Thesis Title The Effects of Leaf Litter Decomposition on Paddy Soil Fertility

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ABSTRACT

Trees which used to have important roles in nutrient cycling both in natural and agricultural ecosystems have rapidly declined. Trees in paddy fields of the Northeast are no exception. An important soil-fertility-enhancement mechanism by trees is decomposition of litter. The objectives of the studies were to analyze the decomposition process of the leaf litter from various commonly-found paddy trees and to analyze the effects of the leaf litter on soil fertility through soil nutrient contents and soil organic matter characteristics. Six tree species were selected, i.e. kabok (Irvingia malayana Oliver), chamchuree (Samanea saman Merr.), teng (Shorea obtusa Wall.), daeng (Xylia xylocarpa Taub.), pluang (Dipterocarpus tuberculatus Roxb.), and makham (Tamarindus indica Linn.). Leaf

litter decomposition studies were conducted in both field and laboratory conditions. The field experiment employed litter bag technique. Sampling was done every two weeks for six months. The laboratory experiment also employed litter bags containing 1 g of leaf litter discs, buried in a plastic pot containing 200 g of the soil from the study area. Sampling was done at 3, 7, 10, 20, 40, 60 and 90 days. Completely randomized design was used for both experiments. Soil organic matter characterization employed soils compositely collected from underneath the trees' canopies, and soil from a nearby open field as a controlled. Total soil organic matter and partially decomposed organic debris (macroorganic matter) were determined. Humic acids were extracted by alkali solution. Chemical (C content) and optical (E_4/E_6) characteristics of the humic acids were determined.

The field decomposition experiment produced the following decomposition rates (k values-month^{-1}) : the daeng (0.386) > the chamchuree (0.356) ≃ the teng (0.356) > the pluang (0.215) > the makham (0.189) > the kabok (0.135). Changes in leaf litter weights were significantly influenced by soil faunal activities. At the end of the 6-month period the contents of these nutrients in the leaf litter decreased with an exception of Ca. The laboratory decomposition experiment produced the following decomposition rates (k values-month^{-1}) : the makham (0.161) > the kabok (0.132) > the chamchuree (0.085) > the teng (0.062) > the daeng (0.059) > the pluang (0.042), which did not correspond to

the C/N ratios in some leaf litter. The leaf litter decompositions led to increases in soil microbial biomass as measured by microbial biomass N over that of the controlled. Patterns of changes in microbial biomass N during the decompositions corresponded to the groupings of decomposition rates (the makham and the kabok in one group and the other in another group). The pH of the soils medium of decomposition decreased as the decomposition proceeded; and the pH had high and significant positive correlation with rates of leaf litter weight loss. Nutrient contents in the soil medium, which were higher in leaf-litter-treated soil than the controlled, increased at the end of the decomposition period with an exception of Ca. Total soil organic matter and the quantities of organic debris varied with organic material input from leaf litter fall. Humic acid contents varied with soil organic matter contents, however C content in humic acid (in % total organic carbon) did not vary with the soil organic matter. The C content in humic acid decreased in the following order : the controlled (30.79) > the pluang (22.71) > the kabok (21.76) > the daeng (19.03) > the teng (18.82) > the chamchuree (14.27) > the makham (9.84), which was considered corresponded to E_4/E_6 ratios (an indicator of degree of humification). The increasing order of E_4/E_6 of various leaf litter studied was as followed : the controlled (4.54) < the teng (4.58) < the pluang (4.76) < the kabok (5.20) < the daeng (5.23) < the chamchuree (5.82) < the makham (6.10).