

Pest Management of Vegetable Crops under Protected Environment

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Introduction

Greenhouses provide high-tech production facilities for various fruits, vegetables and flowering plants. The food commodities can be grown as both seasonal and off seasonal due to the controlled environmental conditions in the greenhouses. These are usually made up of 3mm (1/8") horticultural glass or polyethylene plastics. Different techniques are used in the greenhouse to regulate the optimum temperature, relative humidity, ventilation and lightning. Vegetables commonly grown in greenhouses are tomatoes, capsicum, cucumber and eggplant besides onions, greens, lettuce, carrots, spinach, cole crops, peppers etc. However, owing to presence of warm, humid conditions along with the abundance of food, least competition and lack of natural enemies, the insect pests and disease are the major constraints for the production and productivity of various vegetables grown in the protected cultivation. Some commonly found pests and disease in greenhouse are summarized below

Key pests of greenhouse vegetables:

Crop	Insect pests	Diseases
Tomato	Thrips; Aphids; Mites; Whitefly; Beetles; Fruit fly; Cluster caterpillars; Looper caterpillars; Potato moth; Heliothis (Helicoverpa).	Tomato spotted wilt virus (TSWV); Tobacco mosaic virus (TMV); Bacterial canker; Bacterial speck; Bacterial spot; Damping-off; Powdery mildew; Tomato yellow leaf curl virus; Tomato leaf curl virus; Early blight; Bacterial wilt; Grey mould; Sclerotinia rot; Anthracnose; Fusarium wilt; Nematodes.
Capsicum	Aphids; Thrips; Beetles; Queensland fruit fly;	Bacterial spot; Bacterial wilt; Anthracnose; Cercospora spot; Powdery mildew; Stem rot;

	Whitefly; Mites.	Sudden wilt; Tomato spotted wilt virus (TSWV); Tomato yellow leaf curl virus; Capsicum chlorosis virus (CaCV); Cucumber mosaic virus (CMV); Pepper mild mottle virus (PMMV); Potato mosaic virus (OVY); Tobacco mosaic virus (TMV); Nematodes.
Eggplant	Aphids; Thrips; Leafhoppers; Two-spotted mite; Beetles; Whitefly; Heliothis (Helicoverpa); Cecropid (spittle) bug; Leafminers; Potato moth.	Damping-off; Root rots; Tomato spotted wilt virus; Tobacco mosaic virus; Tobamoviruses; Bacterial wilt; Nematodes.
Cucumber	Thrips (WFT, Onion thrips); Aphids; Whitefly; Caterpillars (Looper caterpillar, cluster Caterpillar); Mites.	Powdery mildew; Black root rot; Damping-off, Fusarium and Pythium root rots; Rhizoctonia; Sclerotinia; Beet pseudo-yellows virus; Botrytis rot.

Integrated disease management:

Integrated disease management is the practice of using a range of measures to prevent and manage diseases in crops. Hazard analysis is used to identify the potential for infection so that preventative or curative measures can be put in place to minimize the risk of disease infection and spread. During the cropping cycle, regular crop monitoring is used to decide if and what action is needed. Some important steps include: hygiene; control entry; use disease-free plants; control growing environment; inspect plants regularly; undertake waste management; control insects and weeds; and use fungicides.

- Use healthy seeds or treat in trisodium phosphate (TSP).
- Remove all weeds within and around the nursery regardless of virus symptoms.
- Locate seedling production areas well away from cropping areas.
- Use new potting mix and new or thoroughly cleaned containers to raise seedlings.



- Ensure greenhouses are within a clean zone on your property and control the movements of people, plants, vehicles, and materials into the greenhouse areas.
- Treat each greenhouse as a separate unit and keep protective clothing, tools, gloves, and bins in each greenhouse. Do not move them between units.
- Rotate susceptible crops in a two-year rotation and keep areas free of weeds, which can host the virus.
- Wash hands and small tools in milk.
- Dip hands in milk every five minutes when handling plants, or use disposable gloves and discard into a rubbish bin after use.
- Disinfect stakes, implements, and picking bins with household bleach.
- Using hot water and strong detergent to wash any clothing that has come into contact with diseased plants.
- Remove infected plants, taking care not to touch other plants when removing them.
- Protect propagation areas and all entrances and vents of tunnel houses and glasshouses with thrips-proof netting
- Remove ornamental plants in the vicinity of the nursery, especially if vegetatively propagated, regardless of virus symptoms.
- Use resistant plant varieties that is available in the marketplace.

Management of fungal diseases such as Pythium, Fusarium and Rhizoctonia is aided by avoiding cold and wet soil or root substrates. Additionally disinfect and regularly test the water supply.

Integrated insect pest management:

Growers often focus just on biological controls – predators, parasites, and pathogens – when considering an IPM approach but it is essential to recognise that IPM encompasses the combination of cost-effective cultural, physical, chemical, and biological management strategies that prevent, suppress, or control pests and diseases. The use of synthetic pesticide sprays is only undertaken when all other alternatives have been considered and exhausted. Effective insect pest management requires correct identification of the pest in its different life stages and regular, routine monitoring of pest populations. Routine monitoring for pests allows growers to manage pests in a timely manner. Management decisions are based on the stage of the crop growth, as well as the actual pest population levels.

Sanitation:

Sanitation is the first step in pest management. Always clean up before and after a crop. Prevent algae from growing in drains, channels, and other areas of the greenhouse. Control weeds on your farm and work with neighbours to control weeds around the area. Clean footwear, clothing, and equipment along with gloves, disposable coveralls will all help in reducing the risk of spreading insect pests and diseases. Do not move infested greenhouse crops to a clean crop.

Environmental control:

Providing the right environment for the crop is one of the most important parts of growing a healthy productive crop. The level of light, the day and night temperatures, the relative humidity, the amount and frequency of irrigation, the nutrition and air quality all influence crop growth. Controlling these factors is important. Large variations in growing conditions can also reduce plant productivity and increase insect pest and disease problems.

Knowing the pest:

Not only is correct identification critical, but you need to understand the life cycle of the pest, at what stages they are most vulnerable, and what specific management strategies are available. IPM is about using the most effective and lowest impact combination of strategies to control crop pests.

Beneficials:

Biocontrol agents for use in greenhouses include Encarsia (whitefly parasitoid); Entomopathogenic nematodes (fungus gnat and cluster caterpillar control); Green lacewing (general predator); Hypoaspis (fungus gnat predator); Montdorensis (thrips predator); and Persimilis (spider mite predator).

