

**Module 1**

1. **Which of the following is an example of a microbial pathogen used in biological pest management?** a) Pyrethrum b) *Bacillus thuringiensis* (Bt) c) *Trichoderma* spp. d) Neem oil

**Answer: b) *Bacillus thuringiensis* (Bt)**

2. **Entomopathogenic nematodes are used to control:** a) Fungal diseases in crops. b) Weeds in agricultural fields. c) Insect pests in the soil. d) Viral infections in livestock.

**Answer: c) Insect pests in the soil.**

3. **Which of the following is a fungal pathogen commonly used for biological control of insect pests?** a) *Bacillus thuringiensis* (Bt) b) *Beauveria bassiana* c) *Trichoderma harzianum* d) *Pseudomonas fluorescens*

**Answer: b) *Beauveria bassiana***

4. **The use of pathogens in pest management is an example of:** a) Chemical control. b) Physical control. c) Cultural control. d) Biological control.

**Answer: d) Biological control.**

5. **Which of the following statements about microbial pathogens in pest management is true?** a) They have broad-spectrum activity and may harm non-target organisms. b) They are ineffective in humid environments. c) They can be genetically modified to increase their virulence. d) They have no impact on pesticide resistance in target pests.

**Answer: c) They can be genetically modified to increase their virulence.**

6. **Which of the following pathogens is commonly used to control mosquito larvae in aquatic habitats?** a) *Beauveria bassiana* b) *Bacillus thuringiensis israelensis* (Bti) c) *Metarhizium anisopliae* d) *Paecilomyces lilacinus*

**Answer: b) *Bacillus thuringiensis israelensis* (Bti)**

7. **Which of the following is a viral pathogen used for controlling insect pests?** a) *Trichogramma* spp. b) *Steinernema carpocapsae* c) Granulovirus d) *Chrysoperla carnea*

**Answer: c) Granulovirus**

8. **What is the primary mode of action of microbial pathogens in biological pest management?** a) Disruption of insect nervous system b) Inhibition of insect feeding c) Physical puncturing of insect cuticle d) Blockage of insect spiracles

**Answer: a) Disruption of insect nervous system**

9. **Which of the following substances do weaver ants use to glue leaves together during nest construction?** a) Silk b) Wax c) Formic acid d) Resin

Answer: a) Silk

10. **Weaver ants belong to which taxonomic family?** a) Formicidae b) Hymenoptera c) Arachnida d) Coleoptera

**Answer: a) Formicidae**

11. **What is the scientific name of the most common species of weaver ant?** a) *Oecophylla smaragdina* b) *Atta cephalotes* c) *Camponotus floridanus* d) *Solenopsis invicta*

**Answer: a) *Oecophylla smaragdina***

12. **Which of the following insects is commonly known as an assassin bug and is known for its predatory behavior against various pest species?** a) Ladybird beetle b) Reduviid bug c) Lacewing d) Hoverfly

**Answer: b) Reduviid bug**

13. **What is the primary role of reduviids in biological control?** a) Pollination b) Herbivory c) Predation on insect pests d) Seed dispersal

**Answer: c) Predation on insect pests**

14. **Reduviids are effective predators of which of the following pest species?** a) Caterpillars b) Aphids c) Leafhoppers d) All of the above

**Answer: d) All of the above**

15. **Which of the following is an example of a predatory bioagent used in agroecosystems?** a) *Bacillus thuringiensis* (Bt) b) *Trichoderma* spp. c) Ladybird beetles d) *Rhizobium* bacteria

**Answer: c) Ladybird beetles**

16. **What is the primary role of parasitoid bioagents in agroecosystems?** a) They control weed populations. b) They promote soil fertility. c) They prey on pest insects. d) They fix atmospheric nitrogen.

**Answer: c) They prey on pest insects.**

17. **Which of the following bioagents is used to control caterpillar pests by parasitizing their eggs?** a) *Trichogramma* wasps b) *Bacillus thuringiensis* (Bt) c) *Beauveria bassiana* d) *Rhizobium* bacteria

**Answer: a) *Trichogramma* wasps**

18. **What is the primary mode of action of microbial biocontrol agents such as *Beauveria bassiana* in agroecosystems?** a) They fix atmospheric nitrogen. b) They produce insecticidal toxins. c) They infect and kill insect pests with fungal disease. d) They promote plant growth by colonizing roots.

