

How to identify, scout, and control insect pests in vegetable crops

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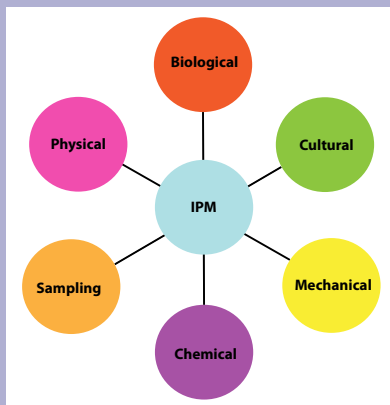


Figure 1. IPM scheme.



Figure 2. Scouting for pests in a strawberry field.

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Correct identification of pest problems is the beginning of a successful integrated pest management (IPM) program. Regular scouting can provide early warning of problems, allow the widest range of control options, and bring favorable economic, ecological, and social consequences.

Two or more methods of pest control are usually more effective than a single method (Figure 1). The following five methods control and prevent pest damage:

- Mechanical control—use of machinery or hand labor
- Physical methods—manipulating environmental factors such as temperature, light, humidity, heat, and/or solarization
- Cultural methods—growing plants that resist pests, crop rotation, planting dates, fertilization, irrigation, elimination of crop residues, or other practices that keep pests away from the crop
- Biological control—natural enemies such as parasites, predators, or microbes (which can be reared if not present)
- Pesticide use—for prevention and control of pests. For a list of effective pesticides registered for use on specific vegetables, review the current *Pacific Northwest Insect Management Handbook* (<http://pnwpest.org/insects>).

It is important to take action against pests only when they threaten crops. Base your management decisions on **which** pest is present, **how many** pests there are and whether their numbers are increasing or decreasing, **when** the pest is present, and **how much damage** the crop can tolerate.

Scouting field crops for pests

Scouting techniques vary, depending on the pest involved (Figure 2). Early detection is important because crop damage may be severe and/or management options limited if problems are not detected early.

Regular scouting can:

- Prevent a serious problem
- Determine the exact cause(s) of the problem
- Determine where the problem occurs
- Determine the most economic control option
- Provide evidence for the effectiveness of the control method used



Figure 3. Aphids on a strawberry leaf.



Figure 4. Aphid damage on strawberries.

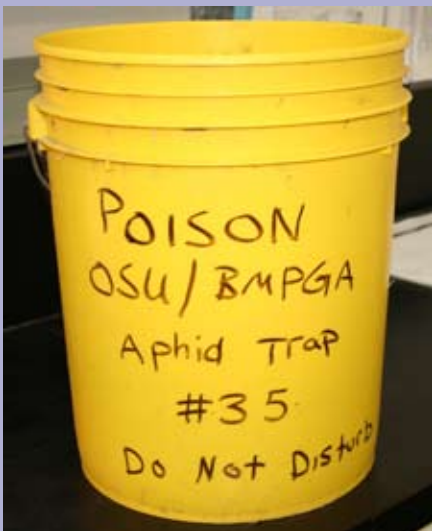


Figure 5. Winged aphids are attracted to yellow water pans because of the color. A film on the water surface traps the aphids.

Season-long record keeping of pest populations (including life stages), weather, and crop conditions help determine which control strategies work and where improvements should be made.

Pest identification is the most important step; misidentification is a common cause of control failure. Knowing the correct pest and its biology and life cycle is the key to selecting control measures that work.

Common insect pests that affect vegetable crops

Most vegetable crops are subject to pest damage; seeds, roots, stems, leaves, and fruit are all susceptible. Damage ranges from reduced plant vigor to plant death and crop loss. Common problems in the Pacific Northwest are described below.

For more complete insect control information categorized by crop, please visit the *PNW Insect Management Handbook* website, where you will find pictures, additional print-on-demand information, and other useful links: <http://pnwpest.org/pnw/insects>.

