alternative pest & disease controls

A "how to" guide for using least-toxic controls in the garden

Green Gardening Program

About the Green Gardening Program

The Green Gardening Program is sponsored by the Seattle Public Utilities in an effort to promote alternatives to lawn and garden chemicals.

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City of Seattle

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Introduction

Many common lawn and garden pest problems can be prevented or controlled without using highly toxic pesticides.

This booklet is designed to help you use less-toxic alternatives effectively and safely. To succeed with alternative pest controls, you need to know how they work and how to use them. Even the least-toxic products must be used with care.

You may not even need the tools described in this book if you follow some of the basic steps described on the next page in caring for your lawn or garden.

Contents

Basic Steps to Reduce Pest Problems

- Plant a variety of species, using pest-resistant plants and plants that attract beneficial insects and birds.
- Build good soil with compost and other organic amendments and give plants the sun, water, and nutrients they need. A healthy plant is better able to resist insect pests and diseases, but even a pest-resistant plant may have pest problems if it is not properly placed and cared for.
- Keep garden pathways and beds clean and clear of weeds and other objects that may harbor pests. Remove garden wastes to the compost pile unless plants are diseased.
- Rotate crops every year to avoid soil diseases.
- Don't expect to kill all pests or have picture-perfect plants every time. Some pests will always be in your garden, and they do have a place in the ecosystem. Monitor your plants carefully and tolerate some damage.
- When damage occurs, be sure to identify the pest properly. The insect you see near a damaged leaf may actually be a beneficial insect that devours pests.

If pest control is truly necessary, this booklet can help

First, try appropriate physical controls, such as traps, barriers, or hand removal. If needed, the next choice would be biological controls—beneficial insects or bacteria, for example.

The last resort is to use a chemical. The chemicals listed in this booklet are among the least toxic. Still, they may be a hazard to fish or beneficial insects, especially if used improperly, so be sure to read the label carefully and use the product only as directed. You are breaking federal law if you disobey the directions on the label.

If you must use a chemical, take special care that the chemical only goes where it should. And finally, for advice about disposal of any unwanted pesticide products, call the Household Hazards Line at 206-296-4692 or 888-TOXIC-ED, or send an email to haz.waste@metrokc.gov. For more information call the Natural Lawn & Garden Hotline at 206-633-0224.

Floating Row Cover

Type of control: Physical barrier

Examples: Reemay™, Agronet, Argyl P17,
Dalen's Landscaping Fabric, Fabrico, Ross Garden Netting

Effective against: Leaf miners, carrot rust fly, cabbage root maggot, cabbage looper, imported cabbage worm, and others

Crops: Annual vegetables such as spinach and beets (leaf miner), carrots (carrot rust fly), cabbage family (cabbage worms and root maggot).

When to use: Damage is done by the insect larvae. Netting prevents the adult from landing to deposit eggs on the plant. Floating row cover should be placed over the entire crop at seeding or transplanting. It must cover the plants for their entire lifetime. Floating row cover is generally used in the spring and summer but is not usually necessary for crops grown over the winter. Use in the winter can be helpful to conserve heat.

Be sure that edges are covered with soil so that insects cannot get underneath.

How to use: Cut a piece of netting larger than the area to be covered. Lay it out over the bed, leaving extra slack fabric for growth. Secure the edges by scooping a little soil onto the cloth, completely covering the edge. Anchor the fabric with rocks or other weights. It is important that there not be any openings in or under the cloth. You may raise the edge to weed or harvest, but replace the seal as soon as possible.

Alternate method: Build a framework to support the cloth or buy a kit like those available at some garden stores.

Floating row cover allows sunlight and water to enter, so it is not necessary to remove the cloth. In fact, the cloth acts as a greenhouse, keeping the plants warm and allowing them to grow more quickly than uncovered plants.

Advantages: Completely non-chemical method. Highly effective. Heat trapping speeds the growth of plants. The fabric can be used for several seasons and is machine washable, though somewhat fragile.

Disadvantages: Plants remain covered and out of direct view. Harvesting and weeding require removing netting and replacing it. Floating row cover is not effective if pests are already in the soil, so it is important to rotate crops each year. Not intended for ornamental plants.

You can support the cloth on a framework if you wish. The fabric can be used for several seasons and is machine washable, though somewhat fragile.

Copper Slug Barrier

Type of control: Physical barrier

Examples: Snail Barr™, Dr. Harvey's Copper Mountain, generic sheet copper, Surefire Copper Barrier Tape

Effective against: Slugs, snails

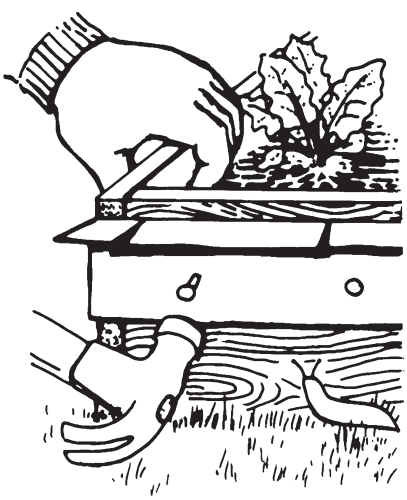
Crops: Any susceptible crops that can be surrounded by the barrier—slug-prone crops include tender leafy greens, strawberries, dahlias, hosta, and marigolds, among others.

