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Effects of Water Repellency on Soil Organic Matter Decomposition by Microbes

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Abstract

Maintenance of soil organic matter (OM) is essential due to rapid decomposition under tropical conditions by soil microbial biomass. Measurement of microbial activity is considered to reflect the OM decomposition rate. During the decomposition process, organic carbon converts into CO_2, which concentrates in the atmosphere resulting global warming. Soil water repellency occurs by hydrophobicity might be a tool to reduce OM decomposition by restricting microbial activity. The objectives of this study were to examine the effects of water repellency on soil organic matter decomposition by soil microorganisms. Air-dried and sieved surface soils of Red Yellow Podzolic soils (Ultisols) from the research farm of the Faculty of Agriculture, University of Ruhuna were mixed with powdered cattle manure (CM), goat manure (GM), *Gliricidiamakulata* (GL) and *Cassuarinaequisetifolia* (CE) leaves. The rates used were, 5% of each and with 2% CE+5% manure (CM, GM, GL), along with a control (no amended manure). The OM contents were estimated by loss on ignition method and the microbial activity by NaOH-CO_2 trapping method at 1, 3, 7 and 30 days intervals. Water repellency was recorded using Water Drop Penetration Time (WDPT) test. Results revealed that OM content decreased with increasing CO_2 evolution. The CO_2 evolution increased with a decreasing rate, with time, showing higher logarithmic correlations (R^2= 0.95, 1.00, 1.00, 0.97, 0.97, 0.98, 0.99 and 0.96, respectively, for control, GL, CE, CM, GM, GL+CE, CM+CE and GM+CE samples). The highest CO_2 evolution rate was observed in GL samples and the lowest rate was found in CE 5% sample. This might be because Gliricidia was hydrophilic (WDPT $\leq$ 10 s) and Cassuarina was hydrophobic (WDPT > 50 s). The CM and GM amended samples (WDPT $\leq$ 40s) also showed higher CO_2 evolution than CE sample. Water repellency can be considered as a tool for farmers to reduce OM decomposition to lower manure application cycles.

Keywords: *CO_2 evolution, Decomposition, Microbial Activity, Organic matter, Water repellency,*