

# Biofertilizers & Biopesticides

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# Introduction

- Green revolution has revolutionized the world agriculture by increasing the yields of food crops by the development of high-yielding varieties but the continuous and excess use of chemical fertilizers has changed the soil characteristics to acidic/alkaline leading to the reduction in the naturally occurring microorganisms in soil that resulted in the stagnation/reduction in crop yields.
- In some areas the use of chemical pesticides and fertilizers has reached alarming levels with grave implications for human health, the ecosystem and ground water.
- Use of microorganisms (biofertilizers and biopesticides) as an alternate to synthetic fertilizers and pesticides to increase the soil fertility and disease and pest control in agriculture is gaining prominence.
- Biofertilizers and biopesticides are environmental friendly products.

# Biofertilizers

- Biofertilizers are considered to be an important alternative source of plant nutrition.
- They are the preparations containing live or latent cells of efficient strains; microorganisms such as bacteria, algae or fungi used for application to seed, soil or composting areas with the objective of increasing number of such microorganisms and accelerate those microbial processes which augment the availability of nutrients that can be easily assimilated by plants.
- Biofertilizers are biologically active products, with the ability to provide plants with nutrients and may be nitrogen fixers, phosphorus solubilizers, sulphur oxidisers or organic matter decomposers. In short, they are called as bioinoculants which on supply to plants improve their growth and yield.
- They are being essential component of organic farming.

# Types of Biofertilizers

- Most biofertilizers belong to one of two categories: nitrogen fixing and phosphate solubilising.
- 1. Nitrogen fixing biofertilizers:** Nitrogen fixing biofertilizers fix atmospheric nitrogen into forms which are readily useable by plants. These include *Rhizobium*, *Azotobacter* and *Azospirillum*, Blue Green Algae (BGA) and *Azolla*.
- While *Rhizobium* requires symbiotic association with the root nodules of legumes to fix nitrogen, others can fix nitrogen independently.
- 2. Phosphate solubilising micro-organisms:** Phosphate solubilising micro-organisms such as *Bacillus*, *Pseudomonas*, *Aspergillus* etc. secrete organic acids which enhance the uptake of phosphorus by plants by dissolving rock phosphate.
- Some others are **phosphate mobilizers** and **zinc solubilizers**.

# Advantages of Biofertilizers

- Renewable source of nutrients.
- Sustain soil health and increase the grain yields by 10-40%
- Supplement chemical fertilizers and replace 25-30% chemical fertilizers,
- Decompose plant residues, and stabilize C: N ratio of soil.
- Improve texture, structure and water holding capacity of soil.
- Stimulates plant growth by secreting growth hormones and has no adverse effect on plant growth and soil fertility.
- Solubilize and mobilize nutrients.
- Eco-friendly, non-pollutant and cost effective method.

## Limitations of biofertilizers

- Non availability of appropriate and efficient strains of bacteria.
- Lack of suitable carrier, due to which self life is short, is another constraint.
- Marketing of biofertilizer is not easy as the product contains living organisms.
- Seasonal demand and production of biofertilizers.
- Scarcity and viability of vesicular Arbuscular Mycorrhizal (VAM) inoculum during storage and transportation is the major problem.
- Lack of awareness of farmers.
- Inadequate and inexperienced staff.

VAM is a fungus which has the ability to dissolve the phosphates found in abundance in the soil.

# Biopesticides and Bio-control Agents

- Biopesticides are a vital component of sustainable agriculture.
- Biopesticides are derived from natural materials such as animals, plants, bacteria, and certain minerals widely used for controlling insects and disease causing pathogens.
- The biopesticides are categorized under microbial pesticides, plant-incorporated-protectants and biochemical pesticides, which are produced through naturally occurring substances that control pests by non-toxic mechanisms.
- Biopesticides are usually inherently less toxic; generally affect only the target pest, effective in very small quantities, easily biodegradable, thereby resulting in lower exposures and largely avoiding the pollution problems.

# Classes of Biopesticides

- Biopesticides fall into three major classes:

