

Microbes in Production of Biogas as Biocontrol Agents & Biofertilisers

1 Mark Questions

1. Name the type of association that the genus *Glomus* exhibits with higher plants. [All India 2014]

Ans. The genus *Glomus* exhibits symbiotic association with higher plants.

2. State one reason for adding blue-green algae to the agricultural soil. [Delhi 2014C]
or

Mention two advantages of adding blue-green algae to paddy fields.

[All India 2011C]

Ans. Blue-green algae are added to agricultural soil because they add organic matter to the soil and also increase its fertility.

3. Mention the role of cyanobacteria as biofertilisers. [All India 2012]

Ans. Role of cyanobacteria as biofertilisers Cyanobacteria fix atmospheric nitrogen and increases the organic matter of the soil through their photosynthetic activity,

4. Name any one symbiont, which serve as biofertiliser. Mention its specific role. [All India 2010C]

Ans. *Rhizobium* is a symbiont bacteria that serve as biofertiliser

The bacteria fix the atmospheric nitrogen into organic forms, which is used by the plants as nutrients.

5. Which of the following is a free-living bacteria that can fix nitrogen in the soil? *Spirulina*, *Azospirillum* and *Sonalika*. [Delhi 2009]

Ans. *Azospirillum*

6. Which of the following is a cyanobacterium that can fix atmospheric nitrogen? *Azospirillum*, *Oscillatoria* and *Spirulina*. [All India 2009]



Ans. Oscillatoria

7. How is the presence of cyanobacteria in the paddy fields beneficial to rice crop? [Delhi 2009C]

Ans. In the paddy fields, cyanobacteria such as blue-green algae fix atmospheric nitrogen to enrich the nitrogen content of soil. Therefore, the entire need of nitrogen to rice crop can be supplied by blue-green algae, leading to increase in yield.

8. Name the group of organisms and the substrate that act on to produce biogas. [Delhi 2009]

Ans. Methanogens are the group of organisms that acts on cellulosic materials/cow dung to produce biogas.

2 Marks Questions

9. How do mycorrhizae act as biofertilisers? Explain. Name a genus of fungi that forms a mycorrhizal association with plants. [Delhi 2012]

Ans. Fungi form symbiotic association with plants, which is called mycorrhiza. The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant. Thus, acts as a biofertiliser. The fungi belonging to the genus *Glomus* form mycorrhizal associations with plants.

10. How do methanogens help in producing biogas? [Delhi 2012]

Ans. Methanogens grow anaerobically on cellulosic material and produce large amount of methane along with CO_2 and H_2 . Since, biogas is a mixture of methane and CO_2 , methanogens help in its production

11. Why is *Rhizobium* categorised as a symbiotic bacterium? How does it act as biofertilisers? [Delhi 2012]

Ans. The nodules on the roots of leguminous plants are formed by *Rhizobium* bacteria for their survival. These bacteria fix atmospheric nitrogen into organic form, which is used by the plant as nutrients. Since, *Rhizobium* forms symbiotic association with leguminous plants these are considered as symbiotic bacteria, (I) *Rhizobium* fixes the atmospheric nitrogen into organic form, i.e. nitrates which can be utilised by the plant as nutrient. So, it is used as biofertilisers.

12. How do plants benefit from having mycorrhizal symbiotic association? [Foreign 2010]

Ans. The plants get benefits from mycorrhizal symbiotic association in the following two ways:

- (i) The fungal symbiont in mycorrhizal associations absorb phosphorus from soil and passes it to the plant.
- (ii) It also provides resistance to root borne pathogens and increases plant growth and development.

13. What are methanogens? Name the animals in which methanogens occur and the role they play there. [Delhi 2014]

Ans. Methanogens are groups of anaerobic bacteria, that produce large amount of methane. Methanogens are found in rumen of cattle and intestine of humans.

The methanogens present in intestine of animals and humans act on cellulosic part of food and digest them, thereby releasing methane along with CO_2 and H_2 .

