

Formulation of The Microbial Bio-Stimulant for Chili Cultivation in the Dry Zone of Sri Lanka

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The use of bio-stimulants, particularly microbial bio-stimulants, has attracted significant interest in recent years due to their potential to enhance agricultural and horticulture activities. When applied to plants or soil, these substances stimulate natural processes and encourage beneficial microbial activity, which contributes to sustainable agriculture and long-term soil health. The worldwide bio-stimulant production is estimated to reach \$6.2 billion by 2027, with a \$3.5 billion forecast for 2022. Tomato, rose, basil, sunflower, and wheat are examples of economically significant crops that can benefit from bio-stimulation. This study investigated the soil microbiological analysis of soil samples taken from a chili growing area of Madavachchiya, Anuradhapura district. Soil samples were spread vertically, labeled, and then bacterially isolated on Luria agar media. Subcultures were done, and bacterial isolates with a clear zone of inhibition were kept on nutrient agar plates. Staining techniques included negative staining for cocci, bacilli, and spirilla, as well as gram staining for separating gram-positive and gram-negative bacteria. DNA extraction, quantification, and gel electrophoresis were carried out using standard and commercial genomic analysis techniques. This study, I was conducted in a greenhouse at Mihintale. 45 chili plants were exposed to recommended nutrients (NPK), compost (C) and bacterial culture and growth parameters like plant height and number of leaves were recorded to understand the effect of soil sample microbial composition on chili crop. Staining results indicated different bacterial forms and gel electrophoresis provided details regarding DNA quality. The greenhouse test focused on growth parameters and it was significantly different in mean height among the three treatment groups (T1=C+B; T2=NPK as control group; T3=NPK+B) ($p=0.001$) 24.67, 19.72 and 20.81 cm. Bacterial growth in the treated groups was evident. Further studies should be conducted to interpret the results more accurately. Microbial bio-stimulants are critical in arid climates and assist in alleviating drought stress and addressing challenges such as limited water availability and soil nutrient deficiencies. Challenges include variability in productivity and limited lifetime, but the design of microbial biocatalysts remains a cost-effective tool for bio catalytic optimization.

Keywords: *Microbial bio-stimulants; Agricultural sustainability; Crop bio stimulation; Microbial analysis; DNA extraction techniques; Greenhouse experiment; Growth parameters; Arid agriculture*