

Insect Management in the Home Vegetable Garden

Insects are part of any garden. Beneficial insects pollinate plants, destroy pests, or improve the soil by scavenging and burrowing. Some insects cause problems and become pests. Learn to recognize commonly encountered insects. If an insect is identified as a destructive species, determine whether it is causing serious damage to the crop before making management decisions. Chemical control can cause additional problems by killing natural enemies of many pests. Aim to use the least disruptive pest control methods. Most garden plants can tolerate some insect feeding, and pests can often be washed off after harvest. There are many options for reducing pest insects in the garden without resorting to pesticides: mechanical or cultural methods can modify conditions in the garden to repel pests, disrupt their life cycle, or destroy them directly. At the same time, beneficial insects can be encouraged.

Sanitation – Many insects overwinter in weeds or plant debris in or near the garden. Remove and compost weeds and debris, or spade them under as soon as harvest is completed. Incorporate compost. Look under mulch material regularly for a buildup of earwigs, slugs, snails, and millipedes. Check transplants before buying or planting – do not use infested plants. Bury garden debris in the fall.

Rotation – Do not grow the same crop in the same area in consecutive seasons. This helps to reduce the buildup of soil insects such as grubs, wireworms, and maggots. Eggs and pupae of most insects overwinter in the soil or attached to a host plant.

Avoid planting crops susceptible to grubs where grass grew the previous year. If Japanese beetles are a problem, avoid growing roses and grapes, which attract beetles, near the vegetable garden.

Planting – Healthy, vigorously growing crops usually can tolerate some insect damage. Therefore, provide the best possible growing conditions. Check the fertility and pH (acidity) of the soil regularly and make appropriate adjustments. Use mulch (e.g. straw, leaf mold, untreated grass clippings) to conserve soil moisture and suppress weeds or cultivate the soil to kill weeds, which can harbor pests.

Handpicking – Many pests are controlled effectively by picking them off the foliage and destroying them. With perseverance, this works against Japanese beetles, Mexican bean beetles and Colorado potato beetles.

Physical Barriers – Barriers placed around some plants will control some insect pests.

Collars – Protect newly planted peppers and tomatoes from cutworms by placing a collar around each plant made from cardboard, a paper or plastic cup, or a milk carton with the bottom cut off. The collar should be at least 3" tall and pushed 1-2" into the soil. The collar prevents the cutworm caterpillar from reaching and damaging the stems of plants.

Shields – A 6" collar (with a 3" radius slit across to a center hole for the stem) made from carpet or tar paper, laid flat on the ground and fit snugly around individual transplants will prevent the adult cabbage root maggot fly from laying eggs at the base of the plants.

Row Covers – Lightweight, floating row covers provide an excellent barrier to some early pests such as cabbage root maggot fly, flea beetles, spinach leaf miner, striped cucumber beetles, European corn borers, aphids and Colorado potato beetles. Row covers prevent pests from feeding on plants as long as the insect did not over-winter in the same location that is being covered. A pest that emerges near its target plant under the protection of a row

cover may damage plants even faster than usual! Avoid this by moving, or rotating, crops from the place they were planted the year before.

Row covers are made of lightweight fabric that can be laid directly over plants, leaving enough excess fabric so plants can grow under it. The fabric needs to be secured at the edges to keep pests out. This can be accomplished using rocks, burying the fabric edges with soil down each side of the row, or by using metal staples made for this purpose. Row covers can also be supported with hoops. The fabric allows water and light to pass through and protects young plants from wind. Row covers should be removed from vine crops such as cucumbers when flowers appear because vine crops need bees for pollination. Covers should also be removed when temperatures regularly reach the high 80's for four or more hours per day.

Traps and Lures – Traps attract insects with visual or chemical cues. Visual traps such as yellow, sticky boards are generally used to detect whether specific insects are present or not. Lure traps, such as Japanese beetle traps, contain chemical attractants. These traps can lure increased numbers of pests – keep them at least 30 feet away from the garden. Electronic and ultraviolet traps are not recommended.

Biological Control – Biological control refers to the actions of beneficial insects, mites, nematodes and diseases in controlling garden pests. Native beneficial insects and mites can be encouraged and protected by avoiding unnecessary use of all insecticides and miticides. Gardeners can also purchase commercially available beneficial organisms. One of the more common materials is *Bacillus thuringiensis* (B.t.), a bacterium, which is used to control caterpillars and some beetles. Beneficial insects, mites and nematodes are sold in quantities based on the area they will cover, such as one package per 1,000 square feet of garden space. Beneficial insects and mites are living organisms and need to be released as soon as possible. Beneficials are available from some garden centers and through mail order and on-line companies that specialize in them. Some organisms, such as beneficial nematodes, need refrigeration, while others need to be stored in a cool, dry place.

