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Effects of Biofilm Biofertilizer Amended Martian Simulant Soils on Rice Growth

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Improving the fertility of Martian regolith is essential for sustainable agriculture in extraterrestrial colonization, as its infertility is due to nutrient deficiencies. This study evaluates the potential of Biofilm Biofertilizer (BFBF) to advance the quality of Martian Soil Simulants (MSS) for improved plant growth. Serpentine soil as MSS, collected from Ussangoda (6° 05´N 80° 59´E) in the Southern Province, was sterilized and subjected to four treatments: (i) BFBF alone, (ii) Nutrient solution (NS) alone, (iii) BFBF combined with NS (10 µL:5 mL), and (iv) Control (no amendments), with three replicates in completely randomized design. Rice was used as the test plant. Seeds were germinated directly in four treatments and thinning was performed after 10 days retaining three healthiest plants for further growth. Two weeks later, plants were uprooted, and shoot and root lengths, as well as their dry weights were measured. Soil nutrients and soil microbial abundance by plate count method were assessed before and after treatments. The results showed significant improvements (p = 0.002) in total phosphorus (0.1499 ± 0.0055) in MSS treated with BFBF combined with NS. Additionally, there was a notable increase in the abundance of soil fungi (p = 0.022) and diazotrophs (p = 0.018) in BFBF alone treatment. These findings suggest that the application of BFBF with sufficient nutrients can improve the quality of MSS by enhancing soil nutrients and promoting soil microbial activities, which are critical for healthier plant growth and development. However, further research is needed to fully understand the impact of BFBF on improving MSS quality.

Keywords: *Biofilm Biofertilizer, Mars, Mars simulant soil, Martian regolith, Sustainable agriculture*

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