

Investigation of the P solubilising effect of phosphate solubilising bacteria in high P conditions

Sara De Bolle, Gebremikael T. Mesfin, Stefaan De Neve

Ghent University, 9000 Ghent, Belgium
Sara.debolle@ugent.be

As a result of decades of excessive phosphorus fertilization, most acid sandy soils in Flanders (Belgium) and the Netherlands are phosphorus (P) saturated. This saturation entails a risk of significant P leaching to groundwater, and therefore very strict P fertilizer restrictions are enforced in these areas. One of the strategies to reduce the P concentration in these soils is through P mining by crops. However, despite the large P concentrations, the efficiency of mining rapidly decreases over time because most P is not directly plant available. Phosphate solubilising bacteria (PSB) transform unavailable P into plant available forms, and could thus prove to be very useful even in P saturated soils under severe fertilization restrictions, namely to increase the P mining efficiency. Until now, PSB have never been tested in such conditions, and therefore the goal of this research was to investigate the potential of PSB for increasing P extraction in conditions of high total P content.

Five PSB species, namely three *Bacillus* and two *Pseudomonas* species, were selected. In a first experiment they were tested on several growth media with different amounts and kinds of insoluble phosphate such as FePO_4 , AlPO_4 or CaPO_4 . This was done to check the growth ability of the PSB and their P solubilising potential under completely controlled conditions. The colony growth after 14 days of inoculation showed that all five bacteria were able to grow on each of the tested growth media. For the second experiment the bacteria were brought in a more realistic environment, namely in quartz sand with a nutrient solution that supplied all nutrients for the bacteria except P. The P was again provided in an insoluble form as FePO_4 , AlPO_4 or CaPO_4 . The water soluble P ranged from 3.2 to 6.9 and 29.0 to 40.7 mg kg^{-1} sand for the insoluble Al-P and Fe-P treatments respectively. *Pseudomonas putida* and *Bacillus brevis* perform best as PSB in high P conditions where the P is fixed with Al or Fe, which is the case for the acid sandy soils in Flanders.