

Managing diseases and insects without pesticides

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There are a wide variety of cultural and biological techniques you can use to manage or prevent disease and insect damage. Consult your OSU Master Gardener, Extension agent, or nursery professional for more information.

✦ **Select the proper cultivar** for your climate and soil. For example, Liberty, Prima, Akane, and Chehalis apples are resistant to apple scab, while Granny Smith and Gala are not (see EC 1334, *Scab-immune Apple Varieties*, for a more complete list). Apricots are not well adapted west of the Cascades. Wet springs prevent fruit set and result in high disease incidence.

✦ **Water and fertilize properly.** Over-watering can lead to root rot, while over-fertilizing can increase disease and insect problems. A soil test is the best first step in managing soil fertility.

✦ **Proper pruning.** Improves fruit quality, air circulation, and pesticide spray coverage.

✦ **Good sanitation.** Remove and burn diseased branches and leaves. Remove and destroy old fruit from the tree and the ground. Don't use diseased leaves as mulch.

✦ **Pest monitoring.** Know which pests are likely to attack your trees, and when they might appear. Inspect your orchard regularly. Pheromone and sticky traps are useful pest management tools. Contact your local Extension agent or nursery professional for more information.

✦ **Biorational pesticides.** Insecticidal soaps and oils are effective against a wide range of tree fruit pests. Microbial pesticides like *Bacillus thuringiensis* (*Bt*) control certain caterpillars.

✦ **Biological control.** Enhanced control by natural enemies can be achieved by limiting the total number of pesticide sprays, and by using selective pesticides when possible. See PNW 343, *Beneficial Organisms Associated with Pacific Northwest Crops*, for more information.

Moss and lichen

These plants do not damage fruit and nut trees. Regular pruning and the dormant chemical sprays (copper fungicides or lime sulfur) you use for disease and insect control will reduce the amount of moss and lichen in trees.

Managing Diseases and Insects in Home Orchards

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This pest management guide was prepared for the home gardener. It doesn't meet the exacting requirements of the commercial fruit grower. In the home orchard, more pest damage generally can be tolerated than in commercial orchards. The number of suggested materials and the times of application have been kept to a minimum. Many fungicides and insecticides are available, which, when used according to the label directions, are effective in managing diseases and insects listed on the label. For more complete information, consult the Pacific Northwest pest management handbooks or local pest management guides.

To effectively manage diseases and insects in your orchard, you'll need to combine a number of techniques. In addition to using pesticides, there are cultural and biological practices that can help prevent and/or manage diseases and insects. Timing and thorough spray coverage are the keys to good pest management. Good coverage means thoroughly wetting the leaves, twigs, and branches, which is difficult with hand sprayers. Wettable powders (WPs) tend to settle out after mixing, so be sure to shake or stir the spray mix frequently during application.

To avoid excess chemical residues, observe the rate and proper interval between the last spray and harvest, as indicated on the label. Table 1 lists the preharvest interval for all the recommended pesticides. Be sure to wash fruit with water before eating.

Importance of controlling diseases and insects in commercial fruit districts

Many commercial fruit growers in Oregon are adopting nonchemical approaches to managing orchard pests. These "soft" control practices may become less effective if pests spread from unmanaged trees nearby. If homeowners maintain fruit trees for fruit production, it is critical that they help prevent the spread of pests to commercial orchards. Because of recent changes in pesticide

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registrations, home orchardists will have to use diligence to provide the degree of control necessary to prevent damage to nearby commercial orchards. If you have fruit trees in your yard or landscape that are maintained primarily for shade or aesthetic value, you might consider replacing those trees with types that do not harbor economically important pests. Contact your local Extension office for suggested trees.

Applying pesticides safely

There are many formulations of pesticides available for home garden use. Many are variations with the same active ingredient. Look for pesticides that can be used on a wide range of fruit, vegetables, and ornamentals, so you can limit the number of pesticides you need to purchase and store.

The pesticides listed in this publication were selected on the basis of their effectiveness, availability, and safety to you, the applicator and consumer. Always apply pesticides according to the label instructions—this is very important. The label contains valuable application information and safety precautions to protect you, others, and the environment. Before you purchase or open the container, read the label. Read it again before you mix, store, or dispose of the product.

