Plant growth promoting Rhizobacteria: A boon for sustainable agriculture

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Abstract :

The past couple of decades, Plant Growth Promoting Rhizobacteria (PGPR) will begin to replace the use of chemicals in agriculture, horticulture, silviculture and environmental cleanup strategies. Scientific researchers involve multidisciplinary approaches to understand adaptation of PGPR, effects on plant physiology and growth induced systemic resistance, bio-control of plant pathogens and bio-fertilization. PGPR are naturally occurring soil bacteria that aggressively colonize in plant roots and play a vital role in crop protection, growth promotion and in the improvement of soil health. The study was conducted to isolate plant growth promoting Rhizobacteria from sugarcane rhizosphere and assess their potential with combination of chitosan for plant growth and bio-control activities. Isolated Rhizobacteria were characterized by morphological, physiological, biochemical and molecular identification of bacteria by 16S rRNA sequencing. They were screened in vitro plant growth promoting traits viz., production of indole acetic acid, hydrogen cyanide, ammonia production and antifungal activity against Colletotrichum falcatum. Five isolates showed highest plant growth promoting activities. All isolates identified as Enterobacter hormaechei, Bacillus megaterium, Bacillus cereus, Bacillus thuringiensis and Bacillus pumilus. For bio-control activities against Colletotrichum falcatum, the significant growth inhibition was observed. This study was further preceded in sugarcane. Sugarcane setts were soaked into PGPR and chitosan solution for 12 hours. Germination percentage, growth parameters, chlorophyll, proline content, nitrate reductase activity, anti-oxidative enzyme superoxide dismutase activity showed significant findings. The study suggests that PGPR and chitosan can be used as an effective biological fertilizer combination for increasing sugarcane production. Recent Publications Katiyar D, Hemantaranjan A, Singh B (2015) Chitosan as a promising natural compound to enhance potential physiological responses in plant: a review. Indian Journal of Plant Physiology; 20(1): 1-9. Katiyar D, Hemantaranjan A, Singh B (2016) Plant growth promoting Rhizobacteria- an efficient tool for agriculture promotion. Advances in Plants & Agriculture Research; 4(6): 00163.

Introduction:

Plant Growth Promoters-PGP are the substances that improve the general health growth and development of plants. These substances could also be either synthetically made or obtained from Biological derivatives.

Plant Growth Promoters (PGP) are effective in upping the crop, quality and productivity considerably. PGPs, particularly biological derivatives are simpler & safe. they will be counseled for all crops.

Among the PGPs, the Amino acids ar bio organic derivatives that are obtained biological sources like fish waste, animal waste (slaughterhouse waste), Plant macromolecule like Soyabean, maize, groundnut etc;

Presently among totally different categories of PGPs, Amino acids are enjoying a significant chunk of market share owing to their properties that facilitate plant growth and development like flowering, mature and overall increase in yield. From the top of table it's clear that the demand for Amino acids for his or her plant growth promoting properties is large. therefore there's a large potential for Amino Acids within the PGPs market.

Rhizobacteria are root-associated bacterium that have kind dependent relationships with several plants. The name comes from the Greek rhiza, that means root. tho' parasitic kinds of rhizobacteria exist, the term sometimes refers to bacterium that kind a relationship useful for each parasites (mutualism). they're a crucial cluster of microorganisms employed in biofertilizer. Biofertilization accounts for about sixty fifth of the gas provided to crops worldwide.citation needed] Rhizobacteria are typically said as plant growth-promoting rhizobacteria, or PGPRs.

Plant Growth Promoting Rhizobacteria have {different|totally totally different|completely different} relationships with different species of host plants. The 2 major categories of relationships are rhizospheric and endophytic. Rhizospheric relationships accommodate the PGPRs that colonize the surface of the foundation, or superficial living thing areas of the host plant, typically forming root nodules. The dominant species found within the rhizosphere may be a microorganism from the genus Azospirillum.Endophytic relationships involve the PGPRs receding and growing within the host plant within the apoplastic area.

Nitrogen fixation is one in every of the foremost useful processes performed by rhizobacteria. gas may be an important nutrient to plants and volatilised gas (N2) isn't on the market to them because of the high energy needed to interrupt the triple bonds between the 2 atoms.
Rhizobacteria, through biological processes and are able to convert volatilised gas (N2) to ammonia (NH3) creating an associated on the market nutrient to the host plant which might support and enhance plant growth. The host plant provides the bacterium with amino acids in

order that they don't have to be compelled to assimilate ammonia. The amino acids ar then shuttled back to the plant with new fastened gas. enzymes are associated accelerators

concerned in biological process and needs anaerobic conditions. Membranes among root nodules ar able to give these conditions. The rhizobacteria need atomic number 8 to metabolise, therefore atomic number 8 is provided by a hemoprotein macromolecule known as leghemoglobin that is made among the nodules. Legumes ar well-known nitrogen-fixing crops and are used for hundreds of years in crop rotation to keep up the health of the soil.

The following are inherent in the organization process: ability to survive vaccination onto seed, to multiply within the spermosphere (region encompassing the seed) in response to seed exudates, to connect to the foundation surface, and to colonize the developing scheme. The powerlessness of Plant Growth Promoting Rhizobacteria within the field has typically been attributed to their inability to colonize plant roots. a spread of microorganism traits and specific genes contribute to the present method, however solely many are known. These embody motility, taxis to seed and root exudates, production of pili or fimbriae, production of specific cell surface parts, ability to use specific parts of root exudates, macromolecule secretion, and gathering sensing. The generation of mutants altered in expression of those traits is aiding our understanding of the precise role all plays within the organization method.

Conclusion:

Plant Growth Promoting Rhizobacteria are capable of enhancing plant growth by direct and indirect means that, however the particular mechanisms concerned haven't all been well characterised. Direct mechanisms of plant growth promotion by PGPRs are often incontestable within the absence of plant pathogens or different rhizosphere microorganisms, whereas indirect mechanisms involve the flexibility of PGPRs to cut back the harmful effects of plant pathogens on crop yield. PGPRs are reportable to directly enhance plant growth by a spread of mechanisms: fixation of part gas transferred to the plant,production of siderophores that chelate iron and create it on the market to the plant root, solubilization of minerals like phosphorus, and synthesis of phytohormones. Direct improvement of mineral uptake because of will increase in specific particle fluxes at the foundation surface within the presence of PGPRs has additionally been reportable. PGPR strains might use one or additional of those mechanisms within the rhizosphere. Molecular approaches victimization microbic and plant mutants altered in their ability to synthesize or reply to specific plant products have raised understanding of the role of phytohormone synthesis as an immediate mechanism of plant growth improvement by PGPRs. Plant Growth Promoting Rhizobacteria that synthesize auxins and cytokinins or that interfere with plant olefin synthesis are known.

Keywords: Plant Growth Promoters,Plant Growth Promoting Rhizobacteria,Nitrogen fixation,Plant Growth

Biography :

Deepmala katiyar is currently pursuing her Post-doctoral Studies on Plant Growth promoting Rhizobacteria of sugarcane. She has attended more than 20 National and International conferences. She has published 25 research papers and 4 book chapter and 1 book. She has received 1 young scientist awards and 6 best paper presentation awards from various National and International conferences. She is the Editorial Board Member of International Journal of Pharma and Biosciences

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