How to use: Snail Barr works best when attached to raised-bed gardens. The copper should be installed vertically like a fence rather than flat on the ground. **The strip should be at least three inches high**. Snail Barr has tabs that can be folded over to form an additional obstacle. Dr. Harvey's Copper Mountain is a freestanding barrier made of copper-impregnated plastic. If you use sticky backed copper tape, a double band is suggested to increase the width.

As soon as the barrier is installed, any slugs trapped inside must be removed. Go out at night for several evenings and capture the slugs found within the barrier. Also be sure to keep plants trimmed or pruned so that they don't lie across the barrier, forming a bridge that slugs can use to cross. The copper will gradually weather to a greenish-blue color, but it still works. Wear gloves when working with sheet metal to avoid cutting yourself on sharp edges. If slugs are numerous, combine slug fences with traps (baited with beer) and regular slug hunting expeditions.

Advantages: Highly effective. Avoids the use of chemical baits. Low effort and maintenance once installed.

Disadvantages: Rather expensive. May be difficult to find. Phone around to locate or search the Internet.



Sheet copper can be nailed directly to raised-bed gardens.

Sticky Barrier

Type of control: Physical barrier

Examples: Tanglefoot™, Tangletrap™

Effective against: Root weevils, ants (which crawl up plants to tend aphids).

Crops: Rhododendrons, trees

When to use: Any time that damaging insects are traveling up and down stems or trunks of plants. Ants are not usually a problem unless the aphid population is extreme on the host plant, in which case interrupting the ant traffic with a sticky barrier can be helpful in controlling the aphids. (Ants protect aphid populations from predators in order to harvest the sweet substance they produce.)

How to use: Read the label before using. Squeeze out the material and use a putty knife or flat piece of wood to spread it into a band at least four inches wide around the trunk of the plant. For immature plants, wrap the trunk first with a protective layer of waterproof tape or paper and spread the barrier on top of the tape. The material is very sticky, so try to avoid getting any on yourself or your clothing. Be sure that the treated trunk is the only access route. Prune back branches or leaves that touch the ground, fences, or other plants.

Advantages: Highly effective, non-toxic, easy to use

Disadvantages: Does trap some harmless or beneficial insects, so should not be used indiscriminately. May have to be used in combination with other controls. Paint thinner is required to clean any tools that come in contact with the material—you can use a piece of scrap wood instead.

Use a piece of scrap wood to spread the material on the trunk.

Sticky Traps

Type of control: Trap

Examples: Biolure™, Yellow Sticky Traps, Safer™ Flying Insect Traps

Effective against: Aphids, whiteflies—especially effective in greenhouses

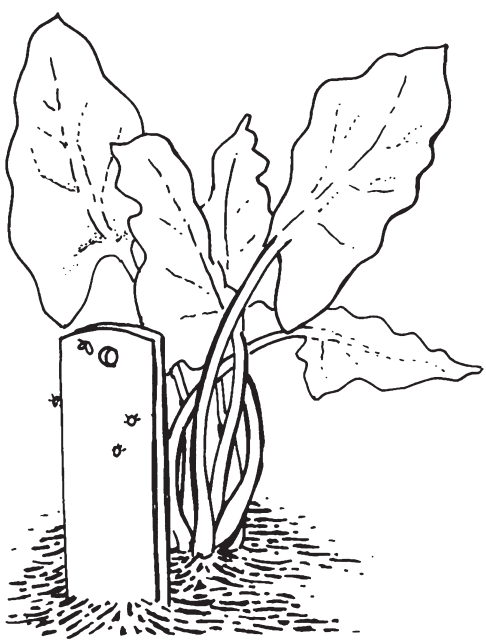
Crops: All vegetables and ornamentals

When to use: Whenever aphids or whiteflies are present

How to use: If you use a commercial trap, peel off the protective coating and install the trap near the plants you wish to protect. Traps can be hung from branches or attached to stakes. The traps will collect pests continuously. This reduces the pest population and also is useful for monitoring. To make a homemade trap, paint a board or piece of cardboard with yellow paint and cover it with Tanglefoot Insect Trap Coating or other sticky material. The yellow color attracts the insects.

Advantages: Non-toxic. Easy to install. Very useful for monitoring pest populations.

Disadvantages: Several traps may be required. Traps are quite visible. Traps alone are unlikely to provide sufficient control. Should be used in conjunction with other controls.



Small traps can be stuck in the ground or attached to stakes.

Weed Control Techniques

Mulch

Type of control: Physical barrier

Examples: Compost, bark, composted steer manure, wood chips, leaves, dry grass clippings, sawdust

Effective against: Annual weeds such as chickweed, annual bluegrass, bitter cress, etc.

Best uses: Vegetable beds, perennial borders or beds, or around shrubs and trees.

When to use: any time. Let vegetable beds warm up in spring before mulching so as not to slow plant growth.

How to use:

1) To keep weeds down: Place mulch over landscape as indicated below.