**Answer: c) They infect and kill insect pests with fungal disease.**

**19. Which of the following bioagents forms symbiotic relationships with leguminous plants and fixes atmospheric nitrogen?** a) Trichoderma spp. b) Rhizobium bacteria c) Ladybird beetles d) Pseudomonas spp.

**Answer: b) Rhizobium bacteria**

**20. What is the role of plant growth-promoting rhizobacteria (PGPR) in agroecosystems?** a) They control soil-borne pathogens. b) They prey on pest insects. c) They fix atmospheric nitrogen. d) They promote plant growth and nutrient uptake.

**Answer: d) They promote plant growth and nutrient uptake.**

## **Module 2**

1. Which of the following is NOT a type of biofertilizer?

- a) Rhizobium
- b) Azotobacter
- c) Urea**
- d) Mycorrhizae

2. Which type of biofertilizer is commonly used for nitrogen fixation in leguminous crops?

- a) Azotobacter
- b) Rhizobium**
- c) Phosphate solubilizing bacteria
- d) Mycorrhizae

3. Mycorrhizae is a type of biofertilizer that enhances the absorption of which nutrient from the soil?

- a) Nitrogen
- b) Phosphorus**
- c) Potassium
- d) Sulfur

4. Which of the following is a primary function of biofertilizers in agriculture?

- a) Controlling pests and diseases
- b) Improving soil structure
- c) Enhancing water retention

**d) Providing essential nutrients to plants**

5. Which type of biofertilizer helps in the solubilization of phosphorus from insoluble forms in the soil?

- a) Azospirillum
- b) Azotobacter

**c) Phosphate solubilizing bacteria**

- d) Rhizobium

6. What is the importance of biofertilizers in sustainable agriculture?

- a) They increase the acidity of the soil.

**b) They reduce soil erosion.**

- c) They decrease soil fertility.
- d) They increase dependence on chemical fertilizers.

7. Which of the following statements about biofertilizers is true?

- a) They contribute to soil degradation.
- b) They have no impact on crop yield.

**c) They promote the growth of beneficial microorganisms in the soil.**

- d) They contain synthetic chemicals harmful to the environment.

8. Biofertilizers are important in organic farming because they:

- a) Replace the need for crop rotation.
- b) Increase reliance on chemical pesticides.

**c) Enhance soil fertility without the use of synthetic chemicals.**

- d) Contribute to soil degradation.

9. Which of the following is NOT a type of biopesticide?

- a) Bacillus thuringiensis (Bt)

**b) Neonicotinoids**

- c) Beauveria bassiana
- d) Trichoderma spp.

10. Bioagents are used in agriculture primarily to:

- a) Increase soil fertility

**b) Control pest populations**

- c) Enhance plant growth
- d) Improve water retention in the soil

11. Which of the following is an example of a microbial biopesticide?

- a) Pyrethrum
- b) Neem oil
- c) *Bacillus thuringiensis* (Bt)**
- d) Copper sulfate

12. Biopesticides and bioagents are commonly used in conjunction with which farming approach?

- a) Traditional monoculture
- b) Conventional farming
- c) Integrated pest management (IPM)**
- d) Industrial agriculture

13. Which of the following organisms is commonly used as a bioagent to control aphids in agriculture?

- a) *Bacillus thuringiensis* (Bt)
- b) Ladybird beetles**
- c) *Rhizobium* bacteria
- d) *Azospirillum* spp.

14. What is the primary advantage of using biopesticides and bioagents in organic farming systems?

- a) Increased reliance on synthetic chemicals
- b) Reduced crop yields
- c) Minimal environmental impact**
- d) Soil degradation

15. Which of the following statements about biopesticides and bioagents is true?

- a) They are harmful to beneficial insects and pollinators.
- b) They have a long residual effect in the environment.
- c) They provide effective pest control without synthetic chemicals.**
- d) They contribute to soil erosion.

