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Bio- Fertilizer - A useful Source of Sustainable Food Supply to Crops

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SUMMARY

The availability of food is decreasing day by day. For the growth of crops, three major nutrients namely nitrogen, phosphorus and potassium are mainly required, hence it has become mandatory to supply these nutrients from time to time. The fertility of the soil depends on the amount of different microorganisms present in it. The number of different microorganisms varies depending on the properties of the soil and the condition of the soil. These microorganisms directly and indirectly affect the physical and chemical properties of the soil in various ways, which is why it has an impact on soil formation. Therefore, increasing the number of microorganisms in the soil and maintaining their number at a beneficial level is considered essential for maintaining soil fertility and increasing crop production. For this, the use of Bio-fertilizers is a useful source of sustainable food supply to crops.

INTRODUCTION

Bio-fertilizers are mixtures of useful living or dormant microorganisms in a sterile carrier. When applied to seeds and plants by inoculation or through soil, their number increases to a large extent and through useful processes such as nitrogen fixation, phosphorus dissolution, decomposition of organic matter, etc. they provide abundant supply of nutrients required by the crops, there by significantly increasing production.

Why should we use Bio-fertilizers: -

There is no doubt that irrigation, hybrid varieties, chemical fertilizers and crop protection drugs play a significant role in increasing food grain production, but if we do not pay attention to the side effects of these factors in time, the land is in danger of becoming barren and lifeless. As a solution to this, the role of bacterial fertilizers is important in the future in fulfilling the nutrient needs of crops without spoiling the physical, chemical and biological condition of the soil by using chemical, organic fertilizers, green manures and compost manure in the right amount under integrated fertilizer management. When the deficiency of chemical fertilizers cannot be completely filled by using bacterial fertilizers, it is beneficial to use these fertilizers as supplementary fertilizers along with chemical fertilizers.

Types of Bio-fertilizers: -

Nitrogen-fixing bacteria:-

The earth's atmosphere contains up to 78 % nitrogen, but plants cannot use that nitrogen. Some bacteria live freely in the soil and fix nitrogen in the soil. Fixation, while some bacteria (rhizobium) establish a symbiotic relationship with the cereal crop and fix nitrogen. These bacteria convert nitrogen gas into ammonia and form other nitrogen compounds from ammonia and these are available to the plants.

1. Azotobacter bacteria:-

These bacteria live independently in the soil around the roots of the plant and perform the function of nitrogen fixation in the air in a non-biological manner. There are many species of these bacteria, but in the soil of tropical regions like India, the species “Azotobacter crococum” is mainly seen. Azotobacter bacteria stabilize the nitrogen gas present in the free form in the air and make it available to the crop, due to which the crop grows vigorously, gets 10 to 25 % more yield and saves 20 to 25 kg/ha of nitrogen fertilizer. This bacterial fertilizer can be used for any crop other than pulses, e.g. cereals, millets, vegetables, fruit trees, potatoes, sugarcane, ginger, flowers, etc. Since Azotobacter bacteria live on the energy produced by the decomposition of organic matter, this bacteria works best in soil that has a high content of organic matter.

2. Rhizobium bacteria:-

These bacteria work symbiotically; these bacteria fix nitrogen from the air in the root nodules of the crop. Since these bacteria can not fix nitrogen independently without the crop, these bacteria are called symbiotic

bacteria. These bacteria form nodules on the root and obtain the food they need from the plant and absorb nitrogen from the air and supply it to the crop in the form of ammonia. There are seven different groups of Rhizobium in terms of efficiency and the crops that fall into that group are as follows.

Rhizobium group name Crops

1. Rhizobium itler -Pea group Pea, lentils
2. Rhizobium fasciolus- Ghewda group Shravan Ghewda
3. Rhizobium trifolii -Barseem group Barseem grass
4. Rhizobium meloloti -alpha group Fenugreek, garlic grass
5. Rhizobium lupine - Gram group Gram
6. Rhizobium japonicum - Soybean group Soybean
7. Brady Rhizobium species- Chavali group Groundnut, Tur, Moong, Urid, Chavali, Wal, Matki, Hulga.

Bacteria of one group are not useful for crops of another group. Since bacteria of a specific group are beneficial if used for crops of the same specific group, it is very important to make sure which group they belong to when using Rhizobium bacteria. After the Rhizobium bacteria are cultured on the seeds, due to the moisture in the soil, these bacteria can survive on organic matter around the seeds for a few days. As soon as the plant is formed from the seed, these bacteria accumulate around the roots of that plant because the roots of the plants secrete some organic acids, sugars, vitamins and growth promoting substances, the skin of the root becomes soft and the part between the two cells dissolves and the Rhizobium bacteria enter the root. This entry is continuous like a rope. More than one nodule is formed on a single root, the pigment "leghemoglobin" which is necessary for nitrogen fixation in these nodules keeps the colour of the nodule pink and the function of nitrogen fixation is carried out in these nodules.

