

Evaluating the Performance of Selected Commercial Bio-Fertilizers on Soybean Production in Bungoma, Kenya

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Abstract

The study was conducted to compare the performance of promising commercial bio-fertilizers that have been evaluated under the green-house conditions at TSBF-CIAT, in farmers' conditions through the use of promiscuous soybean variety (SB19). The trials were laid out on small scale farms in Bungoma County, situated in Western Kenya. The experiment was established in March 2010 during the long rains (LR) and repeated during the short rains (SR) of 2010; laid out in multi-locational one farmer field one replicate design. Treatments were not replicated within each field. During LR 2010, 50 farms were researched on and 100 farms in the second season (SR 2010). A promiscuous medium-maturity soybean variety TGx1740-2E (SB 19) was inoculated with Legumefix (Rhizobia) or/and Rhizatech (mycorrhizae) inoculants. The mycorrhizae inoculum was applied to the soil in the seed furrows at the recommended rate of 30 kg ha⁻¹. Nodulation was examined at mid-podding (50% podding) by carefully uprooting all plants with their entire root system from a 1 m² section in each plot. Nodules were counted and weighed; the root and shoot parts separated, and fresh and dry weights assessed. Analysis of variance was conducted to determine the effects of (and interactions between) the two inoculants on plant parameters using a mixed linear model (MIXED procedure, SAS). Rhizobial inoculation resulted in significantly ($p < 0.01$) higher nodule biomass (0.93 g plant⁻¹) compared to the control (0.27 g plant⁻¹) across many farms. Mycorrhizal inoculation had no significant effect on nodulation when applied solely (0.38 g plant⁻¹), but co-inoculation of Rhizobia and mycorrhizae increased nodule biomass further by 0.09 g plant⁻¹. There was a significant difference ($p < 0.01$) in terms of biomass yield between treatments. Rhizobial inoculated plants had the highest biomass production of 2086 kg/ha. Rhizobial inoculation resulted in higher grain yields of 1116 kg/ha above the control. Soybean inoculation increased both nitrogen and phosphorus uptake in the biomass. Rhizobial inoculant had the highest soybean N uptake of 48.6 N kg/ha which was significantly different ($p < 0.05$) from control and sole application of mycorrhizae. Statistical analysis showed that soil factors (pH, P, C, N) significantly ($p < 0.001$) affected soybean grain yields during both seasons. It is concluded from this study that rhizobial inoculants have a high potential as commercial bio-fertilizers and can substitute the need for mineral N fertilizer in the legume farming systems. However, there is need to target these inputs to the most responsive fields. Further studies are needed to elucidate the conditions under which synergism between both inoculants may occur, with specific focus towards soil P availability and management of P inputs.

Keywords: Soybean, Rhizatech, Legumefix, Inoculant, Grain Yield.