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POPULAR ARTICLE

Role of microorganisms in organic farming

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Intricacies of the subject

Farming is the practice of growing crops and/or raising animals for food, fibre, fuel, and other useful products. It is an important part of agriculture and provides food and raw materials for people and industries. Organic farming is a sustainable agricultural system that relies on natural processes and biological inputs to maintain soil fertility, crop productivity, and environmental health while minimizing the use of synthetic fertilizers and pesticides. Microorganisms play a fundamental role in organic farming because they are responsible for several essential biological processes in soil, including decomposition of organic matter, nutrient cycling, nitrogen fixation, phosphorus solubilization, and suppression of plant pathogens. Beneficial microorganisms such as *Rhizobium*, *Azotobacter*, *Azospirillum*, phosphate-solubilizing bacteria, mycorrhizal fungi, Trichoderma, and *Bacillus species* contribute significantly to plant growth and soil health. They convert complex organic materials into simpler forms that can be readily absorbed by plants. Microbial decomposition of crop residues, farmyard manure, compost, and other organic materials increases the availability of nutrients and contributes to the formation of soil organic matter. Microorganisms also act as natural biofertilizers and biocontrol agents. Nitrogen-fixing bacteria increase the availability of nitrogen to crops, while phosphate-solubilizing microorganisms improve phosphorus availability. Mycorrhizal fungi enhance root development and facilitate the uptake of water and minerals. Certain beneficial microbes protect crops against diseases by competing with pathogens, producing antimicrobial compounds, and stimulating the plant's natural defense mechanisms.

Fig: Concept of organic farming in rice

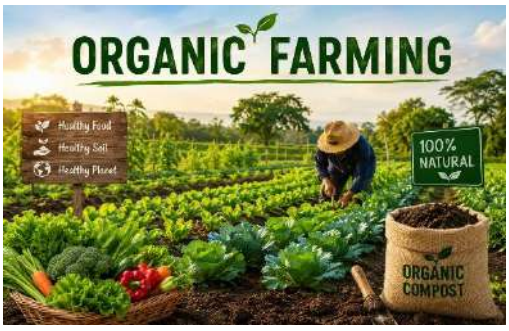

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Table: Microorganisms in organic farming

S. No.	Microorganisms role	Microorganisms involved	Importance in organic farming
1	Decomposition of organic matter	Bacteria, fungi, actinomycetes	Break down crop residues, animal manure and other organic materials into simpler substances.
2	Nutrient cycling	Bacteria, fungi	Convert nutrients present in organic matter into forms that can be absorbed by plants.
3	Nitrogen fixation	*Rhizobium*, *Azotobacter*, *Azospirillum*	Convert atmospheric nitrogen into plant-available forms, reducing the need for synthetic nitrogen fertilizers.
4	Phosphorus solubilization	*Bacillus*, *Pseudomonas*, *Aspergillus*, *Penicillium*	Convert insoluble phosphorus into soluble forms that plants can utilize.
5	Potassium mobilization	*Bacillus*, *Pseudomonas*, fungi	Release potassium from mineral sources and make it more available to plants.
6	Production of plant growth-promoting substances	*Azotobacter*, *Azospirillum*, *Pseudomonas*	Produce substances such as auxins, gibberellins and cytokinins that stimulate plant growth.
7	Mycorrhizal association	Arbuscular mycorrhizal fungi (AMF)	Improve phosphorus and micronutrient uptake and enhance plant tolerance to drought and other stresses.
8	Biological control of pests and diseases	*Trichoderma*, *Bacillus*, *Pseudomonas*, *Beauveria*	Suppress harmful pathogens and insects through competition, antibiosis, parasitism or other mechanisms.
9	Improvement of soil structure	Bacteria, fungi, actinomycetes	Promote soil aggregation and improve aeration, water-holding capacity and root development.
10	Composting	Bacteria, fungi, actinomycetes	Accelerate the breakdown of organic wastes and produce nutrient-rich compost.
11	Degradation of harmful substances	Various soil microorganisms	Help break down certain pesticide residues and other organic pollutants in soil.
12	Improvement of soil fertility	Bacteria, fungi and other beneficial microbes	Increase nutrient availability and maintain biological activity in the soil.
13	Enhanced plant resistance	*Pseudomonas*, *Bacillus*, mycorrhizal fungi	Stimulate plant defense mechanisms and improve resistance to diseases and environmental stresses.
14	Reduction of chemical fertilizer dependence	Biofertilizing microorganisms	Provide nutrients naturally and support sustainable crop production.
15	Promotion of sustainable agriculture	Beneficial microbial communities	Maintain soil health, support biodiversity and contribute to environmentally friendly agricultural production.

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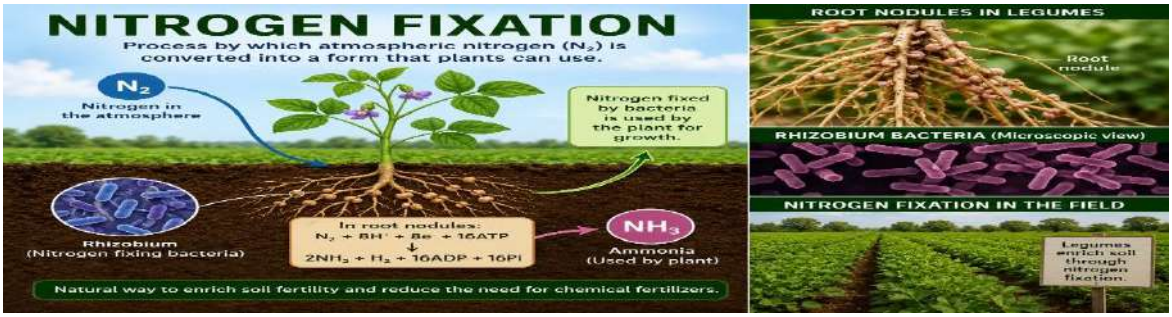
Fig: Nitrogen fixation concept in nodule producing plants



Thus, microorganisms serve as an important biological foundation of organic farming by improving soil fertility, enhancing nutrient availability, promoting plant growth, reducing dependence on chemical inputs, and supporting sustainable agricultural production. Their effective utilization can contribute to maintaining long-term soil productivity while protecting biodiversity and the surrounding environment.

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