Aphids (Order Homoptera)

Pest description and biology. This soft-bodied insect usually lives on new shoots, crowns, and undersides of leaves (Figure 3). In general, aphids are slender and dark green to yellow. The aphid life cycle includes eggs, nymphs, and adults. Adults can be either wingless or winged. Nymphs are small and similar in shape to adults. Most female aphids reproduce asexually, giving birth to live young that quickly reach maturity and then reproduce. A short life cycle accounts for rapid increases in populations. Under crowded conditions, winged forms develop, disperse, and colonize other areas.

Damage. Aphid nymphs and adults feed by inserting a needle-like structure (stylet) into the plant and removing plant sap, thus reducing plant growth. Symptoms of aphid damage include curled, twisted and/or stunted leaves, yellowish spots, and glossy leaves. Heavy infestations in seedlings or transplants can cause plants to wilt and/or die. Black sooty mold (due to a fungus) may develop on leaves due to the presence of sticky honeydew, which is released by aphids through the cornicles or “tube-like” structures at the tip of the abdomen (Figure 3). The presence of this mold may reduce photosynthesis, make the plant unattractive, and possibly reduce flowering and yields (Figure 4). Some species spread plant viruses. Prevention of aphid-vectored viruses is a primary reason for aphid control in vegetables.

Hosts. All vegetable crops.

Sampling. Check fields at least weekly, starting right after planting. Aphids often concentrate in hot spots close to the field margins; however, checking only hot spots could overestimate the population present in the field. Yellow water pans (Figure 5) set next to the field give an indication of aphid flight activity and possible colonization by others that fly in.

Control. Spray insecticidal soap, dishwashing liquid, and oils to clog the aphids' breathing holes and kill them. After a few hours, wash off the oil and soap with a garden hose. Repeat the application as necessary. It is very important to cover the entire plant thoroughly. For more information, visit <http://extension.oregonstate.edu/catalog/pdf/ec/ec1586.pdf>.

Aphids have several natural enemies, such as lady beetles (Figure 6), hover flies (Figure 7), lacewings (Figure 8), and parasitic wasps (Figure 9). When present in adequate numbers, natural enemies can suppress aphid populations.

Thrips (Order *Thysanoptera*)

Pest description and biology. Onion thrips (Figure 10, page 4) and Western flower thrips (Figure 11, page 4) are two of the most damaging pests in the Pacific Northwest. Other species of thrips also thrive here. Immature and adult thrips are tiny, slender, and vary in color. They live mainly in flowers and can be seen walking and feeding on leaves and other plant parts. Adults are very active and when disturbed move quickly and disperse. Their mouthparts can be either chewing or piercing-sucking types.

Damage. Damage caused by large numbers of feeding thrips appears silvery in color (Figure 12, page 4) and plants can die. Feeding on young fruit may result in scarring and russeting. Thrips are most damaging in the early stages of a crop; plants might have difficulty recovering. Some species can transmit viruses. For example, Western flower thrips, tobacco thrips, and onion thrips transmit Tomato Spotted Wilt Virus (TSWV). Onion thrips transmit Iris Yellow Spot Virus, which was devastating in the early 2000s in the Pacific Northwest (Figure 13, page 5).

Hosts. Beans, broccoli, Brussels sprouts, cabbage, cauliflower, cucumbers, garlic, leeks, shallots, onions, green peas, and potatoes.



Figure 8. Lacewings.



Figure 6. Lady beetles.



Figure 7. Hover fly.



Figure 9. Parasitic wasps.



Figure 10. Onion thrips. Hairs on the lower, but not upper margin.



Figure 11. Western flower thrips. Row of hairs along both the upper and lower margin of the prothorax (first segment behind the head).



Figure 12. Typical rasping-type damage done by thrips.

Sampling. Scout for thrips weekly to determine population increases. Remove and bag at least five plants per area and count the thrips on these plants. There is no action threshold for applying control measures. However, recommendations suggest the application of control measure at 1 thrips/plant.

