

Insect –pests Management Strategies in Organic FarmingAnkit Kumar¹, Anjali Bhardwaj², Aditya Kumar Sharma³ and Abhishek Kumar Yadav⁴**Abstract: -**

Organic farming is a sustainable agricultural system that promotes soil health, biodiversity, and environmental conservation by minimizing the use of synthetic agrochemicals. Effective pest management in organic farming relies on an integrated approach involving cultural practices, biological control agents, botanical pesticides, habitat management, and regular pest monitoring. Crop rotation, intercropping, and trap cropping reduce pest incidence, whereas predators, parasitoids, entomopathogenic microorganisms, and plant-based pesticides provide eco-friendly pest suppression. Habitat diversification enhances the abundance of natural enemies and pollinators, improving ecosystem stability. Continuous field surveillance and timely interventions maintain pest populations below the economic injury level while preserving environmental quality. Thus, integrated organic pest management offers a sustainable, environmentally safe, and economically viable strategy for crop protection, ensuring long-term agricultural productivity and food security.

Keywords: Organic farming, Biological pest management, Botanical pesticides, Monitoring and Economic etc.

Introduction:

Organic farming is a production system that prohibits the use of synthetically produced agro-inputs (fertilizers and pesticides). Instead, it relies on organic material (such as crop residues, animal residues, legumes, bio-pesticides) for

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“maintaining soil productivity and fertility and managing pests under conditions of sustainable natural resources and a healthy environment.

Eliminating synthetic or chemical-based inputs is, however, only one aspect of the organic production system. More importantly, it emphasizes a whole-system approach in which all the individual components (soil minerals, organic matter, micro-organisms, insects, plants, animals, and humans) create a sustainable and self-regulating ecosystem. The National Organic Standards Board of the United States Department of Agriculture (USDA) defines it as "An ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on the minimal use of off-farm inputs and management practices that restore and enhance ecological harmony or Organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection. Organic agriculture is a widely employed strategy aimed at mitigating the detrimental impacts of synthetic fertilizers and pesticides. Over the

past three decades, farming in India has increasingly displayed characteristics of unsustainability. Organic agriculture was implemented as a means of addressing the adverse impact inflicted upon the natural environment by the use of chemical and synthetic fertilizers. Organic agriculture denotes a recently adopted agricultural system that aims to reinstate soil fertility whilst simultaneously preserving and enhancing the ecological equilibrium (Mishra *et al.*, 2025).

Organic farming is an eco-friendly and sustainable farming system. It avoids or minimizes the use of synthetic fertilizers, pesticides, hormones, and chemicals. It mainly depends on:

1. Organic manures.
2. Crop residue
3. Bio-fertilizers
4. Crop rotation
5. Biological pest management

Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs (FAO).

Principle of Organic farming: -It is 4 types

1. Principle of health

2. Principle of Ecology
3. Principle of Fairness
4. Principle of care
1. **Principle of health:** It sustains and enhances the health of soil, plant, animal, human and planet. Healthy soil produces healthy crops and nutritious food. It avoids harmful chemicals and synthetic inputs.
2. **Principle of Ecology:** Organic farming is based on living ecological systems and natural cycles. It works with nature, emulates and helps sustain it by promoting biodiversity, recycling and ecological balance. It maintains soil fertility and environmental quality while sustaining and enhancing the health of soil, plants, animals, humans and the planet. Healthy soil produces healthy crops, nutritious food and organic farming avoids the use of harmful chemicals and synthetic inputs, ensuring a safer and more sustainable agricultural system.
3. **Principle of Fairness:** Organic farming promotes fairness and equity among all stakeholders, including farmers, workers, processors, traders, and consumers. It enhances quality of life while strengthening food sovereignty through sustainable agricultural practices. Responsible use of natural resources ensures their availability for present as well as future generations. Respect for animal welfare further encourages humane living conditions, reflecting the ethical values of organic farming.
4. **Principle of care:** Organic farming is managed in a precautionary, responsible manner to safeguard the health and well-being of present as well as future generations while protecting the environment. It avoids risky technologies, preferring safe, eco-friendly practices that support sustainable agriculture. Traditional knowledge is combined with scientific innovations through a careful approach, ensuring ecological integrity, environmental sustainability, and long-term agricultural resilience.

PEST MANAGEMENT STRATEGY STRATEGIES

It involves different combination of techniques in a judicious manner that maintains the pest population below the economic injury level. Organic farming is gaining global importance because of the increasing demand for healthy, chemical-free food. Pest management remains one of the major challenges in organic agriculture, requiring sustainable approaches that maintain ecological balance. Rather than eliminating pests completely, organic farming aims to keep their populations below economically

damaging levels. This approach supports biodiversity, preserves environmental sustainability and protects crop productivity, safeguards human as well as animal health.

Cultural Practices for Prevention of

Pest: Preventing pests from becoming settled is the first step towards organic farming. Some of the common cultural practices include:

- 1. Crop rotation:** Changing different crop each season disrupt the life cycle of pest and increase the fertility of the land.
- 2. Inter cropping:** Planting multiple crops at the same time baffles the pest and attract the beneficial insect.

