



# AGRICULTURE REVIEW

## Soil Science (Soil Biology) Review

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**1. Which group of soil microorganisms is typically the most abundant in agricultural soils by number?**

- A. Fungi
- B. Bacteria
- C. Actinomycetes
- D. Algae

**2. Which of the following microorganisms is primarily responsible for the 'earthy' smell of freshly plowed soil?**

- A. Nematodes
- B. Fungi
- C. Actinomycetes
- D. Protozoa

**3. What is the biological process of converting atmospheric nitrogen gas (N<sub>2</sub>) into ammonia?**

- A. Nitrification
- B. Denitrification
- C. Nitrogen Fixation
- D. Ammonification

**4. Which genus of bacteria forms a symbiotic nitrogen-fixing relationship with leguminous plants?**

- A. Azotobacter
- B. Rhizobium
- C. Clostridium
- D. Nitrosomonas

**5. The conversion of organic nitrogen into ammonium ( $\text{NH}_4^+$ ) by soil microbes is known as:**

- A. Ammonification
- B. Nitrification
- C. Immobilization
- D. Denitrification

**6. Which specific group of bacteria is responsible for converting ammonium ( $\text{NH}_4^+$ ) to nitrite ( $\text{NO}_2^-$ )?**

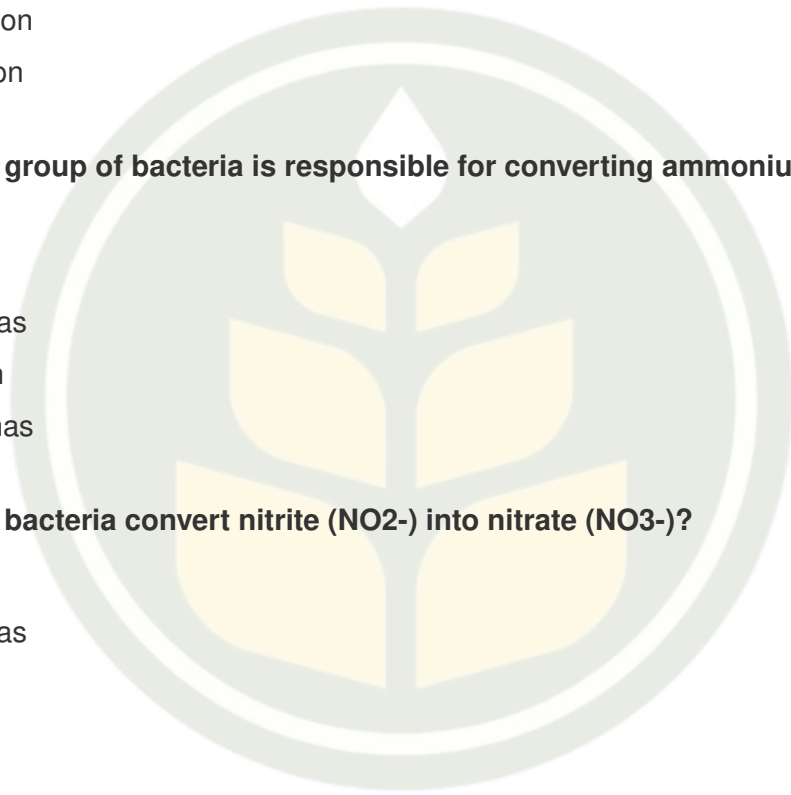
- A. Nitrobacter
- B. Nitrosomonas
- C. Azospirillum
- D. Pseudomonas

**7. Which specific bacteria convert nitrite ( $\text{NO}_2^-$ ) into nitrate ( $\text{NO}_3^-$ )?**

- A. Nitrobacter
- B. Nitrosomonas
- C. Rhizobium
- D. Frankia

**8. The process of converting nitrate ( $\text{NO}_3^-$ ) into gaseous nitrogen ( $\text{N}_2$  or  $\text{N}_2\text{O}$ ) is called:**

- A. Nitrification
- B. Denitrification
- C. Volatilization
- D. Mineralization



**9. What type of soil conditions primarily favor the process of denitrification?**

- A. Well-aerated soils
- B. Dry, sandy soils
- C. Waterlogged, anaerobic soils
- D. Highly acidic soils

