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Microbial community, biomass and physico-chemical properties of soil in dry tropics

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Abstract

Soil physicochemical and microbial properties can be regarded as an important tool to assess soil quality and health. Studying the soil properties under different land use types is of great practical significance for land use and soil management regarding soil carbon dynamics and climate change mitigation. However, the changes in land use types and their effects on soil physicochemical and microbial properties are largely debated and rather unclear. Four different land use types were used to study soil microbial and soil physicochemical properties. Soil organic carbon and total nitrogen, soil microbial biomass, and microbial diversity were determined by micro-kjeldahl method, fumigation and extraction method, and FAME GC-Ms, respectively. Among all land use patterns, the highest water holding capacity (40.06±0.74 %), porosity (0.539±0.011 %), soil macro-aggregates (64.16±2.64 %), organic carbon (0.84±0.054 %), total nitrogen (0.123±0.013 %), microbial biomass carbon (570.65±35.05 g/g) and nitrogen (84.21±3.186 g/g), basal respiration (3.64±0.064 g/g) and b-glucosidase (809.68±39.7 g g PNP g^{-1} dry soil h^{-1}) were found to be under natural forest followed by in decreasing order, bamboo plantation, degraded forest, and agricultural land. Significant differences were observed among the land use types in microbial biomass carbon and B-glucosidase activity. Furthermore, the correlation analysis showed that microbial biomass, organic carbon, b-glucosidas activity, total nitrogen, moisture content, porosity, water holding capacity, and soil macroaggregates were positively correlated with each other and negatively correlated to bulk density, meso and micro-soil aggregates at $p < 0.05$. The PLFA analysis showed that microbial community diversity exhibited distinct patterns among land-use types. With the conversion of natural forest to other land use types, the amount of PLFA were reduced significantly. The natural forest had high microbial diversity followed by in decreasing order bamboo plantations, degraded forest, and agricultural land. Among the organisms G- bacteria and fungi were showed decreasing order from natural forest, bamboo plantation, degraded forest, and agricultural land. The reverse was true for G+ bacteria. The results of this study showed that soil physico-chemical and microbial properties were significantly affected by land use types. Thus, bamboo-based fallow has the potential for improving soil quality and properties in the short term.

Keywords: Land use type, microbial biomass, microbial soil diversity, soil physico-chemical properties

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