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Eco-friendly biofilm biofertilizer practice enhances endophytes and secondary metabolites in tea cultivation

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As the world's second-most consumed beverage after water, tea (*Camellia sinensis* (L.) O. Kuntze) possess unique sensory and medicinal benefits, attributed to its rich profile of secondary metabolites (SM). Tea cultivation mainly relies on chemical fertilisers (CF), which, when overused, degrade agroecosystems and reduce quality of the harvest. As an eco-friendly alternative to CF, biofilm biofertilizer (BFBF) was introduced for tea showing its potential to increase endophytes and SM in preliminary studies. The present study investigates this further by comparing two fertiliser practices i.e. (a) 100% CF (T750 and U709, as recommended by Tea Research Institute, Sri Lanka), and (b) BFBF (50% CF + 2.5 L BFBF ha^{-1}) in a field experiment conducted in Elpitiya, Sri Lanka. Fifteen leaf samples were collected from each plot and analyzed for total phenolic content (TPC), total flavonoids content (TFC), and caffeine contents using modified Folin-Ciocalteu assay, aluminium chloride colorimetric assay, and dichloromethane extraction method, respectively. Both plant and soil samples were analyzed for total bacteria and diazotrophs contents. One-way ANOVA followed by Tukey's HSD test was performed to compare the means by considering 0.1 as the probability level for statistical significance. Results revealed that the BFBF practice increased soil total bacteria (p = 0.038), soil diazotrophs (p = 0.067), endophytic diazotrophs (p = 0.065), and caffeine (p = 0.011) contents compared to the 100% CF practice. Endophytic total bacteria, TPC, and TFC were comparable in both BFBF and CF practices. These results suggest that the BFBF is capable of reducing the CF use in tea cultivation while increasing endophytes and SM production in tea, within the limitations of the study.

Keywords: *Caffeine, eco-friendly fertilisers, endophytes, sustainable agriculture*