TURN - OVER OF ORGANIC NITROGEN AS INDICATED BY BIOMASS CARBON AND NITROGEN AND NITRIFIER POPULATION IN CROP RESIDUE TREATED SRI LANKAN SOILS

By

RAJAPAKSE MUDIYANSELAGE CHANDANIE PUSHPALATHA RAJAPAKSE

Thesis

Submitted in partial fulfilment of the requirements

for the degree of

MASTER OF PHILOSOPHY

in the

POSTGRADUATE INSTITUTE OF AGRICULTURE

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

October 1993.

ABSTRACT

The effects of addition of organic materials on the change of microbial biomass C and N were assessed in 15 Sri Lankan soils. Chloroform Fumigation Incubation Technique was used to assess native biomass C and N contents of unamended soils and altered biomass C and N contents after incorporating two crop residues, namely, gliricidia (Gliricidia sepium) and rice straw into soils. The native biomass C of experimental soils varied from 14 to 369 μg^{-1} g soil. In most soils biomass C contributed more than 0.5% to total C. The effect of soil organic matter content was predominant on native soil biomass C. However, the adverse effects of low pH and CEC on biomass C was not observed. A decomposition period of 2 h was sufficient to produce higher biomass C contents in 12 soils when gliricidia was added. The altered biomass C contents with straw were less than those of with gliricidia. The favourable effects of addition of straw were obvious only in few soils. In general, soils with low biomass C contents decomposed organic materials more actively and produced high amounts of biomass C.

The adverse effects of fumigation on N mineralization was equally significant in unamended as well as amended soils. Native biomass N contents varied from 0.63 to 94 $\mu g\ g^{-1}$ soil. The native biomass N contributed 2-5% of total N. The native biomass N of experimental soils was correlated

significantly with organic matter, total N, pH and CEC. With gliricidia, biomass N was established more effectively than with straw. Straw decomposition was found to be limited by unavailability of N in experimental soils and its favourable effects on biomass N was observed only in three soils.

A pot experiment was carried out to investigate the dynamics of nitrite oxidizing bacteria population related to NH_4^+, NO_2^-, NO_3^- fractions and soil pH using an alfisol for different crop residue treatments. A net N mineralization in gliricidia amended soil and a net immobilization in straw amended soil continued upto the end of the experiment. There were evidences for NO_3^--N immobilization. The accumulation of NO_2^--N was observed only when growth of nitrite oxidizing bacteria was suppressed. Addition of crop residues increased soil pH by few units.

The changes of the bacteria population upto 12 th day was exponential and the whole growth pattern could be explained by quadratic equations. The reduction of number of bacteria after the 12th day of experiment in gliricidia amended soil could be attributed to the high NH_4^+-N concentrations (22 μg g^{-1} soil) in soil environment. The retardation of straw amended soil was caused by low NH_4^+-N concentrations (2 μg g^{-1} soil) as microorganisms may undergo unavailability of nutrients (mostly N) and energy materials.