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Insect Pest Management for the Home Vegetable Garden

A Guide to Reducing Insecticide Use

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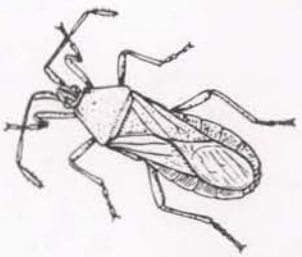
College of Agriculture



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Gardening provides much personal satisfaction and pleasant exercise. But proper planning of pest control is needed to ensure bountiful yields of top-quality vegetables. Many consumers concerned about pesticide residues are turning to home-grown vegetables, yet ironically, pesticide use around the home accounts for most of the public's exposure to pesticides. One way to reduce your exposure to pesticides is to use integrated pest management (IPM). You can follow the steps outlined here to design effective and environmentally safe insect controls for your home garden.

The IPM approach combines good gardening practices with biological and mechanical controls that make gardens less susceptible to pest invasion and establishment. Rather than rely on one-shot chemicals to kill pests after problems occur, IPM looks to nonchemical measures that help prevent problems from developing in the first place. With IPM, the role for chemical insecticides is one of last resort if alternatives fail to correct the problem. Pesticides never are applied according to a preset schedule or spray calendar. Instead, they are used only if close inspection shows they really are needed to prevent severe damage.

IPM recognizes that it is not necessary to eliminate insect pests. Garden plants can tolerate some feeding by insects without any loss in harvestable produce or vegetable quality. The presence of a pest does not necessarily mean that you have a pest problem. This especially is true for leaf-feeding insects on potato plants such as caterpillars or beetles, which do not directly attack the edible produce. Be willing to accept some cosmetic blemishes on the produce itself. Small amounts of damage may be unsightly but can be cut away.

An IPM checklist

Create a healthy environment for plant growth

A vigorously growing plant is better able to defend itself from insect attack than a plant weakened by water stress, weeds, or an unfavorable environment. Germinating seeds, seedling plants, and new transplants especially are susceptible to pest injury.

Give plants the head start they need to outgrow early season pests through proper seedbed preparation, fertilizer application, and watering schedules. Avoid planting in cool, wet soils. These conditions can slow germination and establishment and allow the pest to overtake the plant. If you do plant under these unfavorable conditions, increase your seeding rate and thin to the proper spacing once the plants become established.

Use hot caps, transplant collars, row covers, or similar commercial and home-made barriers to keep insects and slugs from colonizing young plants. But be sure to remove covers before the heat of late spring or early summer.

Transplants can be sources of aphids and mites on cabbage, eggplant, peppers, and tomatoes. Insist on pest-free material from your retailer, and check your own home-grown plant stocks before you set them out.

Work composts and manures into the soil. Soils with large amounts of organic matter on the soil surface are prone to cutworms, root maggots, symphylans, and wireworms. But there is a trade-off: Soils high in organic matter also have high fertility and tilth. You will have to decide how to balance the short-term pest control benefits of low levels of soil organic matter with the long-term soil tilth benefits of high levels of organic matter.

Excessive fertilization and watering can be as bad as too little. Too much nitrogen and water favors aphid outbreaks. Too little fertilizer and water diminishes the plant's ability to regrow and recover from pest damage.

Destroy pest overwintering sites and other infestation sources

Virtually all of Idaho's important vegetable insects spend the winter in the garden protected within the garden soil or under old plant debris in adjoining trashy areas.

Break the infestation cycle by rototilling or spading after harvest and by composting plant residues before planting the next crop. Eliminate crop volunteers that emerge after harvest; they can harbor pests from one growing season to the next.

Eliminate weedy patches. During the spring, weeds are common sources of cutworms, slugs, and snails. Later, weeds harbor aphids, earwigs, grasshoppers, and thrips that move into the garden.

Alter planting patterns

Commercial farmers break infestation cycles of soil pests by rotating their crops — planting unrelated crops each season rather than always planting the same crop in the same field. You can apply the same principle in your own garden.

Although rotating entire gardens to new spots is a space luxury few can afford, you can rotate the location of crops within garden plots each year. For example, if root maggot and wireworm infestations perennially attack your carrots, radishes, and other root

crops, try planting them where you haven't grown them for several years.

Interplanting and companion planting likewise apply the concept that plant arrangement in the garden can slow or even repel invading pests. Interplanting means breaking a solid planting of one crop into several smaller plantings scattered across the garden; this can isolate infestations and lower damage.

Companion plants are said to protect adjacent crops from pests by producing repellent odors or creating a camouflage effect that makes it difficult for pests to find the crop plant. While observations by many home gardeners seem to confirm companion effects of aromatic herbs and of flowering plants such as marigolds and nasturtium, benefits have been much less clear-cut under formal research tests. Make observations from your own experience, and decide if companion planting works for you.

Take advantage of pests' natural enemies and other biocontrol agents.

Diverse communities of beneficial predatory and parasitic insects and insect-infecting diseases occur in virtually every garden every year. But with the exception of flashily colored lady beetles, the roles of these biocontrol agents in naturally keeping pests in check often go unnoticed.

The best way to conserve existing populations of your pests' natural enemies is to avoid using broad-spectrum insecticides. Except for the microbial insecticide *Bacillus thuringiensis*, all insecticides used in home gardens (including organics such as rotenone and pyrethrin) are at least moderately lethal to the common beneficial predators and parasites. Many are highly toxic. Indiscriminate or excessive insecticide application eliminates natural enemies and allows pest populations to rebound without check. If insecticides are necessary, spot treat rather than make broadcast applications that blanket the garden.

Attracting beneficials

The adult stages of many beneficial predators and parasites require nectar and pollen to complete their life cycles. Make your garden more attractive to them with border plantings of small-flowered ornamentals that bloom through the season. If you choose self-seeding or perennial plants, keep in mind that they may become troublesome weeds next year.

Artificial food supplements called "wheast" are sold commercially as BugPro, Pred Food, and others. They can be applied to plants as foliar sprays. They have shown promise in increasing egg laying by predatory lacewings under some experiments.

Commercial biocontrol agents

A number of biocontrol agents can be purchased for mass release through garden magazines, catalogs, and local retailers. Lady beetles and praying mantids are popular but often provide less-than-reliable control. Lady beetles, especially the commonly available convergent lady beetle (*Hippodamia convergens*), are highly mobile and commonly migrate quickly from the garden after release. However, they have proven effective when released in greenhouses. Adult mantids generally eat large flying insects and even other beneficials instead of the more important garden pests.