16. Which type of bioagent is used to control pest populations by parasitizing or infecting them?

- a) Predators
- b) Parasitoids
- c) Pathogens**
- d) Competitors

17. Who is credited with the discovery of the first biofertilizer, nitrogen-fixing bacteria, in the late 19th century?

- a) Louis Pasteur
- b) Robert Koch
- c) Sergei Winogradsky
- d) Martinus Beijerinck**

18. The commercial production of biofertilizers began in which decade?

- a) 1930s
- b) 1950s
- c) 1970s**
- d) 1990s

19. Which country was among the first to adopt large-scale production and use of biofertilizers in agriculture?

- a) United States
- b) India**
- c) China
- d) Brazil

20. The Green Revolution in the 1960s and 1970s led to increased demand for chemical fertilizers. However, concerns about environmental sustainability prompted renewed interest in biofertilizers in which decade?

- a) 1950s
- b) 1970s
- c) 1990s**
- d) 2000s

### Module 3

**1. Which type of microorganism forms symbiotic associations with leguminous plants to fix atmospheric nitrogen in biofertilizers?** a) Arbuscular mycorrhizal fungi b) Nitrogen-fixing bacteria c) Phosphate-solubilizing bacteria d) Nematodes

**Answer: b) Nitrogen-fixing bacteria**

**2. Which group of microorganisms is commonly used in biofertilizers to enhance soil fertility by breaking down organic matter and releasing nutrients?** a) Actinomycetes b) Protozoa c) Yeasts d) Viruses

**Answer: a) Actinomycetes**

**3. What is the primary source of nitrogen for plants in the soil?** a) Atmospheric nitrogen gas ( $N_2$ ) b) Nitrate ions ( $NO_3^-$ ) c) Ammonium ions ( $NH_4^+$ ) d) Nitrogen-fixing bacteria

**Answer: a) Atmospheric nitrogen gas ( $N_2$ )**

**4. Which of the following processes converts atmospheric nitrogen gas ( $N_2$ ) into a form that plants can use?** a) Nitrification b) Denitrification c) Nitrogen fixation d) Ammonification

**Answer: c) Nitrogen fixation**

**5. Which group of organisms is primarily responsible for biological nitrogen fixation in the soil?** a) Denitrifying bacteria b) Nitrifying bacteria c) Nitrogen-fixing bacteria d) Ammonifying bacteria

**Answer: c) Nitrogen-fixing bacteria**

**6. Which enzyme is essential for the conversion of atmospheric nitrogen gas ( $N_2$ ) into ammonia ( $NH_3$ ) during nitrogen fixation?** a) Nitrate reductase b) Nitrogenase c) Nitrogenase reductase d) Nitrogenase synthase

**Answer: b) Nitrogenase**

**7. Where do free-living nitrogen-fixing bacteria reside in the soil?** a) Within the roots of leguminous plants b) Within specialized nodules on the roots of leguminous plants c) In the rhizosphere surrounding plant roots d) Within the plant tissues

**Answer: c) In the rhizosphere surrounding plant roots**

**8. Which of the following is NOT a common strategy used by nitrogen-fixing bacteria to access atmospheric nitrogen?** a) Associative symbiosis with plant roots b) Endophytic colonization of plant tissues c) Formation of root nodules on leguminous plants d) Formation of specialized structures called heterocysts

**Answer: b) Endophytic colonization of plant tissues**

**9. What is the role of nitrogenase enzymes in nitrogen fixation?** a) They convert ammonia ( $NH_3$ ) into nitrate ( $NO_3^-$ ) b) They break down organic nitrogen compounds into ammonia ( $NH_3$ ) c) They catalyze the conversion of atmospheric nitrogen gas ( $N_2$ ) into ammonia ( $NH_3$ ) d) They convert nitrate ( $NO_3^-$ ) into nitrogen gas ( $N_2$ )

**Answer: c) They catalyze the conversion of atmospheric nitrogen gas (N<sub>2</sub>) into ammonia (NH<sub>3</sub>)**

10. Which of the following is NOT a benefit of nitrogen fixation for plant growth? a) Increased availability of nitrogen for protein synthesis b) Enhanced plant growth and yield c) Reduced dependence on synthetic nitrogen fertilizers d) Increased susceptibility to nitrogen toxicity

