



## Integrated Pest Management for Vegetable Gardens

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**Introduction** The best way to control insects and disease problems is to prevent them before they get a foothold in your garden.

**Soil Preparation** Maintain a slightly acid soil (around pH 6.5). If in doubt, have a soil analysis done through your local Extension office, by a private lab, or with a commercial soil test kit. Lime can be used to increase soil pH and sulfur can lower it. Maintain adequate levels of soil fertility through additions of potassium and phosphorus-releasing materials, such as commercial fertilizers or animal manures. Soil testing should be done every three years to determine levels of these important nutrients. Build a biologically active, healthy soil through regular addition of organic matter, such as yard waste, compost, and manure. Avoid using manure and yard waste that were previously treated with herbicide as well as manure from animals that fed on herbicide treated pasture. Use a winter cover crop, till the soil before seeding and this exposes pests living near the surface to natural enemies and will kill most insects overwintering in crop residues. After tilling plant a cover crop such as clover or rye grass, to reduce soil erosion and provide additional organic matter.

### Plant Selection

- Plant crops and varieties that are well-suited to the soil and climate, and recommended by Virginia Cooperative Extension.
- When seeding directly, use disease-free, certified seed, if available.
- Select for maximum insect- and disease-resistance in vegetable varieties.
- Select healthy, sturdy transplants with well-developed root systems. Diseases and insects in young seedlings may start in greenhouses or plant beds and cause heavy losses in the garden.
- Buy plants from a reputable grower who can assure you that they are disease- and insect-free.

**Cultural Practices** The most effective and most important of all practices is careful observation in the garden. Many serious disease or insect problems can be halted or brought under control early by the gardener

who knows what to look for and regularly visits the garden for trouble-shooting. In addition:

- Water in the morning so plants have time to dry before the cool evening. Prolonged leaf wetness favors disease. Drip irrigation systems prevent foliage from getting wet when watering.
- Use interplantings in the vegetable garden as opposed to solid plantings of a crop. This can slow the spread of diseases and insects, giving you more time to deal with them if they occur.
- Space plants properly and thin young vegetables to a proper stand. Overcrowding causes weak growth and reduces air movement, resulting in increased insect and disease problems.
- Control weeds and grass that grow in the garden. They often harbor pests and compete for nutrients and water. Leaf and other organic mulches are extremely effective for weed control, as are inorganic weed mats, plastic, and other fabrics.
- Use a mulch to reduce soil splash, which brings soil and soil-borne pathogens into contact with lower leaves.
- Rotate your garden plot if you can. Do not grow the same kind of produce in the same place each year. Use related crops in one site only once every three or four years. Avoid mixing soils in different areas by forming permanent raised beds with distinct borders.
- Avoid injury to plants. Broken limbs, cuts, bruises, cracks, and insect damage are often the site for infection by disease-causing organisms.
- Stay out of the garden when the plants are wet with rain or dew to prevent spreading diseases.
- Do not use tobacco products, such as cigarettes or cigars, when working in the vegetable garden. Tomato, pepper, and eggplant are susceptible to a mosaic virus disease common in tobacco and may be spread by your hands.
- Remove and dispose of infected leaves from diseased plants as soon as you observe them. Remove severely diseased plants before they contaminate others.
- Clean up crop refuse as soon as you are finished for the day.
- Sanitize stakes and wire cages prior to use with a light bleach solution.

- Keep old sacks, baskets, wooden stakes, decaying vegetables, and other rubbish, which may harbor insects and diseases, out of the garden.
- Staking tall flower and vegetable plants or planting them in wire cages prevents the blossoms or fruit from coming in contact with the soil.
- Time plantings in such a way that the majority of your crop will avoid the peak of insect infestations. For example, plant squash and pumpkins in mid-June to avoid problems with cucumber beetles and squash bugs.
- Plant warm-weather crops after the soil has warmed to avoid problems with seed and root rots and to promote vigorous growth.
- Inspect plants for egg clusters, beetles, caterpillars, and other insects as often as possible. Hand-pick as many pests as you can. Avoid sprays until the population of insects has reached a critical threshold level.
- Where slugs are a problem, use approved baits and traps and try to create drier conditions. Heavy mulches may encourage slugs. Diatomaceous earth, crushed eggshells, and hydrated lime near plants may help deter slug activity.
- Enlist the aid of birds in your garden. Overall, they do more good than harm. Consider planting shrubs and trees with fruits that attract them. Keep in mind, however, if you attract wild birds, you will have to protect ripening fruit (and even some vegetables) by using bird netting or scare devices (aluminum pans banging in the breeze are fairly effective) if damage is noted.

## Encourage Beneficial Insects

Naturally occurring predators and parasites are found in gardens, orchards, and fields. Learn to properly identify these species as benefits of your environment. Avoid using pesticides around them. They are as susceptible to insecticides as the pests.

## Beneficial Insects and Mites

The best way to build up native natural enemies of pests is to not spray insecticides of any kind. Both synthetic and organic pesticides can kill beneficial insects. Many species of beneficial insects and mites can be purchased. Beneficial insects are target specific, and require gardener knowledge of existing pests. Timing of release is an important factor, make sure the pest is present. In general, these insects have specific requirements for long-term survival, and may need to be released anew each season.

**Assassin bug** - Reduviidae - The assassin bug feeds mainly on aphids, caterpillars, Colorado potato beetles, Japanese beetles, leafhoppers, and Mexican bean beetles.

**Damsel bug** - Nabidae - The damsel bug feeds on aphids, leafhoppers, mites, and caterpillars.

**Big-eyed bug** - Lygaeidae - Big-eyed bugs feed on aphids, caterpillar eggs and larvae, immature bugs, leafhoppers, and spider mites.

**Predacious stink bug** - Pentatomidae - Predacious stink bugs feed on Colorado potato beetles and various caterpillar larvae.

**Syrphid fly larvae** - Syrphidae - Fly larvae of this species feed on aphids and mealybugs.

**Lady beetle** - *Hippodamia convergens* - The lady beetle feeds mainly on aphids and other soft-bodied insects, such as mealybugs and spider mites.

**Green lacewing larvae** - *Chrysopa camea* - Lacewing larvae, known as aphid lions, feed on insect eggs, aphids, spider mites, thrips, leafhopper nymphs, and small caterpillar larvae. Adult lacewings are not predacious.

**Predatory mites** - *Phytoseiulus persimilis* and several other species feed on many mite pests, including the two-spotted spider mite.

**Trichogramma wasp** - Trichogrammatidae - This tiny wasp attacks eggs of more than 200 pest species, including cutworms, corn borers, corn earworms, armyworms, codling moths, and cabbage moths. Release time is critical for their effectiveness since they only attack pest eggs.

**Encarsia wasp** - Encyrtidae - The greenhouse whitefly is parasitized by this wasp in third and fourth larval instars when *Encarsia* lay their eggs inside the whitefly scale.

**Chemical Control** If a pest problem requires chemical controls, consult the Virginia Pest Management Guide for Home Vegetables. An Extension agent can help you identify the proper and legal pesticide and the method to use it.

**For more information** Use For more information on selection, planting, cultural practices, and environmental quality, contact your local Virginia Cooperative Extension Office.

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