Plant	Best mulches	Mulch thickness
Annuals or herbaceous perennials	compost, dry grass clippings, leaves, sawdust	1–2 inches
Shrubs and trees	coarse wood chips or bark	2–4 inches

Add new layers from time to time as mulch naturally decomposes. Keep mulch away from stems and crowns of plants. Don't incorporate bark or wood chips into the soil—spread them on top.

2) To kill a lawn in place in order to start or enlarge a garden: Cover entire area with sheets of cardboard or newspaper. Pile several inches of compost, manure or other material on top.

Advantages: Easy. Some mulch materials can be obtained free or at low cost. Provides some weed control. Weeds that grow in the mulch are easy to pull by hand because mulch material is loose.

Disadvantages: Bark can be expensive. Leaves and wood chips tend to blow around. Wood chips and sawdust can deplete nitrogen if worked into soil; be sure to fertilize well. Add 3 pounds of nitrogen (in other words, 30 pounds of 10:0:0 fertilizer) per cubic yard of material.

Recycled Weed Barriers

Type of control: Physical barrier

Examples: Old carpeting, cardboard (appliance boxes are excellent), roofing paper

Effective against: Annual weeds and most perennial weeds.

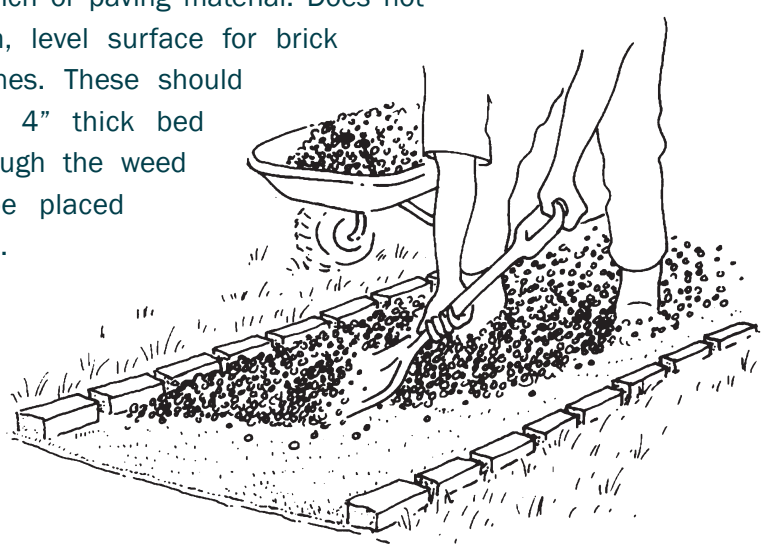
Best uses: Excellent for weed suppression under gravel, stone, or wood chip paths. More effective than landscaping fabric for these uses.

When to use: Year round; barrier is semi-permanent.

How to use: For use under garden paths or driveways, place 2-3 overlapping layers of material as a base, then cover with paving material such as gravel or wood chips. Material remains in place until it eventually breaks downs.

Advantages: Low maintenance; once installed, barrier remains in place until it breaks down. Barrier lets some water and air penetrate. Does not prevent weeds entirely, but provides considerable control if installed properly. Good way to build paths using discarded materials in the landscape.

Disadvantages: Weed seeds can grow in material on top of barrier. Cannot till soil on top of barrier. Unattractive if not covered by mulch or paving material. Does not provide a firm, level surface for brick or paving stones. These should be laid on a 4" thick bed of sand, although the weed barrier can be placed under the sand.



Old carpeting or cardboard make good weed barriers under gravel or wood chip paths.

Weeding Tools

Dandelion Pullers

Type of control: Physical

Examples: Weed Popper, Weed Hound, Amish Ball Weeder, Diggit, D&D Weed Puller

Effective against: dandelions, plantain, poppies, and other weeds with long taproots.

Location: turfgrass, perennial beds, garden beds

When to use: Whenever weeds are present; easiest to use when ground is moist and most effective when weeds are small. Be sure to remove weeds before they set seed.

How to use: Instructions vary somewhat between models. For hand-operated types, insert blade into ground near weed to be removed. Press handle down carefully to pop weed out of the ground. Be careful not to break off root, as remaining pieces can resprout. For foot-operated models, insert blades or tines as directed, press down on foot-lever to remove weed, lift tool to clear. For weeds in lawn, irrigate first if soil is dry to loosen roots. If removal of weeds leaves bare spots in lawn, reseed immediately to prevent weed seeds from sprouting. Carry a small can of seeds mixed with soil, and sprinkle into the hole left by the weed puller.

Advantages: Easy to use, extremely effective, and completely non-chemical. Non-polluting, non-toxic, and no hazardous waste generated. Good exercise.

Disadvantages: Labor-intensive, especially for large areas or very dense weed populations.

Special Purpose Weeders

Type of control: Physical

Examples: Cape Cod Weeder, Yankee Weeder

Effective against: Annual weeds in sidewalk cracks or crack between bricks.

Crops: NA

When to use: Whenever required.

How to use: Insert blade into crack and pull towards you to cut weeds.

Advantages: Ideal shape for the job. More effective and easier to use than tools not specifically designed for this purpose.