**Answer: d) Increased susceptibility to nitrogen toxicity**

11. What is the primary mode of action of Azotobacter in biofertilizers? a) Phosphorus solubilization b) Nitrogen fixation c) Potassium mobilization d) Organic matter decomposition

Answer: b) Nitrogen fixation

12. Which of the following environments is preferred by Azotobacter bacteria for optimal growth and nitrogen fixation? a) Acidic soils b) Waterlogged soils c) Aerobic conditions d) High-temperature environments

Answer: c) Aerobic conditions

13. What is a characteristic morphological feature of Azotobacter cells? a) Rod-shaped cells b) Spiral-shaped cells c) Coccus-shaped cells d) Irregular-shaped cells

Answer: b) Spiral-shaped cells

14. Which of the following pigments is produced by Azotobacter bacteria, imparting a characteristic color to the colonies? a) Chlorophyll b) Carotenoids c) Anthocyanins d) Melanin Answer: b) Carotenoids

15. Azotobacter is known to produce extracellular substances called \_\_\_\_\_, which help in the solubilization of phosphorus in the soil. a) Lipopolysaccharides b) Exopolysaccharides c) Lipid vesicles d) Protein complexes

Answer: b) Exopolysaccharides

16. Which of the following nutrients is NOT directly affected by Azotobacter biofertilizers? a) Nitrogen b) Phosphorus c) Potassium d) Sulfur

Answer: d) Sulfur

17. What is the primary benefit of using Azotobacter biofertilizers in agriculture? a) Increased phosphorus availability b) Enhanced soil aeration c) Improved nitrogen nutrition of plants d) Reduction of soil acidity

Answer: c) Improved nitrogen nutrition of plants

18. Which of the following is a characteristic feature of Azotobacter that makes it well-suited for biofertilizer production and application? a) Obligate anaerobic metabolism b) Ability to fix nitrogen under low temperatures c) Resistance to desiccation and environmental stress d) Dependence on organic carbon sources for growth

Answer: c) Resistance to desiccation and environmental stress



**19. Which of the following is a characteristic feature of Bacillus bacteria that makes them suitable for use as biofertilizers?** a) Obligate anaerobic metabolism b) Ability to fix atmospheric nitrogen c) Production of spores d) Dependence on organic carbon sources for growth

**Answer: c) Production of spores**

**20. What is the primary mode of action of Bacillus biofertilizers in promoting plant growth and soil fertility?** a) Nitrogen fixation b) Phosphorus solubilization c) Potassium mobilization d) Organic matter decomposition

**Answer: b) Phosphorus solubilization**

#### Module 4

1. Which of the following is true about biopesticides?

- a) They are synthetic chemicals
- b) They are derived from natural materials
- c) They have a long residual effect in the environment
- d) They are effective against all types of pests

**Answer: b) They are derived from natural materials**

2. Biopesticides primarily target:

- a) Weeds
- b) Fungi
- c) Insects and other pests
- d) Rodents

**Answer: c) Insects and other pests**

3. Which of the following is an example of a microbial biopesticide?

- a) Glyphosate
- b) Neem oil
- c) Pyrethrum
- d) Bacillus thuringiensis (Bt)

**Answer: d) Bacillus thuringiensis (Bt)**

4. The mode of action of biopesticides is typically:

- a) Chemical inhibition of pest nervous system
- b) Physical trapping of pests

- c) Repelling pests through odor
- d) Alteration of pest behavior or physiology

**Answer: d) Alteration of pest behavior or physiology**

5. Biopesticides are often considered environmentally friendly because:

- a) They have a long persistence in the environment
- b) They have broad-spectrum activity
- c) They are harmful to beneficial insects
- d) They degrade quickly and have low toxicity to non-target organisms

**Answer: d) They degrade quickly and have low toxicity to non-target organisms**

6. Neem-based pesticides primarily affect pests by:

- a) Disrupting their nervous system
- b) Inhibiting their feeding and growth
- c) Killing them on contact
- d) Altering their mating behavior

**Answer: b) Inhibiting their feeding and growth**

7. Biopesticides play a significant role in:

- a) Increasing pesticide resistance in pests
- b) Reducing pesticide residues in food
- c) Eliminating the need for chemical pesticides altogether
- d) Harming beneficial organisms more than pests