Four more-promising biocontrol agents for mass release in the home garden are *Trichogramma* wasps, *Steinernema* and *Heterorhabditis* nematodes, green lacewings, and the predatory mites. *Trichogramma* wasps are nearly dust-sized, nonstinging beneficials that parasitize eggs of leaf-feeding caterpillars. *Steinernema* and *Heterorhabditis* nematodes are microscopic worms applied to the soil where they seek out and kill soil-inhabiting pest insects. They are sold under several trade names, including BioSafe, Scanmask, and Bioquest. Green lacewings, known by the scientific names *Chrysopa carnea* and *Chrysopa rufilabris*, both have predatory larval stages that feed on aphids, thrips, and mites. The predatory mites (sold as *Phytoseiulus persimilis*, *Amblyseius californicus*, *Amblyseius cucumeris*, and *Metaseiulus occidentalis*) control spider mites and thrips. The time for mass releases is when environmental conditions cause the native species to lag so far behind the pests that they cannot check the infestation.

Two additional species of potentially useful beneficials that recently reached the commercial market are the spined soldier bug, *Podisus maculiventris*, and the minute pirate bug, *Orius tristicolor*. The spined soldier bug is a predatory stinkbug that preys upon caterpillars and beetle larvae. The minute pirate bug, like lacewings, feeds on small, soft-bodied insects such as aphids, mites, and thrips. Except for the spined soldier bug, native Idaho species of the other commercially available beneficials discused here occur in most gardens every year.

Microbial insecticides

The microbial insecticide *Bacillus thuringiensis* variety *kurstaki*, also called BTK or more simply BT, is an ideal choice for caterpillars. Sold under the trade names Biobit, B.t. Caterpillar Killer, Caterpillar Attack, Dipel, and others, *Bacillus thuringiensis* is a bacterium that infects only armyworms, cutworms, loopers, and similar leaf-feeding caterpillars. In contrast to conventional insecticides, BT essentially is harmless to beneficials, honeybees, mammals (including people), birds, and fish.

When using BT, application timing is critical for two reasons: (1) BT must be eaten by young caterpillars to be effective and (2) BT breaks down and deactivates in the garden after a few days. Caterpillar control with BT is best if you spray when caterpillars are hatching from eggs and respray 5 to 7 days later, if needed, to kill later hatches. Once ingested, BT disrupts the caterpillar's gut. Infected caterpillars quickly stop feeding but do not die until 2 to 4 days later, so give BT a few days to be effective. Improved, genetically

engineered BT products will soon be on the market.

A new BT called *Bacillus thuringiensis* variety *san diego* shows the same type of infection specificity as the orginal BT but for leaf-feeding beetles such as the Colorado potato beetle rather than for caterpillars. It is sold to home gardeners under the trade names Colorado Potato Beetle Attack and M-One insecticide.

A related microbial insecticide sold as Doom, Grub Attack, and others is a preparation of *Bacillus popilliae* or *Bacillus lentimorbus*. This insecticide causes milky spore disease in certain types of white grubs, especially the Japanese beetle grubs. These products have little value in Idaho because Japanese beetle does not occur here and because our native species of white grubs are only moderately susceptible to milky spore disease.

Know which pests are present and learn their damage cycles

Although hundreds of types of insects can be found in gardens across Idaho, only a handful commonly cause damage. This publication describes the most frequently encountered insect pests as well as their distinguishing damage symptoms and gives control suggestions.

Learn to recognize the common beneficial predators and parasites by consulting Pacific Northwest Extension publication PNW 343, *Beneficial Organisms Associated with Pacific Northwest Crops*.

Check your garden for insects at least once a week during the growing season and more frequently while plants are in the highly vulnerable germination and seedling stages. Especially look for yellowing or wilting plants; twisted, distorted, and chewed leaves; and plants cut off at the soil line. A 10X magnifying lens can be helpful.

Root, fruit, seed, and other nonleaf crops should be checked frequently during flowering, when susceptibility to injury increases. Some common insect pests in the home garden are active only at night; nighttime inspections with a flashlight can go a long way toward correctly identifying these pest problems.

Plant diseases, improper fertilization, and poor growing conditions can produce symptoms similar to insect damage, so even if you find an insect on a damaged plant, it may not be the cause of the damage. If you find pests or damage that do not match the descriptions here, collect pest and plant specimens and have them examined by the Extension agricultural agent at the University of Idaho Cooperative Extension System office in your county.

When sending specimens by mail, pack beetles and other hard-bodied pests in plastic pill vials or similar containers; soft-bodied aphids and caterpillars are best preserved in rubbing alcohol. Include the following information: date and place of collection, name of plant where pest was found, and other pertinent observations. Particularly note any control action already taken.

Consider alternatives to pesticides if infestations develop

Handpick and destroy larger caterpillars, beetles, and egg masses. Smaller insects can be shaken or knocked from plants into a pail of soapy water. Dislodge very small pests with a vigorous spray from your garden hose.

Chickens, ducks, and geese can be effective alternatives to handpicking cutworms, earwigs, snails, and similar pests that take shelter on the soil under trash. Pen poultry within the garden area with 3-foot-tall chicken wire, but fence off tender garden seedlings, lettuce, and other plants favored by poultry. Check local ordinances or covenants that might prevent you from keeping poultry in your yard. Geese eat grassy weed seedlings and so provide the added benefit of weed control.

Sticky traps, bait, and lure traps are available for aphids, leafhoppers, and other small flying insects. Consult the section of this publication on pest descriptions and damage symtoms for specific details.

Choose effective and environmentally safe insecticides

Sometimes pests reach damaging levels despite all alternative controls. Insecticides are chemicals used to kill insects. The more general term, *pesticide*, describes a chemical that kills *pests*. The pest could be an insect, weed, plant disease, or any other harmful organism. Many different insecticides can be used in the home garden. All have been thoroughly tested and are safe when used according to label directions.

Garden insecticides can be divided into two broad categories: (1) synthetic and (2) natural or organic. "Synthetic" refers to manufactured chemicals; diazinon, malathion, and Sevin (carbaryl) are examples familiar to many gardeners. "Natural" and "organic" refer to naturally occurring chemicals used on organically grown vegetables. They include *botanical insecticides* such as neem, nicotine, pyrethrin, quassia, rotenone, ryannia, and sabadilla that are extracted from plants, *inorganic and abrasive dusts* such as sulfur and diatomaceous earth, *insecticidal soap sprays*, *summer oils*, and *microbial insecticides* such as the BT products.

Although there is a common perception that the natural or organic insecticides are inherently safer than the synthetics, some concentrated organics such as nicotine are several times more toxic than the synthetics. But "the dose makes the poison" — the relative degree of hazard depends on the chemical and the extent of exposure. Pesticides for home gardeners deliberately have been diluted so that they pose the lowest possible hazards.

An important difference between synthetic and natural insecticides is how long they last in the garden (their "residual activity"). Natural insecticides tend to break down and deactivate

quickly when exposed to sunlight and water, often within a few days of application. In contrast, synthetics commonly last for a week or more following application. The trade-off between short and long residual activity is crop protection versus potential environmental hazard. Pesticides with short residual activity generally are safer for the environment because they do not leave long-lasting contaminating residues. For the same reason, pesticides with short residual activity pose reduced hazards to beneficials. But because they break down so quickly, repeated applications may be needed to kill later hatches of insects.

