

Microorganisms mediate ecosystem services offered by soil - a case study of vermicompost application

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Soil, the ‘soul of infinite life’, offers critical ecosystem services that support all other lives of the planet Earth. Soil acts as anchoring medium and supplies nutrient to plants, filters water for everyone’s needs, contributes to biodiversity and supplies most of antibiotics used to fight human, animal and plant diseases; it offers resilience to climate change by sequestering carbon and green house gases. Undoubtedly, soil is the most important capital a nation possesses as it provides feed, fodder, fibre and fuel to its population.

However, what gives the otherwise non-living mineral soil its ‘life’ and drives the ‘ecosystem services’ is the enormously diverse microbial communities that reside in it. One table spoon full of soil has more living individually diverse organisms than there are people on earth highlights this reality. Moreover, humans are intimately and inextricably linked to trillions of microbes that colonize a single human body for many of their bodily functions. In fact, it is the soil microorganisms that support all the life on earth and but for them, all complex plants and animals, including human beings, will fail to survive. It is, therefore, imperative that the soil microorganisms are nurtured for sustaining the ecosystem services offered by the soil.

The diverse bacteria, fungi and actinomycetes that inhabit the soil act as chemical engineers performing several functions. They decomposing complex organic wastes added to soil and make important major, minor and micro nutrients available to plants. They produce exo polysaccharides that improve the aggregation and over all physical structure of soil vital for proper aeration, water movement and filtration. Chemicals such as auxins produced by plant-growth promoting bacteria increase the root biomass of plants that holds the soil in place helping in reducing the soil erosion. Actinomycetes present in soil are one of the main sources of antibiotics widely used in disease control. The soil microbial biomass itself contains 350-550 Pg carbon amounting to one of the largest reservoirs of organic carbon sequestered in soil. These are all some of the important functions carried out by the microorganisms that power the ecosystem services offered by soil.

The important component that nurtures the soil microbial populations and their activities is the ‘soil organic matter’ (SOM). The SOM is any component that contains carbon compounds from living organisms. The largest component of soil organic matter (up to 85%) is the litter, the dead and decaying material from plant parts. Living roots contribute about 10% SOM and the remaining by soil organisms. Agriculture, unfortunately, has been one of the single most crucial human activities that have slowly and constantly removed the organic carbon from soil. The organic carbon removal had been mostly unidirectional: soil to plant and plant products. Non-recycling or diminished return of the organic matter and residue has deprived the soil biota of their food causing loss of soil biodiversity attendant with the loss of ecosystem services offered by soil.

One of the technologies that address the return of the organic matter to the soil is vermicomposting technology. Vermicomposting is recycling organic wastes, plant or animal origin, to carbon rich manure by combined activities of earthworms and microorganisms. Addition of vermicompost improve physical structure, water holding capacity, microbial biomass, nutrient mineralization, carbon sequestration and microbial biodiversity of soils. In short, adding vermicompost restores the ecosystem services offered by soil. In this paper, vermicompost production from coconut leaf and its effect on the physical and microbial parameters that drive the ecosystem services of the soil is discussed.