Control. Sanitation is important because thrip populations tend to build up on weeds. Cultivate nearby weedy areas before plants emerge; later cultivation will increase the potential of a thrip problem. Overhead irrigation and rainfall provide some suppression of thrip populations, but treatments often are still necessary. If chemical application is necessary, thorough coverage is essential, as most thrips feed in protected areas of the plant.

Several beneficial insects feed on thrips and contribute to their control; the most notable is the minute pirate bug (Figure 14, page 5). If using biological control, select insecticides that minimize impacts on beneficials.

Whiteflies (Order Homoptera)

Pest description and biology. Adults are tiny, moth-like insects that inhabit undersurfaces of leaves and cause damage by penetrating tissue and removing plant sap with piercing-sucking mouthparts (Figure 15, page 5). In general, whiteflies go through an egg stage, four nymphal stages, and an adult form. Only the first nymphal stage (crawler) is mobile. Nymphs are flat, elliptical in shape, and clear or creamy yellowish in color (Figure 16, page 6).

Damage. Both nymphs and adults feed on leaves and other plant parts. Excess sugar (excrement) causes accumulation of honeydew and subsequent growth of sooty mold (Figure 17, page 6). Some species transmit diseases such as Tomato Mottle Virus (ToMoV) or Tomato Yellow Leaf Curl Virus (TYLCV). Direct crop damage occurs when whiteflies feed in plant phloem, remove plant sap, and reduce plant vigor. With high populations, plants may die.

Hosts. Whiteflies are particularly problematic on tomatoes, squash, cucumbers, beans, and other crops in both field and greenhouse production.

Sampling. Methods of monitoring for whiteflies are **sticky traps** (Figure 18, page 6), **leaf inspection**, and vacuum sampling (suitable for sampling foliage by collecting insects inside a large vial).

Control. Chemical control of whiteflies is expensive and difficult. Take into account factors such as thorough coverage (most whiteflies are located on the underside of the leaves), risk of secondary pest outbreaks, risk of whiteflies developing insecticide resistance, and regulatory restrictions on use of insecticides. Many natural enemies, such as parasitic wasps (Figure 19, page 7), can provide effective biological control, especially under greenhouse situations.

Wireworms (Order Coleoptera)

Pest description and biology. Wireworms are the most damaging of soil insects and attack all types of crops. Larvae (or “worms”) are hard, slender, shiny, and predominantly yellowish (Figure 20, page 7). It is the larva that inflicts damage to crops. Adults are known as “click beetles” (Figure 21, page 7). Wireworms require 2 to 6 years to complete a life cycle. They overwinter in the soil as larvae, pupae, or adults at a depth of 12–24 inches, returning to the surface during the spring. Soil temperature is important for wireworm development. Adults emerge and fly in the spring.

Damage. Wireworms are found around the root zone. Symptoms can appear suddenly, causing significant losses in the plant stand. Heavy infestations can destroy the crop. Damage can be direct (root feeding) or indirect, providing points for pathogen entry, leading to secondary infection and rots. Damage is more common in spring-planted crops where soil has a higher organic content. Fields that have been planted to or are adjacent to alfalfa, pasture, wheat, or uncontrolled weeds are more likely to experience damage.

Hosts. Asparagus, dry beans, lima beans, snap beans, beets, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, cucumbers, eggplant, endive, garlic, horseradish, lettuce, melons, onions, peppers, potatoes, pumpkins, radishes, squash, sweet potatoes, and tomatoes.

Sampling. No sampling plan has been developed to predict damage. However, bait stations have been widely used with mixed results. For a homemade bait station, bury 1 to 2 cups of a 1:1 mixture of corn and/or wheat to a depth of 4 to 6 inches. Pre-soaking the whole grain bait 1 day prior to baiting increases the bait’s attractiveness to wireworms by promoting seed germination and release of carbon dioxide. Mound the soil over the top in a dome shape so rainwater runs off. Cover the mound with a piece of black plastic (3 square feet) to promote warming of the soil. Mark the site with a surveyor’s flag. There should be at least one baiting site for each acre. Distribute traps randomly through the field. An average of one wireworm per site might indicate the need for a preventive method.