Weeding Hoes

Type of control: Physical

Examples: Oscillating Hoe, Scuffle Hoe, Stirrup Hoe, Hand Hoe, Collinear Hoe, Dutch Weeder, Action Hoe, Winged Weeder

Effective against: Larger annual weeds, temporary action on perennial weeds.

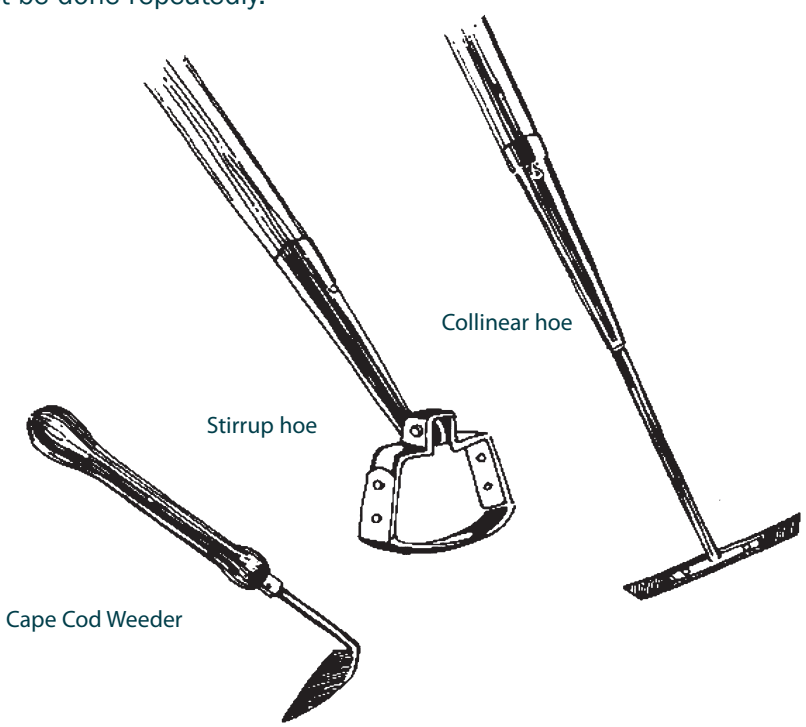
Location: Garden or perennial beds.

When to use: Whenever weeds are present. Repeated hoeing weakens plants by reducing food reserves in roots and will help control perennial weeds.

How to use: Directions vary for different models. Use so that blade moves back and forth under the soil surface to cut stems.

Advantages: Flat hoe blade operates under the soil surface to cut weed stems from roots. Horizontal motion requires less effort than traditional hoes. Does not chop invasive weeds into pieces that can sprout separately. Action less disturbing to soil surface than cultivators or traditional hoes, so that below-surface seeds are not brought up to sprout.

Disadvantages: Not useful for weeds in turf, gravel, or hardpan soil. Must be done repeatedly.



Cultivating Tools

Type of control: Physical

Examples: two tine, three tine and four tine cultivators (short and long handles), Precision Weeder, Heart Weeder (single tine)

Effective against: annual weeds in garden beds

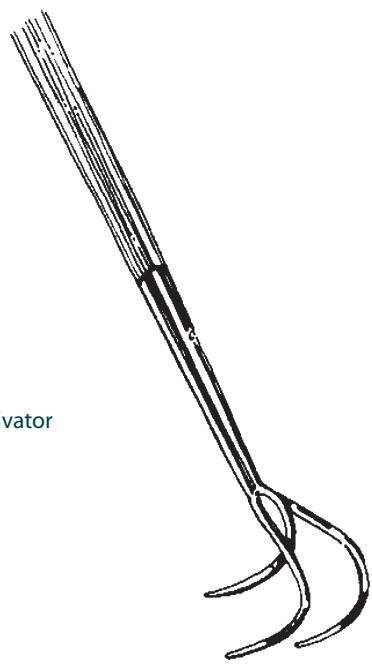
Location: garden or perennial beds

When to use: Most effective when weeds are small and fragile, before they set seed.

How to use: Insert tines into soil and use scratching or hoeing motion to loosen soil and dislodge weeds. Pick up and remove weeds from garden soil after loosening, especially during rainy weather when the roots can begin to regrow.

Advantages: Dislodges most common, shallowly rooted annual weeds. Loosens and aerates soil at the same time. Gets gardener in touch with growth habits of both weeds and desirable plants.

Disadvantages: Not useful for most perennial weeds or weeds with long taproots. Not usable for weeds in turf or gravel. May expose buried weed seeds. Be sure to mulch after weeding.



Three tine cultivator

Flame Weeders

Type of control: Physical control (propane torch)

Examples: Weed Dragon™, Weed Wizard™, generic products widely available at hardware stores

Effective against: annual weeds, especially in gravel, paving cracks, or between pavers

Crops: Not generally used on or around desirable plantings, such as shrubs, because of potential for fire damage.

When to use: Flame weeders are best used when weeds are small, and certainly before they set seed. Never use flame when weeds or nearby plants are dry and may catch fire.