Be aware that you inadvertenly might break the law if you purchase pesticides directly from out-of-state suppliers. Legally, the only pesticides you can use in Idaho must be registered with the Idaho Department of Agriculture. Consult Table 1 for a list of approved products for use in home gardens. If you have questions about the registration of a particular product, contact the Idaho Department of Agriculture in Boise at (208) 334-2986.

Insecticides used to control garden pests come in several forms. Dusts (D), baits, and granules (G) are dry forms that come ready to use. Baits are mixed with a pest attractant; dusts and granules are mixed with an inert carrier. Emulsifiable concentrates (EC) are liquids that form suspensions when mixed with water and require agitation. Soluble powders (SP) dissolve in water and require no agitation before spraying. Wettable powders (WP) have to be agitated constantly to stay in suspension in sprays.

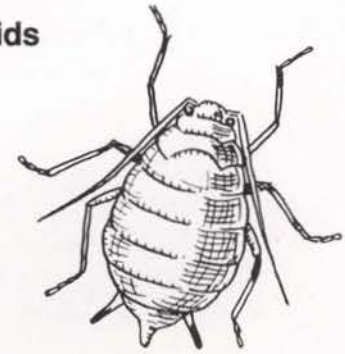
Steps to follow when using pesticides around the home

- Read the label before you buy any pesticide, read it again before you open the container, and reread it before you use the pesticide. Unless the pest and vegetable plant you want to spray are listed on the label, you have the wrong pesticide. If you use the wrong material, you may contaminate produce with unsafe toxic residues, chemically burn or kill the plants, or pollute water and soil.
- Review first aid instructions on the label before you begin. If you accidentally spill a concentrate or spray on your skin or clothing, immediately remove the contaminated clothing and wash yourself and your clothes thoroughly. If you need a doctor, take the pesticide label with you.
- Follow all personal safety precautions. Never smoke, eat, or drink when mixing or applying pesticides. At a minimum, wear a long-sleeved shirt, long pants, and unlined rubber gloves. The label will tell you if additional protective gear is needed. (For more information, see CIS 779, *Clothing Selection for Pesticide Application.*)
- Mix only as much pesticide as you can use right away, following all instructions for dilutions and application rates. Permanently label your measuring spoons and cups "Poison: for pesticide use only." More is not better when it comes to pesticide application rates. Do not store leftover spray solutions. Never pour them down the drain or into storm sewers. Dispose of pesticides during local hazardous waste collection days or contact your local health department to find out if you have other options for disposal.
- Keep all pesticides in their original containers, outside the home, and in a locked storage out of reach of children and pets.
- Thorough coverage of all plant surfaces is necessary for good results when using sprays and dusts. Usually, spray until the insecticide begins to run off the foliage, or dust until a very thin layer covers the foliage. Do not make applications if the weather forecast calls for rain within the next 1 to 2 days; pesticides likely will wash off plants before they have a chance to act. Application to soils saturated with water or during breezy weather increases the risk of environmental contamination through runoff or spray drift.
- Take special precautions when making applications around play areas, ponds and creeks, kennels and other pet houses, and similar sensitive locations. Clear the area of people and pets, and wait until sprays have dried before allowing reentry.
- Wash and change to clean clothing immediately after spraying. Always wash clothing before rewearing it, and wash contaminated clothing separately from family wash. For more information see CIS 781, *Laundering Pesticide-Contaminated Clothing.*
- After you have applied a pesticide, be sure to wait the number of days specified on the label before harvesting vegetables. The "days-to-harvest" time interval is a safeguard against unhealthy residues on produce.

Pests

Warning: Check Table 1 for pesticides that can be applied to specific crops.

Aphids



The many kinds vary in color from light yellow to dark green, brown, red, and almost black. Although a few species move from one type of vegetable to another, most attack only one type. Aphids suck sap from plant tissues, causing foliage and blossoms to wilt and shrivel. Severely injured plants turn yellow, dry, and die. Some aphids also transmit diseases from sick to healthy plants. Summertime populations are made up entirely of females that reproduce without mating, so infestations can grow explosively.

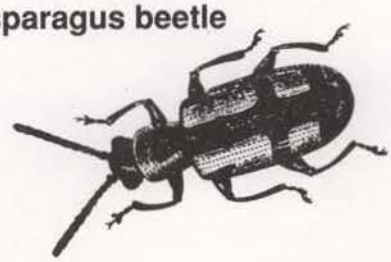
Control — Wash aphids off plants with soapy water, or forcefully spray older, sturdy plants with a garden hose. Sheets of aluminum foil as collars or mulches on the ground under plants confuse and repel flying aphids, though they also may repel natural enemies. Polyester fiber row covers can be draped over plants to protect them from flying aphids, but before draping, check to see that the plants are aphid-free.

Trap aphids with yellow sticky cards or bright yellow dishpans filled with soapy water. At the end of the growing season, compost culls and residues (especially from cabbage crops) and destroy wild mustards that can harbor overwintering aphids. During the growing season, you may benefit from leaving disease-free plant culls in place; they can serve as reservoirs for aphid parasites and predators that will help control aphids on later plantings.

Natural biological controls can be very important. Besides the familiar lady beetles and lacewings, look for the dark, shrivelled, fuzzy cadavers of aphids killed by fungus diseases or the stiff, tan shells of aphid mummies killed by parasitic wasps. You can learn to recognize the beneficial wasps by scanning aphid-infested plants; look for pinhead-sized, shiny, dark-bodied insects with clear wings. Provide biocontrol agents with supplementary nectar and pollen sources. Mass releases of the aphid midge, *Aphidoletes aphidimyza*, have been successful in greenhouses.

Insecticides — Apply Cygon, diazinon, malathion, or Thiodan when colonies of aphids are observed damaging plants. Repeat treatments may be required. Insecticidal soaps, pyrethrin, and rotenone are alternatives that pose less threat to natural enemies than synthetic materials.

Asparagus beetle



One-quarter-inch long, shiny, metallic-blue-black beetles attack asparagus. The area behind the head is red, and each wing cover is edged in red and marked with three square yellow spots. Full-grown larvae are olive-gray, humpbacked, sluggish grubs with black heads. Dull brown bullet-shaped eggs about 1/16 inch long attach by one end to shoots and ferns. Beetles and grubs chew on growing tips and ferns, causing brown scars and black stains on spears.

Control — Handpick and crush eggs, larvae, and adults, or wash them off with a vigorous spray from a garden hose. Interrupt the pest life cycle by harvesting spears as soon as they are ready. Destroy plant debris and trash within and around the garden; adult beetles take shelter there during the winter.

Insecticides — diazinon, malathion, pyrethrin, rotenone, or Sevin.

Blister beetles

Blister beetles are spotted, striped, or solid gray; solid blue; or solid black. They measure up to 3/4 inch long. They differ from most beetles in having soft, flexible wing covers. These beetles feed on tender foliage and flowers. Larvae are beneficial predators of grasshopper eggs, so adult beetles often are numerous after years of high grasshopper populations. Generally, blister beetles attack the garden and move away in hours, so treatment often is not necessary.