**10. What is the generally accepted ideal Carbon to Nitrogen (C:N) ratio for rapid decomposition of organic matter?**

- A. 10:1
- B. 24:1
- C. 50:1
- D. 100:1

**11. Organisms that derive their energy from sunlight and their carbon from carbon dioxide are called:**

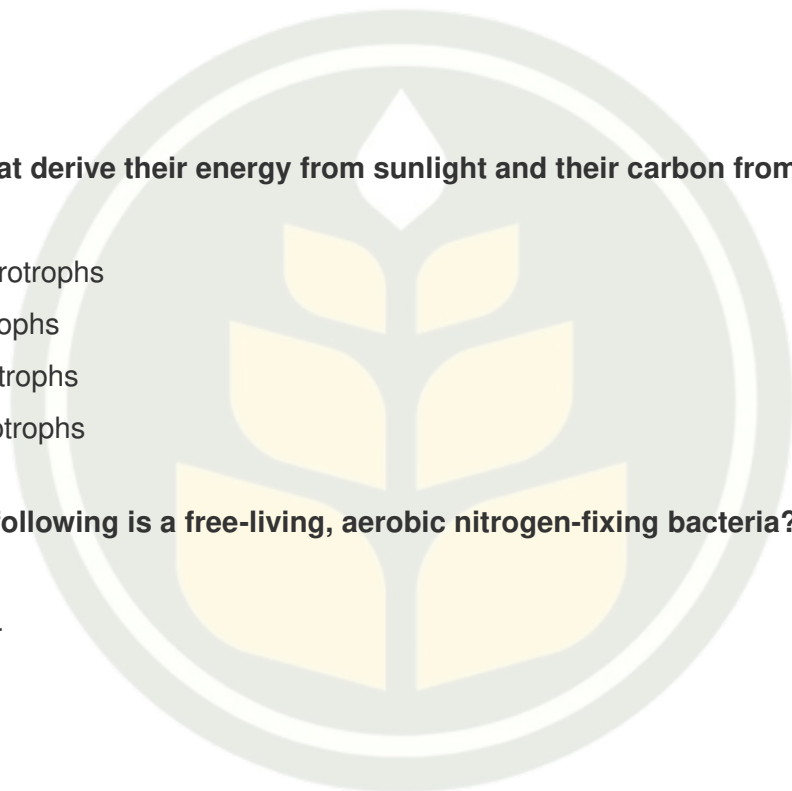
- A. Chemoheterotrophs
- B. Photoautotrophs
- C. Chemoautotrophs
- D. Photoheterotrophs

**12. Which of the following is a free-living, aerobic nitrogen-fixing bacteria?**

- A. Clostridium
- B. Azotobacter
- C. Rhizobium
- D. Nitrobacter

**13. Which of the following is a free-living, anaerobic nitrogen-fixing bacteria?**

- A. Clostridium
- B. Azotobacter
- C. Bradyrhizobium
- D. Nitrosomonas



**14. Fungi that form a mutually beneficial symbiotic association with plant roots are known as:**

- A. Nematodes
- B. Actinomycetes
- C. Mycorrhizae
- D. Cyanobacteria

**15. Vesicular-arbuscular mycorrhizae (VAM) are highly effective in helping plants absorb which relatively immobile nutrient?**

- A. Nitrogen
- B. Phosphorus
- C. Potassium
- D. Calcium

**16. Which group of soil organisms is primarily responsible for the initial physical fragmentation of organic residues?**

- A. Bacteria
- B. Fungi
- C. Macrofauna (e.g., Earthworms)
- D. Actinomycetes

**17. The dark, complex, and highly stable fraction of soil organic matter that resists rapid decomposition is called:**

- A. Cellulose
- B. Lignin
- C. Humus
- D. Hemicellulose

**18. When inorganic nutrients (like nitrate or ammonium) are taken up by soil microbes and converted into organic forms, the process is called:**

- A. Mineralization
- B. Immobilization
- C. Nitrification
- D. Ammonification

**19. Mineralization is defined as the process where:**

- A. Inorganic elements are converted to organic compounds
- B. Organic compounds are converted to plant-available inorganic forms
- C. Nitrogen gas is converted to ammonia
- D. Nitrate is lost as nitrogen gas

**20. Most soil bacteria prefer a soil pH that is:**

- A. Highly acidic (pH 3-4)
- B. Moderately acidic (pH 4-5)
- C. Near neutral (pH 6-8)
- D. Highly alkaline (pH 9-10)

