

Dynamics of Soil Microflora in Different Land Use Systems

Soil microflora plays a pivotal role in evaluation of soil conditions and in stimulating plant growth (Kiran Singh *et al.*, 1999). Microorganisms are beneficial in increasing the soil fertility and plant growth as they are involved in several biochemical transformation and mineralisation activities in soils. Type of cultivation and crop management practices found to have greater influence on the activity of soil microflora (Mc Gill *et al.*, 1980). Continuous use of chemical fertilizers over a long period may cause imbalance in soil microflora and there by indirectly affect biological properties of soil leading to soil degradation (Manickam and Venkataraman, 1972). Thus, present investigation was initiated to know the demography of soil microflora viz., bacteria, actinomycetes and fungi and their relationship with soil properties under different land use systems.

Study areas are located at Agricultural Research Station farm, Honnavile and at a small village Abbalagere in Shimoga district of southern transition zone of Karnataka. Geographically, Honnavile is situated in between 13° 54' 00" N latitude and 75° 39' 30" E longitude, whereas Abbalagere is situated between 13° 59' 30" N latitude and 75° 35' 30" E longitude. Both the study sites are located at an altitude of 590 m above the mean sea level. Physiographically study areas are characterized by undulating to rolling topography.

Study area enjoys sub-humid to sub-tropical climate with mean annual rainfall of 888.3 mm. Mean monthly maximum and minimum temperatures are being 32.9 and 20.1° C, respectively. Geological environment of soils under all the land use systems with exception to that of arecanut land use system is either granite and or gneiss. While the geology of soil under arecanut land use system might be schist or transported in nature. Soils under cultivated land use systems are under monocropping system and have not received farmyard manure for the last eight to ten years with exception of arecanut. Four soil profiles under current fallow, mixed forest, paddy and sugarcane land use systems from Honnavile Research Station farm and two soil profiles under Flue Cured Virginia (F.C.V) tobacco and arecanut land use systems from Abbalagere were excavated and soil horizons were demarcated based on visual observations. Horizon wise soil samples were collected, processed and analysed for soil separates, soil reaction, electrical conductivity, soil organic carbon, free iron oxides and exchangeable cations following standard procedures (Black, 1965). To analyse soil for the demography of soil microflora a portion of soil samples collected from different horizons were air dried in inoculation chamber, powdered and passed through sterilized 2.0 mm sieve. Processed soil samples were stored in sterilized glass containers and kept in refrigerator. However soil samples were analysed for the demography of soil microflora within ten days from the date of sampling. Using specific growth media viz., nutrient agar for bacteria, rose bengal agar for fungi and Kuster's agar for actinomycetes, the demography of soil microflora was estimated

Table 1. Demography of soil microflora

Horizon	Depth (m)	Bacteria	Actinomycetes	Fungi
cfu x 10 ⁵ g ⁻¹ soil.				
Currentfallow land use system (Pedon-1)				
A	0.00-0.15	55	34	32
B ₁	0.15-0.40	48	21	29
B _{2t}	0.40-0.65	36	16	21
B _{3t}	0.65-1.05	23	9	18
BC	1.05-1.25+	10	3	2
Mixedforest land use system {Pedon-2}				
A	0.00-0.07	74	42	40
B ₁	0.07-0.30	63	37	38
B ₂	0.30-0.45	57	35	10
B _{3t}	0.45-0.60	45	24	5
BC	0.60-0.90	38	9	2
Paddy land use system {Pedon-3}				
A	0.00-0.18	35	20	32
B ₁	0.18-0.40	27	16	28
B ₂	0.40-0.58	24	13	20
B _{3t}	0.58-0.80	16	10	12
BC	0.80-1.20+	10	5	6
Sugarcane land use system {Pedon-4}				
A	0.00-0.10	42	22	34
B _{it}	0.10-0.35	38	18	30
B ₂	0.35-0.50	29	16	20
B ₃	0.50-0.65	12	11	19
B _{4t}	0.65-0.85	10	8	10
C	0.85-1.1 0	7	4	5
Tobacco land use system {Pedon-5}				
A	0.00-0.15	38	16	25
B _{it}	0.15-0.30	31	12	20
B _{2t}	0.30-0.55	14	9	16
B ₅	0.55-0.85	9	6	5
C	0.85-1.1 0	Nil	2	Nil
Arecanut land use system {Pedon-6}				
A	0.00-0.15	66	48	12
B ₁	0.15-0.40	62	41	10
B _{2w}	0.40-0.65	58	38	8
B _{3w}	0.65-1.10	51	30	5
B _{4w}	1.1 0-1.35	42	22	3
B ₅	1.35-1.70+	31	18	Nil

