Termitarium Soil as a Viable Source of Biofertilizer, Compost Fortification and Biocontrol

Kamaksha Guleria[1]*, Devanshi Sharma[2], Sanjeev K. Sandal[3] and Narender K. Sankhyan[4]

*[1]*M.Sc. (Ag.), [2]M.Sc. (Ag.), [3]Principal Scientist, [4]Head cum Principal Scientist, Department of Soil Science, CSK HPKV, Palampur, HP, India-176062*

Corresponding Author
Kamaksha Guleria
Email: kamaksha.guleria@gmail.com

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ABSTRACT

In order to control plant pests and improve soil fertility and raise food production to fulfill the growing demand for food globally, the rapid increase in population has led to a severe increase in the usage of pesticides and artificial fertilizers. The use of pesticides and inorganic fertilizers has increased dramatically, which has had a negative impact on the ecosystem and human health by destroying the food chain (owing to eutrophication), polluting the air and contaminating groundwater. Given these harmful effects of chemical pesticides and fertilizers, using environmentally friendly techniques, such as applying biofertilizers, has become more popular. The special substrate found in termite mounds, known as termitarium soil, presents a viable option for environmentally friendly farming methods. Termitarium soil exhibits the capacity to solubilize phosphate and potassium, create indole acetic acid, and control plant soil pathogens. Termite mound soil contains useful bacteria that are capable of decomposing lignin and cellulose, fixing nitrogen, solubilizing phosphate, and suppressing plant soil pathogens. Termite mound soil makes a useful bulking material for composting because of its greater cation capacity, organic carbon and nitrogen concentration, water-holding capacity, and clay content. These have put them

in a position to function as biofertilizers and biocontrol.

INTRODUCTION

Termites and their modest home, the termitarium, play an important part in agriculture sustainability, but their reputation as pests has long overshadowed their contributions. Still, termite mounds are home to a wealth of biological diversity and ecological usefulness that has great potential for sustainable farming. With its varied microbial communities and complex nutrient cycling mechanisms, termitarium soil—the rich substrate supported by termite activity—embodies the essence of a dynamic ecosystem. Moreover, termitarium soils harbor diverse microbial communities, including symbiotic bacteria and fungi, which contribute to nutrient transformation and organic matter decomposition (Eggleton, 2011). The potential of termitarium soil as a fundamental component of sustainable soil management practices has been shown by advances in soil science and agricultural research, despite its traditional disregard. Some bacteria isolated from termite mound soil could be utilized in an eco-friendly way as a potential material for antimicrobial production, biofertilizers and biocontrol which can increase soil fertility and enhance crop production, thereby guaranteeing environmental sustainability (Enagbonma and Babalola 2019). Termitarium soil's fine texture and high organic matter content provide the perfect environment for microbial growth, which promotes soil organic matter turnover and nutrient mineralization. Moreover, the complex system of tunnels and galleries found in termite mounds facilitates water penetration and soil aeration, improving the soil's capacity to retain moisture. Hence, termitarium soil serves as evidence of the biological processes' transformative ability to shape soil fertility and resilience. The agricultural world has recently started to realize that termitarium soil is a versatile instrument that may be used for crop production and soil management. Termitarium soil provides a comprehensive response to the numerous issues confronting contemporary agriculture, ranging from its function as a strong biofertilizer to its effectiveness as a natural biocontrol agent against pests and diseases. Metagenomics unlocks innovative prospects for developing ecologically friendly means to maximize the benefits of microbe-mediated agricultural technologies (Enagbonma and Babalola 2023). A sustainable road to better crop yields, healthier soil, and less environmental impact can be unlocked by farmers by utilizing the natural characteristics of termitarium soil and incorporating it into agricultural systems.

Composition and Properties of Termitarium Soil:

Termitarium soil, the product of termite activity within their mounds, exhibits a complex array of physical, chemical, and biological characteristics that distinguish it from surrounding soils. Understanding its composition and properties is crucial for harnessing its potential in agricultural applications.

1. Physical Properties: Termitarium soil typically possesses a fine texture, with particles ranging from silt to clay-sized fractions. This fine texture contributes to its high-water retention capacity and enhances soil structure, promoting aeration and root penetration. Moreover, the intricate network of tunnels and galleries within termite mounds confers a porous structure to termitarium soil, facilitating water infiltration and drainage, even in heavy rainfall events.

