Effect of Biofilm Biofertilizer on Tea Cultivation

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ABSTRACT

Biofilm is an assemblage of microbes adherent to each other and/or biotic/abiotic surfaces and embedded in a self-produced extracellular matrix of polymers (EPS). Such biofilms can also be developed *in-vitro* using beneficial microbes, and can be used as biofilm biofertilizers (BFBFs). In tea (*Camellia sinensis* L.) cultivation, decreased soil quality can be seen where tea has been grown for a long time, especially when the soil nutrient content becomes depleted. Use of chemical fertilizers (CF) in the growers' practice causes leaching out of CF, thus polluting water basins, depleting beneficial micro-organisms and insects, decreasing plant immunity and reducing soil fertility, which accompany a huge damage to the overall ecosystem. Once applied, the BFBFs break the dormancy of microbial forms in the soil seed bank and enhance nutrient cycling and availability for crop growth as well as biocontrol of pests and pathogens, thus improving crop productivity and soil fertility. The objective of this study was to determine the effects of the biofilm biofertilizers on soil moisture, pH, soil available potassium (K), total nitrogen (N), total phosphorus (P), organic carbon, labile carbon, made tea production, total polyphenols (SPAD), endophytic diazotrophs and soil carbon sequestration. The fields were applied with two treatments separately; (a) growers' CF practice (100% CF of Tea Research Institute (TRI) recommendation of vegetatively propagated tea mixture for Uva (VPUva) 925), and (b) BFBF practice (75% CF of TRI recommendation of VPUva 925 + BFBF 2.5 L ha^{-1}). All data were analyzed with two-sample t-test (independent samples t-test). Results indicated that the selected parameters varied among the two treatments. An increasing trend was observed in endophytic diazotrophs (P=0.08) in BFBF treatment over the growers' CF treatment. The quantity of made tea produced and the amount of soil carbon sequestered were significantly ($P<0.05$) higher in the BFBF practice over growers' CF practice. Also, a significantly ($P<0.05$) higher soil pH, moisture content, labile carbon content, organic carbon content, total nitrogen content and leaf total polyphenols content were observed in the BFBF practice over the growers' CF practice. However, a significant ($P>0.05$) difference could not be observed for soil available potassium and soil total phosphorous contents. Application of BFBF improved the nutrient utilization efficiency of plants and led to increase tea yield over CF alone application in the growers' CF practice while cutting down CF usage by 25%. Therefore, it is concluded that the BFBF is an eco-friendly and economically viable method to replace growers' current practice of CF alone application.