by plate count method (Baruah and Barthakur, 1997). In the soils under different land use systems sand, silt, clay, organic carbon, free iron oxides, soil reaction, exchangeable basic cations and exchangeable acidic cations were in the range of 16.4 to 82.7%, 4.3 to 40.7%, 10.8 to 48.6%, 1.0 to 13.2 g Kg⁻¹, 0.17 to 0.85%, 4.1 to 8.0%, 9.6 to 39.7 C.mol (p+) kg⁻¹ 0.01 to 0.62 C.mol (p+) kg⁻¹ respectively. Soil texture was more finer (sc) in the soil under mixed forest land use system than the soils under remaining land use eco systems. Soils under all the land use of

systems were acidic except the soil under arecanut land use system where the soil reaction was neutral. Basic and acidic exchangeable cations were comparatively more in the soils under arecanut and tobacco land use systems, respectively. Free iron oxides content was comparatively more in the soil under current fallow land use system.

Irrespective of land use systems, the activity of soil microflora (bacteria, actinomycetes and fungi) was comparatively more in surface than in subsurface horizons and decreased with depth due to decrease in organic matter. In general, activity (Table 1) of soil microflora (bacteria, actinomycetes and fungi) was highest (58, 34 and 23 cfu X 10⁵ g⁻¹ soil, respectively) under mixed forest land use system followed by irrigated (arecanut, sugarcane and paddy) and rainfed (tobacco) land use systems. This could be attributed to high, moderate and low organic matter content, in soils under mixed forest, irrigated and rainfed land use systems respectively. Similar kind of observations were also made by Bopaiah (1991), Dovan (1980) and, Gupta and Tripathi

(1988) in their studies. Despite appreciable amount of organic matter in the soil under arecanut land use system, the lowest population of fungi could be attributed to the neutral soil pH. Correlation studies indicated that demography of soil microflora viz., bacteria, actinomycetes and fungi was significantly correlated with sand (-0.417*, -0.454* and 0.492), silt (0.487**, 0.584** and -0.423), soil organic carbon (0.695**, 0.710** and 0.694**), soil reaction (0.510**, 0.497** and -0.484**), free iron oxides (0.405*, 0.340* and 0.188), exchangeable acidic (-0.375*, -0.422** and 0.406*) and basic (0.307*, 0.379* and -0.584**) cations. Present study indicated that soil properties, land use and management practices have profound influence on demography of soil microflora especially in surface than in subsurface horizons. As the soils under cultivated land use systems other than that of arecanut land use system are acidic, liming and application of organic manures to the soils under cultivated land use systems are must to improve the activity of soil microflora for sustainable soil productivity.

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References

- BARUAH, T.C. AND BARTHAKUR, H.P., 1997, *A Textbook of Soil Analysis*. Vikas Publishing House Pvt. Ltd. 1-334.
- BLACK, C.A., 1965, *Methods of Soil Analysis*, Parts 1 & 2, American Society of Agronomy. Inc., Publisher, Madisen, Wisconsin, USA. 1-1378.
- BOPAI AH, B.M., 1991, Soil microflora and biological activities in the rhizospheres and root regions of coconut based multi storied cropping and coconut monocropping systems. *Soil Biology and Biochemistry*, **23**: 89-94.
- DOVAN, J.W., 1980, Soil microbial and bio chemical changes associated with reduced tillage. *Soil Science Society of American Journal* **44**:765-771.
- GUPTA, R.D. AND TRIPATHI, B.R., 1988, Microflora in some soil profiles of North West Himalyas. *Journal of Indian Society of Soil Science*, **36**: 75-82.
- KIRAN SINGH, JAISHREE BORANA AND SOBHA SRIVASTAVA., VA., 1999, Effect of thiram on root growth, root nodules and nitrogen fixation in Glycine max (L) merril by Brady rhizobium japonicom. *Journal of Soil Biology and Ecology*, **19** : 11-14.
- MANICKAM, T.S. AND VENKATARAMAN, C.R., 1972, Effect of continuous application of manures and fertilizers on some physical properties of soils. II under irrigated conditions. *Madras Agricultural Journal*, **59**:508-512.
- MC.GILL, W.B., CANNON, K.R., ROBERTSON, J.A. AND COOK, F.D., 1980, Dynamics of soil microbial biomass and water stable organic carbon in Breton.L after fifty years of cropping rotation. *Canadian Journal of Soil Science*. **66**: 1-19.