Releasing Biological Control Agents

How to apply biological control agents depends on the type you plan to use. Follow the specific directions that come with them. In general, release them in a protected location out of direct sunlight such as early in the morning or on an overcast day. Natural enemies work slowly over a period of time and may require multiple applications.

Released in cases, on cards or on tape: Praying mantis, *Trichogramma* wasps

Sprinkled: Some arrive as active mobile immature insects or adults ready for immediate release such as aphid parasites, green lace wings, lady beetles, leaf miner parasites

Broadcast granulated materials: Some, such as aphid predators, green lacewing eggs and predatory mites, arrive in small containers mixed with a material like rice hulls, bran hulls, or vermiculite to help disperse them evenly. Sprinkle a small amount of the mixture onto infested plants, distributing them evenly over the targeted garden space.

Spray: Some organisms such as beneficial nematodes and B.t. come in a powder or liquid form that needs to be mixed with water and applied with a watering can, hose or sprayer.

Habitat for Beneficial Insects – Dedicate about 10% of your vegetable garden to flowers and cover crops that provide shelter, nectar and pollen for beneficial insects. Plant patches of quick flowering herbs such as borage, dill, cilantro and chamomile successively throughout the summer. Allow a few parsley, fennel, caraway and other biennials in the carrot family to bloom in their second year. Establish a small bed of perennial yarrow and plants in the daisy family. Seed some white clover for a living mulch among vine crops and buckwheat to cover bare spaces during the summer. These resource patches provide shelter for toads, too.

Pesticides – Pesticides should be used as a supplement to the methods described above, not as a first line of defense. Pesticides vary in their toxicity and in their potential ecological impact.

Pest control materials for organic gardens include botanicals, microbials, minerals, soaps and synthetic materials. Identify pests accurately before choosing a product. Always read the label to be sure both the insect and the crop are listed. Avoid blanket applications – spray only where pests occur.

Common Pests and Organic Management Strategies

Aphids: Lady beetles, braconid wasps, green lacewings and tiny flies are common natural enemies. To minimize the succulent plant growth that aphids prefer, use slow-release nitrogen and avoid applying in excess. Repel aphids with reflective plastic mulch, especially under crops affected by aphid-carried diseases such as mosaic virus. Spray with strong stream of water to temporarily remove from plants. Use spray of insecticidal soap

Beetles (General): Many beetles such as lady beetles, ground beetles and rove beetles are predators of other insects, so learn to recognize and encourage these. Handpick beetle pests into soapy water.

Colorado potato beetle: Protect young seedlings by using row covers. Remove before flowering. Handpick eggs, larvae and adult beetles into soapy water. Natural enemies include twelve-spotted ladybeetle, spined soldier bug, a ground beetle, and a parasitic fly. Use *Bacillus thuringiensis* 'san diego' or 'tenebrionis' (biological control) to control young, small larvae.

Flea beetle: Dust plants lightly with a mild alkali such as wood ash or lime. Protect young seedling by using row covers. Generally, plants outgrow damage inflicted by flea beetles.

Japanese beetle: Control grubs in turf with parasitic nematodes. Handpick adults into soapy water.

Mexican bean beetle: Monitor plants for clusters of orange eggs found on undersides of leaves and destroy when found. Handpick adults and larvae. Plant early and use quick-maturing varieties of beans. *Pediobius foveolatus* is a commercially available parasitic wasp for Mexican bean beetle control and works best if released at the first sign of pest infestation and allowed to reproduce in successive plantings of beans.

Caterpillars (Cabbage looper, Imported cabbage worm): Monitor plants and handpick eggs, caterpillars and pupae. A tiny braconid wasp often parasitizes small caterpillars. The most important time to control caterpillars is just before head formation.

European corn borer: Clean garden at end of growing season. Winter sanitation is essential to kill pupae overwintering in stalks. Monitor corn leaves for white egg masses in late May and early June and destroy when found. Plant corn late (late June through early July). Natural enemies include the twelve-spotted ladybeetle which preys on eggs and small larvae. Releases of *Trichogramma ostriniae*, a tiny parasitic wasp that attacks ECB eggs, can reduce the need for insecticide applications. Use *Bacillus thuringiensis* 'kurstaki' or 'aizawai' (biological control) on young caterpillars before they bore into stalks and ears.

Squash vine borer: Use row covers to exclude the flying adult moth and remove when plants begin to flower to allow for pollination. Monitor for tiny, reddish-brown eggs along stems and on leaves and destroy when found. Monitor stems for frass (debris left by insect) which is a sign of borer infestation. Cut out larvae with a lengthwise slash. Cover slash with soil. Encourage rooting by covering nodes with soil. Butternut squash is resistant.

Squash bug: Remove all vine crop residues at the end of the season. Good sanitation helps to control this insect. Monitor and hand pick brown adult bugs and shiny bronze egg masses found under the leaves from mid-June through July. Newly hatched and small nymphs are susceptible to azadirachtin (a botanical pesticide).

