



## **Role of Marigold in Natural Pest Management**

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### **Abstract**

Marigold (*Tagetes* spp.) is widely cultivated as an ornamental flower, but its role extends far beyond decoration. It is an important plant in natural and sustainable pest management systems. Marigold possesses insecticidal, nematicidal, repellent, and allelopathic properties due to the presence of bioactive compounds such as thiophenes, flavonoids, and essential oils. It is commonly used as a companion crop, trap crop, and cover crop in vegetable and horticultural production systems. Scientific research has demonstrated that marigold suppresses root-knot nematodes (*Meloidogyne* spp.), repels insect pests, and attracts beneficial insects. As concerns about chemical pesticide residues and environmental health increase, marigold offers an eco-friendly alternative for integrated pest management (IPM). This article explores the mechanisms, applications, and benefits of marigold in natural pest control.

### **Introduction**

Sustainable agriculture aims to reduce dependence on synthetic pesticides while maintaining crop productivity. Excessive use of chemical pesticides has led to environmental pollution, pest resistance, and health risks. As a result, natural pest management strategies such as crop rotation, biological control, and companion planting are gaining importance.

Marigold (*Tagetes erecta*, *Tagetes patula*, and other species) belongs to the family Asteraceae. Traditionally known for its ornamental and cultural value, marigold has also been recognized for its pesticidal properties. Farmers have long planted marigold alongside vegetables to reduce pest incidence. Modern research confirms that marigold produces secondary metabolites that suppress soil-borne pathogens, repel insects, and improve soil health.



## **Bioactive Compounds Responsible for Pest Control**

Marigold contains several biologically active substances, including:

- **Thiophenes ( $\alpha$ -terthienyl)** – toxic to nematodes and soil insects
- **Essential oils (limonene, ocimene, tagetone)** – insect-repellent properties
- **Flavonoids and phenolics** – antimicrobial activity
- **Alkaloids and terpenoids** – defensive compounds

Among these,  $\alpha$ -terthienyl is particularly important for nematode suppression. It becomes highly toxic to nematodes under sunlight exposure.

## **Role of Marigold in Pest Management**

### **1. Control of Root-Knot Nematodes**

Root-knot nematodes (*Meloidogyne* spp.) are major pests affecting vegetables like tomato, brinjal, chilli, and okra. Marigold roots release thiophenes that are toxic to nematodes. Studies show that growing marigold as a preceding or intercrop significantly reduces nematode populations in soil.

Marigold acts in two ways:

- Suppresses nematode reproduction
- Produces toxic root exudates that kill larvae

This makes marigold an effective biofumigant crop in crop rotation systems.

### **2. Companion Planting**

Marigold is widely used as a companion plant in vegetable gardens. When planted alongside crops like tomato, cabbage, and beans, it helps:

- Repel whiteflies and aphids
- Reduce thrips infestation
- Deter certain beetles



The strong scent of marigold masks host plant odors, making it difficult for pests to locate their target crops.

### **3. Trap Cropping**

In some systems, marigold is used as a trap crop to attract pests away from main crops. Certain insects prefer marigold flowers, allowing farmers to monitor or manage pest populations more effectively.

### **4. Attracting Beneficial Insects**

Marigold flowers attract pollinators and natural enemies such as:

- Ladybird beetles
- Lacewings
- Parasitic wasps

These beneficial insects feed on harmful pests like aphids and caterpillars, supporting biological control.

### **5. Antifungal and Antibacterial Effects**

Marigold extracts exhibit antimicrobial properties that suppress soil-borne pathogens. Incorporation of marigold residues into soil can reduce fungal diseases and improve soil microbial balance.

### **6. Use in Organic Farming and IPM**

Marigold fits well into Integrated Pest Management (IPM) programs because it:

- Reduces chemical pesticide requirement
- Enhances biodiversity
- Improves soil health
- Is cost-effective and easy to cultivate

It is particularly suitable for small-scale and organic farmers seeking eco-friendly pest solutions.



### **Mechanisms of Action**

Marigold controls pests through multiple mechanisms:

1. **Chemical toxicity** – Release of nematicidal compounds like  $\alpha$ -terthienyl.
2. **Repellent action** – Volatile oils repel insects.
3. **Allelopathy** – Inhibits growth of certain harmful organisms.
4. **Habitat diversification** – Supports beneficial insects and biodiversity.

This multi-target approach reduces the likelihood of pest resistance compared to synthetic pesticides.

### **Limitations and Considerations**

Although marigold is beneficial, its effectiveness depends on:

- Proper species selection (*T. patula* often more effective against nematodes)
- Adequate planting density
- Crop rotation planning
- Environmental conditions

Marigold is not a complete substitute for all pest control measures but serves as a valuable component of integrated strategies.

### **Conclusion**

Marigold is a multifunctional crop that plays a significant role in natural pest management. Its nematicidal, insect-repellent, antimicrobial, and beneficial insect-attracting properties make it an effective tool in sustainable agriculture. By incorporating marigold into cropping systems through companion planting, crop rotation, or intercropping, farmers can reduce reliance on chemical pesticides and promote ecological balance. As the demand for organic and environmentally safe farming practices increases, marigold stands out as an affordable and practical solution for integrated pest management. Continued research and farmer awareness can



further enhance its utilization in sustainable crop production systems.

## References

1. Hooks, C. R. R., & Johnson, M. W. (2003). Impact of agricultural diversification on insect communities of cruciferous crops. *Crop Protection*, 22(2), 223–238.
2. Marahatta, S. P., Wang, K. H., & Hooks, C. R. R. (2012). Effects of marigold (*Tagetes* spp.) on plant-parasitic nematodes. *Journal of Nematology*, 44(3), 273–280.
3. Ploeg, A. T. (2002). Effects of selected marigold varieties on root-knot nematodes and tomato and melon yields. *Plant Disease*, 86(5), 505–508.
4. Dharmagadda, V. S. S., et al. (2005). Antimicrobial activity of essential oils from *Tagetes patula* and *Tagetes erecta*. *Fitoterapia*, 76(7–8), 690–693.
5. Khan, M. R., & Mohiddin, F. A. (2012). Role of marigold in management of plant parasitic nematodes: A review. *Indian Journal of Nematology*, 42(1), 1–11.
6. Isman, M. B. (2006). Botanical insecticides, deterrents, and repellents in modern agriculture. *Annual Review of Entomology*, 51, 45–66.