EVALUATION OF DEVELOPED FUNGAL-BACTERIAL BIOFILMS AS MICROBIAL AMELIORATORS FOR POTATO (*SOLANUM TUBEROSUM* L.) CULTIVATION

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Though chemical inputs have created devastating impacts on soil biological properties due to excessive and indiscriminate use, they seem necessary for crop production. Long term application of chemicals causes collapse of beneficial soil microbial communities, increase environmental pollution due to accumulation of soil toxicities. As potato tuber is entirely an underground plant part, there is a possibility to contaminate tubers with numerous soil toxins. Rhizosphere associated beneficial microbial inoculants such as biofilmed biofertilizers (BFBFs) have emerged as an environmental friendly biofertilizing method. Therefore, current study aimed to develop and assess BFBFs as an ameliorator for crop productivity of potato and to improve soil quality. In developing BFBFs, fungal-bacterial biofilms (FBBs) were first constructed using beneficial microorganisms isolated from the rhizosphere of potato crop cultivated at Regional Agriculture Research and Development Center, Bandarawela, Sri Lanka. Then, different combinations of the beneficial biofilms were applied to potato plants as biofertilizers (BFBF1 and BFBF2) in combination with chemical fertilizers (CF). Growth and biochemical responses of potato plants, soil quality amelioration and rhizoremediation of nitrosamine and heavy metals by different BFBF and CF treatments were evaluated under greenhouse and different agroclimatic conditions for tuberization (Bandarawela, Bibile and Padukka). Results showed that treatment BFBF1 + 50% CF increased tuber weight at Bandarawela and Padukka field sites compared to recommended CF (100%). BFBF1 + 50% CF showed the lowest soil and plant tissue pH, the highest soil organic carbon (SOC) and microbial biomass carbon (MBC), and the highest leaf chlorophyll and tissue calcium (Ca^{2+}) contents compared to the 100% CF at all three field sites. Further, soil Ca^{2+} content was significantly enhanced by the same treatment compared to the 100% CF at Bandarawela and Bibile field sites. In addition, internal sugar and starch contents were altered by BFBF1 + 50% CF, inducing tuberization. The same treatment enhanced rhizoremediation of soil nitrosamines and heavy metals. Thus, it can be concluded that the exogenous, favorable biochemical and physiological conditions created by the BFBF1 induced internal biochemical mechanisms, leading to enhanced tuberization, while improving rhizo-remediation. Further, the climatic requirements for potato tuberization have been compensated by the biofilm microbial actions. The findings also confirmed that the CF can be reduced by 50% along with the developed BFBF, and this is an enormous environmental and economic gain that improves soil health.