Microbial Community, Biomass and Physico-Chemical Properties of Soil in Dry Tropics

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1. INTRODUCTION

❖Soil Microbes

- An important components of terrestrial ecosystems and
- drive many soil services such as
  - nutrient cycles and maintenance of soil function
- involved in mediating global climate change
- Therefore, microbial community and biomass are an early index of land use conversion

1.1 PROBLEM STATEMENT

- Land use change leads loss of biodiversity, change in ecosystem services etc but also affects soil biological and physico-chemical properties

-Land use change significantly influenced soil health and quality

-land-use change affects the community composition in terms of disturbance and ecosystem restoration in the dry tropics has yet not been well-studied

1.2 OBJECTIVES

▪Investigate the effect of different land-use types on

- the microbial community in the soil (Activity and biomass)
- physic-chemical properties of soil

2. MATERIALS AND METHOD

❖ **Soil sample processing and analysis**

- Soil samples were collected from four land use types (NF, Natural Forest; BP, Bamboo Plantation; DF, Degraded Forest and AL, Agricultural Land)

-From the collected soil sample samples

- Physico-chemical properties
- Soil Microbial Biomass
- Basal Respiration and soil enzyme
- Soil microbial community were analyzed

3. Results

1. Soil Physico-chemical properties

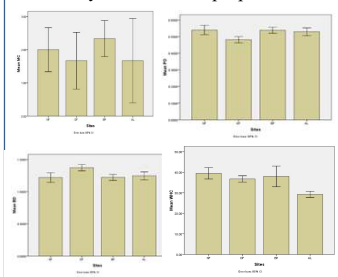

Figure 2. Comparison of MC, BD, porosity and WHC under different land use types: Natural Forest (NF), Degraded Forest (DF), Bamboo Plantation (BP) and agricultural Land (AL)

Table 1. Percentage of distribution of different dry aggregate soil size classes in different land use types.

Soil aggregates (%)	Land use type				LSD
	NF	DF	BP	AL	
Macro-aggregates	64.16±2.64^{a}	46.83±1.00^{b}	51.65±5.4^{b}	42.94±1.11^{b}	8.48
Meso aggregates	25.68±2.48^{a}	35.16±0.73^{b}	33.10±4.74^{b}	36.39±1.69^{b}	9.28
Micro-aggregates	10.16±1.38^{a}	18.01±0.96^{b}	15.25±1.86^{ba}	20.66±1.81^{b}	4.65

Table 2. Table 2. Soil organic carbon (SOC), soil total nitrogen (STN), Microbial biomass carbon (MBC), Microbial biomass nitrogen (MBN) and soil basal respiration (SBR) under different land use types.

Land use type					LSD
	NF	DF	BP	AL	
SOC (%)	0.84±0.054^{a}	0.448±0.113^{b}	0.72±0.074^{a}	0.435±0.042^{b}	0.21
STN (%)	0.123±0.013^{a}	0.027±0.003^{b}	0.033±0.0034^{b}	0.014±0.0016^{b}	0.021
MBC (µg/g)	570.65±35.05^{a}	233.94±60.36^{b}	479.03±21.48^{a}	225.59±20.84^{b}	114
MBN (µg/g)	84.21±3.186^{a}	48.95±2.506^{b}	63.05±4.281^{c}	43.14±1.784^{b}	9.23
MBC/MBN	6.77	4.78	7.59	5.23	
SBR (µg CO_2)	3.64±0.064^{a}	2.69±0.11^{b}	3.37±0.067^{a}	2.56±0.11^{b}	0.29
B-glucosidase (µgµg PNP g-1 dry soil h-1)^{g}	809.68±39.7^{a}	380.50±17.02^{c}	577.28±84.39^{b}	492.88±58.13^{c}	181.35

Table 3. Correlation matrix for physical, chemical, and microbiological characteristics of soils from different land uses.

Soil variable	SBR	SOC	MBC	B-glucosidase	STN	MBN
SOC	.997**	1				
MBC	.997**	1.000**	1			
B-glucosidase	0.877	0.91	0.903	1		
STN	0.815	0.828	0.811	0.901	1	
MBN	.960*	.963*	.955*	0.924	0.944	1
MC	0.583	0.548	0.571	0.205	0.01	0.34
PO	0.758	0.703	0.703	0.401	0.555	0.712
WHC	0.808	0.76	0.756	0.499	0.66	0.789
BD	-0.776	-0.722	-0.722	-0.423	-0.568	-0.727
MA	0.926	0.929	0.918	0.909	.970*	.994**
ME	-0.89	-0.901	-0.887	-0.929	-.989*	-.982*
MI	-.951*	-0.946	-0.937	-0.876	-0.936	-.994**

Table 3 Continued

Soil variable	MC	PO	WHC	BD	MA	ME
SOC						
MBC						
B-glucosidase						
STN						
MBN						
MC	1					
PO	0.615	1				
WHC	0.547	.991**	1			
BD	-0.624	-1.000**	-.992**	1		
MA	0.251	0.703	0.787	-0.717	1	
ME	-0.154	-0.623	-0.718	0.637	-.994**	1
MI	-0.35	-0.778	-0.848	0.79	-.993**	.973*

Note: HBD, bulk density; WHC, water holding capacity; SOC, soil organic carbon; STN, total nitrogen; MBC, microbial biomass carbon; SBR, soil basal respiration; MBN, microbial biomass nitrogen; PO, porosity; MA, macro aggregates; ME, meso aggregates; MI, micro aggregates

Table 4. The amount of total phospholipid fatty acids (PLFAs), bacterial, Gram-positive bacterial, Gram-negative bacterial, and fungal PLFAs (mg/g DW) under four land uses.

	NF	BP	DF	AL
G-	37.43±2.21^{a}	22.51±1.75^{d}	15.78±0.85^{b}	5.29±0.477^{c}
G+	15.61±1.25^{a}	25.17±2.02^{c}	30.64±0.82^{b}	39.4±3.73^{c}
Fungi	20.49±1.24^{a}	15.55±1.14^{c}	10.96±0.86^{b}	8.06±0.59^{b}
Total	73.55	63.23	57.38	52.75
G^{+}/G^{-}	0.42	1.12	1.94	7.44
F/B	0.386	0.326	0.236	0.18

4. CONCLUSION

- The natural forest had high microbial diversity followed by in decreasing order bamboo plantation, degraded forest and agricultural land.
- The result 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.

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