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Agri-Advances: Modern Techniques for Organic Farming & Resilient Crop Management

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INTRODUCTION

Agriculture is facing major challenges such as climate change, soil degradation, declining water resources and increasing pest outbreaks. To overcome these problems, farmers are increasingly adopting sustainable and eco-friendly farming practices. Organic farming and resilient crop management focus on maintaining soil fertility, conserving natural resources and improving crop productivity without excessive dependence on synthetic chemicals. These approaches help ensure food security while protecting environmental health and promoting sustainable agricultural development.

Organic farming emphasizes the use of natural inputs such as organic manures, compost, biofertilizers and biological pest control methods to maintain soil fertility and crop productivity. At the same time, resilient crop management focuses on improving the ability of crops to withstand environmental stresses such as drought, floods, pests and diseases. By integrating modern technologies with ecological farming practices, farmers can achieve sustainable production while protecting natural resources and maintaining environmental balance.

Modern Techniques in Organic Farming



Fig: - Organic farming field sowing crop diversity, mulching and sustainable soil management practices.

1. Composting and Vermicomposting

Composting is the biological decomposition of organic materials such as crop residues, farmyard manure, leaves and kitchen waste into a stable organic fertilizer. This process is carried out by microorganisms under controlled conditions.

Vermicomposting is an advanced composting method that uses earthworms such as *Eisenia fetida* to convert organic waste into highly nutritious vermicompost.

Advantages

- ❖ Improves soil fertility and organic matter content
- ❖ Enhances soil structure and aeration
- ❖ Increases microbial activity in soil
- ❖ Improves water holding capacity of soil

Regular application of compost improves long term soil productivity and reduces the need for chemical fertilizers.



Fig: - Preparation of vermicompost using organic farm waste and earthworms to produce nutrient-rich manure.

2. Biofertilizers

Biofertilizers are living microorganisms that enhance nutrient availability to plants by fixing atmospheric nitrogen, solubilising phosphorus or stimulating plant growth.

Common biofertilizers used in organic farming

- ✚ **Rhizobium** – forms symbiotic association with legume crops and fixes atmospheric nitrogen.
- ✚ **Azotobacter** – fixes nitrogen in non-leguminous crops such as wheat and maize.
- ✚ **Azospirillum** – promotes root growth and improves nutrient uptake.
- ✚ **Phosphate Solubilizing Bacteria (PSB)** – convert insoluble phosphorus into plant-available forms.

The use of biofertilizers reduces chemical fertilizer dependency and improves soil biological activity.

3. Green Manuring

Green manuring involves growing specific crops and incorporating them into the soil while they are still green and succulent.

Common green manure crops include:

- ❖ Sunhemp (*Crotalaria juncea*)
- ❖ Dhaincha (*Sesbania aculeata*)
- ❖ Cowpea (*Vigna unguiculata*)

Benefits

- ❖ Adds organic matter to the soil
- ❖ Improves soil fertility and structure
- ❖ Enhances microbial activity
- ❖ Reduces soil erosion and nutrient loss

Green manuring is particularly beneficial in improving nitrogen content and soil productivity.

Resilient Crop Management Practices

1. Crop Diversification

Crop diversification is an important strategy to improve farm resilience and reduce the risks associated with climate variability and pest outbreaks.

Methods of crop diversification

- ❖ Mixed cropping
- ❖ Intercropping
- ❖ Crop rotation

Crop rotation helps break pest and disease cycles, improves soil fertility and enhances nutrient utilization.

Example: Rice followed by pulses or oilseeds.

2. Water Conservation Techniques

Efficient water management is essential for sustainable crop production, particularly in regions facing water scarcity.

Important techniques include:

- ✚ **Drip irrigation** – supplies water directly to plant roots, minimizing wastage
- ✚ **Mulching** – covering soil surface with organic materials such as straw or crop residues to reduce evaporation.
- ✚ **Rainwater harvesting** – collection and storage of rainwater for irrigation.

These practices help conserve water, improve soil moisture retention and increase crop productivity.

3. Integrated Pest Management (IPM)

Integrated Pest Management is an eco-friendly approach that combines different pest control strategies to minimize pest damage while reducing chemical pesticide use.

Components of IPM

- ❖ Cultural control practices such as crop rotation and field sanitation
- ❖ Mechanical control methods like hand-picking of pests
- ❖ Biological control using predators and parasitoids
- ❖ Botanical pesticides such as neem extracts
- ❖ Monitoring pests using pheromone traps and light traps

IPM ensures sustainable pest control while protecting beneficial organisms and the environment.

4. Climate Resilient Crop Techniques

Climate-resilient agriculture focuses on practices that improve the ability of crops to withstand environmental stresses such as drought, floods and temperature fluctuations.

Important strategies include:

- ❖ Adoption of drought-tolerant and stress-tolerant crop varieties
- ❖ Improving soil organic matter and soil health
- ❖ Efficient irrigation management
- ❖ Early warning systems for pest and disease outbreaks
- ❖ Crop insurance and climate-based advisory services

These strategies help farmers adapt to climate change and maintain stable crop yields.

Table: Comparison Between Conventional and Organic Farming

Parameter	Conventional Farming	Organic Farming
Fertilizers	Chemical fertilizers	Compost, FYM, biofertilizers
Pest Management	Synthetic pesticides	Biological and botanical control
Soil Health	Often deteriorates	Improves over time
Environmental Impact	Higher pollution	Environment friendly
Sustainability	Short-term productivity	Long-term sustainability

Do's and Don'ts

Do's

- ❖ Regularly inspect crops for pests and diseases
- ❖ Use organic manures and biofertilizers to maintain soil fertility
- ❖ Adopt crop rotation and diversification
- ❖ Use biological and mechanical pest control methods
- ❖ Practice water conservation techniques

Don'ts

- ❖ Avoid excessive use of chemical fertilizers and pesticides
- ❖ Do not burn crop residues in the field
- ❖ Avoid monocropping for many seasons
- ❖ Do not ignore soil testing and proper nutrient management

CONCLUSION

Organic farming and resilient crop management practices play a crucial role in achieving sustainable agricultural development. By adopting modern techniques such as composting, biofertilizers, green manuring, crop diversification, efficient water management and integrated pest management, farmers can enhance soil fertility, improve crop productivity and reduce environmental pollution. These practices also strengthen the resilience of farming systems against climate change and ensure long-term food security and environmental sustainability.