



SCIGEM

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Biofertilizers



(Picture courtesy: indiaclimatedialogue.net)

Throughout ages the growth and sustainability of any civilization has been largely attributed on its efficiency to generate significant agricultural output. An agriculturally superior nation always corresponds to an economically stable and developed nation. With the rapid increase in the population worldwide there has been a steady need to increase the allotment of food resource and hence agricultural productivity to feed the population. The discovery of chemical fertilizers served this goal and in a way revolutionized agriculture. They played a benevolent role in increasing the net productivity or yield of crops but not without its fair share of health hazards. Thus the need for a better and safer alternative was in demand. This was brought about by biofertilizers, which as the name implies are fertilizers of biological origin.

Biofertilizers- What the name implies?

Biofertilizers are defined as preparations containing living or latent cells of efficient strains of microorganisms which when applied through seed or soil helps crops/plants' to uptake nutrients effectively through their interactions in the rhizosphere. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants. Several microorganisms and their association with crop plants are being exploited in the production of biofertilizers. They can be grouped in different ways based on their nature and function.

Use of biofertilizers

Bio-fertilisers are living microorganisms of bacterial, fungal and algal origin. Their mode of action differs and can be applied alone or in combination.

- Biofertilizers fix atmospheric nitrogen in the soil and root nodules of legume crops and make it available to the plant.
- They solubilise the insoluble forms of phosphates like tricalcium, iron and aluminium phosphates into available forms.
- They scavenge phosphate from soil layers.
- They produce hormones and anti metabolites which promote root growth.
- They decompose organic matter and help in mineralization in soil.

When applied to seed or soil, biofertilizers increase the availability of nutrients and improve the yield by 10 to 25% without adversely affecting the soil and environment.

Bio-Fertilizers in India

In India the first study on legume Rhizobium symbiosis was conducted by Dr. N. V. Joshi and the first commercial production of biofertilizers started as early as 1956. However the Ministry of Agriculture under the Ninth Plan initiated the real effort to popularize and promote the input with the setting up of the National Project on Development and Use of Biofertilizers (NPDB). Although biofertilizers have been promoted as supplement or complement of chemical fertilizers, in reality they are two alternative means of accessing plant nutrients. The strength of complementarity as against substitution between the two inputs is open to empirical verification, but there is no denying that farmers and producers do perceive the substitutability relation and believe that to an extent biofertilizers have various benefits. Besides accessing nutrients, for current intake as well as residual, different biofertilizers also provide growth-promoting factors to plants and some have been successfully facilitating composting and effective recycling of solid wastes. By controlling soil borne diseases and improving the soil health and soil properties these organisms not only help in saving, but also in effectively utilising chemical fertilizers and result in higher yield rates. To attain production targets, the Govt. of India implemented a central sector scheme called National Project on Development and use of Biofertilizers (NPDB) during the Ninth Plan for the production, distribution and promotion of biofertilizers. A National Biofertilizers Development Centre was established at Ghaziabad as a subordinate office of the Department of Agriculture and Cooperation with six regional centres.

Table 1. Some examples of the biofertilizers

Groups	Examples	Crops suited for
Free-living N ₂ fixing biofertilizers	<i>Azotobacter, Beijerinckia, Clostridium, Klebsiella, Anabaena, Nostoc,</i>	Soil treatment for leguminous crops
Symbiotic N ₂ fixing biofertilizers	<i>Rhizobium, Frankia, Anabaena azollae</i>	Legumes like pulses, grains etc.
Associative Symbiotic N ₂ fixing biofertilizers	<i>Azospirillum</i>	Non-legumes like maize, barley, oats, sugarcane, rice etc.
P Solubilizing biofertilizers -Bacteria	<i>Bacillus megaterium var. phosphaticum, Bacillus subtilis, Bacillus circulans, Pseudomonas striata</i>	Soil application for all crops
P Solubilizing biofertilizers- Fungi	<i>Penicillium sp, Aspergillus awamori</i>	Soil application for all crops
P Mobilizing biofertilizers - Arbuscular mycorrhiza	<i>Glomus sp., Gigaspora sp., Acaulospora sp., Scutellospora sp. & Sclerocystis sp.</i>	Many trees, some crops and some ornamental plants.
P Mobilizing biofertilizers Ectomycorrhiza	<i>Laccaria sp., Pisolithus sp., Boletus sp., Amanita sp.</i>	Many trees and some crops
P Mobilizing biofertilizers- Ericoid mycorrhizae	<i>Pezizella ericae</i>	Many crops
P Mobilizing biofertilizers- Orchid mycorrhiza	<i>Rhizoctonia solani</i>	Many crops
Biofertilizers for Micro nutrients- Silicate and Zinc solubilizers	<i>Bacillus sp.</i>	Many crops and trees
Plant Growth Promotion- Pseudomonas	<i>Pseudomonas fluorescens</i>	Many crops and trees

