

Effects of selected functional bacteria on maize growth and nutrient use efficiency

ABSTRACT

Plant growth-promoting rhizobacteria (PGPR), which include isolates from genera *Paraburkholderia*, *Burkholderia* and *Serratia*, have received attention due to their numerous plant growth-promoting mechanisms such as their ability to solubilize insoluble phosphates and nitrogen-fixation. However, there is a dearth of information on the potential plant growth-promoting effects of these three groups of bacteria on non-legumes such as maize. This study determined the influences of the aforementioned strains on soil properties, maize growth, nutrient uptake and nutrient use efficiency. A pot trial using maize as a test crop was done using a randomized complete block design with 7 treatments each replicated 7 times. The treatments used in this study were: Control (no fertilizer), chemical fertilizer (CF), organic-chemical fertilizers combination without inoculum (OCF) and with inocula consisting of single strains [cellulolytic bacteria (TC), organic fertilizer and chemical fertilizer with N-fixing bacteria (TN), organic fertilizer and chemical fertilizer with P-solubilizing bacteria (TP)) and three-strain inocula (TCNP), respectively. The variables measured included plant growth and nutrient content, soil nutrient content and functional rhizospheric bacterial populations. *Paraburkholderia nodosa* NB1 and *Burkholderia cepacia* PB3 showed comparable effects on maize biomass and also improved N and P use efficiencies when compared to full chemical fertilization. Nitrogen-fixing rhizobacteria had a positive effect on above-ground biomass of maize. *Paraburkholderia nodosa* NB1 improved soil total C and organic matter contents, besides being the only bacterial treatment that improved K use efficiency compared to OCF. The results suggest that *P. nodosa* NB1 and *B. cepacia* PB3 have potential usage in bio-fertilizers. In contrast, treatments with *Serratia nematodiphila* C46d and consortium strains showed poorer maize nutrient uptake and use efficiency than the other single strain treatments. Bacterial treatments generally showed comparable or higher overall N and P use efficiencies than full chemical fertilization. These findings suggest that at least half the amounts of N and P fertilizers could be reduced through the use of combined fertilization together with beneficial bacteria.

Keyword: *Paraburkholderia nodosa*; *Burkholderia cepacia*; *Serratia nematodiphila*; PGPRs; Integrated nutrient management