Abstract

Plants and microorganisms use similar mechanisms to increase phosphate availability in the rhizosphere. Both exude low-molecular weight organic acids (LOAs) which can carry varying negative charge, depending on dissociation properties and number of carboxylic groups. This allows the complexation of metal cations like Fe in solution and the displacement of anions such as phosphate from soil particles (Jones, 1998).

A plant-culture system to investigate the effect of microorganisms on the LOA composition of the rhizosphere soil solution under axenic conditions was developed. Therefore sterile seedlings are transferred to aerated glass tubes filled with quartz sand. The system allows sterile plant culture for up to seven weeks and a non-destructive in situ collection of the rhizosphere soil solution.

Using phosphate sorbed to goethite the interactions between plant roots and rhizosphere microorganisms regarding LOA exudation and phosphate availability in the rhizosphere soil solution were studied. While sterile tomato seedlings (*Lycopersicum esculentum* Mill., cv. ‘Freude’) showed no exudation of LOAs in the presence of phosphate sorbed to goethite, quality and quantity of the LOAs in the rhizosphere soil solution were altered by the presence of microorganisms under axenic conditions. An increase in the exudation of succinate was found in the dual culture of the tomato cultivar ‘Freude’ with both isolates (*Pseudomonas fluorescens* Pf-5, *Gordonia* sp.) used.