GreenariA
Go Green, Learn Green
An Agricultural Monthly e-Magazine
Volume 04, Issue 05, 2026
ISSN: 2584-153X
Article ID: G-26-0502

BIOPESTICIDES IN FRUIT FARMING: A SUSTAINABLE APPROACH TO PEST MANAGEMENT

Hariprasanth T[1*], Pavithra G[2], Jegan KP [1], Bonipas Antony J[3], Dhamotharan P[3] and Sakthivel S[2]

[1]Department of Fruit Science, Tamil Nadu Agricultural University, Coimbatore
[2]Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore
[3]Department of Genetics and Plant Breeding, Tamil Nadu Agricultural University, Coimbatore
**Corresponding Author Mail ID: prasanthhari246@gmail.com*

Introduction

In agriculture, the term "biocide" has grown increasingly popular. Biopesticides helps in fruit farming because they are natural and for both the plants and people. As the demand for organic and sustainably grown produce rises, fruit farmers are increasingly turning to biopesticides as a safer, eco-friendly alternative to chemical pesticides. Special products from natural sources such as plants, bacteria, fungi, and minerals, and they offer an effective way to control pests without using harsh chemicals.

Unlike chemical pesticides, which often come with a litany of side effects, biopesticides boast lower toxicity to humans, animals, and beneficial insects. They play a significant role in sustainable agriculture, particularly in fruit farming, by providing an environmentally friendly alternative to synthetic chemical pesticides.

Biopesticide not only support the health of ecosystem ecosystems but also contributes to the long term viability of fruit farming in an increasingly environmentally conscious world.

Types of Biopesticides.

Biopesticides are natural substances or organisms used to control pests.

They can be classified into three main types.

1. Microbial Biopesticides

Derived from living microorganisms (e.g., bacteria, fungi, viruses) that target specific pests. For example, *Bacillus thuringiensis* (Bt) is a bacterial biopesticide widely used to control caterpillars in fruit crops such as apples and grapes.

***Bacillus thuringiensis* (Bt)**

- ✓ Bt is a microbial biopesticide used to target caterpillars and larvae that feed on mango leaves and fruits.
- ✓ It acts by producing toxins that specifically target the gut of these pests, leading to their death without harming beneficial insects or the environment.

2. Botanical Biopesticides

These are derived from plants with natural pesticidal properties, such as neem oil, which acts as an insect repellent and disrupts the lifecycle of various pests in fruit crops like citrus and mango.

Neem-Based Biopesticides

- ✓ Neem oil and neem cake (a byproduct of neem oil extraction) were applied to control a range of pests, including hoppers and mealybugs.
- ✓ Neem's active compounds, azadirachtin and other limonoids, are known to disrupt insect growth and reproduction, making it an effective and natural pest deterrent.

Pyrethrin (flower power)

Derived from chrysanthemum flowers, pyrethrin is another popular biopesticide used effectively against a range of fruit pests. Its fast acting properties make it a favourite for farmers looking for immediate results.

Insecticidal Soaps

Insecticidal soaps work by suffocating insects, making them an excellent option for soft bodied pests. They're especially great for organic fruit farming and safe to use during the fruiting phase.

3. Biochemical Biopesticides

These include natural substances like pheromones that control pests by non-toxic mechanisms by interfere with pest mating patterns or disrupt their behaviour.

Pheromone Traps:

- ✓ These traps were introduced to manage fruit fly populations, a significant pest in mango orchards.
- ✓ The traps use synthetic pheromones to lure male fruit flies, reducing the mating population and subsequently lowering the pest pressure.

Application Methods

Spraying Techniques

Spraying is the most common application method. To minimize the risk of harming beneficial insects, apply biopesticides in the early morning or late evening.

Soil Application

Some biopesticides can be incorporated into the soil, promoting a beneficial soil ecosystem. This method can be incredibly effective against root pests.

Biopesticide in fruit crops

Papaya: In the 1990s, the papaya industry in Hawaii faced a severe crisis due to the papaya ringspot virus (PRSV), which devastated crops and led to a significant decline in production. To combat these challenges, Hawaiian papaya farmers adopted a comprehensive integrated pest management (IPM) approach, incorporating biopesticides as a key component. One of the most successful biopesticides used was *Bacillus thuringiensis* (Bt), a naturally occurring soil bacterium that produces proteins toxic chemical. Bt was used to target the fruit fly larvae that were causing significant damage to papaya crops.

Apple: The use of *Bacillus thuringiensis* to control apple pests has shown significant success in reducing the need for chemical pesticides, leading to more sustainable production.

Citrus: Neem oil has been effectively used to manage a variety of pests in citrus farming, particularly in controlling aphids and mites.

Mango: Neem based biopesticide and pheromone traps are used to control pest on mango. The integrated use of these biopesticides has reduced chemical pesticide usage by up to 50%. This approach has made mango production more sustainable and also opened up opportunities for exporting the mango.

Benefits of biopesticide

- ✓ One of the primary benefits of biopesticides is the reduction of chemical residues on fruits.
- ✓ Biopesticides generally target specific pests, unlike their chemical cousins, which can be a broad-spectrum weapon. This specificity is crucial because it helps preserve beneficial insects like bees, which play a significant role in pollination.

- ✓ Using biopesticides can encourage natural predators and enhance biodiversity in fruit-growing ecosystems. This balance is essential for long-term agricultural health.
- ✓ By opting for natural over synthetic chemicals, farmers can reduce pollution and help protect water sources from contamination.
- ✓ Fruits grown with biopesticides are often marketed as organic or environmentally friendly, attracting health-conscious consumers and potentially higher market prices
- ✓ While the initial cost of biopesticides may be higher than conventional options, they can lead to savings in the long run. Additionally, as more consumers demand organic products, employers might see better profit margins.
- ✓ With lower toxicity and specific action, biopesticides help in managing resistance in pests, which is a significant problem with synthetic pesticides.

Challenges in Using Biopesticides

1. Limited Spectrum

Biopesticides often have a narrow spectrum of activity, targeting specific pests, which may require the use of multiple products for effective pest management.

2. Variability in Performance

Their effectiveness can be influenced by environmental conditions like temperature and humidity, making their performance less predictable compared to chemical pesticides.

3. Shorter Shelf Life

Many biopesticides have a shorter shelf life, requiring proper storage and timely application to maintain efficacy.

Future of Biopesticides in Fruit Farming

The future looks promising for biopesticides, with ongoing research and development focusing on improving their efficacy, reducing costs, and expanding their availability. As consumers continue to demand sustainable and organic fruit, the adoption of biopesticides is likely to grow, helping to create a more sustainable and resilient fruit farming industry

Conclusion

Biopesticides offer a sustainable and effective solution for pest management in fruit farming. By integrating biopesticides into their practices, farmers can protect their crops, safeguard the environment, and meet the growing consumer demand for cleaner, safer food. This approach not only supports the health of ecosystems but also contributes to the long-term viability of fruit farming in an increasingly environmentally conscious world.

.