

## ABSTRACT

Nitrogen (N) fixation through legume-*Rhizobium* symbiosis is important for enhancing agricultural productivity and is therefore of great economic interest. Growing evidence indicates that other soil beneficial bacteria can positively affect symbiotic performance of rhizobia. Nodule endophytic plant growth promoting rhizobacteria (PGPR) were isolated from common bean nodules from Nakuru County in Kenya and characterized 16S rDNA partial gene sequencing. The effect of co-inoculation of *rhizobium* and PGPR, on nodulation and growth of common bean (*Phaseolus vulgaris* L.) was also investigated using a low phosphorous soil under greenhouse conditions. Gram-positive nodule endophytic PGPR belonging to the genus *Bacillus* were successfully isolated and characterized. Two PGPR strains (*Paenibacillus polymyxa* and *Bacillus megaterium*), two rhizobia strains (IITA-PAU 987 and IITA-PAU 983) and one reference rhizobia strain (CIAT 899) were used in the co-inoculation study. Two common bean varieties were inoculated with *Rhizobium* strains singly or in a combination with PGPR to evaluate the effect on nodulation and growth parameters. Co-inoculation of IITA-PAU 987 + *B. megaterium* recorded the highest nodule weight (405.2 mg) compared to IITA-PAU 987 alone (324.8 mg), while CIAT 899 + *B. megaterium* (401.2 mg) compared to CIAT 899 alone (337.2 mg). CIAT 899 + *B. megaterium* recorded a significantly higher shoot dry weight (7.23 g) compared to CIAT 899 alone (5.80 g). However, there was no significant difference between CIAT 899 + *P. polymyxa* and CIAT 899 alone. Combination of IITA-PAU 987 and *B. megaterium* led to significantly higher shoot dry weight (6.84 g) compared to IITA-PAU 987 alone (5.32 g) but no significant difference was observed when co-inoculated with *P. polymyxa*. IITA-PAU 983 in combination with *P. polymyxa* led to significantly higher shoot dry weight (7.15 g) compared to IITA-PAU 983 alone (5.14 g). Plants inoculated with IITA-PAU 987 and *B. megaterium* received 24.0 % of their nitrogen demand from atmosphere, which showed a 31.1% increase compared to rhizobium alone. Contrast analysis confirmed the difference between the co-inoculation of rhizobia strains and PGPR compared to single rhizobia inoculation on the root dry weight. These results show that co-inoculation of PGPR and Rhizobia has a synergistic effect on bean growth. Use of PGPR may improve effectiveness of *Rhizobium* biofertilizers for common bean production. Testing of PGPR under field conditions will further elucidate their effectiveness on grain yields of common bean.