**21. Fungi generally have an advantage over bacteria in environments that are:**

- A. Highly alkaline
- B. Acidic
- C. Waterlogged
- D. Devoid of organic matter

**22. Microorganisms that grow best at moderate temperatures (usually between 20°C and 40°C) are classified as:**

- A. Psychrophiles
- B. Mesophiles
- C. Thermophiles
- D. Hyperthermophiles

**23. Which of the following plant constituents is the most resistant to microbial decomposition?**

- A. Sugars
- B. Proteins
- C. Cellulose
- D. Lignin

**24. Cyanobacteria are also commonly referred to as:**

- A. Green algae
- B. Blue-green algae
- C. Actinomycetes
- D. Mycorrhizae

**25. Which of the following is considered a soil microfauna?**

- A. Earthworm
- B. Mite
- C. Nematode
- D. Millipede

**26. The genus Frankia is an actinomycete that forms nitrogen-fixing nodules primarily on:**

- A. Legumes like soybeans
- B. Non-leguminous trees like Casuarina or Alder
- C. Grasses like corn and wheat
- D. Aquatic plants like Azolla

**27. The aquatic fern Azolla is widely used as a biofertilizer in rice paddies because it has a symbiotic relationship with which nitrogen-fixing organism?**

- A. Rhizobium
- B. Anabaena
- C. Azotobacter
- D. Frankia

**28. Microorganisms that strictly require oxygen for respiration and growth are called:**

- A. Obligate anaerobes
- B. Facultative anaerobes
- C. Obligate aerobes
- D. Microaerophiles

**29. Microorganisms that can function and survive with or without the presence of oxygen are known as:**

- A. Obligate aerobes
- B. Facultative anaerobes
- C. Obligate anaerobes
- D. Aerotolerant aerobes

**30. What is the primary source of energy for heterotrophic soil bacteria?**

- A. Sunlight
- B. Oxidation of inorganic minerals
- C. Soil organic matter
- D. Atmospheric carbon dioxide

**31. Which soil enzyme is responsible for the hydrolysis of urea into ammonia and carbon dioxide?**

- A. Cellulase
- B. Nitrogenase
- C. Urease
- D. Dehydrogenase

**32. Which of the following is a primary product of complete, aerobic decomposition of organic matter?**

- A. Methane (CH<sub>4</sub>)
- B. Hydrogen sulfide (H<sub>2</sub>S)
- C. Carbon dioxide (CO<sub>2</sub>)
- D. Lactic acid

**33. The area of soil immediately surrounding plant roots, which exhibits high microbial activity due to root exudates, is called the:**

- A. Pedosphere
- B. Rhizosphere
- C. Lithosphere
- D. Hydrosphere

**34. Which of the following organisms are single-celled eukaryotes that often feed on soil bacteria, helping to regulate bacterial populations?**

- A. Protozoa
- B. Actinomycetes
- C. Nematodes
- D. Cyanobacteria

**35. Nitrosomonas and Nitrobacter are examples of:**

- A. Chemoheterotrophs
- B. Photoautotrophs
- C. Chemoautotrophs
- D. Photoheterotrophs

**36. A farmer incorporates wheat straw with a C:N ratio of 80:1 into the soil. What will be the immediate effect on the plant-available nitrogen in the soil?**

- A. Rapid mineralization will increase available nitrogen
- B. Nitrogen immobilization will occur, potentially causing plant nitrogen deficiency
- C. Nitrogen fixation will immediately double
- D. Denitrification will accelerate

**37. Which condition is most likely to result in a net mineralization of nitrogen in the soil?**

- A. Incorporation of a material with a C:N ratio of 15:1
- B. Incorporation of a material with a C:N ratio of 60:1
- C. Extremely cold soil temperatures
- D. Continuous waterlogging

**38. The process of nitrification is biologically driven and can affect soil pH. What is the effect of nitrification on soil acidity?**

- A. It has no effect on soil pH
- B. It raises soil pH (makes it more alkaline)
- C. It lowers soil pH (makes it more acidic) by releasing H<sup>+</sup> ions
- D. It neutralizes acidic soils

**39. Which of the following environmental factors would most drastically suppress the nitrification process in an agricultural field?**

- A. Good soil aeration
- B. Soil pH of 7.2
- C. Prolonged soil flooding and waterlogging
- D. Warm soil temperatures (25-30°C)

**40. Ectomycorrhizae differ from endomycorrhizae (like VAM) primarily because ectomycorrhizae:**

- A. Penetrate deep into the plant root cells
- B. Form a dense sheath or mantle over the surface of the root
- C. Are entirely bacterial rather than fungal
- D. Fix atmospheric nitrogen directly

**41. In agricultural practices, what is the primary purpose of 'inoculating' legume seeds before planting?**

- A. To protect the seeds from fungal diseases
- B. To ensure the presence of specific, effective Rhizobium strains for nodulation
- C. To increase the seed's resistance to drought
- D. To provide immediate macro-nutrients for germination