3. Azospirillum bacteria:-

Like Azotobacter, the use of Azospirillum bacteria fertilizers is useful for cereals, pulses, vegetables, fruit trees, potatoes, sugarcane, ginger, flowers, sweet potatoes, carrots, garlic, etc. crops, except for pulses. By using this, you can get 10 to 40 % more production depending on the availability of organic matter in the soil.

4. Blue-green algae:-

There are many types of blue-green algae, but among them, nitrogen-fixing species are only 4 % of the total species. There are two types of nitrogen-fixing algae, unicellular and multicellular. Out of these, the multicellular type is important and some cells in their filamentous cell threads are double-stranded. The process of nitrogen fixation takes place in such double-stranded cells. 40 to 50 % of the total nitrogen required by the rice crop can be obtained from blue-green algae. A total of 30 to 40 kg per hectare. Nitrogen is made available to the crop. After planting for rice crop, 20 to 30 kg per hectare of blue-green algae should be used.

5. Azolla:-

Azolla is a plant of the Niche class that grows on water and is used as a nitrogen-rich green fertilizer in rice farming. Since Azolla is a green plant, it is nourished by absorbing carbon from the air. Azolla leaves are green on the upper side and white on the lower side. There is a micro-cavity on the upper side of each leaf, in which there is a filamentous blue-green algae called "Anabaena azoli" that fixes nitrogen from the air. Azolla and blue-green algae have a symbiotic relationship, and the algae's job is to fix nitrogen from the air and supply it to Azolla. In return, the algae gets some nutrients from Azolla. Since Azolla itself cannot fix nitrogen, it has to depend on algae for the availability of nitrogen. Azolla contains 94 percent water, 1 percent minerals and 5 percent nitrogen. Due to the high amount of water and nitrogen, Azolla decomposes in the soil within a week, making nitrogen available to rice. Azolla can be used as a green manure or Azolla can be grown along with rice crops in rice fields.

6. Acetobacter bacteria: -

These bacteria are endophilic and fix nitrogen in all parts of the sugarcane (leaves, stems and roots), so the nitrogen fixed by them is completely used for the growth of sugarcane. Since the bacteria live in sugarcane, the carbon required for its growth is taken from sugar, so the efficiency of the bacteria to fix nitrogen increases and more nitrogen is fixed. Using 10 kg/ha of this bacterial fertilizer increases the length, thickness and sugar content of sugarcane stalks.

7. Phosphorus-soluble bacteria: -

The phosphorus provided by chemical fertilizers is not available to all crops, of this 20 to 25 % of the phosphorus can be used by crops. The remaining 70 to 80 % of phosphorus is fixed on the soil particles and is not available to the crop. Crops cannot fully utilize the available phosphorus, for which specific types of bacteria perform the function of dissolving phosphorus, thus making it available to the crops. Fixed on the soil particles and available they decompose the unavailable phosphorus and convert it into a liquid form that can be dissolved in water. Many microorganisms participate in phosphorus bacterial fertilizer. For example, bacteria, fungi and mycorrhizae work to dissolve phosphorus. Many organic acids like citric acid, lactic acid, malic acid, fumaric acid are produced by the phosphorus-soluble bacteria and combine with the insoluble phosphorus and convert it into a soluble, available form.

8. Bacteria that decompose organic matter:-

In order to decompose any organic matter, the activity of bacteria that decompose organic matter has to take place on it. The participation of organic matter in the soil is very important for maintaining the productivity of the soil. For this, efforts are needed to increase the number of microorganisms that decompose organic matter in the soil. Organic matter introduced into the soil undergoes a process of decomposition under the influence of various microorganisms in the soil, resulting in the formation of new organic matter and ultimately its conversion into humus. In this process of decomposition and formation of humic matter, the plant nutrients locked in the original organic matter are released into the soil. They become easily available to the crops. In this way, the plant's nutrients are fully utilized cyclically.

Benefits of using bacterial fertilizers:-

1. Bacterial fertilizers are cheaper than chemical fertilizers and their prolonged use improves the soil structure.
2. Due to the significant increase in the number and length of roots, the nutrients and water present in the soil far and deep from the main trunk become available to the crop, which leads to a significant increase in production.
3. Due to the increase in the disease and pest resistance of crops, there is a slight saving in crop protection costs.
4. The amount of phosphorus available in the soil increases.
5. Bacteria in bacterial fertilizers produce substances necessary for the growth of crops, thus having a good effect on the germination and growth of seeds and helping in increasing production.
6. The fertility of the soil increases and the texture improves.

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