Control — Handpick and destroy adult beetles. Wear gloves because some species exude a chemical that may leave a blister on bare skin.

Insecticides — When beetles are numerous, contact sprays of malathion, methoxychlor, Sevin, or Thiodan are effective. Pyrethrin is an organic alternative.

Cabbage looper

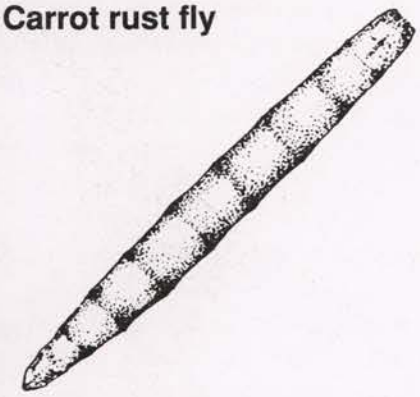
Cabbage loopers are cream to light- or dark-yellowish green with two whitish stripes on the back and one on each side. They grow to about 1 1/2 inches in

length and crawl in a looping fashion. Older larvae may bore into heads of cabbage and lettuce, notch pea pods, and devour entire leaves. There are three or more generations each year.

Control — Handpick and destroy. Watch for blackened, flaccid, decomposing loopers stuck to leaves or hanging upside down; these are caterpillars that have been killed by a naturally occurring virus disease that spreads as the season progresses. Mass releases of *Trichogramma* wasps have been used experimentally. Polyester row covers can protect plants, but check first for eggs or caterpillars already present.

Insecticides — BT *kurstaki* products are ideal against young larvae; other organics are rotenone and pyrethrin. Sevin and Thiodan are effective against small loopers; malathion generally is less effective.

Carrot rust fly



Larvae seriously damage carrot roots left in the soil after late September in northern Idaho. Damage first appears as small holes and later as surface tunneling. Root rot organisms enter feeding wounds and cause the whole root to rot.

Control — Trap adults with yellow or orange sticky cards. Harvest carrots and destroy culls by late September; this avoids the fall generation of flies, which lays eggs in carrots during September and October. Eliminate wild carrots and related weeds that serve as alternate host plants.

Insecticides — Diazinon sold as 5 percent granules (*not* the EC or emulsifiable concentrate formulation) is the only insecticide that can be used.

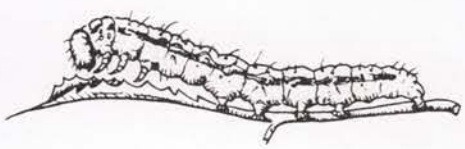
Colorado potato beetle

Colorado potato beetles are yellow, convex, and about 3/8 inch long. They have black spots just behind the head and five black lines on each wing cover. These beetles are found on potato plants throughout the growing season. The eggs are yellow-orange and laid in clusters, usually on the underside of potato leaves. Lady beetle eggs look similar but are smaller. The larvae are humpbacked, red, and have black spots along the sides. When numerous, they can completely defoliate and kill potato plants, eggplants, and sometimes tomatoes.

Control — Handpick and destroy egg masses, larvae, and adults. Rototill after harvest to kill overwintering pupae in the soil.

Insecticides — A BT *san diego* product called Colorado Potato Beetle Attack is effective when applied during egg hatch or before larvae grow to more than 1/4 inch long. Do not confuse this BT product with the BT *kurstaki* products for caterpillar control or the BT *israelensis* insecticides for mosquitoes, both of which are ineffective against Colorado potato beetle. Synthetic insecticides include Sevin, methoxychlor, diazinon, and Thiodan. A second spray may be needed. Rotenone and pyrethrin are organic alternatives.

Corn earworm

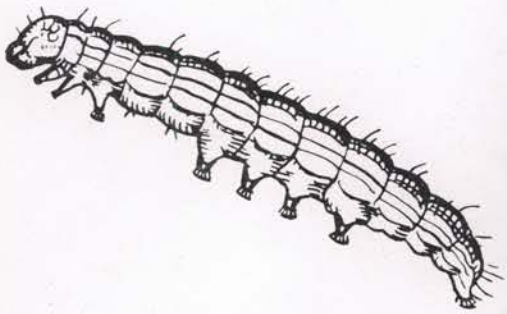


This moth is attracted to fresh green corn silks for egg laying. Larvae are yellowish green to green and grow to 1 1/2 inches long. The tiny larvae eat their ways through the silks into the ear where they destroy the developing kernels. Early season infestations sometimes destroy the whorls.

Control — Plant corn as early as possible to avoid the heaviest infestations. Beginning when silks first appear, apply 20 drops of clear mineral oil into the corn silk every 3 to 7 days until the silks turn brown; use a medicine dropper or a hand-held oiler. BT *kurstaki* products also can be applied to silks on the same schedule. Fall tillage destroys overwintering pupae in the soil.

Insecticides — As corn silks appear, apply Sevin or diazinon dusts or sprays to silks and ears at 3- to 4-day intervals until silks turn dry and brown.

Cutworms



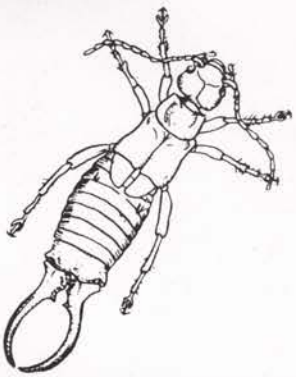
Generally smooth, shiny, and gray to black, cutworms are usually found just under the soil surface during the day. They feed mostly at night and attack nearly all plants. Surface cutworms feed on plants near the soil surface, whereas climbing cutworms crawl up plant stems and feed on foliage. Subterranean cutworms remain under the soil surface and feed on underground portions of plants. Some cutworms are migratory and move in mass from one crop to another.

Control — With the aid of a flashlight, handpick at night when the cutworms are on the foliage. Place hot caps or other protective barriers around new transplants; milk cartons or tin

cans with their ends cut out work nicely. Trap cutworms under boards on the soil surface; inspect the boards and destroy cutworms daily, but watch for shiny, black, fast-crawling beneficial ground beetles that eat cutworms and other pests. Use BT k*urstaki* products before cutworms grow to more than 3/4 inch long. Eliminate weedy patches and trash piles.

Insecticides — Diazinon, Dursban, or Sevin applied to the ground surface around attacked plants.

European earwig

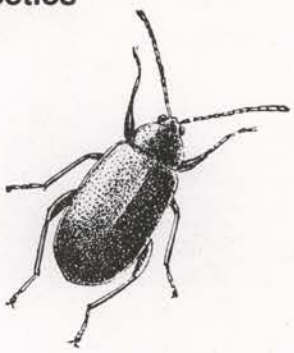


This nuisance pest grows to about 3/4 inch long with a reddish brown body; yellowish brown legs, antennae, and wing covers; and forceps on the rear of the body. Earwigs do not bite; their forceps deliver a barely perceptible pinch. They feed on tender portions of many different plants during the night. A complicating control consideration is that earwigs are predators of other pests.