14. How are baculoviruses and *Bacillus thuringiensis* used as biocontrol agents? Why are



they preferred over readily available chemical pesticides? [2014c]

Ans. *Bacillus thuringiensis* as biocontrol agent

- (i) Through genetic engineering, the gene coding for the toxic protein is introduced into crop plants, which make them resistant to insect pests.
- (ii) When they are eaten by the larvae, the toxin becomes active in the gut of larvae and kills the larvae.
- (iii) They are available in sachets as dried spores, which have to be mixed with water and sprayed onto vulnerable plants.

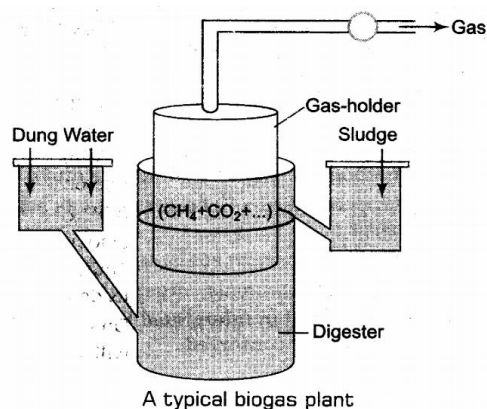
Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

- (i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.
- (ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.
- (iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

15. Draw a labelled sketch of a typical biogas plant. [2014c]

Ans. Biological control of pests and pathogens must be preferred over conventional use of chemical pesticides because

- (i) the chemicals cause pollution to soil, ground water and agricultural products.
- (ii) the chemicals are toxic and harmful to both human being and animals.
- (iii) overuse of chemical fertilisers make soil infertile.
- (iv) kills harmful as well as useful organisms indiscriminately.



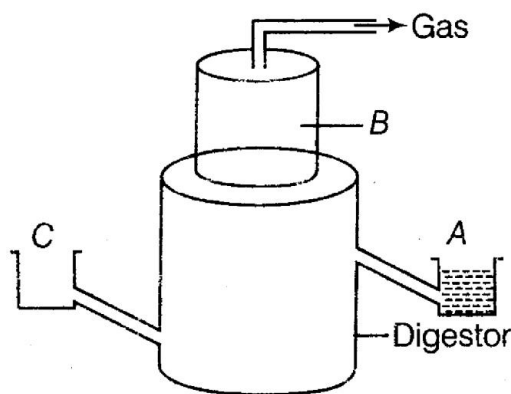
3 Marks Questions

16. How is the Bt cotton plant created as a GM plant? How is it protected against bollworm infestation? [Delhi 2013C]

Ans. Bt cotton is created by using some strains of a bacterium known as *Bacillus thuringiensis*. This bacterium produces protein that kills certain insects such as Lepidopterans, Coleopterans and Bt gene is cloned from this bacteria and had been expressed in cotton plant to provide resistance to the insects without the need for insecticides.

It is protected against corn borer disease by encoding cry protein with the gene cryIAb. These genes produces Bt toxins which are released in the gut of insects, who feed upon them, thus killing them and protecting the plant from the pests.

17.



The diagram above is that of a typical biogas plant. Explain the sequence of events occurring in a biogas plant. Identify A, B and C. [Delhi 2011]

Ans. The sequence of events occurring in a biogas plant are as follows:

- (i) The biogas plant tank is fed with a slurry of dung.
- (ii) A floating cover is placed over the slurry, which keeps on rising as the gas is produced in the tank due to the microbial activity.
- (iii) Methanogens like *Methanobacterium* grows anaerobically on cellulosic plant material in cow dung to produce large amount of methane, CO_2 and H_2 .
- (iv) The plant has an outlet, which is connected by a pipe to supply biogas in nearby houses.
- (v) The spent slurry is removed through another outlet and used as biofertilisers.

A-Sludge tank

B-Gas holder

C-Dung water

18.(i) Why do farmers prefer biofertilisers to chemical fertilisers these days? Explain, (ii) How do Anabaena and mycorrhiza act as biofertilisers? [Delhi 2011]

Ans. (i) A farmer relies on biofertilisers then chemical fertilisers because

- (a) Chemical fertilisers significantly increase the soil pollution and reduce quality of soil, as well as water pollution, when it drains into nearby water bodies, after rain.
- (b) Overuse of chemical fertiliser makes the soil infertile.

