Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 05, Issue: 06 (NOV-DEC, 2025)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Bio-Fertilizers for Sustainable Farming

*J. Vijay
Ph.D., Department of FLA, College of Horticulture, Nauni,
Dr YS Parmar University of Horticulture & Forestry, Solan, H.P.-173230, India
*Corresponding Author's email: jvijaykr@gmail.com

Man has started agricultural practices since time immoral in an organized and organic manner and soon realized that the same land and organic practice cannot meet the need of the growing population on the earth.

- Gradually the concept of organic nutrition with traditional practices has been transformed to chemical fertilizers with modern techniques during the time of green revolution not only in the world but also in India.
- In India start-up of green revolution brought significant developments in food production but with insufficient concern for land suitability and sustainability.
- Indiscriminate use of chemical fertilizers with the aim of higher growth and yield of produce would mean further loss in soil quality, possibilities of water contamination and unsustainable burden on the fiscal system.
- There is a huge need to reduce wide use of chemical fertilizers by suitable substitutes of nutrient resources.
- Bio fertilisers are natural resources of plant nutrients implemented by the nature for the protection against the anthropogenic hazards.
- Bio fertilizer is a large population of beneficial microorganisms either living or latent cells, which enhance the productivity of the crop, when applied to seed, plant surfaces or soil colonizes the rhizosphere or the interior of the plant and promotes growth and yield by increasing supply or availability of plant nutrients to the host plant.
- Organic farming which is based on the principle of restoring, recycling and enhancing ecological balance is highly promising technology. Bio fertilizers are important and indispensible component of organic farming. Organic system of cultivation increases productivity in long run. It also improves the quality of produce and economic returns apart from ensuring sustainability of agriculture.

Development of bio fertilizers

- The bio-fertilizers were initially identified by a Dutch scientist in 1888.
- The commercial production of bio fertilizers has been started with the promotion of 'Nitragin' by Nobbe and Hiltner, a laboratory culture of Rhizobia in 1895.
- In India, N. V. Joshi studied the legume Rhizobium symbiosis and the first commercial production was started in 1956.
- Ministry of Agriculture under the Ninth Plan initiated the real efforts to popularize and promote the input with the setting up of the National Project on Development and Use of Bio fertilizers (NPDUB).

Necessity of bio fertilizers

- All the plants need major and minor nutrients for their growth and development.
- Nitrogen, phosphorus and potassium being the major plant nutrients plays vital role in development of plant.

- Most of the bio fertilizers fixes nitrogen and mobilises or solubilises the phosphorus, some bio fertilizers solubilises micro nutrients and make them available to the plants.
- Plant inoculation with bio fertilizers increases number of lateral root and accelerates root hair formation and increases absorption of soil minerals.
- Atmosphere air contains about 80% nitrogen, even the plant cannot utilize it in free form, but the microbes can fix and solubilize the unavailable form of nutrients to available form.
- Fixed insoluble phosphate in the soil can be solubilized by a group of microbes, known as phosphate solubilizing microorganisms (PSM). These have biochemical mechanisms to convert insoluble unavailable phosphate to soluble available phosphate through organic acid production.
- In addition to nutrients supplement, microbes secrete growth promoting substances like hormones, vitamins, amino acids etc.
- Bio fertilizers supply the nutrients continuously to the plant under the favourable conditions. Bio fertilizers maintain long term soil productivity and ecological sustainability and also make the nutrient supply at cheaper cost along the soil health management.

Classification of bio fertilizers

Bio fertilizers for macro nutrients	
N_2 fixing bio fertilizers	
a. Free-living	*Azotobacter, Beijerinkia, Derxia, Nostoc*
b. Symbiotic	*Rhizobium, Frankia, Anabaena azollae*
c. Associative Symbiotic	*Azospirillum,Gluconoacetobacter diazotrophics*
P solubilizing bio-fertilizers	
a. Bacteria	*Bacillus megaterium* var. *phosphaticum, Bacillus subtilis, Bacillus circulans, Pseudomonas striata*
b. Fungi	*Penicillium sp, Aspergillus awamori*
P mobilizing bio-fertilizers	
a. Arbuscular Micorrhizae	*Glomus sp.,Gigaspora sp.,Acaulospora sp., Scutellospora sp.* and *Sclerocystis sp.*
K mobilizing bacteria	*Frateuria aurantia*
Sulphur oxidizers	*Thiobacillus thiooxidans, Thiobacillus ferrooxidans*
Bio fertilizers for micro nutrients	
1. Silicate solubilizers	*Erwinia, Pseudomonas* sp., *Bacillus* sp
2. Manganese solubilizers	*Pencillium citrinum*
3. Iron solubilizers	*Acidithiobacillus ferrooxidans*
4. Zinc solubilizers	*Bacillus* sp., *Pseudomonas* sp., *Aspergillus niger*
Others	
Plant growth promoting rhizobacteria	
a. PGPR Bacteria	*Pseudomonas fluorescens, Bacillus* sp. Burkholderia, *Herbaspirillum*
b. PGPR Fungi	*Piriformospora indica*
Bio-filmed bio-fertilizers	Fungal-bacterial bio-films (FBB), Fungal-rhizobial bio-films (FRB)
Microbial Consortium	Combination of different microbes

Conclusion

- Basically, India is a country with organic agriculture back ground, but the demand driven forces shifted it to inorganic.
- Use of proper nutrients in agriculture is the most important input for the economic and sustainable crop production.
- As the trend in farming is changing from indigenous cultivation to modern intensive cultivation.
- Bio fertilizer is an organic product, can be amended in soil to improve soil and plants health.