Development of Biofilmed Biofertilizers for Bean *(Phaseolus vulgaris)*

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Soil nitrogen deficiency may result in poor yields or failed crops and has traditionally been overcome by applying chemical fertilizers. But it is more expensive and can be harmful to the environment. The associations between fungi and root nodulating rhizobia as Fungal-Rhizobial Biofilms (FRBs) in leguminous plants is advantageous due to their ability to convert atmospheric nitrogen in to useful form in a process known as Biological Nitrogen Fixation (BNF). Although common bean *(Phaseolus vulgaris)* is the most frequently consumed legume worldwide, the yield is low and the plants have a low nitrogen fixing capacity compared to other legume plants. Therefore, this study describes the potential application of developed FRBs as Biofilmed Biofertilizers (BBs) to improve bean crop production.

Biofilms were developed by combining bacteria and fungi isolated from the bean root nodules and rhizosphere. Then the developed biofilms were applied to the bean plants, which were grown in pots inside a greenhouse. These were compared with chemically fertilized plants. After 25 days from germination (early growth), dry weight of shoot, root and nodules of the plants were measured. Means of shoot, root and total plant dry weights of the treatments were compared using student's T-test.

Three different types of fungi and bacteria were isolated from the bean root rhizosphere, according to their morphological differences. A successful biofilm formation was observed between selected fungi and bacteria isolated from the root rhizosphere. Among the treatments applied with BBs, those with *Rhizobium* showed better performance such as higher shoot and root dry weight with low variability and higher nodule dry weight during early growth stage. The results obtained by applying developed BBs to bean showed relatively low initial shoot growth compared with the chemical fertilizer applied bean plants due to competition between microbes of the BBs and the plant for nutrient acquisition. At harvest, the nodulation had just started. Plant biomass did not reflect the contribution of nodulation and biological nitrogen fixation, due to harvest in early growth. Therefore, further studies are necessary to evaluate the effect of BBs on bean at maturity.

Key words: Biofilms, Biofilmed biofertilizers, Common bean