

Studies on Optimizing the Level of Liquid Biofertilizers in Peanut and Maize and Their Economic Analysis

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Abstract : Biofertilizers containing live microbial cells can mobilize one or more nutrients to plants when applied to either seed or rhizosphere. They form an integral part of nutrient management strategies for sustainable production of agricultural crops. Annually, about 22 tons of lignite-based biofertilizers are being produced and supplied to farmers at the Institute of Organic Farming, University of Agricultural Sciences, Dharwad, Karnataka state India. Although carrier based biofertilizers are common, they have shorter shelf life, poor quality, high contamination, unpredictable field performance and high cost of solid carriers. Hence, liquid formulations are being developed to increase their efficacy and broaden field applicability. An attempt was made to develop liquid formulation of strains of *Rhizobium* NC-92 (Groundnut), *Azospirillum* ACD15 both nitrogen-fixing biofertilizers and *Pseudomonas striata* an efficient P-solubilizing bacteria (PSB). Different concentration of amendments such as additives (glycerol and polyethylene glycol), adjuvants (carboxyl methyl cellulose), gum arabica (GA), surfactant (polysorbate) and trehalose specifically for *Azospirillum* were found essential. Combinations of formulations of *Rhizobium* and PSB for groundnut and *Azospirillum* and PSB for maize were evaluated under field conditions to determine the optimum level of inoculum required. Each biofertilizer strain was inoculated at the rate of 2, 4, 8 ml per kg of seeds and the efficacy of each formulation both individually and in combinations was evaluated against the lignite-based formulation at the rate of 20 g each per kg seeds and a un-inoculated set was included to compare the inoculation effect. The field experiment had 17 treatments in three replicates and the best level of inoculum was decided based on net returns and cost: benefit ratio. In peanut, the combination of 4 ml of *Rhizobium* and 2 ml of PSB resulted in the highest net returns and higher cost to benefit ratio of 1:2.98 followed by treatment with a combination of 2 ml per kg each of *Rhizobium* and PSB with a B:C ratio of 1:2.84. The benefits in terms of net returns were to the extent of 16 percent due to inoculation with lignite based formulations while it was up to 48 percent due to the best combination of liquid biofertilizers. In maize combination of liquid formulations consisting of 4 ml of *Azospirillum* and 2 ml of PSB resulted in the highest net returns; about 53 percent higher than the un-inoculated control and 20 percent higher than the treatment with lignite based formulation. In both the crops inoculation with lignite based formulations significantly increased the net returns over un-inoculated control while levels higher or lesser than 4 ml of *Rhizobium* and *Azospirillum* and higher or lesser than 2 ml of PSB were not economical and hence not optimal for these two crops.

Keywords : *Rhizobium*, *Azospirillum*, phosphate solubilizing bacteria, liquid formulation, benefit-cost ratio

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