UNIVERSITY OF THE PHILIPPINES

Doctor of Philosophy in Environmental Science

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Modeling the Dynamics of soil organic matter accumulation in tilled and non-tilled rice and mango agroecosystems

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ABSTRACT

Soil organic matter (SOM) is a critical determinant of the fertility status and productivity of soil, yet SOM status in tilled and non-tilled croplands is degrading. The sustainable use of soil for crop production requires optimum level of SOM. This study investigated the dynamics of SOM fractions, Fn (<0.05mm) and Lf (<2mm), in rice field and mango orchard through field experimentation during the 2018 wet and 2019 dry seasons. Results from the experiment were used for parameterization and calibration of temperature, moisture, soil nutrients and the biological components of a system dynamics model of SOM accumulation. The model simulation runs at every 14-day cycle for the duration of 20 years. Incorporation of rice residues at 20 tons ha^{-1} yr^{-1} into the soil through tillage has SOM accumulation of 0.034% yr^{-1} from 2.29% to 3.01%. Compared with the non-tilled rice field, the model projected higher SOM accumulation of 0.054% yr^{-1} from 2.29% to 3.42%. For the mango orchard, incorporation of mango leaf litter at the rate of 11.2 tons ha^{-1} yr^{-1} into the soil through tillage also improved SOM status from 3.09% to 3.22% with the rate of 0.006% yr^{-1}. Compared with the non-tilled orchard, SOM accumulation has higher rate of 0.061% yr^{-1}, from 3.09% to 4.36%. Despite the reduced SOM accumulation rate in tilled croplands compared with that of non-tilled croplands, it is still plausible to sustain the fertility status. Through the incorporation of require volume of crop residues into the soil by tillage, SOM accumulation in croplands can be sustained.