Control — Eliminate trash piles and other hiding places. Earwigs seek out close, confined quarters for shelter; you can use this behavior for control by placing soda straws, sections of old garden hose, or similar materials on the ground. Earwigs will congregate there overnight and can be dumped into a pail of soapy water the next morning. Shallow pans of vegetable oil placed around the garden also are effective traps; clean and refill them as needed.

Insecticides — Baits of Sevin or Sevin and metaldehyde applied as a protective border around the garden and nearby hiding places.

Flea beetles

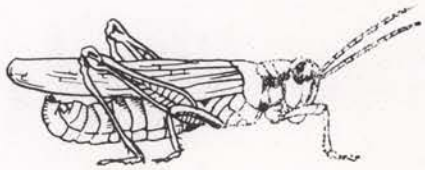


These tiny bronze or black beetles, about 1/16 inch long, hop when disturbed. They eat "shot holes" (tiny holes resembling buckshot) in plant leaves and may kill seedlings.

Control — Clean up weedy patches in the garden and trash piles adjoining the garden where beetles overwinter. Flea beetles are most damaging on emerging seedlings; use protective row covers.

Insecticides — Dusts or sprays of diazinon, Sevin, or Thiodan. Several treatments may be necessary. Pyrethrin and rotenone are organic alternatives.

Grasshoppers



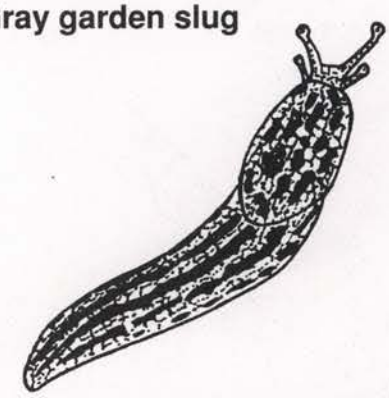
Only about five of the more than 200 species in Idaho attack garden plants. They have enormous appetites and can quickly defoliate the garden. Problems are worst where grasshoppers build up during early summer on nearby weedy pastures, rangeland, and roadside fencerows and then move into the garden during late summer when these areas become dry.

Control — Use vented row covers for protection from invading grasshoppers. Synthetic materials may hold up better to grasshopper nibbling than cloth fabrics. Try planting two rows of corn as a nonharvested trap crop along the edge of the garden facing grasshopper-infested pastures or rangeland. Spray the trap crop with Sevin to kill grasshoppers before they invade the garden.

Microbial insecticides are available that contain spores of the disease-causing protozoan *Nosema locustae*. They are sold under the trade names Grasshopper Attack, Nolo Bait, Semaspore, and others. However, because these *Nosema* products require weeks or even months to be effective and because they kill only 50 to 60 percent of the population, they are ill-suited for short-term control around the home garden. This especially is true where grasshoppers invade the garden from neighboring yards, rangeland, or meadows that remain untreated.

Insecticides — Sevin or diazinon. You may be able to limit sprays to border areas facing infestation sources.

Gray garden slug



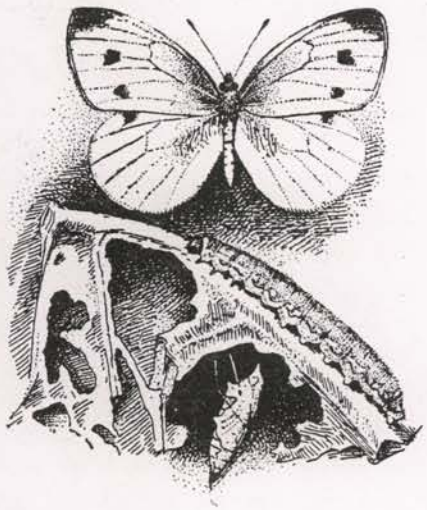
Slugs are relatives of snails and clams but lack a shell. They spend the winter in the soil as eggs; young and adult slugs often rest in night crawler tunnels. Slugs appear in early spring and attack tender seedling plants. Their color varies from white to pale yellow to lavender-purple to nearly black with brown spots, specks, and mottlings.

Control — Eliminate cool, moist, dark hiding places where slugs seek shelter, especially low-growing weeds, stones, and other trash. Prevent reinvasion with copper screens or copper strip barriers. Commercial traps are available. Shallow pans placed at ground level and filled with stale beer are good homemade alternatives. Shingles, boards, and flower pots placed on the

ground as hiding places also make good traps; check traps daily and scrape off and destroy slugs with a trowel or putty knife. Regularly handpick slugs from plants at night; you likely will want to wear gloves because slugs are covered with slimy mucus. Commercial preparations of diatomaceous earth (microscopic, fossilized skeletons of aquatic plants called diatoms) can be effective as a protective barrier if kept dry.

Insecticides—Commercial metaldehyde bait is generally effective but can attract and be toxic to pets. Effectiveness is improved and extended when the bait is placed under a protective cover such as a 5-inch-diameter pie tin or a 4- by 4-inch piece of board. Fresh baits are most effective. Do not allow bait to come in contact with edible parts of plants.

Imported cabbageworm



The adult is a white butterfly often seen flying about cabbage and other cruciferous plants. They lay their white eggs on the undersurface of the leaves. The worms are light velvet green with a narrow orange stripe down the middle of the back and grow to about 3/4 inch long. When numerous, these worms can defoliate all members of the cabbage plant family.

Control — Handpick and crush eggs and caterpillars. Take care not to destroy any small clumps of yellow fuzzy "eggs" found glued to leaves. These are the cocoon stage of a beneficial parasitic wasp that kills cabbageworms. Compost culls and other plant debris after harvest to kill overwintering pupae. Mass releases of *Trichogramma* can be effective. Use row covers as noted for the cabbage looper.

Insecticides — As for cabbage loopers, BT *kurstaki* products are ideal against young larvae. Sevin and Thiodan also are most effective against small worms; malathion generally is less effective. Rotenone and pyrethrin are organic alternatives.

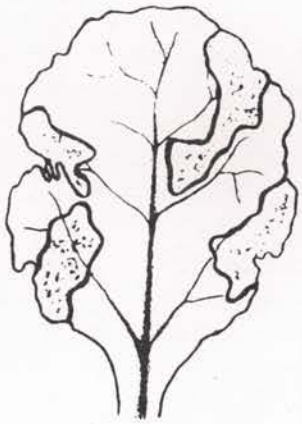
Leafhoppers and spittlebugs

These insects injure plants by direct feeding, causing white spots on the leaf surfaces and stunting plant growth. Adults easily move long distances and can transmit diseases from sick plants to healthy plants. You can recognize spittlebugs from the spittle the nymphs secrete on the foliage. Damage from direct feeding usually is not serious.

Control — Eliminate weedy patches. Hang yellow sticky cards to attract and kill leafhoppers; they are available commercially or can be made by painting boards or plastic sheets bright yellow and coating them with a film of insect or bird Tanglefoot. Foil mulches suggested for aphid control likewise repel leafhoppers.

