Effect of Biofilm Biofertilizer on Availability of Soil Diazotrophs, Plant Endophytic Diazotrophs and Increasing of Grain Yield in Rice (*Oryza sativa*) Cultivation of Sri Lanka

A.T.D. Rathnathilaka[1], G. Seneviratne[2], H.M.S.P. Madawala[3], E.M.J.M. Rizvi[4]

Diazotrophs are microorganisms that are able to grow without external sources of fixed nitrogen and play a vital role in the persistence of microbial communities in the soil while increasing the crop productivity. Indiscriminate use of chemical fertilizers (CFs) particularly nitrogen based fertilizers adversely affect on the nitrogen fixers and ultimately cause the declining of soil health, crop productivity and agricultural sustainability in rice cultivation of Sri Lanka. Currently, farmers tend to give their attention to the application of organic fertilizers and biofertilizers. Biofilm biofertilizer (BFBF) is a novel product which can be used effectively to increase soil fertility and crop productivity without suppressing the microbial community in soil. BFBF is consisting of microbial cells and extracellular polymeric substances (EPS), which are secreted by themselves to have structural and biochemical protection. There are no sufficient studies carried out to evaluate BFBF in rice cultivation in farmers' real field conditions with special reference to the soil and plant endophytic diazotrophs that are vital in biological nitrogen fixation and enhance the crop growth. Therefore, this study focused on the effect of BFBF to enhance the rice yield by increasing the availability of soil diazotrophs and plant endophytic diazotrophs using rice as the test plant. The study was carried out at the farmers' fields in Ampara district, a major rice growing area in Sri Lanka. Eighteen farmers' fields were selected from different locations in Ampara district. Two consecutive, uniform paddy fields (whole *liyaddas*-one acre paddy fields) were applied separately with BFBF + 50 % CF practice (90 kg/ac CF NPK + 1000 ml/ac BFBF application) and farmers' CF alone practice (180 kg/ac CF NPK application). Fertilizer applications were done in multiple applications. Rhizosphere soil and plant samples were collected by uprooting five hills as replicates from each paddy field at flowering in Maha season. Plant dry weight and leaf chlorophyll content were measured. Microbes were isolated and grown in nitrogen free Combine Carbon Media (CCM) prescribed for growing soil diazotrophs and plant endophytic diazotrophs. Rice grain yields were recorded at harvest. Results were analyzed using two sample t-test and ANOVA using R software at $\alpha = 0.05$ probability level. According to the obtained results, soil diazotrophs (the increase by 69%) and plant endophytic diazorophs (54%) abundances, plant dry weight (49%), leaf chlorophyll content (38%) and grain yield (26%) of BFBF + 50% CF application significantly higher ($p<0.05$) than the farmers' CF alone practice. Furthermore, correlation analysis clearly showed a significantly positive correlation between grain yield and soil diazotrophs ($r^2 = 95.7\%$, $p < 0.05$) and plant endophytic diazotrophs ($r^2 = 91.8\%$, $p < 0.05$) respectively. The study concludes that the application of BFBFs together with a reduced dosage of CFs has the potential to increase soil diazotrophs and plant endophytic diazotrophs while increasing the rice yield in comparison to CFs alone, thus showing promising potential of BFBFs in rice cultivation in Sri Lanka.

Keywords: Biofilm biofertilizer; Diazotrophs; Endophytes; Farmers' fields; Rice

[1] National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka, *thilini.ra@nifs.ac.lk*
[2] National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka
[3] Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
[4] Faculty of Applied Sciences, South Eastern University of Sri Lanka