

# Effect of Cattle Manure, Mineral Fertilizer and Rhizobium Inoculation on Climbing Beans Production and Soil Properties in Burera District, Rwanda.

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## Abstract:

Agriculture is the major engine of Rwandese economy, accounting for about 40% of the GDP, 85% of employment and 80% of exports. Known as “meat for the poor”, beans constitute a predominant source of proteins in Rwandese diet since they supply 65% of national dietary proteins compared to 4% from animal sources. However, the on-farm bean productivity is about 0.8 – 1.0 tons/ hectare which is quite low compared to 5 tons/hectare that is achieved under optimal management conditions. The aim of this study was therefore to determine the effect of cattle manure, mineral fertilizer and Rhizobium inoculation on production of climbing beans and subsequently the soil properties in Burera District. The experimental design was a split plot in completely randomized design (CRD) with two main plots (with and without Rhizobium inoculum); four sub-plots (Cattle Manure, DAP, Cattle manure + DAP, untreated control) with quantities applied at single level for each treatment, i.e. 20t/ha for Cattle manure, 50 kg/ha for DAP and 100 g of inoculum which was mixed with 15 kg of beans. The experiment involved 8 treatments which were replicated three times to give 24 plots. The mean bean grain yields from inoculated treatments and non-inoculated treatments showed statistically significant difference ( $P < 0.0001$ ), that is 3900 kg/ha from inoculated plots and 2946 kg/ha from non-inoculated. Statistical significant differences were also found among treatments ( $P < 0.0001$ ) with the highest mean yield of 4782 kg/ha obtained from treatment Inoculum + DAP + Cattle Manure against 2640 kg/ha from untreated (control) plots. The mean number of nodules was significantly different ( $P < 0.0001$ ) between inoculated (60 nodules) and non-inoculated (15 nodules) plots. The highest number of nodules (95) was recorded from plots that were treated with Inoculum + DAP + Cattle Manure and the lowest (14) in the untreated control plots ( $P < 0.0001$ ). Regression analysis between yield and nodule number showed a coefficient of determination  $R^2$  of 0.8 and a p value of  $< 0.0001$ , which confirmed the dependence of the yield on nodules number. In terms of cost-benefit analysis, in the highest yielding treatment (I+FYM+DAP) scenario, a farmer is likely to earn around 1,330 USD per season per hectare; while in the middle and lowest yielding treatment (I and UNTREATED CONTROL), the farmer is likely to lose 43.8 USD and 388 USD per season per hectare, respectively. On the effect of treatments on soil chemical properties, no tangible changes were observed in pH, CEC and organic matter at the end of season. According to these results a combination of mineral fertilizer, inoculum and cattle manure application gave the best results in terms of bean yield, nodulation and nitrogen uptake and therefore could be better considered for recommendation to climbing bean growers in the region.