Efficiency of Biofilm Biofertilizer in Increasing Plant Growth Parameters of Rice Cultivation In Sri Lanka

S.W. Meepegamage[1], G. Seneviratne[2], R.G.S.C. Rajapakse[3]

Agricultural land per unit area needed to obtain the highest productivity and quality products, in order to win the challenging need for food products to feed a growing world population. For that, excessive chemical fertilizers (CF) are used for a long period of time for the agricultural lands which affect adversely on soil health and plant production. Application of CFs on cultivated lands suppresses the soil microbial activities and leading to develop poor microbial communities with law biomass. Microbial biofertilizers, a viable substitute for CFs are reported to increase diversity and abundance of soil microbes by introducing beneficial microbes which are depleted in agroecosystems. They consist of live beneficial microbes such as fungi, bacteria and algae which may include single or multiple combinations to enhance microbial activities. Among biofertilizers, more efficient biofilm biofertilizers (BFBF) which consist of developed microbial communities and extra polymeric substances play a crucial role in plant growth and soil processes. BFBFs are observed to produce various plant hormones, hydrogen cyanide and siderophore like exudates and amelioration of plants from stress. Moreover, they are involved in activities like nitrogenase activity, antagonistic activity defense against plant pathogens and solubilization and mineralization of soil nutrients such as phosphorus. BFBFs which ensure the sustainability of agroecosystem help for plant growth and development. Thus, the present study focused on the effect of BFBF on plant growth parameters under CF reduction in the conventional agriculture using rice as the test plant. A rice field experiment was conducted with four treatments viz: 100% CF DOA recommendation (DCF, 136 kg NPK per acre), NIFS CF recommendation for BFBF practice (NCF, 90 kg NPK per acre), NIFS CF recommendation for BFBF practice + BFBF (NCF + BFBF, 1000 ml BFBF per acre), and the control (without CF and BFBF), each having three replicates. Plant samples were collected randomly from all four treatments and leaf chlorophyll content was measured in the field using SPAD-502-Chlorophyll meter. Furthermore, total dry weight per hill, total number of tillers per hill, circumference of plant shoot, thousand seed weight and chaff content were measured. The data were analyzed using Minitab statistical package. There were significant increases in total dry weight of the plant (increase by, with respect to DCF: 89%, NCF: 98%, control: 98%), total number of tillers per hill (with respect to DCF: 93%, NCF: 73%, control: 86%) and circumference of the plant shoot (with respect to DCF: 52%, NCF: 35%, control: 40%) ($p < 0.05$) in the NCF + BFBF treatment over the other three treatments. NCF + BFBF showed the higher leaf chlorophyll content (with respect to DCF: 6%, NCF: 1%, control: 33%), thousand seed weight (with respect to DCF: 3%, NCF: 1%, control: 9%) and the lower chaff content (decrease by, with respect to DCF: 33%, NCF: 8%, control: 33%) than those of other three treatments. The study concludes that the BFBF application together with a reduced dosage of CFs improves the plant growth and grain yield in conventional rice cultivation.

Keywords: Biofilm Biofertilizer; Chemical fertilizer; Grain yield; Plant growth; Rice

[1] National Institute of Fundamental Studies, Hantana Road, Kandy 20000, Sri Lanka; Postgraduate Institute of Science, University of Peradeniya, Sri Lanka, *sachiniwayanthimali@gmail.com*
[2] Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka
[3] Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka; Postgraduate Institute of Science, University of Peradeniya, Sri Lanka