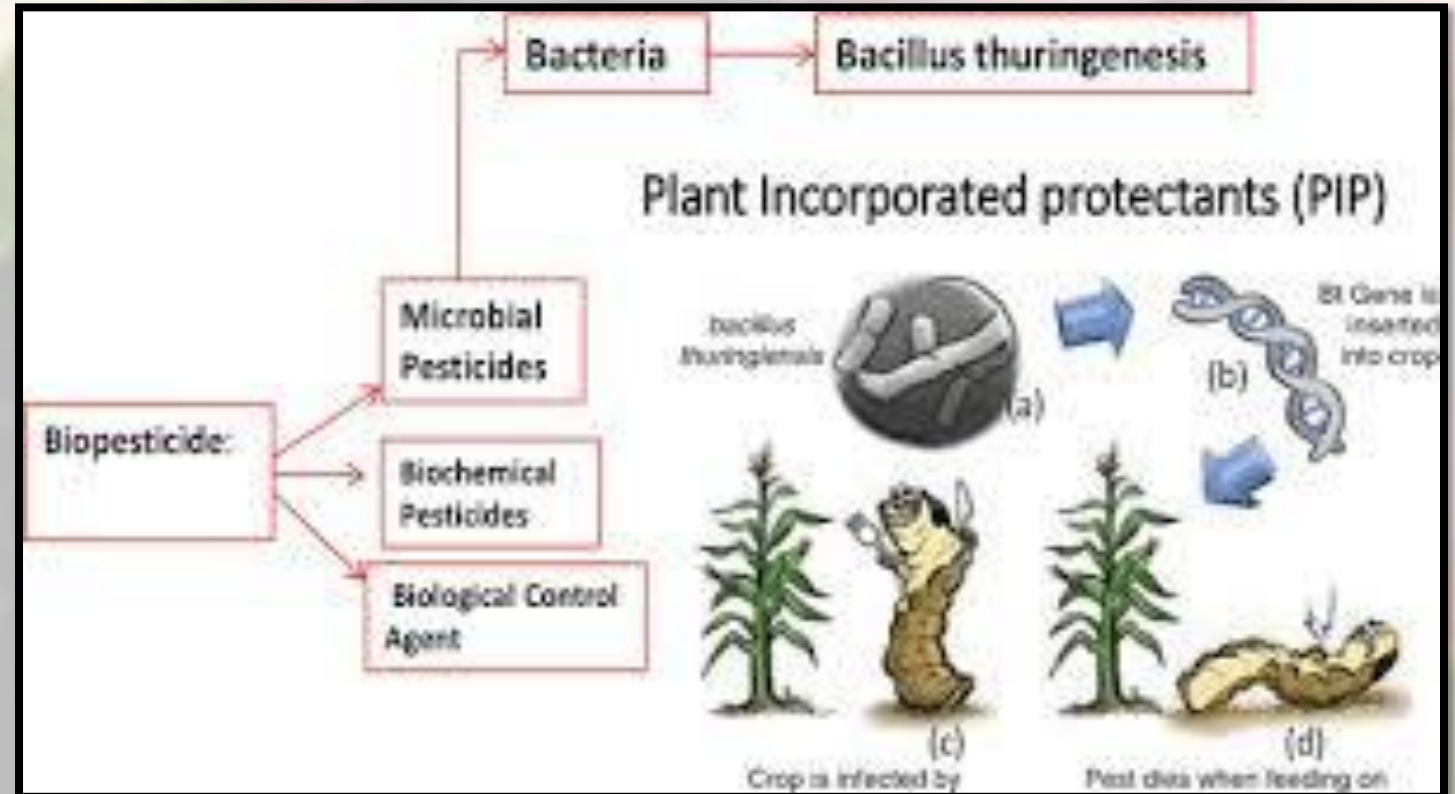
**1. Microbial pesticides:** Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pest[s]. For example, there are fungi that control certain weeds, and other fungi that kill specific insects. The most widely used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or Bt. Each strain of this bacterium produces a different mix of proteins, and specifically kills one or a few related species of insect larvae. While some Bt's control moth larvae found on plants, other Bt's are specific for larvae of flies and mosquitoes.

**2. Plant-Incorporated Protectants (PIPs):** PIPs are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt. pesticidal protein, and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt. bacterium, manufactures the substance that destroys the pest.



# Classes of Biopesticides

**3. Biochemical/ herbal pesticides:** Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Biochemical pesticides include substances, such as insect sex pheromones that interfere with mating as well as various scented plant extracts that attract insect pests to traps.



# The Advantages of Biopesticides

- Biopesticides are usually inherently less toxic than conventional pesticides.
- Biopesticides generally affect only the target pest and closely related organisms.
- Biopesticides often are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution Problems.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly decrease the use of conventional pesticides, while crop yields remain high.

# Disadvantages of Biopesticides

- Instability of the protection effect.
- Limited period of activity.
- Biopesticides are usually are used with normal pesticide application techniques.
- Difficulty in establishment of the biopesticide agents in the fields.
- Ambiguity of modes of protection.
- Low potency.
- High cost of production.

# Difference Biopesticides and Chemical Pesticides

<b>Biopesticides</b>	<b>Chemical Pesticides</b>
Friendly to non-target species	Harmful to non-target species
Do not cause pollution	Serious pollution to the environment
Relatively cheaper	Relatively expensive
Pests never develop resistance	Pests eventually become resistant
Growing market preference	Diminishing market

Thank you . . .