Tracing of Two Pseudomonas Strains in the Root and Rhizoplane of Maize, as Related to Their Plant Growth-Promoting Effect in Contrasting Soils

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Author(s) Mosimann, Carla; Oberhänsli, Thomas; Ziegler, Dominik; Nassal, Dinah; Kandeler, Ellen; Boller, Thomas; Mäder, Paul; Thonar, Cécile
Author(s) at UniBasel Boller, Thomas ; Mosimann, Carla ;
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TaqMan-based quantitative PCR (qPCR) assays were developed to study the persistence of two well-characterized strains of plant growth-promoting rhizobacteria (PGPR), Pseudomonas fluorescens Pf153 and Pseudomonas sp. DSMZ 13134, in the root and rhizoplane of inoculated maize plants. This was performed in pot experiments with three contrasting field soils (Buus, Le Caron and DOK-M). Potential cross-reactivity of the qPCR assays was assessed with indigenous Pseudomonas and related bacterial species, which had been isolated from the rhizoplane of maize roots grown in the three soils and then characterized by Matrix-Assisted Laser Desorption Ionization (MALDI) Time-of-Flight (TOF) mass spectrometry (MS). Sensitivity of the qPCR expressed as detection limit of bacterial cells spiked into a rhizoplane matrix was 1.4 Œ 10(2) CFU and 1.3 Œ 10(4) CFU per gram root fresh weight for strain Pf153 and DSMZ 13134, respectively. Four weeks after planting and inoculation, both strains could readily be detected in root and rhizoplane, whereas only Pf153 could be detected after 8 weeks. The colonization rate of maize roots by strain Pf153 was significantly influenced by the soil type, with a higher colonization rate in the well fertile and organic soil of Buus. Inoculation with strain DSMZ 13134, which colonized roots and rhizoplane to the same degree, independently of the soil type, increased yield of maize, in terms of biomass accumulation, only in the acidic soil of Le Caron, whereas inoculation with strain Pf153 reduced yield in the soil Buus, despite of its high colonization rate and persistence. These results indicate that the colonization rate and persistence of inoculated Pseudomonas strains can be quantitatively assessed by the TaqMan-based qPCR technique, but that it cannot be taken for granted that inoculation with a well-colonizing and persistent Pseudomonas strain has a positive effect on yield of maize.
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