**Answer: b) Reducing pesticide residues in food**

8. Which of the following is a botanical biopesticide?

- a) Malathion
- b) Spinosad
- c) Rotenone
- d) Chlorpyrifos

**Answer: c) Rotenone**

9. Biopesticides are less likely to cause:

- a) Pest resurgence
- b) Harm to humans and animals

- c) Increased soil fertility
- d) Resistance in pests

**Answer: b) Harm to humans and animals**

10. The use of biopesticides can help in:

- a) Promoting biodiversity
- b) Depleting soil nutrients
- c) Accelerating global warming
- d) Eliminating all pest populations

**Answer: a) Promoting biodiversity**

11. Which of the following is an example of a viral biopesticide?

- a) *Bacillus thuringiensis* (Bt)
- b) *Trichoderma* spp.
- c) Granulovirus
- d) *Beauveria bassiana*

**Answer: c) Granulovirus**

12. Biopesticides are often used in:

- a) Indoor settings only
- b) Agricultural, commercial, and residential settings
- c) Marine environments exclusively
- d) Desert regions

**Answer: b) Agricultural, commercial, and residential settings**

13. Which of the following statements about biopesticides is true?

- a) They are always more expensive than chemical pesticides
- b) They have a shorter shelf life compared to chemical pesticides
- c) They do not pose any risk to non-target organisms
- d) They are subject to the same regulatory requirements as chemical pesticides

**Answer: d) They are subject to the same regulatory requirements as chemical pesticides**

14. Biopesticides are typically used as:

- a) Fertilizers
- b) Growth regulators

- c) Herbicides
- d) Insecticides

**Answer: d) Insecticides**

15. Biopesticides derived from fungi are known as:

- a) Botanicals
- b) Microbials
- c) Biochemicals
- d) Biofungicides

**Answer: d) Biofungicides**

16. Which of the following biopesticides acts by disrupting the cell membranes of target pests?

- a) Neem oil
- b) Bacillus thuringiensis (Bt)
- c) Beauveria bassiana
- d) Rotenone

**Answer: c) Beauveria bassiana**

17. Biopesticides are often integrated into pest management programs to:

- a) Maximize chemical pesticide use
- b) Minimize environmental impact
- c) Increase pesticide resistance in pests
- d) Eliminate the need for crop rotation

**Answer: b) Minimize environmental impact**

18. Biopesticides have been found to be particularly effective in controlling pests that have developed resistance to:

- a) Chemical pesticides
- b) Biological pesticides
- c) Cultural control methods
- d) Mechanical control methods

**Answer: a) Chemical pesticides**

19. Biopesticides are commonly used in organic farming because they:

- a) Are cheaper than chemical pesticides
- b) Are more toxic to humans than chemical pesticides
- c) Are naturally occurring and align with organic principles
- d) Have a longer residual effect in the environment

**Answer: c) Are naturally occurring and align with organic principles**

20. The development and use of biopesticides contribute to:

- a) Soil erosion
- b) Loss of biodiversity
- c) Sustainable agriculture
- d) Increased use of synthetic fertilizers

**Answer: c) Sustainable agriculture**

### **Module 5**

1. What does FCO stand for in the context of biofertilizers?

- a) Fertilizer Control Organization
- b) Fertilizer Classification Order
- c) Fertilizer Composition Outline
- d) Fertilizer Control Order

**Answer: d) Fertilizer Control Order**

2. FCO specifications for biofertilizers are primarily regulated by:

- a) International standards organizations
- b) National agricultural departments or agencies
- c) Environmental protection agencies
- d) Private biofertilizer companies

**Answer: b) National agricultural departments or agencies**

3. Which of the following is NOT typically included in FCO specifications for biofertilizers?

- a) Microbial count and viability
- b) Nutrient content
- c) pH level
- d) Shelf life in years

**Answer: d) Shelf life in years**

4. Quality control of biofertilizers involves testing for:

- a) Presence of chemical pesticides
- b) Heavy metal contamination
- c) Viability of beneficial microorganisms
- d) All of the above