The coexistence of smaller new units with the larger ones of higher vintage has increased the variety in industry as measured by the coefficient of variation. Public sector fertilizer giant IFFCO is located in Phulpur in Uttar Pradesh, IFFCO's MLN Farmers' Training Institute produces all strains of biofertilizers and have it distributed in other states. About 70% of the small biofertilizer units came into being after March 1995. The small units show some tendency to specialize in either nitrogen fixers or phosphate solubilizers while all the large units produce both kinds. Eastern states like West Bengal, Bihar and Orissa have also served their part in producing biofertilizers but the production and distribution has gone notably down during the last few years.

The total requirement of various bio-fertilizers that are required for seed/root treatment and soil is estimated to be about 0.426 million ton, based on net cultivated area. Government is promoting bio-fertilizers through various schemes of National Mission for Sustainable Agriculture (NMSA)/ Paramparagat Krishi Vikas Yojana (PKVY),

Rashtriya Krishi Vikas Yojana (RKVY) and National Mission on Oilseeds and Oil Palm (NMOOP), National Food Security Mission (NFSM) and Indian Council of Agricultural Sciences (ICAR). The Indian Council of Agricultural Research (ICAR) under Network project on Organic Farming has undertaken many research projects to develop location specific organic farming package of practices for crops and cropping systems. Presently, the project is being implemented in 20 centres covering 16 States. Organic farming practices for 18 crops/cropping systems have been developed as a systematic package. Under ICAR's network project on Soil Biodiversity and Biofertilizer, improved and efficient strains of biofertilizers specific to different crops and soil types have been developed. Liquid biofertilizer technology with higher shelf life has also been developed. The Council has developed technologies to prepare various types of organic manures such as phosphocompost, vermicompost, municipal solid waste compost, bio-enriched compost etc. from various organic wastes. The ICAR also imparts training, organizes front line

demonstrations to educate farmers on all these aspects.

World's first biosynthetic nano-fertiliser developed in India

A new variant of nano-fertilizers was developed by Dr J.C Tarafdar, an agro-scientist of the Central Arid Zone Research Institute under the Indian Council of Agricultural research (ICAR). The fertilizer was prepared by developing a methodology to use microbial enzymes for breakdown of the respective salts into nano-form. The newly developed nano-fertilizer has been estimated to bring down the use of chemical fertilizers by 80-100 times, thus saving considerable foreign exchange in import of fertilizers. It increases the Nutrient Use Efficiency (NUE) of crops by three-fold and makes them 10 times more stress tolerant. This nano-fertilizer is completely of biological source, is eco-friendly and improves moisture retention and soil aggregation. There is no precarious health hazard and is suitable for more or less all crop varieties. However, more research and marketing is essential to successfully establish the

biofertilizer industry in India. A dedicated and simpler approach to help the farmers understand the need and relevance of biofertilizers will surely provide a larger benefit. The initiatives taken by the government and public sectors along with the initiatives from numerous state funded research units must be put forward effectively as soon as possible. As the market is quite unsaturated currently, these initiatives will ultimately lead to commercial success once the technology is transmitted to the field and draw private enterprises to invest in establishing industries.



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