How to use: Move the flame back and forth, searing weeds but not burning them. Do not use on bark mulch, plastic, or near flammable debris or dry plants. Keep flame well away from your feet, hands, or clothing, and move backwards as you work to avoid walking over hot surface. Keep a fire extinguisher or water supply handy.

Advantages: Quick and effective way to kill annual weeds or control some perennials. Excellent in gravel areas or pavement cracks. Avoids use of chemicals.

Disadvantages: Requires initial equipment purchase, typically from about $50. Single treatment does not kill most perennial weeds. Fire and burn hazard.

Bacillus thuringiensis kurstaki (B.t.k.)

Type of control: Biological

Examples: Dipel™, Bonide™, Thuricide™, Safer™ Caterpillar Killer, B.t.

Effective against: Tent caterpillars, gypsy moths, cabbage loopers, tomato hornworms, and other leaf-eating caterpillars.

Crops: Trees, shrubs, tomatoes, and other vegetables.

When to use: Use B.t.k. only if pests cannot be removed by physical means such as pruning or hand removal. It is essential to treat when larvae are young and feeding, but before too much damage has occurred. At this stage some larvae will be seen outside the tent. (Once caterpillars begin to pupate, they stop eating and it is too late to spray.) Applications may be repeated at 3 to 14 day intervals as needed.

How to use: Read the label before using and take all specified precautions when applying. Check to see that this material is registered for your crop or plant. B.t. is a stomach poison, not a contact poison, so the caterpillars must eat it. Spray infested plants to provide a thorough coverage of foliage. It may take several days for the caterpillars to die. Be sure that the product is fresh when purchased—the bacteria become inactive as the product ages or if exposed to extreme temperatures. Do not save mixed spray; use entire mixture.

Advantages: Selective to caterpillars. Relatively non-toxic to humans, pets, birds, and beneficial insects (except caterpillars).

Disadvantages: Toxic to caterpillars that become beautiful butterflies. Timing of spray is critical (see above). Some species may develop resistance if over-used. Some people may experience allergic reaction or skin irritation from contact with the material.

Bacillus thuringiensis israeliensis (B.t.i.)

Type of control: Biological

Examples: Mosquito Dunks™ and Mosquito Bits™ are the only B.t.i. products registered for homeowner use in Washington state.

Effective against: Mosquito larvae

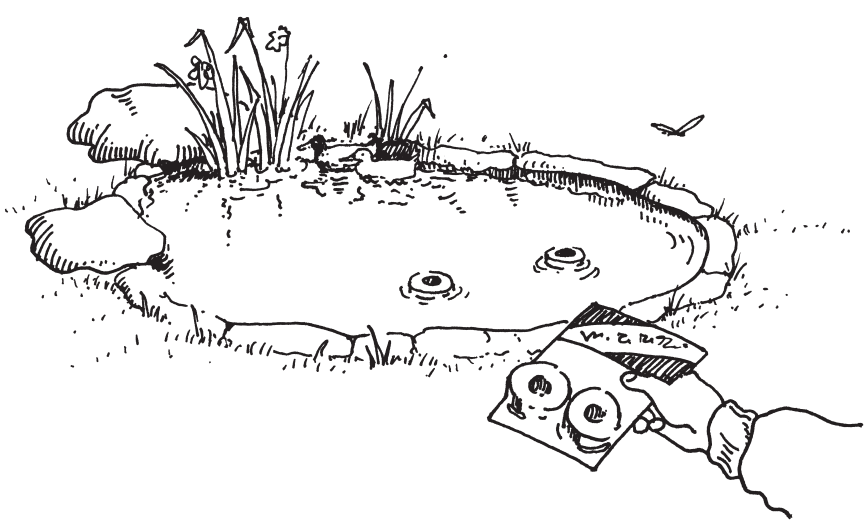
Crops: Not used on crops. Applied to standing water in containers and small ponds.

When to use: Use when larvae are expected to be present. In Western Washington, where winters are warm and wet, can use at any time.

How to use: Eliminate unnecessary breeding sites wherever possible. Change water in bird baths weekly. Use B.t.i. when draining of water is not practical. Apply to surface of water. Do not exceed labeled application rate. Can be used whole or broken into portions and applied to containerized standing water found near the home such as unused swimming pools, rain barrels, roof gutters, tree holes, and very small ponds. To prevent them from being washed away, the dunks can be anchored using a string tied through the center hole, or they can be staked in place. Do not apply to drinking water sources or to lakes or other large water bodies.

Advantages: Highly effective against mosquito larvae. Low toxicity to humans, fish, birds, and other non-target organisms. Easy to use.

Disadvantages: May be toxic to some species of aquatic invertebrates. May not be legal for consumer use in some states; check with local pesticide regulation agency if unsure. Effective for only about 30 days before reapplication.