Insecticides — Cygon, diazinon, Sevin, malathion, and methoxychlor, but control is seldom necessary. Insecticidal soaps and pyrethrin also are registered for use.

Leafminers



Leafminers primarily attack beets, spinach, and chard. Adults are small gray flies that deposit eggs on the leaf surface. A white to yellowish maggot hatches, feeds on the tissue between the upper and lower leaf surfaces, and makes long, winding mines or blisters that make the leaves unsuitable as eating greens. On older plants, only the most extensive leaf mining reduces beet size.

Control — Protect seedlings with row covers. Clip and destroy infested leaves. Natural biological control usually keeps leafminer populations at acceptably low levels; insecticides applied for other garden insects can lead to leafminer outbreaks by killing natural enemies. Eliminate related weedy hosts, especially lambsquarters.

Insecticides — Spray or dust with diazinon or malathion when damage is first noticed.

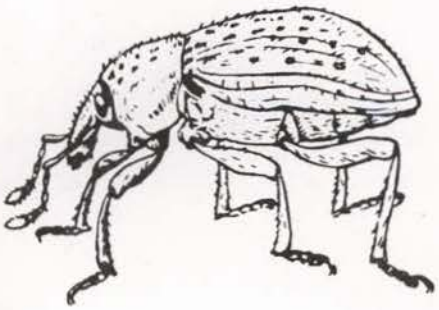
Mexican bean beetle

This is the most damaging insect pest of beans, but it is confined to the Boise area. The coppery yellow beetles with 16 black spots on their wings spend the winter in garden trash. Beetles appear in mid-June, feed on leaves, and lay clumps of yellow eggs on the undersides of bean leaves. The larvae are soft yellow, 1/3 inch long, and covered with black-tipped spines. They eat the undersurfaces of leaves, leaving only a lacy skeleton of leaf veins. At times, they feed on bean pods and stems. Contact county offices of the University of Idaho Cooperative Extension System if you find Mexican bean beetles.

Control — Handpick eggs, larvae, pupae, and adults. Mexican bean beetle eggs are virtually identical to those of beneficial lady beetles. Clean up and compost plant debris and trash at harvest. The Idaho Department of Agriculture in cooperation with the Idaho Bean Commission has released parasites to control this pest.

Insecticides — Repeated sprays of Sevin, malathion, pyrethrin, rotenone, or Thiodan are generally required.

Pea leaf weevil

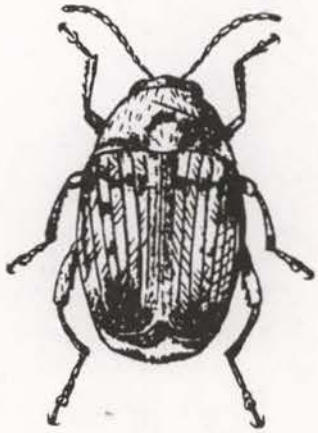


Pea leaf weevils occur only in northern Idaho and the Magic Valley. They are grayish, elongated weevils, about 3/16 inch long, with three light stripes extending from the head to the abdomen. Their feeding produces notches on leaf margins as the plants emerge from the soil. Weevil feeding may retard growth and sometimes kills small plants. Larvae live in root nodules where they feed on nitrogen-fixing bacteria but seem to do little damage to the pea crop.

Control — Plant as early as possible so that peas have grown beyond the highly susceptible seedling stage when adults begin to feed. Eliminate adjoining clover, vetch, and other legume cover crops where adults spend the winter. Warm, wet winters favor infection of adult beetles by the naturally occurring fungus *Beauveria basiana*.

Insecticides — Spray emerging and seedling plants with Sevin. A second treatment may be needed.

Pea weevil

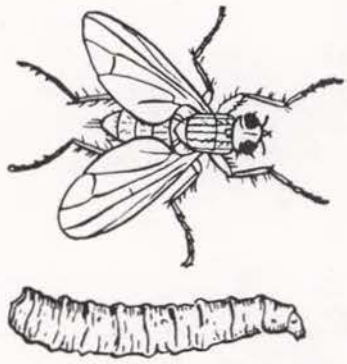


Beetles are chunky, 1/5 inch long, and brown flecked with white, black, and gray patches. Eggs are laid on the side of the developing pea pod. The tiny larva eats its way into the pod and seed where it feeds until mature.

Control — Bury plant debris immediately after harvest. Eliminate trashy areas where adults can spend the winter; rogue volunteer pea plants that sprout after harvest.

Insecticides — Dust or spray with methoxychlor, Sevin, malathion, or rotenone when first pods are 1/2 inch long. Apply a second treatment in 7 days.

Root maggots



Root maggots are small, whitish, wedge-shaped fly larvae without legs or a distinct head. They scar or tunnel into roots and bulbs; infested plants often wilt and die. The adult gray fly, smaller than a housefly, lays tiny, white eggs in soil alongside corn, onion, peas, beans, and cabbage and its relatives. There may be three or more generations each season. Root maggots are most troublesome during cool, wet springs and in soils rich with organic matter.

Control — Protect newly transplanted cabbage crops and onion sets from egg laying during the critical plant establishment stage. Use commercial hot caps and plant collars or homemade window screen cones and tar paper disks shaped into collars around plants. Corn and bean seedlings similarly can be protected with muslin row covers. Keep in mind that any flies emerging from soil overwintering sites beneath the row cover will find themselves in an ideal environment, so covers may not work if your garden has a history of heavy root maggot infestations. Commercially available predatory nematodes have been used as root dips. Till and apply compost immediately after harvest.

Insecticides — Treat furrows with diazinon or Dursban granules or spray when planting seed or transplanting. Where root maggots are abundant, dust or spray a diazinon or malathion border around the base of seedling plants. Repeat two or three times at 10-day intervals.

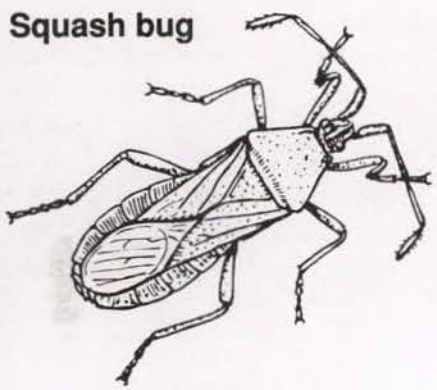
Spider mites

Spider mites are barely visible, only 1/50 inch long. They are oval and yellow, green, or reddish brown with two dark spots on the back. Early feeding results in mottled or speckled foliage. Dense webs on the undersides of infested leaves or a brownish, paperlike appearance to the leaves indicates severe infestation.

Control — Vigorously spray foliage with a garden hose daily to wash off mites as soon as you notice infestations. *Amblyseius*, *Metaseiulus*, and *Phytoseiulus* predatory mites can be purchased for mass release. Spider mite outbreaks can result when insecticides are used for controlling other pests in the garden; insecticides not only eliminate the mite's natural enemies, but some, such as Sevin, also seem to act as mite hormones that stimulate increased egg laying. Late-season infestations may not cause serious plant damage.

