of this material, however, remains in the soil and contributes to its stabilization by humus build up. The productivity and stability of soil as a medium for plant growth depends greatly on the balance between living and non-living components. Energy from the sun and nutrients essential for growth stored in the fabric of crop plants, are recovered for reuse through decomposition activities of microorganisms in soil. The soil organic matter formed during this process serves both as a continuous nutrient supply and a factor stabilizing the soil physical environment (Howard, 1972). To maintain productivity, soluble nutrients removed from soil through plant growth and harvest must be replaced, either as fertilizers or through biological decomposition of organics. Soil micro-organisms play a vital role in soil health but are often forgotten in farming systems. There is a growing interest in their beneficial effects, their role as soil health indicators and factors that influence their abundance and diversity. As soil microorganisms decompose the organic matter, they also assimilate a portion of the nutrients in soil to build up their body. The nutrients in soil microbial biomass are mineralized from the dead microorganisms. Therefore, soil microbial biomass is considered as a source and sinks for nutrients and is an active pool of organic matter in soils. Because of its important role in various ecological systems, nitrogen and carbon contained in soil microbial biomass (*i.e.* SMBN and