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Importance of Bio fertilizers in Organic Farming

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Organic farming is one of the leading ideas for quality food production with sustainability of soil and environment. This can serve as a good alternative for sustainable food production without the risk of chemical residues on the same. Organic farming is a system of crop production without the use of synthetic inputs like fertilizers or pesticides. For the long term safety and health concerns, organic farming is the ultimate option to choose and implement on particular crops and climatic conditions.

And to enhance the effect of organic farming, bio fertilizers are the key essential elements of inputs. Bio fertilizers contain nitrogen fixing, phosphate solubilizing, and cellulolytic microorganisms used for application to seeds, soil, and composting areas with a view to increase number of microbes and accelerate microbial activity.

Microbial activity is essential for good growth of plants which help in the improvement of nutrient availability and uptake by plants. Plant growth is impeded in the insufficient availability of nutrients. Bio fertilizers are known to improve the yield upto 40%.

Bio fertilizers: Nature's own formula for sustainable farming.

What is the need of Bio fertilizers?

The impacts of excessive use of chemical inputs are clearly visible on the farms, soil health and human health. Number of cancer patients are increasing and many of them belong to the farmer families.

Bio fertilizer is a sustainable, less harmful, target oriented, and environmentally safer option.

People are getting more aware about the impacts of conventional farming. They prefer organic products over the conventionally produced goods. People are also ready to pay premium prices for them. Bio fertilizers play a crucial role in achieving this.

What are Bio fertilizers?

Bio fertilizers are products which are used to enrich the soil fertility and nutrient availability by incorporating living microorganisms and their products into the soil. *Rhizobium, Azolla, Azotobacter, Azospirillium, Acetobacter* etc. Are some examples.

Nitrogen fixing *Rhizobium*:

Rhizobium belongs to the family Rhizobiaceae. It is symbiotic in nature and fixes nitrogen in association with legumes. Rhizobium can fix nitrogen about 50-100 kg per hectare. *Rhizobium* is strain specific which acts in association with a particular crop only. It forms tumor like growth on the roots of plants called root nodules. These root nodules are colonized by the bacteria and fix atmospheric nitrogen by converting them into nitrate form. Nitrate form of nitrogen is available for uptake by plants.

Rhizobium leguminosarum – Peas

Bradyrhizobium spp. – Soybean

Rhizobium meliloti - Alfalfa

Rhizobium loti – Lotus

Azospirillium:

It belongs to the family Spiriliaceae. It is heterotrophic and associative in nature. They have a nitrogen fixing ability of about 20 to 40 kg per hectare along with the ability to produce growth regulating factors.

Although there are many discovered species of *Azospirillium* like *A.amazonense, A.brasilense, A.lipoferum* etc., but the worldwide distribution and benefits of inoculation have been proved for *A.lipoferum and A.brasilense. Azospirillium* forms symbiotic association with rhizosphere of C4 plants and utilise the organic acids like malic and aspartic acid removed as a product of the C4 photosynthetic pathway.

Azotobacter:

Belonging to the family of Azotobacteriaceae, *azotobacter* is aerobic , free living and heterotrophic in nature. They are mostly found in neutral to alkaline soils. *A. chroococcum* is the most commonly occurring species in the arable soils used for farming. *A.vinelandii, A.beijerinckii, A.insignis* and *A.macrocytogenes* are some other reported species. The population of *Azotobacter* in soil rarely exceeds 104 to 105 per gram of soil due to lack of organic matter and presence of antagonistic microorganisms present in them. The bacteria

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produce anti-fungal antibiotics which inhibit the growth of several pathogenic fungi in the soil and around the plants, thus protecting the seedlings from mortality upto a certain extent.

Blue Green algae (cyanobacteria) and *Azolla*:

Blue green algae belonging to eight different families are phototrophic in nature and produce auxin, gibberellic acid, indole acetic acid and fix 20 to 30 kg Nitrogen per hectare. These are usually used in association with *Azolla* which is a type of fern, inside which the cyanobacteria inhabit. This association is highly used in the submerged conditions of paddy fields which take up nitrogen in the ammoniacal (NH_4^+) form. They are also known as 'Paddy Organisms' as they are used as key inputs in the lowland paddy production. They act a major source of Nitrogen in these kinds of paddy fields. Approximately 40 to 60 % nitrogen requirement is met through the combination of mineralization of soil organic nitrogen and by the biological nitrogen fixation of *Anabaena azollae*. *Azolla* contains 4-5% nitrogen on dry basis and 0.2 to 0.5 % on wet basis.

Modern Aspect of Bio fertilizers:

The modern aspect of bio fertilizers takes into account the use of Nano-biofertilizers. It is a high- tech hybrid of Nano-technology and biological sciences.

