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IMPROVEMENT OF PGPR BY TRANSFORMATION: PROSPECTS AND CHALLENGES

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Plant growth promotion by rhizobacteria has been well-established for a variety of crops and ability of PGPR to solubilize mineral phosphates, produce siderophores and plant hormones are some of the aspects studied. Advances are being made to understand the reasons behind the differences in the efficacy of PGPRs in laboratory as compared to field conditions. Recent investigations leading to the unraveling of biochemical and molecular basis of the action of PGPRs has opened the possibility to develop these properties in native rhizobacteria by genetic modification.

Incorporation of buffer and low concentration of nutrients in the screening medium have resulted in the isolation of P-solubilizing bacteria (PSB) which are different and more efficient than the PSB isolated by conventional methods. PSB that could tolerate high salinity have also been isolated. P-starvation inducible quinoprotein glucose dehydrogenase (Gcd) has been shown to be responsible for the high gluconic acid secretion resulting efficient P solubilization.

Nature of the C-source affects the P-solubilzation efficiency because of the differences in the metabolism of the substrate thereby resulting in the secretion of different organic acids. Gluconic acid producing PSB show P-solubilizing ability on a mixture of low concentrations of several sugars as a consequence of the broad substrate specificity of the Gcd enzyme. Since Gcd in certain bacteria is under catabolite repression by TCA cycle intermediates, the P-solubilization phenotype of these organisms is adversely affected by the presence of organic acids such as succinate, malate etc. The significance of these findings in light of the field performance of PSB will be discussed.

Expression of PQQ synthase gene has been demonstrated to be sufficient to confer P-solubilization ability in transgenic bacteria. Alternatively, mineral phosphate solubilizing genes have been cloned from *Synechocystis* PCC 6803 in *E. coli* from genomic DNA library. Attempts are also being made to develop P-solubilization ability by the over-expression of phospho*enol*pyruvate carboxylase gene. Conditional repression of TCA cycle genes by antisense RNA could also help in developing PGPRs with P-solubilization ability. These studies demonstrate the potential of metabolic engineering to develop P-solubilzation ability in native rhizobacteria.