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# Biofilm-based Biofertilizers and Microbial Mixed Cultures: Are they Different on Plant Growth?

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## Abstract

Intensive agriculture has increased crop yields, but at the same time has posed severe environmental problems. Organic agriculture is a good alternative to intensive agriculture in safeguarding the environment. However, handling bulky organic materials in large-scale cultivations limits the widespread use of organic agriculture. In this context, microbial biofertilizers can play a major role in replacing intensive agriculture, which is based only on chemical inputs. As a recent development in microbiology, biofilms have been formulated in vitro to be used as biofertilizers, which are then called biofilmed biofertilizers (BFBFs). Biofilms are complex, surface-attached communities of multiple microbial species that produce a wider range of ecologically important biochemicals. The present study investigated the biochemical expression and the effect on plant growth of BFBFs and just mixed cultures of the BFBF microbes, using tomato (*Solanumlyco persicum*) as the test plant. A plant assay and a pot experiment were carried out to evaluate this. Fourier Transform Infrared (FTIR) spectroscopy was used to analyze the biochemical expression of the BFBFs and the mixed cultures. Seeds inoculated with BFBF showed significantly higher germination percentages and seedling lengths than the mixed cultures. The BFBFs and the mixed culture increased the vigor index of tomatoes up to 177% and 120%, respectively over the non-amended control. BFBFs inoculations significantly improved the root growth and resulted in significantly higher biomass production and plant height than the mixed cultures, and this was proportional to the production of more diverse functional groups and nitrogenous compounds by the BFBFs. Thus, it can be concluded that the BFBFs secrete a wider range of biochemicals than their mixed cultures, thus leading to higher plant productivity.

***Keywords:*** Biofilms, Biofertilizer, Tomato, Organic agriculture