(ii) *Anabaena* fix atmospheric nitrogen, thus enriching the nitrogen content of the soil, as well as the organic matter.

In mycorrhiza, the fungal symbiont absorbs phosphorus from the soil and passes it to the plant and provides resistance to root borne diseases. Since, they fulfil the nitrogen and phosphorus requirement they act as biofertilisers.

19. (i) Why do organic farmers not recommend eradication of insect pests? Explain giving reasons.

(ii) How do ladybird beetles and dragonflies act as biocontrol agents? [Delhi 2009C]

Ans. (i) The organic farmers do not recommend eradication of insect pests as without them, the beneficial predatory and parasitic insects which depend upon pests as food or hosts would not be able to survive.

(ii) The ladybird beetles and dragonflies feed upon aphids and mosquitoes respectively. Hence, they act as biocontrol agents by helping to get rid of them.

20. Name the genus to which baculoviruses belong. Describe their role in the integrated pest management programme. [Delhi 2011; Foreign 2011]

Ans. Baculoviruses belongs to the genus Nucleopolyhedrovirus.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

- (i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.

- (ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.
- (iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

21. An organic farmer relies on natural predation for controlling pests and diseases. Justify giving reasons, why this is considered to be a holistic approach? [Foreign 2010]

Ans. Organic farming is a holistic approach that seeks to develop an understanding of the webs of interaction among the myriads of organisms that form the flora and fauna of the field.

- (i) An organic farmer works to create a system, where the insects are not eradicated, but kept at manageable level by a complex system of checks and balance within a living and vibrant ecosystem.
- (ii) Organic farmer states that the eradication of pests is not only possible but also undesirable, because many beneficial predatory and parasitic insects cannot survive without them.
- (iii) This use of biocontrol methods reduces the use of chemical pesticides and thereby pollution.

22. (i) Baculoviruses are excellent candidates for integrated pest management in an ecologically sensitive area. Explain giving reasons.

(ii) What is organic farming? Why is it suggested to switch over to organic farming? [Foreign 2008]

Ans.(i) Baculoviruses belongs to the genus Nucleopolyhedrovirus.

Baculovirus (Nucleopolyhedrovirus) as biocontrol agents:

- (i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.
- (ii) They show no negative impact on plants, mammals, birds, fish or even non-target insects.
- (iii) These are especially desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.
- (II) The use of biofertilisers and biopesticides to improve the crop yield is called organic farming.

It is advised to switch over organic farming due to the following reasons:

- (a) Use of excess chemical fertilisers make the soil unsuitable for cultivation.)
- (b) Natural resources get depleted due to the manufacturing of chemical fertilisers.
- (c) Avoids killing harmful as well as useful life forms or organisms indiscriminately, thus maintains ecological balance.

23. Why should biological control of pests and pathogens be preferred to the conventional use of chemical pesticides? Explain how the following microbes act as biocontrol agents?

(i) Bacillus thuringiensis (ii) Nucleopolyhedrovirus. [Delhi 2008]

Ans. Bacillus thuringiensis as biocontrol agent

- (i) Through genetic engineering, the gene coding for the toxic protein is introduced into crop plants, which make them resistant to insect pests.
- (ii) When they are eaten by the larvae, the toxin becomes active in the gut of larvae and kills the larvae.
- (iii) They are available in sachets as dried spores, which have to be mixed with water and sprayed onto vulnerable plants.

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- (i) These are excellent candidates for species-specific, narrow spectrum insecticidal application.
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overall Integrated Pest Management (IPM) programme.

24. Explain the role of baculoviruses as biological control agents. Mention their importance in organic farming. [All India 2008]

Ans. (i) Baculovirus are pathogens that attack insects and other arthropods.

(ii) The majority of baculoviruses used as biocontrol agents are in genus Nucleopolyhedrovirus.

(iii) These viruses are excellent for species-specific, narrow spectrum insecticidal applications.

(iv) They do not show negative impacts on plants, mammals, bird, fish or even non-target insects. Therefore, they play an important role as biocontrol agents.

Importance in organic farming:

(i) It is desirable when beneficial insects are being conserved to aid in an overall Integrated Pest Management (IPM) programme.

(ii) It is used to conserve beneficial insects and kill harmful ones.