Beneficial Insects

Type of control: Biological

Examples: Lacewings, ladybugs, trichogramma wasps

Effective against: Aphids primarily, but also other pests

Crops: Any plants that are heavily damaged by aphid infestations

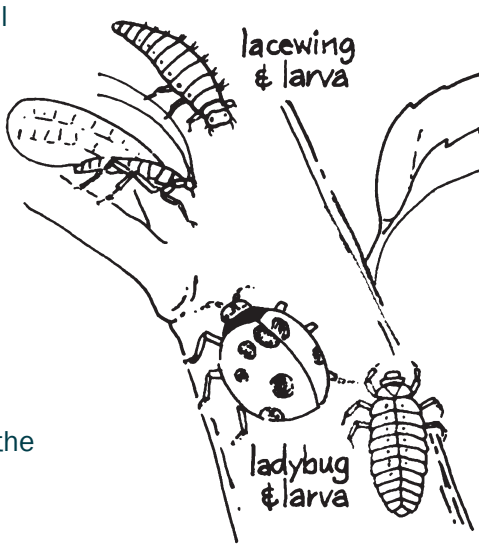
When to use: Beneficial insects can be purchased for release in the home landscape. Releases should be timed as directed by supplier. Some will ship only at the best time for your area. A better approach is to attract beneficial insects to the garden naturally by planting a variety of plants, including those with umbrella-shaped flower heads, such as parsley, dill, fennel, and carrot. Let some of these plants flower. This avoids the need to purchase predators year after year.

How to use: Lacewings are the best all-purpose predator. First, be sure that no insecticides have been used recently on the plant; if systemics have been used, wait one year. Lacewings should be released in three successive intervals, about 5 to 7 days apart. For prevention, use 1,000 eggs per 900 sq. ft. For control of moderate aphid populations, use 1,000 eggs per 200 sq ft. or about 500 per large tree. Most effective if released after the first larvae have begun to hatch out.

Ladybugs tend to fly away when released. They will stay only if prey if plentiful. Release adults in the evening after watering down the area. One pint covers about 5,000 sq. ft.

Advantages: Natural control mechanism. No toxic chemicals. Fun! Encourages creation of a garden ecosystem.

Disadvantages: Insects may not remain in your yard. Lacewings are better than ladybugs in this respect. Lacewings available for purchase are not native to this region and are not hardy through freezing weather. Need to reapply in the following season.



Beneficial Nematodes

Type of control: Biological

Examples: Scanmask™, Biovector™, Nemesis™, Orcon™

Effective against: Cranefly larvae (leatherjackets), flea larvae, root weevils

Crops: Turfgrass (cranefly, flea larvae), rhododendrons (root weevils)

When to use: Nematodes (specifically Steinernema carpocapsae) should be applied during the late spring to fall months when larval pests are present and soil temperatures are warm enough (at least 55˚ F). For craneflies, monitor first in early April by removing several one foot square areas of sod, tearing them apart, and counting the number of grubs. If more than 25 grubs per square foot are found, you can use nematodes if soil temperature is high enough. For flea larvae, apply to lawn areas in summer if flea populations require it and indoor flea controls are not sufficient. A second application may be needed after 6 weeks to 2 months. For root weevils, apply in spring after soil temperatures warm. A second application is suggested in late summer of fall.

How to use: Purchase nematodes fresh; consider buying directly from the manufacturer. Use them as soon as possible after receiving them. Store in a refrigerator if you can't use them right away, but do not allow them to freeze. Read and follow label directions carefully. Most formulations must be mixed with water and applied using a sprayer or watering can. Do not apply until soil temperatures reach required temperatures. Apply them in the early morning or evening to give them the best chance of survival. Water them into the soil after application, and keep moist throughout the six weeks nematodes are active in the soil. Nematodes will die if there is either too much or too little water.

Advantages: Non-chemical control is non-toxic to humans, pets, or beneficial insects. Effective against a number of serious pests that live in the soil.

Disadvantages: Cool soil temperatures prevent early application in spring for cranefly. For summer flea control, lawn must be kept watered, and fleas must also be controlled on pets and in indoor areas with other methods. Product is fairly expensive and difficult to use properly. Effectiveness not as high as chemical controls but is adequate to reduce damage below levels that threaten plants.

Corn Gluten Weed Killers

Type of control: Chemical, pre-emergence herbicide

Examples: Wow™, Wow Plus™, Walt's Organic Weed Stopper Plus™, Concern™

Effective against: Prevents most broadleaf weed seeds from sprouting

Crops: Turfgrass only

When to use: Product is most effective if watered in immediately and then allowed to dry out for two weeks. In the Pacific Northwest, landscapers have had success with the product when used in August and early September. Effect is gradual and becomes more pronounced over several seasons. Do not apply on newly seeded lawns as it will inhibit grass seed germination.

How to use: Read and follow label directions for application methods and amounts. Can be used in spreaders. Water in thoroughly after application. Since corn gluten releases nitrogen on breakdown, consider reducing nitrogen levels of fall fertilization. Some product manufacturers offer companion fertilizers that provide a complementary nutrient balance.

Advantages: Non-toxic and natural product is exempt from EPA pesticide registration. Provides some nutrients in addition to weed control.

Disadvantages: Effect is gradual. Does not kill existing weeds. Timing of application is important to success. May be less effective if prolonged rainy period occurs after application.

Acid-Based Weed Killers

Type of control: Chemical, non-selective

Examples: Nature's Glory™, BurnOut™, Herbisafe™, Blackberry & Brush Block™

Effective against: Annual weeds, provides some control of grasses and perennial weeds

Crops: Can be used with care in planting beds. Best on gravel, pavement.

