

Adoption of Biofertilizers in the Agricultural Industry

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Abstract: Nutrients are essential for production of plants/ crops and a supply of food for the increasing population of the world. Soil management strategies have adopted the use of chemical based fertilizers, which have an adverse impact on human health and lead to environmental deterioration. Biofertilizers contain micro-organisms and are a substitute to the conventional chemical fertilizers, which provide the plants with the nutritional requirements while protecting the environment. The use of biofertilizers helps improve the productivity and quality of the yield, and is an eco-friendly and cost effective solution for agriculturalists and farmers.

Keywords: Biofertilizers, fertilizers, bacteria, soil fertility, crop yield, acidification, nitrogen fixation.

Need for Fertilizers

Soil provides plants with nutrients such as nitrogen, potassium, calcium and phosphorus to grow. The soil may lose its fertility due to soil erosion, soil run off, burning of crop residues and leaching, and thus will not be able to provide the plants/ crops with the required nutrients. As a result of which the plants/ crops will not grow due to nutrient deficiency. This may lead to a shortage of the food/ crop produce essential to feed the world population.

After a harvest of crops for the human consumption the soil loses its nutritional value and needs to be renewed and rejuvenated. Thus in order to maintain the fertility of the soil, farmers turn to fertilizers. Fertilizers contain plant nutrients such as nitrogen, phosphorus and potassium to supplement the elements that are naturally present in the soil.

Types of Fertilizers

The fertilizers are available in different forms- powder, liquid and granular. The liquid fertilizers are often used for gardening with the help of a water hose attachment. The powder fertilizers can be spread on the soil by hand and need to be watered for absorption by the soil. The Granular fertilizers can be spread on top of the soil and the nutrients get soaked in soil overtime, by watering. There are primarily 3 different types of fertilizers essential for the growth of plants:

1. Nitrogen Fertilizers- Nitrogen is essential for the growth of the plant and is crucial in the middle stage of plant's growth when the plants develop new leaves.
2. Phosphate Fertilizers- Phosphorus is needed by the plant throughout its life cycle as it helps in strengthening the roots and stems of the plants. Phosphorus helps improve the process of flowering, seeding and the eventual fruiting. As phosphorus is a slow acting nutrient, the fertilizer should ideally be used in the soil before planting.
3. Potassium Fertilizers- Potassium helps the plant roots grow stronger and deeper. Potassium protects the plant when they are deficient from other nutrients. Potassium is essential for photosynthesis and has the ability to reduce the impact of any disease that that may infect the plants.

Harmful impact of fertilizers on the soil:

As fertilizers improve the productiveness and efficiency of the crops, the farmers tend to use excess fertilizers. Fertilizers that are used on crops tend to be washed out due to rains and get washed away into environments. Excess use of fertilizers is a major cause of soil and water pollution across the globe.

Presence of excess fertilizers in soil may lower the oxygen levels deteriorating the habitability of the micro fauna organisms that live there, eventually leading to negative impact on the environment. Over application of chemical fertilizers to soil may lead to a condition known as chemical leaf scorch, where in the leaves turn yellow or brown hampering the overall crop yield.

The decrease in organic matter in the soil due to the use of fertilizers can lead to soil acidification which may damage the top soil resulting in a reduced crop yield. Continuous use of fertilizers may lead to depletion of the soil nutrients. As a result the food produced will have less vitamin and mineral content. Chemical fertilizers destroy the soil bio-mass that is essential for maintaining the crop ecosystem and ends up damaging the food chain.

What are Bio fertilizers?

Biofertilizers comprise of micro-organisms, which when added to the soil, plant surface or seeds boost the growth of the produce by colonizing the rhizosphere (Interior of the plant). Biofertilizers boost the yield by increasing the availability and supply of primary nutrients by natural processes like nitrogen fixation, solubilizing phosphorus and stimulating crop growth via synthesis of substances that promote growth. The microorganisms present in plants help restore the natural nutrient cycle in the soil while building soil organic matter. This in turn enhances the soil sustainability and soil health.

Components of Biofertilizers

The different components of Biofertilizers include the following:

1. Bio Compost- Plant matter is decomposed by piling up the wastes in fields and leaving it unattended for a long period of time. Worms and fungi are added to aid the process of decomposition. During the decomposition, ammonia and carbon dioxide is

- produced. The ammonia is in turn used by microbes, which make it available to plants as nitrates and nitrites
2. Azotobacter- Free living bacteria with metabolic capabilities promoting atmospheric nitrogen fixation by conversion to ammonia. It protects the roots of the plants from pathogens.
 3. Phosphorous- Phosphorous is an essential element for development of plants. Phosphate solubilizing fungi and bacteria such as penicillin, bacillus, aspergillus etc are used to hydrolyze insoluble compounds into soluble forms, for the growth of the plant
 4. Vermicompost- Worms such as red wigglers, earthworms and white worms are used to decompose vegetables and food waste. The end product is called vermicast which helps reduce contaminants and improve the saturation of nutrients in the soil. Vermicompost provides water-soluble nutrients to the soil and is an excellent soil conditioner. It is used in farming and small scale sustainable, organic farming.
 5. Tricho-card- It helps preserve the plants by acting as an antagonistic hyper parasitic agent against the eggs of several bores, fruits and flower eating pathogens, by killing the pest while it is in the egg stage.

Examples of biofertilizers

1. Rhizobium- It is a symbiotic nitrogen fixing bacteria, which seeks shelter and food from the plant and in return provides Nitrogen to the plants. The use of rhizobium is prominent in the growth of leguminous crops
2. Azospirillum- It provides nitrogen to the plants by a process called associative mutualism, wherein the bacteria lives around the roots of the plants and collects the plant exudate which is used as food by the bacteria.
3. Blue Green Algae or Cyano bacteria- Liverworts, Cycad roots, lichens and fern aid in the nitrogen fixation process for the growth of paddy in upland and lowland conditions.
4. Free living bacteria- Saprotrophic anaerobes such as azobacter, clostridium beijerinckii are free living soil bacteria that perform nitrogen fixation

Benefits of biofertilizers

The use of biofertilizers has a number of proven benefits for the yield of the crop while preserving the environmental equilibrium of the nature. A few benefits associated with the use of biofertilizers are

1. Biofertilizers provide the required nutrients to the soil that that essential to produce a healthy yield of crops/ plants
2. The microorganisms in the biofertilizers help in converting complex organic materials into simpler compounds that are used by plants. This helps in improving the soil fertility and the natural habitat of the soil
3. Use of biofertilizers can lead to an increase crop yield, while providing protection against drought and other soil borne diseases
4. Biofertilizers improve the soil texture by promoting healthier soil leading to farming sustainability
5. It is an eco-friendly and cost effective method
6. Biofertilizers prevent pathogens to flourish and destroy many harmful substances in the soil that cause plant diseases.
7. Biofertilizers have proved to be effective in unfavorable semi arid conditions
8. Biofertilizers being natural fertilizers protect the environment

Conclusion

The use of chemical fertilizers has led to a production of life threatening chemicals which are hazardous for humans and also disrupt the ecological balance. The attention is now shifting to crops grown from biofertilizers. It is important for us to realize the benefits of biofertilizers in the modern day agriculture practice. The beneficial micro-organisms present in biofertilizers play a pivotal role in enhancing the crop productivity, sustainability of the soil and protecting the environment while being an eco-friendly solution. Thus the use of biofertilizers can create a low input system, which can be used to meet the future requirements of sustainable farming

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