Insecticides — Malathion, Cygon, or diazinon sprays repeated at 7- to 9-day intervals. Thorough coverage is absolutely necessary. Insecticidal soaps are generally less harmful to natural biological control agents but may require frequent application.

Squash bug

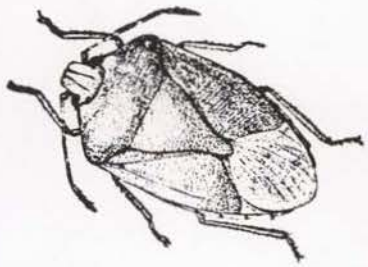


This is a pale- or dark-grayish-brown bug with an orange margin around its body. It attacks pumpkin and squash plants; zucchinis are least susceptible. Young, immature bugs have reddish legs, thorax, and head. Their bodies turn grayish with black legs when mature. They feed by sucking the plant sap, causing the vines to wilt. Like stink bugs, squash bugs have a distinctly unpleasant odor.

Control — Look for brick red egg masses on the undersides of leaves. Handpick and destroy eggs, nymphs, and adults. Nymphs and adults congregate under boards placed on the soil surface. Destroy insects every morning by shaking boards over a pail of soapy water. At the end of the season thoroughly till the soil, compost all plant vines, and eliminate trashy piles, stones, and other overwintering areas of the adults. Plant next year's crop as far away as possible from last year's.

Insecticides — Spray or dust with Sevin or Thiodan when necessary.

Stink bugs

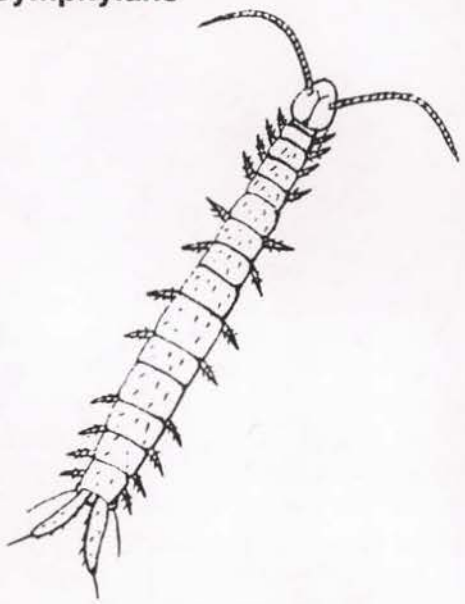


These shield-shaped bugs, about 5/8 inch long, are brown, solid green, or green with four white spots on the back. Their attacks cause distorted growth or blotches in the plant tissue under the skin. Eggs are barrel shaped and laid in small clusters on leaves. Nymphs are similar to the adults in form but initially are bright colored and then turn gray-green to brown.

Control — Eliminate weedy patches that harbor stink bugs during the spring and early summer. Handpick and destroy egg masses, nymphs, and adults.

Insecticides — Spray or dust with Sevin when necessary.

Symphylans



Symphylans are 1/4 inch long, white, and centipedelike. They are subterranean and destroy a plant's fine roots and root hairs. They are very active and quickly run from light. They scar underground parts and stems, stunting or killing plants. Damaged potatoes and root crops have holes surrounded by black rot.

Control — Flooding and drying as described for wireworms can be effective. Symphylans often are associated with soils high in organic matter or with rotting plant debris and manures. Use aged manure and incorporate it several weeks before planting to ensure that it is well decomposed. Isolate your compost pile from the rest of the garden.

Pesticides — Treat the soil surface with diazinon just before planting and incorporate it immediately to a depth of 6 to 8 inches.

Thrips

These slender, torpedo-shaped insects, about 1/25 inch long, vary in color from distinctly white-and-black banded to uniformly pale yellow, uniformly pale green, or uniformly pale tan. Adults have bar-shaped wings with a feathery fringe along the edge. Thrips commonly are seen on the leaves and flowers of snap beans and on flower heads of dandelions, daisies, and other ornamentals. Common host plants in the garden include cabbage and related cole crops, cucumber, onions, peas, and sweet corn. Thrips feed by rasping leaves and sucking sap that leaks from the wounds. Infestations cause characteristic silvery feeding tracks and patches on leaf surfaces. Tiny black fecal spots are another sign of thrips infestation. Hot, dry weather favors rapid population increase.

Control — Many of the methods listed for aphids also are effective against thrips. Vigorously spray plants with water from the garden hose to dislodge thrips. Aluminum foil mulches have shown promise in experiments. Remove weeds and grasses that can serve as overwintering habitats; garden infestations often occur when thrips migrate from patches of dying weeds. Fluorescent yellow sticky cards are attractive to certain species; light blue sticky traps are attractive to others. Damsel bugs, lacewings, minute pirate bugs, and other naturally occurring predators commonly keep thrips in check. Commercially available predatory mites (*Amblyseius mckenziei* and *Amblyseius cucumeris*) have been used in greenhouses for thrips control.

Insecticides — Unless severe infestations develop on young seedlings, control with insecticides is not justified. Insecticidal soaps are effective. Conventional sprays are diazinon, malathion, and Sevin.

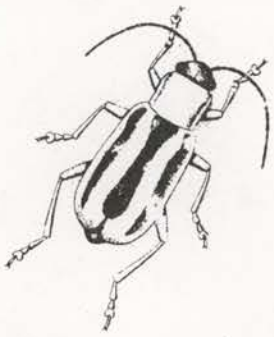
Tomato hornworm

Green caterpillars up to 3 or 4 inches long, tomato hornworms have eight diagonal, white stripes along the sides and a hooked (but harmless) horn at the rear. They are the larvae of the dusk-and-dawn-flying hawk or hummingbird moth, which feeds on nectar of petunias and similar plants. Larval feeding can cause severe defoliation of tomato and eggplant.

Control — Handpicking often is satisfactory. Do not kill caterpillars with fuzzy white "eggs" about the size of a grain of rice on their backs. These are the cocoon stage of a beneficial braconid wasp that soon will kill the caterpillar and then parasitize others. Rototill after harvest to kill overwintering pupae.

Insecticides — BT k*urstaki* products are ideal against small larvae; Sevin and Thiodan also are effective.

Western corn rootworm

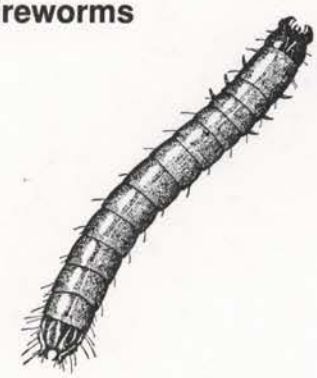


This is a new insect pest of corn that has been found in several areas of southern Idaho. Adults are yellow beetles with black stripes. Larvae are small white worms found feeding on corn roots. Adults feed on silks in some situations, reducing germination and causing blank areas on ears.

Control — Yellow sticky cards attract and kill adults. Larvae easily are controlled by rotating seedings to a different part of the garden each year. Rotation is effective because larvae emerge from eggs laid next to corn plants the previous summer. When corn is planted in a different spot, hatching larvae starve to death because they have no corn roots to eat.