**Answer: c) Viability of beneficial microorganisms**

5. Which of the following methods is commonly used to assess microbial viability in biofertilizers?

- a) Gas chromatography
- b) Polymerase chain reaction (PCR)
- c) Plate count method
- d) Spectrophotometry

**Answer: c) Plate count method**

6. The moisture content of biofertilizers is an important parameter for quality control because:

- a) High moisture content can lead to microbial contamination
- b) Low moisture content indicates poor nutrient availability
- c) Moisture content has no effect on biofertilizer quality
- d) Moisture content determines the pH level of biofertilizers

**Answer: a) High moisture content can lead to microbial contamination**

7. Which of the following is a common parameter for assessing the maturity of compost-based biofertilizers?

- a) Color
- b) Odor
- c) Texture
- d) All of the above

**Answer: d) All of the above**

8. FCO specifications for biofertilizers may vary depending on:

- a) Geographic location
- b) Crop type
- c) Manufacturing method
- d) All of the above

**Answer: d) All of the above**

9. Which of the following is NOT a potential contaminant in biofertilizers?

- a) Plant pathogens
- b) Heavy metals
- c) Chemical fertilizers
- d) Beneficial microorganisms

**Answer: d) Beneficial microorganisms**

10. The presence of which element is typically restricted in biofertilizers due to its potential toxicity?

- a) Nitrogen
- b) Phosphorus
- c) Zinc
- d) Cadmium

**Answer: d) Cadmium**

11. Which of the following techniques is used to determine the nitrogen-fixing efficiency of biofertilizers?

- a) Gas chromatography
- b) Nitrogen content analysis
- c) Acetylene reduction assay
- d) High-performance liquid chromatography (HPLC)

**Answer: c) Acetylene reduction assay**

12. What is the acceptable pH range for most biofertilizers?

- a) 2-4
- b) 5-7
- c) 8-10
- d) 11-14

**Answer: b) 5-7**

13. Which regulatory body in India oversees the implementation of FCO specifications for biofertilizers?

- a) Ministry of Environment, Forest and Climate Change
- b) Food Safety and Standards Authority of India
- c) Department of Fertilizers, Ministry of Chemicals and Fertilizers
- d) Indian Council of Agricultural Research

**Answer: c) Department of Fertilizers, Ministry of Chemicals and Fertilizers**

14. Biofertilizers are primarily derived from:

- a) Synthetic chemicals
- b) Plant extracts
- c) Animal waste
- d) Beneficial microorganisms

**Answer: d) Beneficial microorganisms**

15. Which of the following is NOT a common type of biofertilizer?

- a) Rhizobium
- b) Azotobacter
- c) Ammonium nitrate
- d) Mycorrhiza

**Answer: c) Ammonium nitrate**

16. Quality control measures for biofertilizers aim to ensure:

- a) Maximum chemical content
- b) Long shelf life
- c) Viability and effectiveness of microbial populations
- d) Consistency in color and texture

**Answer: c) Viability and effectiveness of microbial populations**



17. Which of the following is an example of a biofertilizer that enhances phosphate solubilization in soil?

- a) Rhizobium
- b) Azotobacter
- c) Mycorrhiza
- d) Phosphate-solubilizing bacteria (PSB)

**Answer: d) Phosphate-solubilizing bacteria (PSB)**

18. The term "co-inoculation" in biofertilizer production refers to:

- a) Simultaneous inoculation of multiple crop varieties
- b) Mixing different types of biofertilizers together
- c) Coating seeds with biofertilizer formulations
- d) Applying chemical fertilizers alongside biofertilizers

**Answer: b) Mixing different types of biofertilizers together**

19. Which of the following is NOT a factor considered during quality control of biofertilizers?

- a) Particle size distribution
- b) Moisture content
- c) pH of the manufacturing facility
- d) Microbial count and viability

**Answer: c) pH of the manufacturing facility**

20. The main objective of FCO specifications for biofertilizers is to:

- a) Maximize profits for manufacturers
- b) Ensure safety for users and the environment
- c) Reduce competition in the fertilizer market
- d) Increase shelf life of biofertilizer products

**Answer: b) Ensure safety for users and the environment**