When to use: Most effective when weeds are small. Most effective in warm weather, and especially in direct sun.

How to use: Do not exceed labeled application rate. Thoroughly wet leaf surface with spray. Grasses and perennial weeds may need repeat treatments for best control.

Advantages: Low toxicity, rapid biodegradation. Convenient for weeds in gravel areas and in pavement cracks.

Disadvantages: Concentrates may be corrosive (cause burns on contact with skin or eyes). Accidental overspray can damage desirable plantings. Not very effective on tough perennial weeds.

Insecticidal Soap

Type of control: Chemical

Examples: Safer™ Insecticidal Soap, Concern Insect Killer Soap, Schultz Garden Safe™ Insecticidal Soap, Organica™, Bon-Neem™

Effective against: Soft-bodied insects such as aphids, mealybugs, whiteflies, mites

Crops: Foliage plants, flowers, shrubs, trees, vegetables, fruits, and nuts

When to use: First try washing pest off with a stream of water. Apply when insect damage becomes unacceptable and pests are present.

How to use: Read the label and mix as directed. Spray carefully to wet insects thoroughly. Product acts by directly contacting exterior of insects, so you must be sure to wet all insects. Repeat if needed. May damage some sensitive plants, especially when sprayed in direct sunlight. Read label for list of sensitive plants and test on a small area before treating a large portion of plant. Be very careful not to let any soap get into lakes, streams, or other water systems.

Advantages: Relatively non-toxic, biodegradable—contains a combination of soap, alcohol, and water. Not broadly toxic to beneficial insects.

Disadvantages: You may have to apply often to control aphids, perhaps as often as every five days. Toxic to fish and other aquatic species. Spraying may damage some sensitive plants.

Be sure to wet insects thoroughly with the spray. Don't forget under the leaves!

Iron Phosphate Slug Baits

Type of control: Chemical (bait)

Examples: Sluggo™, Escar-go™, Worry Free™, Schultz Garden Safe™ Slug and Snail Bait

Effective against: Slugs, snails

Crops: A wide variety of plants, especially vegetables (corn, lettuce, beans), ornamentals (hostas, astilbe, emerging bulbs) and ripe strawberries.

When to use: Use if hand removal, beer traps, and copper barrier (see page 5) are insufficient. Bait may be used at any time of year that slugs are present. Plants are most at risk when they are young, so spring is a good time to use. Fall is also a good time because you will kill many slugs before they lay eggs.

How to use: Read and follow label directions. Spread granules on ground near plants experiencing damage. Try to make a barrier between the susceptible plants and any obvious slug habitat. It will help if you reduce slug habitat by cutting tall grass and removing dense groundcovers that harbor slugs. Slugs like to feed after rain showers, so that is a good time to bait.

Advantages: Less toxic than metaldehyde baits and apparently less attractive to dogs. Reported to be nearly as effective as metaldehyde baits.

Disadvantages: Somewhat more expensive than metaldehyde baits. Will need to be reapplied in rainy weather. May not be effective in bait stations.

Potassium Bicarbonate

Type of control: Chemical

Examples: Bonide Remedy™, Kaligreen™, or First Step™

Effective against: Powdery mildew—may also help control black spot

Crops: Roses and other susceptible flowers

When to use: For roses, begin applications right after pruning. Repeat once a week if needed. For other plants, apply when mildew is visible. On some annual plants, such as peas, squash, and annual flowers, mildew develops but is not a threat to the plant because it occurs late in the season. Destroy, do not compost, affected leaves when plant is ready to be removed.

How to use: Follow label directions. Mix as directed and spray on leaves to prevent disease. Most effective if applied before symptoms appear because action is primarily protective. Fungal diseases should also be prevented by removing and destroying affected leaves that fall to the ground and by watering at the base rather than overhead. Prune plants to increase air circulation. On roses, remove leaves that form within about a foot of the ground, where splashing rain spreads disease. Consider planting disease-resistant varieties.

Advantages: Low toxicity. Most effective on powdery mildew, especially if treated early.

Disadvantages: Less effective on other fungal diseases.

Neem Oil

Type of control: Chemical

Examples: Green Light Rose Defense™, Green Light Fruit, Nut and Vegetable Spray™, Trilogy™, Concern™, Safer™, Garden Safe™, and Shield All II™

Effective against: Black spot, powdery mildew, rust, leaf spot, botrytis, scab, and other fungal diseases

Crops: Check the label. Rose Defense is labeled for roses. Fruit, Nut and Vegetable Spray is essentially the same product but labeled for a much wider variety of plants. NeemGuard is labeled for indoor or outdoor ornamental plants but not for food crops.

When to use: If plants have shown disease in previous years, apply in spring as new growth appears. Keep new growth covered as it opens by applying at 1–2 week intervals. Stop treatment if bees are present. Will not stop disease of affected foliage already showing black spots. However, many plants can go for years with some mildew or black spot and still do well. To reduce the need for fungicides, plant roses where they get plenty of sun--at least six hours a day--and good air circulation. Choose disease-resistant species or cultivars. Remove leaves from lower 1–2 feet of stem. Prune out any diseased leaves, stems, or flowers. Rake and destroy any diseased leaves from ground around plants.

