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ECO-FRIENDLY PEST MANAGEMENT IN VEGETABLE CROPS THROUGH BOTANICALS

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Introduction

Integrated pest management (IPM) is a comprehensive and sustainable approach for managing pests in agriculture. It incorporates various techniques, including cultural, biological, physical, and chemical methods, to keep pest populations below economically harmful levels while minimizing environmental harm. One eco-friendly and effective element of IPM is the use of botanicals, which are plant-derived compounds with pesticidal properties. In vegetable crop production, botanicals serve as a natural alternative to synthetic chemical pesticides, supporting both pest control and ecosystem health.

Botanicals in IPM

Botanicals are plant-based substances containing bioactive compounds such as alkaloids, terpenoids, phenolics, and essential oils. These compounds serve as natural defenses for plants against herbivores and pathogens. When applied correctly, botanical extracts can interfere with pest behaviour, feeding, reproduction, and development without harming non-target organisms or leaving harmful residues in the environment.

Advantages of Botanicals in IPM for Vegetable Crops

1.Reduced chemical reliance: Botanicals offer a natural alternative to synthetic pesticides, decreasing dependence on harmful chemicals and reducing associated environmental and health risks.

2.Selective pest control: Many botanicals have specific modes of action that target pests without affecting beneficial organisms, preserving the balance of natural ecosystems and agroecosystems.

3.Resistance management: The overuse of synthetic pesticides can lead to pest resistance. Botanicals provide a different mode of action, reducing the likelihood of resistance development.

4.Low residue levels: Botanical pesticides break down more rapidly in the environment than synthetic chemicals, resulting in lower residue levels on crops and less risk to human health.

5.Biodiversity preservation: By sparing beneficial insects and natural predators, botanicals help conserve biodiversity and maintain ecological balance.

Common Botanicals Used in Vegetable Crop IPM

Neem (*Azadirachta indica*)

Neem extracts contain azadirachtin, which disrupts insect moulting and feeding, effectively controlling pests like gypsy moths, leaf miners, whiteflies and mealybugs.

Azadirachta indica

Chrysanthemum cinerariifolium

Pyrethrum (*Chrysanthemum cinerariifolium*)

Pyrethrin extracts, known for their rapid knockdown effect, control aphids, caterpillars and beetles. They are marketed under names like PyGanic and EverGreen.

Garlic (*Allium sativum*) and Onion (*Allium cepa*) extracts

These sulfur-based compounds repel pests and inhibit their feeding, especially soft-bodied insects.

Allium sativum

Allium cepa

Capsaicin (from chili peppers)

Capsaicin disrupts pest feeding and acts as a deterrent for many insects.

Essential oils (rosemary, thyme, eucalyptus)

Essential oils have various effects, including repellence, growth inhibition, and toxicity.

Sabadilla

Extracted from the seeds of Sabadilla lily, effective against caterpillars, leafhoppers, and thrips.

Rotenone

Derived from the roots of Lonchocartus and Derris species, it controls caterpillars, beetles, aphids, flea beetles, and weevils.

Challenges and Considerations

While botanicals offer many benefits, they also come with challenges:

Variable efficacy

Their effectiveness depends on pest species, developmental stages, and environmental factors, making precise application and timing crucial.

Short residual activity

Botanicals often have shorter persistence compared to synthetic pesticides, requiring more frequent applications and increasing labor and costs.

Regulatory barriers

Some botanicals face regulatory approval hurdles, needing to meet safety and efficacy standards.

Cultural practice adjustments

Incorporating botanicals into IPM may require changes in crop management practices and educating farmers on their proper use.

Conclusion

Integrating botanicals into IPM for vegetable crops offers a pathway to more sustainable and eco-friendly farming practices. By leveraging the natural defences of plants, farmers can effectively manage pests while reducing the negative impacts of conventional chemical pesticides. As the demand for sustainable agriculture grows, botanical-based pest management is set to play a key role in ensuring food security and environmental protection.