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PII: S0944-5013(17)31185-0
DOI: https://doi.org/10.1016/j.micres.2018.01.005
Reference: MICRES 26123

To appear in:

Received date: 29-11-2017
Revised date: 13-1-2018
Accepted date: 20-1-2018

Please cite this article as: del Carmen Orozco-Mosqueda Ma, del Carmen Rocha-Granados Ma, Glick Bernard R, Santoyo Gustavo.Microbiome engineering to improve biocontrol and plant growth-promoting mechanisms.*Microbiological Research* https://doi.org/10.1016/j.micres.2018.01.005

Microbiome engineering to improve biocontrol and plant growth-promoting mechanisms

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ABSTRACT

A plant microbiome includes a microbial community that typically interacts extensively with a plant. The plant microbiome can survive either inside or outside of plant tissues, performing various plant beneficial activities including biocontrol of potential phytopathogens and promotion of plant growth. An important part of the plant microbiome includes plant growth-promoting bacteria (PGPB) that commonly reside in the rhizosphere and phyllosphere, and as endophytic bacteria (inside of plant tissues). As new plant microbiome-manipulating strategies have emerged in recent years, we have critically reviewed relevant literature, chiefly from the last decade. We have analysed and compared the rhizosphere, phyllosphere and endosphere as potential ecosystems for manipulation, in order to improve positive interactions with the plant. In addition, many studies on the bioengineering of the endophyte microbiome and its potential impact on the core microbiome were analysed with respect to five different strategies, including host mediated and multi-generation microbiome selection, inoculation into soil and rhizosphere, inoculations into seeds or seedlings, tissue atomisation and direct injection into tissues or