2. Chemical Properties: Chemically, termitarium soil is enriched with organic

matter, nutrients, and minerals derived from termite-mediated decomposition processes. The organic matter content of termitarium soil is often higher than that of surrounding soils, owing to the continuous input of plant material and termite feces. This organic matter serves as a source of energy and nutrients for soil microorganisms, fostering nutrient cycling and soil fertility. Additionally, termitarium soil tends to exhibit favorable levels of essential nutrients such as nitrogen, phosphorus and potassium, which are essential for plant growth and development.

3. Biological Properties: One of the most remarkable aspects of termitarium soil is its rich microbial diversity and activity. The microorganisms inhabiting termitarium soil comprise a diverse array of bacteria, fungi, protozoa, and other soil fauna, which play vital roles in nutrient cycling, organic matter decomposition, and soil ecosystem functioning. Termite-mediated activities, such as tunneling and microbial symbiosis, further enhance microbial diversity and activity within the mound. The synergistic interactions among these microorganisms contribute to soil health and fertility, making termitarium soil a dynamic and resilient ecosystem.

Termitarium Soil as a Biofertilizer:

The rich nutrient composition and dynamic microbial life of termitarium soil, which results from the intricate activity of termites within their mounds, make it an effective biofertilizer. Termite mound soil is rich in mineral nutrients and organic matter which make it a suitable habitat for microorganisms (Nithyatharani and Kavitha 2018). Termitarium soil is rich in organic matter and acts as a store for vital nutrients such as potassium, phosphate, and nitrogen that are necessary for healthy plant growth. Termitarium soil is unique in that it has a slow-release mechanism that minimizes the risk of nutrient leakage and promotes sustained crop output by providing plants with a consistent and balanced supply of nutrients throughout time. Furthermore, the many microbial communities that live in termitarium soil are essential to the cycling of nutrients and the soil health because they promote symbiotic connections with plant roots and increase the efficiency of nutrient uptake.

Compost Fortification with Termitarium Soil:

By taking advantage of the nutrient-rich qualities and microbial variety of both materials, compost fortification with termitarium soil offers a synergistic solution to organic waste management and soil enrichment. A substantial improvement in nutrient content, microbial activity, and general quality of the final compost is obtained by adding termitarium soil to composting processes. Termitarium soil is rich in various types of helpful microbes and enzymes that speed up the breakdown of organic materials and promote the release of nutrients. By increasing the compost's stability and maturity and hastening the compost's decomposition, this microbial activity lowers the likelihood of nutrient loss and odor generation. Additionally, the physical characteristics of the compost, such as soil structure and moisture retention, are enhanced by the addition of termitarium soil, providing the perfect growing medium for plants.

Termitarium Soil as a Biocontrol Agent:

Utilizing the intricate relationships between its microbial communities and the soil ecosystem, termitarium soil acts as a natural biocontrol agent against pests and diseases. Antimicrobial chemicals and antagonistic agents are produced by a variety of microbial populations in termitarium soil, which prevent the growth of pathogenic organisms. Farmers can successfully control insect populations and lower the frequency of plant illnesses in a

sustainable and eco-friendly way by incorporating termitarium soil into their agricultural systems. The fact that termites actively control soil moisture levels and generate microclimatic conditions that discourage insect infestations further improves the biocontrol efficacy of the mound's existence. The resilience of agroecosystems is increased by this all- encompassing approach to pest management, which reduces dependency on synthetic pesticides and increases biodiversity and soil health.

CONCLUSION:

Termitarium soil represents a multifaceted resource with significant implications for sustainable agriculture. Due to this nutrient richness of termite mound soil, small-scale farmers often improve the soil condition of their farmland by using termite mound soil, which they believe can increase crop yield (Deke et al. 2016). Its versatility as a biofertilizer, compost fortification agent, and biocontrol tool underscores its potential to revolutionize soil management practices. By harnessing the inherent qualities of termitarium soil and addressing existing challenges, we can pave the way for a more resilient, productive, and environmentally friendly agricultural future.

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