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ABSTRACT
The production of grain legumes compared to other staple food such as cereals has declined by more than 20% over the last 15 years in Kenya. This is partly due to intensive cultivation of land by smallholder farmers without adequate replenishment of soil nutrients. This study aims at improving grain legume production by use of rhizobia inoculation and N-fertilizer application. It also aims at establishing the abundance of legume nodulating indigenous rhizobia in soils collected from different legume growing areas of Central Kenya.

Field and greenhouse experiments were conducted at the University of Nairobi’s Faculty of Agriculture farm. The field experiment was conducted to determine the effects of rhizobia inoculation and starter-N fertilizer on the performance of six legumes. The legumes used were common bean GLP-2 (*Phaseolus vulgaris*), lima bean (*Phaseolus lunatus*), cowpea M66 (*Vigna unguiculata*), green gram N26 (*Vigna radiata*), pigeon pea Mbaazi 1 (*Cajanus cajan*) and hyacinth bean DH1002 (*Lablab purpureus*). The treatments comprised of rhizobia inoculation, N-fertilizer application (26 kg N ha\(^{-1}\)) and a control (0 kg N ha\(^{-1}\) and no rhizobia inoculation).

Common bean was inoculated with *Rhizobium* spp strain 2674 and the other legumes with cowpea cross-nodulating *Bradyrhizobium* spp strain 3456. The experiment was laid out in a randomized complete block design (RCBD) in a split plot arrangement with three replicates. The parameters determined included the nodule count and nodule mass, biomass accumulation and yield.

The abundance of indigenous rhizobia in soils collected from five field sites was determined using the most probable number technique. Cowpea was used as a “trap” host to determine the presence of cross-nodulating *Bradyrhizobium* spp while common bean was used as a trap host for *Rhizobium* spp. Data collected included nodule count and dry matter; plant tissue-N and the number of rhizobial bacteria cells g\(^{-1}\) dry soil. The results showed that rhizobia inoculation enhanced nodulation hence growth and yields of legumes species. Rhizobia inoculation improved nodule count and dry matter of the legumes while the starter-N fertilizer suppressed them. However, starter-N application improved yield components (number of pods per plant and grains per pod) resulting also to improved yield of legume species. Most of the legumes showed yield improvement with both treatments. Common bean and lima bean produced the highest yield (seasonal average of 2734 kg ha\(^{-1}\) and 2500 kg ha\(^{-1}\) respectively)
while pigeon pea had the least (average of 181 kg ha\(^{-1}\)) over the two seasons. The effect of rhizobia inoculation and starter-N fertilizer application on of most legume shoot biomass was not significant suggesting abundance of indigenous rhizobia and soil nitrogen in the soil.

Soil samples from five field sites were found to be significantly different in population size of cowpea cross-nodulating *Bradyrhizobium* spp., with exception of Machakos and Kajiado soil samples, which were similar. However, all the field sites indicated high presence of common bean *Rhizobium* spp. (more than 900 cell g\(^{-1}\) of dry soil). The results indicate that inoculation with compatible rhizobia improves nodulation and hence the yield of legumes in soils low in rhizobial population. Application of N-fertilizer was found to suppress nodulation of the test legumes. However, substantial amount of nitrogen is required by legumes for their shoot and root growth as well as nodule development before the onset of N\(_2\)-fixation process. High quantities of soil nitrogen should be avoided because nitrate-N reduces nodulation and symbiotic activity. Intensifying production of underutilized legume crops and their diversification will increase food security and provide much-needed protein.