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Perspective

Microbial Inoculants: Dynamics of Agroecosystems

Samira Shah*

Department of Microbiology, University of Delhi, New Delhi, India

DESCRIPTION

Microbial inoculants also identified as soil inoculants or bioinoculants are agricultural amendments that practice beneficial rhizosphericic or endophytic microbes to promote plant health. Several microbes involved form symbiotic relationships with the target crops where both parties benefit (mutualism). While microbial inoculants are applied to progress plant nutrition, they can also be used to stimulate plant growth by stimulating plant hormone production.

Research into the benefits of inoculants in agriculture extends beyond their capacity as biofertilizers. Microbial inoculants can encourage Systemic Acquired Resistance (SAR) of crop species to several common crop diseases (provides resistance against pathogens). So far SAR has been validated for powdery mildew (*Blumeria graminis f. sp. hordei*), take-all (*Gaeumannomyces graminis var. tritici*), leaf spot (*Pseudomonas syringae*) and root rot.

The rhizobacteria commonly applied as inoculants comprise nitrogen-fixers, phosphate-solubilisers and other root-associated beneficial bacteria which enhance the availability of the macronutrients nitrogen and phosphorus to the host plant. Such bacteria are commonly stated as Plant Growth Promoting Rhizobacteria (PGPR).

To improve phosphorus nutrition, the use of Phosphate-Solubilising Bacteria (PSB) such as *Agrobacterium radiobacter* has also received attention. As the name suggests, PSB are free-living bacteria that break down inorganic soil phosphates to simpler forms that enable uptake by plants.

Symbiotic relationships between fungi and plant roots are denoted as Mycorrhiza association. This symbiotic relationship exists in nearly all land plants and gives both the plant and fungi advantages to survival. The plant can give upwards of 5%-30% of its energy production to the fungi in exchange for increasing the root absorptive area with hyphae which gives the plant access to nutrients otherwise not be able to attain. The two most common mycorrhizae are arbuscular mycorrhizae and ectomycorrhizae. *Ectomycorrhizae* associations are most frequently found in woody-species, and have fewer implications for agricultural systems.

Fungal inoculation alone can profit host plants. Inoculation paired with other amendments can further advance conditions. Arbuscular mycorrhizal inoculation joined with compost is a common household amendment for personal gardens, agriculture, and nurseries. It has been observed that this pairing can also encourage microbial functions in soils that have been affected by mining.

CONCLUSION

Certain fungal partners do top in specific ecotones or with certain crops. Arbuscular mycorrhizal inoculation paired with plant growth promoting bacteria resulted in a higher yield and faster maturation in upland rice paddys.

Maize growth improved after an amendment of arbuscular mycorrhizae and biochar. This amendment can also decrease cadmium uptake by crops.

Fungal inoculants can be castoff with or without additional amendments in private gardens, homesteads, agricultural production, native nurseries, and land restoration projects.

The combination of strains of Plant Growth Promoting Rhizobacteria (PGPR) has been shown to benefit rice and barley. The key benefit from dual inoculation is increased plant nutrient uptake from both soil and fertilizer. Multiple strains of inoculant have also been verified to increase total nitrogenase activity compared to single strains of inoculants, even when only one strain is diazotrophic.

PGPR and arbuscular mycorrhizae in combination can be convenient in increasing wheat growth in nutrient poor soil and improving nitrogen-extraction from fertilised soils.

Correspondence to: Samira Shah, Department of Microbiology, University of Delhi, New Delhi, India, E-mail: samiras@aliyun.com

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