3. Trap cropping: Growing a crop that diverts pests away from the main crop (e.g. Mustard to divert aphids away)

4. Timely Planting: Changing the planting and harvesting schedule to prevent the peak periods of pest activity.

Biological Control using Natural

Enemies: Utilization of natural enemies like predators, parasitoids and pathogen to maintain the pest population is called Biological control. Biological control uses living organism to regulate pests naturally. This is an environmentally friendly method and ensures natural bio-diversity in the farm.

Table: List of Some Bio-control agents

Bio-control agent	Effective Against	Crops
Bacteria <i>Bacillus thuringiensis</i>	Lepidopteran pests	Cotton, Sunflower and Vegetable
Entomopathogenic fungi <i>Metarhizium anisopliae</i> <i>Beauveria bassiana</i> <i>Verticillium lecanii</i>	Coleopteran Grub Lepidopteran and Coleopteran Aphids and Whitefly	Coconut, Cotton and Green house vegetable
Insect predators Lady bird beetle <i>Chrysoperla</i> spp	Aphids, Whiteflies and Mealy bug	Fruit and Vegetable
Insect Parasitoids <i>Trichogramma</i> spp <i>Cheloni blackburni</i>	Larva of Lepidopteran	Sugarcane and Tomato
Entomopathogenic Nematodes <i>Heterorhabditis bacteriophora</i> <i>Steinernema carpocapsae</i>	Coleopteran and Lepidopteran	Sugarcane and Plantation crops
Entomopathogenic Viruses <i>Nuclear Polyhedrosis virus</i> <i>Granulosis virus</i>	<i>Helicoverpa armigera</i> and Other Lepidopteran larva	Pulse and Vegetable

Source (Kumar et al., 2018)

These include:

Insect predators: Like lady bird beetle and Green lacewing prey on aphids and soft body insects.

Parasitoids: It is minute wasp which lay eggs within pest larva or egg

Pathogen: Like *Bacillus thuringiensis* (Bt) a bacterium that kills caterpillar but is harmless to beneficial insects.

Botanical Pesticides and Plant Extract: Nature offers a wide range of pest control methods in the form of plant extract.

1. **Neem Oil:** Act as Antifeedant. It disrupts pest feeding and reproduction.
2. **Garlic and chilli sprays:** Repellents for ubiquitous insects.
3. **Pyrethrum Extract:** Obtained from Chrysanthemum flower; used against a broad spectrum of pests.

These plant products are organic registered for use in organic farming and safe.

Habitat Management and Bio-diversity: Organic farming is concerned with developing an efficient eco-system.

Table: 2- List of some Potential Botanicals

Botanical	Active Compounds/Activity	Effective against insect-pest
Neem (<i>Azadirachta indica</i>)	Azadirachtin	Caterpillar, thrips and whitefly
Chrysanthemum <i>Chrysanthemum cinerariifolium</i>	Pyrethrins	Broad spectrum botanical using flying and chewing insects
Garlic <i>Allium sativum</i>	Antifeedant and Repellent	Ant, Aphids, Armyworm, Diamond back moth, whitefly, wireworms and termites
Tobacco <i>Nicotiana tabacum</i> <i>Nicotiana rustica</i>	Nicotine	Sucking and Chewing insect
Fish bean <i>Tephrosia vogelii</i>	Natural Rotenoids	Beetles, Caterpillar and leaf feeding insects
Marigold <i>Tegetes spp</i>	Repellent effect	Root nematode and soil pest
Chilli <i>Capsicum spp</i>	Repellent effect	Aphid, moth and soft bodies insect
Spearmint /Coriandrum/Chives <i>Mentha sp.</i> /Coriandrum sativum <i>Allium schoenoproasum</i>	Repellent activity	Aphid, moths and root flies
Neem cake	Soil pest deterrent	Soil insects and Mice

Source – (Sharma and Kumar 2026)

Hedgerows, flowering borders and waterbodies are conserved by farmers to promote bio-diversity. They are visited by pollinators and natural predators to control pests naturally. A balance eco system ensures that there will be no unchecked increase of any pest population. It support pollinators, Enhance natural predators, improve soil health, conserve water resources and promote bio-diversity.

Hedgrowers: Shelter and habitat for beneficial insects.

Flowering borders: Attract pollinators and natural enemies.

Waterbodies: Support diverse life and microhabitats.

A balanced eco-system is the key to healthy crops, healthy soil and sustainable future.

Continuous Monitoring and Record-Keeping: Having knowledge of the population of the pest enable the farmers to respond quickly. By field scouting, using traps and keeping records farmers can identify early sign of pest infestation and schedule interventions accordingly.

☞ Use of traps: Deploy traps such as sticky traps, pheromones traps and light traps to monitor pest population regularly.

☞ Field Scouting: Regularly inspect crops to detect early sign of pest presence, damage or disease.

☞ Record Keeping: Maintain records of pest observations, traps catches interventions and outcomes for better decision making.

The advantage of this system is enable timely action before pests reach damaging level, Reduces unnecessary intervention and costs, Improves effectiveness of pest management strategies and supports long term eco-system balance; productivity.

Monitor today, protect tomorrow – for healthy crops and sustainable future.

Conclusion

Organic farming pest control is not elimination but balance. By mixing cultural practices, biological control, botanical extracts and ecological methods, farmers can safeguard their crops without harming the environment. And it will take more work and wisdom, but the dividends—are secure food, healthier environments, and sustainable agriculture—are worth it.

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