Insecticides — Sevin can be used for adult beetle control during silking. Diazinon can be used at planting for larval control, but rotation is a better solution.

Wireworms



Shiny, slender, yellow, hard worms up to 5/8 inch long, wireworms bore into seeds, potato seed pieces, potato tubers, root crops, and underground portions of most plants. Adults are the common click beetles often seen around porch lights during summer evenings; they do no damage. Each generation requires 2 to 5 years to mature.

Control — Thoroughly till the soil before planting. Flooding or drying can be effective, but both must be done during the heat of summer. To flood, keep an inch or two of water on the garden with small dikes for 7 days when hot weather is expected. Wireworms will die when the temperature of the water and soil rise to 70°F. Alternatively, allow soil to become bone dry for several weeks.

Insecticides — General soil treatment often is the only satisfactory control. Apply diazinon or Dursban granules, dust, or spray to the soil surface just before planting and incorporate it immediately to a depth of 6 to 8 inches.

Table 1. Insecticide registration for insect control in the home garden.

	Aphids	Asparagus beetle	Blister beetle	Cabbage looper	Carrot rust fly	Colorado potato beetle	Corn earworm	Cutworms	European earwig	Flea beetle	Grasshoppers and crickets	Gray garden slug	Imported cabbage-worm	Leafhoppers
Asparagus	6,7,10	4,7,10,11,12,	7						8,12		12	8		
Beans	3,4,6,7,10,13		7,10,12				1,12	1,4,12	8,12	4,10,11	12	8		3,4,6,7,9,10,12
Beets	4,6		7					1,4	8,12	11,12	12	8		6,9,12
Broccoli	3,4,6,7,10,13		7,10	1,7,10,11,12,13				1,4	8,12	10,11,12	4,12	8	1,7,10,12,13	6,7,10
Brussels sprouts	4,6,7,10,13		7,10	1,7,10,11,12,13					8,12	10,11,12	12	8	1,7,10,12,13	6,7,10
Cabbage	3,4,6,7,10,13		7,10	1,7,10,11,12,13				1,4	8,12	4,10,11,12	4,12	8	1,7,10,12,13	7,6,9,10
Carrots	4,6				4			1,4	8,12	11	12	8		6
Cauliflower	3,4,6,7,10,13		7,10	1,7,10,11,12,13				1,4	12	10,11,12	4,12	8	1,7,10,12,13	6,7,10,12
Celery	4,6,10		7	1,7,10				1,4		4,10	12	8		6,10,12
Corn	6,10						1,4,12	1,4,5,12	8,12	5,12	12	8		6,12
Cucumber	4,6,7,10,13		9,10					1,4	8,12	4,10,11,12,13	12	8		6,7,9,10,12
Eggplant	6,10,11		7,9,10			9,10,11,12		1,12	8,12	10,11,12	12	8		6,7,9,10,12
Kale	4,6,7		7,10	1,7,10,11				1,4,12	8,12	10,12	4,12		1,7,10,11,12	6,7,10,12
Lettuce	3,4,6,10,13		7,10	1,7,11,12,13				1,4	8,12	12	4,12	8		6,9,10,12
Melons	3,4,6,7,10,13		7,9,10					1,4	8,12	4,11,12,13	12	8		3,4,6,7,9,10,12
Mustard	3,6,7,10		7	1,7						12	4,12			6,7,10,12
Onions	4,6		7					1,4				8		6
Parsnips	4,6			1					8,12	4,12	12	8	1,12	6,12
Pea	3,4,6,7,11		7					1,4,12	8,12		12	8		4,6,7
Peppers	3,4,6,10,13		7,10			9,10,12		1,4,12	8,12	10,11,12,13	4,12	8		6,9,10,12
Potato	3,4,6,7,10,11,13		7,9,10			2,4,9,10,11,12,13		1,4,12	8	4,10,11,12,13	12	8		3,4,6,7,9,10,12
Pumpkin	6		7					1		12	12	8		6
Radish	6,10		7					1	8,12	4,10,11,12	4,12	8	1,10,12	6,10,12
Spinach	4,6,10		7	1,7,12				1,4	8,12	10,12	12	8		6,10,12
Squash	4,6,7,10,13		7					1,4	8,12	4,10,11,12,13	12	8		6,7,10,12
Swiss chard	3,6		7	1				1,4	8,12		12	8		6,7,10,12
Tomato	3,4,6,7,10,11,13		7,9,13	1,7		9,10,11,12,13	1	1,4,12	8,12	4,10,11,12,13	4,12	8		3,4,6,7,9,10,12
Turnips	3,4,6,7,10		7	1,7		1		1	8,12	4,10,11	4,12	8	1,7,10	6,7,10,12

1 = BT *kurstaki*, 2 = BT *san diego*, 3 = Cygon, 4 = diazinon, 5 = Dursban, 6 = insectidal soap,
7 = malathion, 8 = metaldehyde, 9 = methoxychlor, 10 = pyrethrin, 11 = rotenone, 12 = Sevin, 13 = Thiodan.

Table 1. (cont).

	Leafminer	Mexican bean beetle	Pea leaf weevil	Pea weevil	Root maggot	Spider mite	Spittlebugs	Squash bug	Stinkbug	Symphylan	Thrips	Tomato hornworm	Western corn rootworm	Wireworm
Asparagus					7	6,7								
Beans		7,10,11,12,13			7	3,6,7			12	4	4,6,7,12			4
Beets	4,7				7	6,7				4	6,7			
Broccoli					4,5,7	6,7	12		12		6,7			4
Brussels sprouts					5,7	6,7	12		12		6,7			
Cabbage					4,5,7	6,7	12			4	4,6,7			4
Carrots						6	12		12	4	6,7			4
Cauliflower					4,5,7	6,7	12				6,7			4
Celery					7	6,7	12		12		6,7			4
Corn					4	6				4	6		4,12	4,5
Cucumber						6,7		12,13			4,6,7			4
Eggplant					7	6,7			12		6,7,12			
Kale					5,7	6,7	12				6,7			4
Lettuce					7	6,7	12		12	4	6,7			4
Melons					7	4,6,7		12,13			3,4,6,7			4
Mustard					7	6,7	12		12		6,7			
Onions					4,5,7	4,6,7					4,6,7			4
Parsnips						6	12		12		6			
Pea			12	7,9,11,12	7	6,7				4	4,6,7			4
Peppers					7	6,7			12		6,7,12			4
Potato					7	6,7			12		4,6,7,12			4
Pumpkin					7	6,7		12			6,7			
Radish					4,5,7	6,7	12		12	4	6,7			
Spinach	4,7				7	6,7			12		6,7			4
Squash					7	4,6,7		12,13			4,6,7			4
Swiss chard	7				7	6,7	12		12		6,7			4
Tomato						6,7			12	4	4,6,7,12	1,12,13		4
Turnips	4,7				5	6,7	12		12	4	6,7			

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