How to use: Apply as directed on the label. Because the product has such high oil content (90%), shake well before using and agitate the spray equipment while using. Ready-to-use product must be at room temperature to pour. Do not apply in full sun. Do not apply while plants are blooming because bees may be killed.

Advantages: Low toxicity for a fungicide, although still considered a skin and eye irritant. Based on a naturally occurring plant oil.

Disadvantages: Toxic to bees exposed to direct treatment, though much less toxic than many other pesticides. Some products are not registered for use on food crops (see “Crops” above).

Sulfur

Type of control: Chemical

Examples: Safer™ Garden Fungicide, Cooke Sulfur Dust, Green Light™, Dusting Sulfur, Lilly Miller™, Multi-Purpose Fungicide, Bowide™ Suflur Plant Fungicide

Effective against: Powdery mildew, black spot, rust, scab, damping-off virus

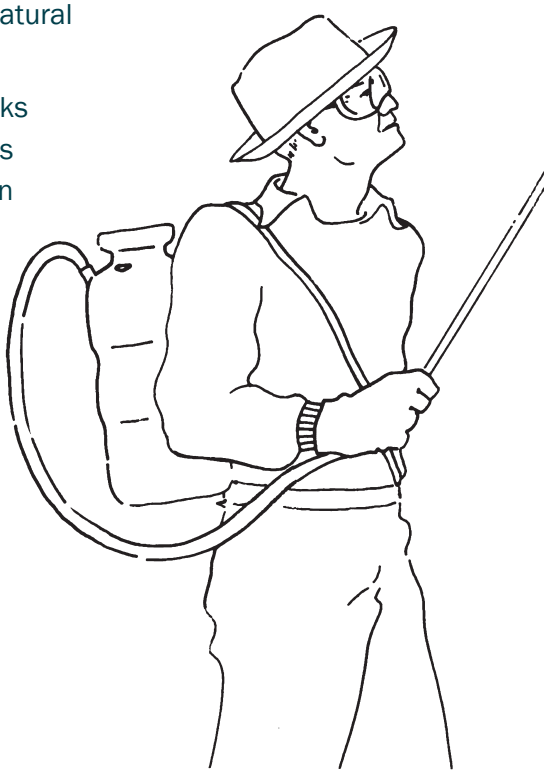
Crops: Flowers, foliage plants, ornamentals, and some food crops (peas, beans, grapes, strawberries)

When to use: Apply to affected plants at the first sign of symptoms, to prevent spread of disease to unaffected areas and new growth. Mildew is reduced by growing plants in sunny locations with good air circulation and by reducing water contact on leaf surfaces.

How to use: Some products are pre-mixed and ready to use. Wettable sulfur must be mixed as directed before application. Always read label directions completely before using. Apply to leaf surface, top and bottom.

Advantages: Less toxic than most fungicides. Natural origin.

Disadvantages: Can cause eye irritation. Works as a preventative only, so repeat applications are necessary every 7 to 14 days, especially in rainy times. Cucurbits (such as cucumbers, squashes, and melons) and roses may be damaged by sulfur, so test on a small area first. Can cause fruit drop once fruit has appeared on apple trees.



Horticultural Oil

Type of control: Chemical

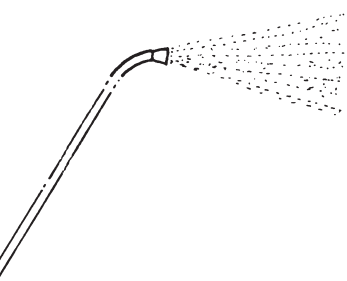
Examples: “Superior” oil, “dormant” oil, SunSpray™ Ultra-Fine Horticultural Spray Oil, Ortho Horticultural Spray Oil, Bonide™ All-Season Horticultural Spray Oil, Oil-Away™, Supreme Insecticidal Spray, Green Light™ Bioganic™

Effective against: Many types of insects and mites, including aphids, scale, mealybugs, spider mites; can also be effective against scab

Crops: Ornamentals plants, fruit trees

When to use: Most effective when applied as dormant or delayed dormant spray during fall or winter when trees are leafless and insects, insect eggs, and mites cling to the bark. Some summer uses; especially on pear trees. Trees susceptible to scab may need a preventative spray before the buds open. Consult an expert for advice.

How to use: Read the label. Dilute as directed (usually about 25:1 or 50:1) and spray to wet surface of plant. Wear gloves and goggles, and avoid breathing spray mist. Keep away from water; avoid runoff.



Advantages: Relatively low toxicity to humans (unless accidentally swallowed), biodegradable.

Disadvantages: May cause skin and eye irritation. Undiluted material can cause serious illness if accidentally swallowed. Toxic to fish. Combustible. Will smother all insects it is sprayed on, including non-pest species; use only where pests are present and causing significant damage. May be toxic to foliage if used when plant is in leaf.

When applying any pesticide by spraying, wear a long-sleeved shirt, long pants, gloves, hat, and eye protection.

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