**42. During anaerobic decomposition (such as in flooded rice paddies), which group of organisms is responsible for the production of methane gas?**

- A. Fungi
- B. Actinomycetes
- C. Methanogenic archaea
- D. Cyanobacteria

**43. Which form of nitrogen is most susceptible to loss via leaching through the soil profile, leading to potential groundwater contamination?**

- A. Ammonium (NH<sub>4</sub><sup>+</sup>)
- B. Nitrate (NO<sub>3</sub><sup>-</sup>)
- C. Organic nitrogen
- D. Atmospheric nitrogen (N<sub>2</sub>)

**44. Volatilization of ammonia (NH<sub>3</sub>) gas is most severe when urea or ammonium-based fertilizers are surface-applied to soils that are:**

- A. Highly acidic
- B. Highly alkaline and dry
- C. Cold and deeply incorporated
- D. Rich in active clay minerals

**45. Actinomycetes share characteristics of both bacteria and fungi. Which of the following best describes them physically in the soil?**

- A. They are microscopic round cells floating in soil water
- B. They form branching, thread-like filaments similar to fungal hyphae
- C. They possess flagella and swim actively
- D. They are macroscopic, visible mushrooms

**46. Biological nitrogen fixation by the nitrogenase enzyme complex is highly sensitive to and rapidly inactivated by which of the following elements?**

- A. Iron
- B. Molybdenum
- C. Oxygen
- D. Sulfur

**47. Which specific mechanism allows legume nodules to protect the nitrogenase enzyme from oxygen while still providing enough oxygen for bacterial respiration?**

- A. Thick waxy cuticles
- B. Production of leghemoglobin
- C. Closing of root stomata
- D. Synthesis of urease

**48. In the absence of oxygen, denitrifying bacteria utilize which molecule as an alternative terminal electron acceptor for respiration?**

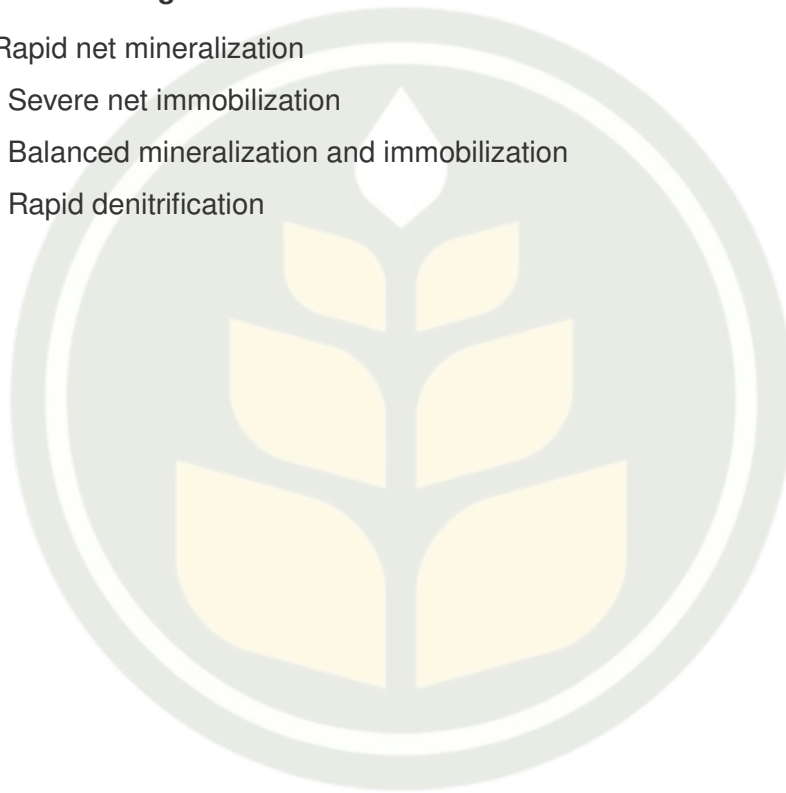
- A. Carbon dioxide (CO<sub>2</sub>)
- B. Ammonium (NH<sub>4</sub><sup>+</sup>)
- C. Nitrate (NO<sub>3</sub><sup>-</sup>)
- D. Sulfate (SO<sub>4</sub><sup>-2</sup>)

**49. As a soil becomes completely waterlogged and redox potential (Eh) drops sequentially, which of the following represents the correct order of alternative electron acceptors used by anaerobic microorganisms?**