Be cautious when using products that contain a combination of one or more insecticides and fungicides, such as the various "home orchard sprays." Some of these products call for applications during bloom to control fungal diseases at that time. However, if you apply an insecticide during bloom, you run the risk of reducing or eliminating bees that are critical for pollination. A better strategy, especially during the spring, is to use products that contain only a single type of pesticide and only when really needed. This approach is less convenient, but may save you trouble in the long run.

There are other effective pesticides than those listed here, but space prevents listing them all. Some of these other pesticides may be packaged in larger quantities for commercial growers, making them impractical if you have only a few trees. Check with your local Extension agent, OSU Master Gardener, or nursery professional for additional information.



Safety tips



- Most accidents occur during mixing, so wear rubber gloves and protect your eyes from spilling or splashing chemicals. Avoid getting pesticides on your skin, and wash your hands when you finish. While spraying, you should wear a long-sleeve shirt, full-length pants, unlined rubber gloves, and goggles or some type of eye protection. All clothes should be washed after spraying.
- Never eat or smoke when using pesticides. Blow your nose AFTER spraying, not during—keep your fingers away from mouth and nose.
- Check your sprayer for leaking hoses or connections, plugged or worn nozzles, and clean filters to prevent accidents. Mix the pesticide at the recommended rate on the label. Mix only the volume needed to complete the task. Don't exceed the label rate; putting more pesticide into the environment than you need for good control is wasteful and dangerous. When you finish, clean your sprayer immediately and dispose of the rinse water properly.
- Apply pesticides at the right time and under the right weather conditions. Never apply pesticides when winds will cause drift of the chemical off the target area or when temperatures exceed 85°F. Be careful not to let pesticides contaminate neighboring ponds or streams. You are liable for any off-site damage that may result from your misuse of pesticides.
- Store pesticides in a safe, secure place, out of the reach of children and in their original container. Never keep pesticides in beverage bottles or other previously used food or drink containers. Properly dispose of empty glass, metal, and plastic pesticide containers after first rinsing them three times with plenty of water.
- Accidents can happen. You can reach the Poison Center at **1-800-222-1222**.

Required Spray Programs

Several Oregon counties have ordinances dealing with backyard fruit tree production that require minimum spray programs to prevent disease/insect spread to commercial orchards. For example, codling moth must be controlled in Wasco, Jackson, Umatilla, and Hood River counties.

The sprays denoted with a (•), if applied at the correct time, should meet the requirements of most counties. Check with your local Extension agent if you are not sure.

The following counties require spray control:

Hood River: apple maggot, codling moth, San Jose scale, scab, pear psylla, cherry fruit fly, leaf curl, coryneum blight, and peach twig borer

Jackson: apple maggot, codling moth, and pear psylla

Josephine: apple maggot

Lane, Linn, Marion, Polk, Union, and Yamhill: cherry fruit fly

Umatilla: apple maggot, codling moth, San Jose scale, scab, and cherry fruit fly

Wasco: apple maggot, codling moth, San Jose scale, and cherry fruit fly

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Trade-name products and services are mentioned as illustrations only. This does not mean that the Oregon State University Extension Service either endorses these products and services or intends to discriminate against products and services not mentioned.

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Table 1.—Homeowner/small orchard products

Common Name	Some Brand Names	Some Uses¹	Preharvest interval²
<i>Bacillus thuringiensis</i> (Bt)	Thuricide	Leafrollers	0
<i>Beauveria bassiana</i>	Naturalis-O	Aphids	?
Botanical oils such as neem and jojoba ⁶	Rose Defense, E-Rase	Powdery mildew	Not specified
Captan	Captan, Fungicide	Diseases	1
Carbaryl	Sevin	Many insects	3
Chlorothalonil (Daconil)	Multi-purpose Fungicide; Hi-Yield Vegetable, Flower, Fruit, and Ornamental Fungicide	Diseases	Do not apply after shucksplit.
Combination spray ³	Home Orchard Spray	Diseases and insects	3 to 7 ⁵
Dormant oil ⁶	Dormant Oil	Winter diseases, insects, mites	Use only during dormant season.
Endosulfan ⁴	Thiodan	Borers, blister and rust mites	7 to 30 ⁵
Esfenvalerate	Bug-B-Gone	Husk fly, codling moth	21 to 28 ⁵
Fixed copper	Microcop, Copper Fungicide, Kop-R-Spray	Diseases	Use only early in season or postharvest.
Horticultural mineral oils ⁶ (HMO) ⁶	Volck Oil, Sunspray-Ultrafine Oil	Spring/summer diseases, insects, mites	0
Insecticidal soap ⁶	Safer's Insecticidal Soap	Soft-bodied pests like mites and aphids	0
Kaolin clay	Surround	Pear psylla, apple maggot	Not specified
Lime sulfur ⁶	Dormant Spray for Disease Control, Polysul Summer and Dormant Spray	Diseases and mites	Use only early in season or postharvest.
Malathion	Malathion	Many insects	1 to 7 ⁵
Myclobutanil ⁷	Immunox, Spectricide Pro	Diseases	1 day stone fruits, 14 days apples
Neem ⁶	Azatin XL, Neemix	Many insects	Not specified
Permethrin	Astro	Many insects	1 to 14 ⁵
Potassium bicarbonate	Remedy	Powdery mildew	Not specified
Rotenone	Rotenone	Many insects	1
Spinosad	Bull's-Eye, Entrust	Leafminers, leafrollers	7 to 14
Sulfur ⁶	Safer's Garden Fungicide, Sulfur Dust, Sulfur	Diseases and mites	1
Thiophanate-methyl ⁷	Halt	Diseases	1

