

Impact of Land use Change from Jhum Land to Plantations and Forest on Soil Microbiological Properties in Acidic Degraded Soils of Mizoram

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Abstract—Shifting cultivation (jhum) occupied a major form of traditional agriculture in the hills of North Eastern India however; recently it has been slowly shifted towards plantations. Other than soil major nutrients like N, P and K, soil microbiological properties are increasingly used to assess the soil quality due to land use change. In this study, the effect of land use change from jhum lands to plantations like oil palm, rubber, areca nut, teak and forest were studied from surface soil samples (0-15 cm). Lowland rice field where jhuming was practiced 60 years earlier was also included. Analysis results suggested that the availability of P was significantly higher at oil palm (7.81 mg kg^{-1}) while K was higher at freshly jhum (229.7 mg kg^{-1}). Water holding capacity was positively correlated with basal respiration, SOC, MBC and MBN revealing the improvement of soil health through moisture retention via accumulation of OM. Forest conversion stores the highest amount of SOC (16.23 g kg^{-1}) and basal respiration ($0.98 \mu\text{g g}^{-1}\text{h}^{-1}$) while the MBC and MBN were more in oil palm soils ($1936 \mu\text{g g}^{-1}$ and $199.12 \mu\text{g g}^{-1}$) suggesting that proper lime and fertilizer application in plantation increase the capacity of microbes to store nutrients to improve soil quality. The microbial quotient (MBC:SOC) ranged from 5.9 % (lowland paddy) to 13.4 % (oil palm) and metabolic quotient ($q\text{CO}_2$) ranged between $0.3 \text{ mg g}^{-1}\text{h}^{-1}$ (oil palm) to $0.86 \text{ CO}_2\text{-C mg g}^{-1}\text{h}^{-1}$ (jhum land) again suggesting that microbial biota under jhum land was under stress with more loss of CO_2 compared to other land use systems. Principal component analysis (PCA) results partitioned soils under jhum land, low land rice and teak in the left plot of the scattered diagram revealing the dominance of soil quality under areca nut, oil palm, rubber and forest soil. Overall our findings suggested that teak soil was inferior compared to plantations and forest. Proper management of soil with lime and fertilizer in acidic soils may increase the soil quality under plantations.

Keywords: Forest fallow, acid soil, hillslope, soil quality, microbial biota.
