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Effectiveness of Assisted Natural Regeneration in Revitalizing Soil Microbial Communities in Former Chena Lands

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Abstract

Restoration of abandoned lands such as old Chena cultivations in the dry zone, enhances soil quality by revitalizing microbial communities. Microbial biomass carbon is the most active part of soil organic matter, and it is a good indicator of soil health as increased Microbial activity correlates with enhanced potential of carbon storage. Current study quantifies Microbial Biomass Carbon (MBC), as a percentage of total Soil Organic Carbon (SOC) in both restored and natural forests. NIFS-Dambulla Arboretum, once an abandoned Chena site restored using Assisted Natural Regeneration (ANR), including old-growth plots (62 years), mid-growth plots (35 years) and naturally regenerated plots (35 years), compared to adjacent natural forest were sampled adopting a randomized design. Only the upper soil layer (0-15 cm) was analyzed, given the rapid decline in microbial biomass and rate of microbial activity with soil depth. Five composite samples were taken from each plot. It was hypothesized that the Microbial Biomass Carbon content of Natural Forest (NF) was higher than the restored forests (H_1). Soil microbial biomass carbon percentage (MBC%) was quantified using the chloroform fumigation and extraction method. Moreover, Soil Moisture was determined using a gravimetric method to correlate with MBC%. One-Way ANOVA for MBC% (p<0.001) indicated a significant difference between the five groups, accepting the alternative hypothesis (H_1). Tukey HSD grouped Old-growth restored forest (Mango dominant) (0.1755±0.22), Old-growth restored forest (Rehabilitated without Mango Plants) (0.1506±0.01), and Natural forests (0.1359±0.01) together, depicting no significant difference between those three forest types. The Mid-growth restored forest (0.0575±0.04) and the naturally regenerated forest (0.0770±0.01) showed significantly lower MBC% than the Old-growth forests and NF. There was a strong, significant positive correlation between soil moisture content and MCB% (Pearson's Correlation: R= 0.870, p<0.001). Soil moisture content is important as microbial activity is directly influenced by soil moisture content. It can be inferred that the long-term ANR can effectively rehabilitate soil microbial communities, allowing them to return to their natural state.

Keywords: *Soil carbon, Assisted natural regeneration, Chena restoration, Revitalizing soil microbes, Microbial biomass carbon, Soil moisture*