Control. Plowing infested fields can reduce the survival of pupae. Also, a 3-year rotation of alfalfa, followed by 1 year of potatoes and 1 or 2 years of corn or beans can reduce wireworm populations. Preplant fumigation and soil-incorporated pesticides continue to be the predominant control methods. Birds destroy wireworms exposed by inverted cultivation such as plowing. No other natural agents have been proven to be effective.

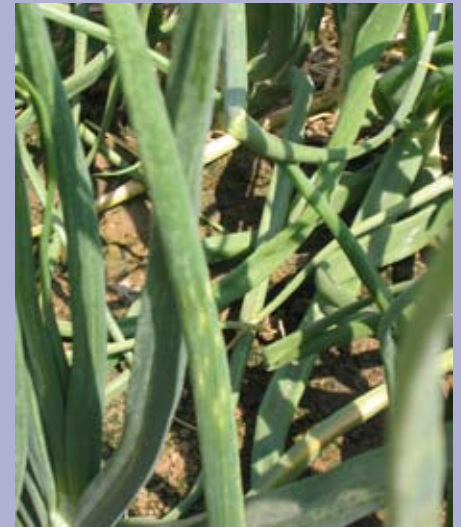


Figure 13. Iris Yellow Spot Virus, a disease transmitted by onion thrips.



Figure 14. Minute pirate bug.



Figure 15. Whitefly adults and nymphs.



Figure 16. Whitefly nymph.



Figure 17. Accumulation of honeydew or excess sugar growth of sooty mold.



Figure 18. Yellow sticky card.

Seedcorn maggot (Order *Diptera*)

Pest description and biology. The seedcorn maggot adult is a slender, light gray fly about 3/8 inch long (Figure 22, page 7). Four stages occur: eggs, larvae (Figure 23, page 7), pupae, and adults. Eggs are white with raised ridges. Seedcorn maggot is abundant primarily in the spring, during or following a wet cycle. It is most common in fields with high amounts of organic matter or recently incorporated vegetation.

Damage. Seedcorn maggots burrow into seeds, preventing germination or reducing vigor (Figure 24, page 7). Slow emergence and poor stand establishment are signs of seedcorn maggot activity. In some crops, such as onions, the larvae will tunnel up the seedling stem, causing plant death. Cool soil temperatures and excessive moisture that cause slow seed germination and emergence of seedlings can increase susceptibility to seedcorn maggot infestation.

Hosts. Dry beans, lima beans, snap beans, broccoli, Brussels sprouts, cabbage, cauliflower, cucumbers, onions, green peas, pumpkins, squash.

Scouting. Slow emergence and poor stand are signs of seedcorn maggot activity. Dig up seed and check for insect feeding.

Control. Recommendations to reduce seedcorn maggot infestation:

- Reduce attractiveness to egg-laying adults by incorporating green plant and organic matter well before planting.
- Delay planting until temperature and moisture are appropriate.
- Plant under ideal soil and weather conditions to assure rapid seed germination and emergence.
- Insecticidal seed treatments are the most commonly used control method.

Entomophagous fungi (fungi that cause disease to the host) are important natural control agents of adults in some areas. Some parasitic nematodes also can be effective (*Steinernema* and *Heterorhabditis*) in controlling seedcorn maggot populations.



Figure 19. Parasitic wasp of whitefly *Encarsia* spp.



Figure 20. Wireworm larva.



Figure 21. Click beetle.



Figure 22. Seed corn maggot adult.



Figure 23. Seed corn maggot larvae.



Figure 24. Damage by seed corn maggot.

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