- A. Nitrate ( $\text{NO}_3^-$ ) -> Manganese ( $\text{Mn}^{4+}$ ) -> Iron ( $\text{Fe}^{3+}$ ) -> Sulfate ( $\text{SO}_4^{2-}$ )
- B. Sulfate ( $\text{SO}_4^{2-}$ ) -> Iron ( $\text{Fe}^{3+}$ ) -> Nitrate ( $\text{NO}_3^-$ ) -> Manganese ( $\text{Mn}^{4+}$ )
- C. Manganese ( $\text{Mn}^{4+}$ ) -> Nitrate ( $\text{NO}_3^-$ ) -> Sulfate ( $\text{SO}_4^{2-}$ ) -> Iron ( $\text{Fe}^{3+}$ )
- D. Iron ( $\text{Fe}^{3+}$ ) -> Sulfate ( $\text{SO}_4^{2-}$ ) -> Nitrate ( $\text{NO}_3^-$ ) -> Manganese ( $\text{Mn}^{4+}$ )

**50. A farmer adds a new organic amendment to the soil. Laboratory analysis shows it contains 40% Carbon and 0.5% Nitrogen. Calculate the C:N ratio and predict the short-term biological effect on soil nitrogen.**

- A. C:N is 8:1; Rapid net mineralization
- B. C:N is 80:1; Severe net immobilization
- C. C:N is 20:1; Balanced mineralization and immobilization
- D. C:N is 40:1; Rapid denitrification



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## Answer Key

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Q 1. B

Q 2. C

Q 3. C

Q 4. B

Q 5. A

Q 6. B

Q 7. A

Q 8. B

Q 9. C

Q 10. B

Q 11. B

Q 12. B

Q 13. A

Q 14. C

Q 15. B

Q 16. C

Q 17. C

Q 18. B

Q 19. B

Q 20. C

Q 21. B

Q 22. B

Q 26. B

Q 27. B

Q 28. C

Q 29. B

Q 30. C

Q 31. C

Q 32. C

Q 33. B

Q 34. A

Q 35. C

Q 36. B

Q 37. A

Q 38. C

Q 39. C

Q 40. B

Q 41. B

Q 42. C

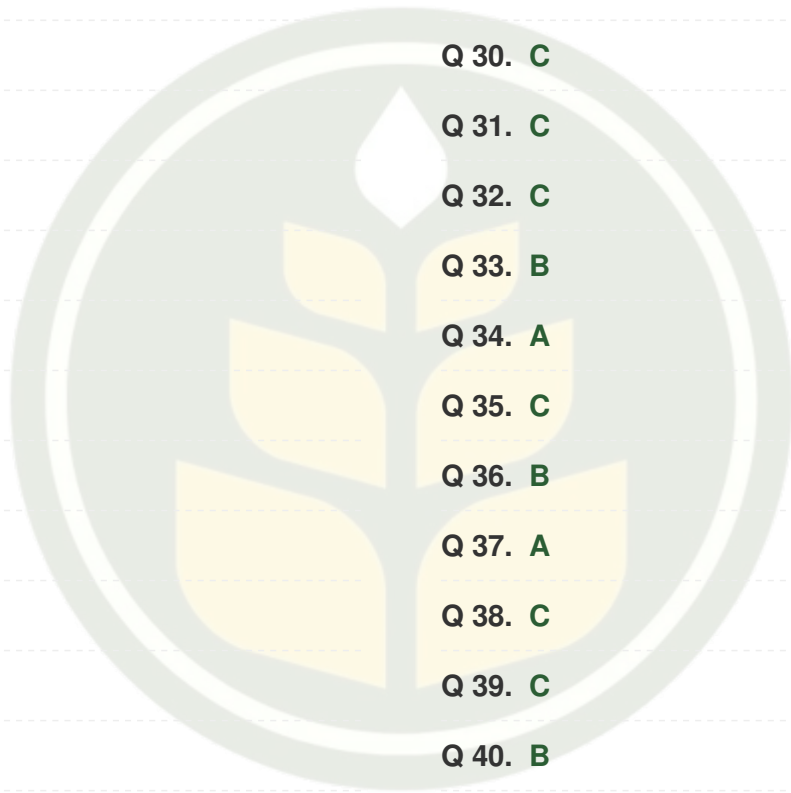
Q 43. B

Q 44. B

Q 45. B

Q 46. C

Q 47. B



Q 23. D

Q 48. C

Q 24. B

Q 49. A

Q 25. C

Q 50. B