Tomato hornworm: Handpick, unless there are white, egg-shaped pupae on the back of the hornworm that indicate a beneficial wasp has parasitized the caterpillar. Protect parasitized hornworms to encourage populations of beneficial wasps. Use *Bacillus thuringiensis* (biological control) on young caterpillars.

Cutworm: Use 3"-4" vertical collars such as a paper cup with bottom removed around each transplant (tomatoes, peppers). Set collars 1"-2" into the soil.

Leaf miners: Use row covers over beets, spinach and Swiss chard. Remove and destroy infested weeds such as lamb quarters.

Root maggots: Use row covers over radishes and scallions. Place 6"- 8" (3"- 4" radius) barrier mat snugly on soil around young seedlings to prevent adult flies from laying eggs at the base of the plants.

Slugs and Snails: These pests feed at night. Eliminate all day-hiding places such as weedy patches, debris and large stones. Place wide boards on 1" runners, or inverted melon rinds, strategically and then remove the congregated slugs during the day. Use trickle irrigation instead of sprayers to reduce ambient moisture. Baits containing iron phosphate, combined with a good cultural management program and used with caution, may be useful.

Responsible Pesticide Use

Useful terminology found on pesticide labels:

Active Ingredient - This is the chemical component of a pesticide formulation that is toxic to the pest. Become familiar with the active ingredients. "Other" or "Inert Ingredients" are carriers, which may or may not be toxic to the target pest. Pesticide products generally are recognized by their advertised brand names. Pesticides with different trade names can have the same active ingredient.

Chemical Formulations - The formulation of a chemical refers to the form in which a pesticide is prepared for sale. Some of the more common formulations that the gardener may encounter include "ready to use" (RTU), "emulsifiable concentrate" (EC), "flowable" (F), "granules" (G), "dust" (D), and "wettable powder" (WP). The same pesticide may be available in more than one formulation. Different formulations of the same pesticide may be more effective in certain circumstances and may be registered for different uses. It is important that the user **read the label** to be sure that the correct material is being selected for the job.

Days to Harvest - Some pesticides require a period of time for residues to dissipate before treated produce can be used safely. This information is found on the LABEL of the pesticide.

Disclaimer -The most reliable information was included that was available at the time this information was compiled. Due to constantly changing laws and regulations, UMass Extension can assume no liability for recommendations. The pesticide user is always responsible for the effects of pesticide residues on their own crops, as well as problems caused by drift from their property to other properties or crops. Always read and follow all instructions on the label.

Partial List of Pesticides by Active Ingredient for Vegetable Gardens

Active Ingredient	Pests	Comments
<i>Bacillus thuringiensis</i>	Caterpillars (cabbageworms, cabbage loopers and others)	Microbial - apply when caterpillars are small.
<i>Beauveria bassiana</i>	Wide range of pests such as thrips, whiteflies, aphids, caterpillars, weevils, and Colorado potato beetle.	Microbial - more effective on immatures than large larvae or adults insects. Caution should be used when applying it when honeybees are actively foraging.

Insecticidal soap	Wide range of insects, especially soft-bodied aphids and whitefly and mites.	Synthetic - do not treat when plants are under stress. Soaps may burn plants. Toxic to invertebrates if spilled into water. Follow label precautions.
Iron phosphate	Slugs	Organic compound - component of a granular bait. Follow label precautions.
Neem (azadarachtin)	Aphids, cabbageworm and other caterpillars, earwigs, flea beetles, leafhoppers, mealy bugs, psyllids, spider mites, spittlebugs, squash bugs, stinkbugs, thrips, and whiteflies.	Botanical - toxic to bees exposed to treatment. Toxic to fish and aquatic organisms. Follow label precautions.
Pyrethrum Note: Pyrethroids are synthetic compounds whose structure and mode of action are similar to pyrethrins but they are not approved for use in organic production. There are many pyrethroids.	Wide range of insects.	Botanical - highly toxic to bees, beneficial insects and fish. Slightly - moderately toxic to bird species. However, because pyrethrum residues break down quickly, the effect on beneficial organisms is reduced. Follow label precautions.
Spinosad	Caterpillars (such as imported cabbageworm, cabbage looper), leaf miners, thrips, Colorado potato beetle, borers, corn borer, squash vine borer, corn ear worm	Microbial - toxic to bees exposed to treatment. Follow label precautions.
Oils such as sesame oil. Can be petroleum, plant or fish based.	Wide range of insects and mites and their eggs.	Synthetic and natural - works by smothering. Oils may burn plants. Follow label precautions.

WARNING! PESTICIDES CAN BE DANGEROUS. Read and follow all directions and safety precautions on container labels. Handle carefully, and store in original containers with complete labels, out of reach of children, pets, and livestock.

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