Think of them as 'smart' fertilizers. While traditional fertilizers are like dumping a bucket of water on plant, nano-biofertilizers are like a precise drip irrigation system applying water directly to the root zone. Nano-biofertilizers also include a team of tiny gardeners to look after the soil requirements. A nano-biofertilizers molecule is basically encapsulated beneficial microorganisms which get released at a slower and consistent rate as per the soil requirement.

How do Nano-biofertilizers Work?

Nano encapsulation is the technology used here. Microbes or nutrients are package in nano-scale coating like Chitosan or Zeolite. This prevents them from leaching out by rain or irrigation.

The concept of targeted release also plays a major role by breaking the coat and releasing the contents only when triggered by specific conditions like moisture availability, change in soil pH or in the response of root exudates. This technology is of use where the nutrients are lacking and can't be retained by the soil for a longer period.

Considering the lacking fertility and decreasing production potential of soils in the current situation, bio fertilizers can act as a sustainable source of nutrients like nitrogen, phosphorus and potassium. Bio fertilizers can't replace all the fertilizer requirement but can contribute to a large extent when used along with conventional inputs. Soil health and biodiversity can also be improved by their use.

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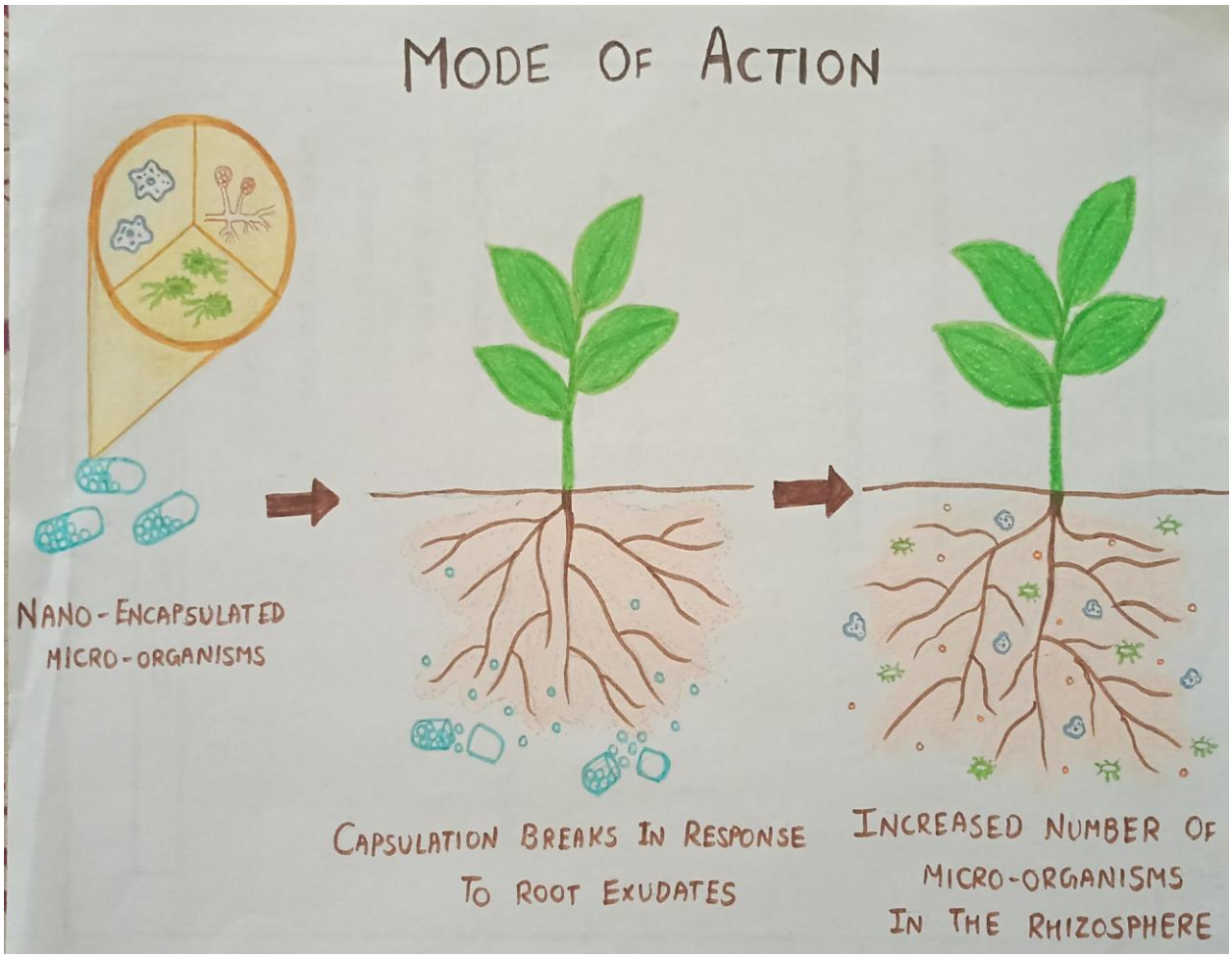
"Feed soil with life then soil will feed the World!"



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