Biofilmed Biofertilizers for Maize (*Zea mays* L.): Effect on Plant Growth under Reduced Doses of Chemical Fertilizers

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Abstract: Maize is cultivated as a second crop next to rice in tropical conditions and depends on chemical fertilizers (CF) which contribute to detrimental ecological consequences. As a recent development, formulated fungal-bacterial biofilms (FBBs) of nitrogen fixing bacteria and fungi have shown potentials to be used as biofertilizers in agriculture, termed biofilmed biofertilizers (BFBFs). Therefore, current study was focused on the effect of developed BFBFs on plant growth and soil nutrient availability under CF reduction. A greenhouse soil pot experiment was conducted for 60 days using treatments; 100% CF (Recommended dose by the Department of Agriculture), 50% CF, 50% CF + BFBF1 and 50% CF + BFBF2, two BFBFs formulations. Plant photosynthetic efficiency and total plant dry weight were measured after 45 and 60 days of plant growth, respectively, and soil available ammonium (NH_4^+), nitrate (NO_3^-), phosphate (PO_4^{3-}) and soil organic carbon (SOC) were measured following standard methods at 60 days of plant growth. Initial availabilities of NH_4^+, NO_3^-, and PO_4^{3-} were 42.76, 15.08, and 2.41 µg/g soil, respectively. Results showed that 50% reduction of CF did not affect plant growth, since nutrient use efficiency was presumably improved by the BFBF. Enhanced plant photosynthetic efficiency under BFBF application was possibly due to sufficient chlorophyll content in plant leave, caused by adequate supply of NH_4^+. In contrast, reduced availability of PO_4^{3-} (0.24 µg/g soil) under BFBF2 could be due to plant uptake, possibly through the enhanced root growth. Thus, BFBF can reduce CF input in maize agriculture for a sustainable system. Further experiments under field conditions are however needed to evaluate their potential use in maize cultivation.

Keywords: Fungal-bacterial biofilms, Biofertilizers, Soil available nutrients, Plant photosynthesis