Phosphate-Solubilizing Microbes and Biocontrol Agent for Plant Nutrition and Protection: Current Perspective

Article *in* Communications In Soil Science and Plant Analysis · February 2020

DOI: 10.1080/00103624.2020.1729379

CITATIONS
94

READS
872

10 authors, including:

Debasis Mitra
Graphic Era University
250 PUBLICATIONS **2,578** CITATIONS
SEE PROFILE

Snezana Andjelkovic
Institute for forage crops Kruševac
93 PUBLICATIONS **674** CITATIONS
SEE PROFILE

Ansuman Senapati
National Rice Research Institute
66 PUBLICATIONS **1,262** CITATIONS
SEE PROFILE

Tanja Predrag Vasić
Faculty of Agriculture, University of Niš
138 PUBLICATIONS **622** CITATIONS
SEE PROFILE

COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS
2020, VOL. 51, NO. 5, 645–657
https://doi.org/10.1080/00103624.2020.1729379

Phosphate-Solubilizing Microbes and Biocontrol Agent for Plant Nutrition and Protection: Current Perspective

Debasis Mitra [a], Snežana Anđelković [b], P. Panneerselvam [a], Ansuman Senapati [c], Tanja Vasić [b], A. N. Ganeshamurthy [a], Manisha Chauhan [d], Navendra Uniyal [e], Bhaswatimayee Mahakur [f], and T. K. Radha [a]

[a]Division of Soil Science and Agricultural Chemistry, ICAR - Indian Institute of Horticultural Research, Bengaluru, India; [b]Institute for Forage Crops, Kruševac, Republic of Serbia; [c]Soil Science and Microbiology, Crop Production Division, ICAR - National Rice Research Institute, Cuttack, India; [d]Multidisciplinary Centre for Advance Research and Studies, Jamia Millia Islamia, New Delhi, India; [e]Genetics and Tree Propagation Division, Forest Research Institute, Dehradun, India; [f]Department of Botany and Biotechnology, Ravenshaw University, Cuttack,Odisha, India

ABSTRACT

Phosphate-solubilizing microbes (PSM) are widely distributed in the rhizosphere and helps plant to acquire phosphates from soil. The availability of phosphates in soil are governed by several factors among which the proton exchange capacity has been regarded to be the most important factor involved in cation complex formations with soluble phosphates making them unavailable to plants, thereby disturbing the phosphorus cycling events found in arable soils. PSM solubilizes the cation complexes and thereby improves the functioning of phosphorus cycle in soil. In addition to involvement in biogeochemical cycling events, PSM have been also found to have antagonistic potential against several plant phytopathogens. These biocontrol microbes represent the most abundant groups of soil microflora. Among which some nutrient solubilizers have been used for effective biocontrol of important plant diseases. This review article shows contributions of different plant growth promoters used in nutrient and disease management practices in agriculture.

Abbreviations: P (phosphorus), PSM (phosphate-solubilizing microbes), PSB (phosphate-solubilizing bacteria), PSF (phosphate-solubilizing fungi), PGPM (plant growth-promoting microbes), PGPB (plant growth-promoting bacteria), SAR (systemic acquired resistance), ISR (induced systemic resistance), TCP (tricalcium phosphate), HCN (hydrogen cyanide), IAA (indole-3-acetic acid), [a]Phosphorus [(SSP) single super phosphate, RP (rock phosphate), PM (poultry manure) and FYM (farm yard manure)], PAL (phenylalanine ammonia lyase), ESI-MS (electrospray ionization mass spectrometry), DAPG (2,4-diacetylphloroglucinol) and NMR (^{1}H nuclear magnetic resonance).

ARTICLE HISTORY
Received 6 February 2020
Accepted 6 February 2020

KEYWORDS
Phosphate-solubilizing microbes; biocontrol agent; plant growth promotion

Introduction

Phosphorus (P) is amongst the most vital macro-element in plant which is essential for improving crop growth and yield. It makes up about 0.2% of the dry weight of the plant and is the second most limiting soil mineral nutrient (Azziz et al. 2012; Tak et al. 2012). On average, the phosphorus in soil is about 0.05% (w/w), from which 0.1% is accessible to plant (Zhu et al. 2011). The inorganic form of phosphates (Pi) is present in high concentration and accounts for 35% to 70% of total P in soil (Harrison 1987). The availability of Pi in soil rarely exceeds 10 µM, which is much lower than that in

CONTACT P. Panneerselvam panneerccri@rediffmail.com Division of Soil Science and Agricultural Chemistry, ICAR - Indian Institute of Horticultural Research, Bengaluru, Karnataka 560 089, India
*Present address: Crop Production Division, ICAR—National Rice Research Institute, Cuttack 753006, Odisha, India