¹See charts for complete list of uses.

²Days to wait after spraying until picking

³Contains fungicides and insecticides. See caution about bee kill under "Applying Pesticides Safely."

⁴Do not use commercial or orchard strength formulations; they are highly toxic and require special safety precautions.

⁵For the fruit or nut tree you're spraying, check the manufacturer's label for the proper interval.

⁶Soaps and oils are not compatible with sulfurs. Mixing together or using one right after the other can result in plant damage.

⁷Frequent use can lead to the development of diseases resistant to the chemical.

Apples

Time of application	Insect or disease	Materials or practices
Late winter (dormant)	Apple anthracnose and scab Scale, aphids, and mite eggs	Proper pruning to open tree canopy and improve air circulation. Remove and burn diseased branches and fallen leaves. Also remove from the orchard any mummified fruit left in the tree. Dormant oil
Prepink (before pink bloom shows)	• Scab only	Captan, lime sulfur, myclobutanil, or thiophanate-methyl
Pink (just before blossoms open)	• Powdery mildew • Scab	Lime sulfur, myclobutanil, or thiophanate-methyl Captan, lime sulfur, myclobutanil, or thiophanate-methyl
Petal fall	• Powdery mildew • Scab Aphids	HMO, lime sulfur, myclobutanil, thiophanate-methyl, or insecticidal soap Captan, lime sulfur, myclobutanil, or thiophanate-methyl Endosulfan, insecticidal soap, neem, permethrin, or malathion. May require two sprays about 10 days apart.
Summer to harvest	• Codling moth Apple maggot Spider mites San Jose or lecanium scale crawlers Aphids	To be effective, insecticide coverage must be maintained whenever fruit and moths are present. Applications every 7–14 days may be necessary, especially near commercial orchards. Kaolin, malathion, rotenone, and esfenvalerate are registered for homeowner use. Pheromone traps can be used to accurately time the first spray. Kaolin, malathion, pyrethrin, or rotenone. Where apple maggot occurs, treat from late July until harvest at 10- to 14-day intervals. Sticky traps can be used for monitoring and control. Insecticidal soap or <i>Beauveria bassiana</i> Neem or malathion <i>Beauveria bassiana</i> , endosulfan, insecticidal soap, malathion, or neem. May require two sprays about 10 days apart.
Postharvest	Apple anthracnose	Fixed copper. Remove and destroy cankered branches from the orchard and any rotted or mummified fruit from the tree.
Leaf fall	Scab	Rake and dispose of leaves by burning, burying, or completely composting. Do not use as a mulch near the orchard.

Thiophanate-methyl may cause russetting on some apple cultivars such as Golden Delicious, Rome, and Stayman. It also kills earthworms, which help decompose leaves.

Lime sulfur rates are lower after bud break, so read label carefully.

Peaches and Nectarines

Time of application	Insect or disease	Materials or practices
Winter dormant	Cytospora canker and Pseudomonas	Can cause branch dieback. Remove and burn infected wood.
Dormant (two sprays: Dec. 15 and before Jan. 15)	• Leaf curl, shothole	Chlorothalonil or fixed copper
Late February	Aphid and mite eggs, scale Leaf curl	Dormant oil. For best results, do not combine with leaf curl spray. Chlorothalonil or lime sulfur
Bloom stages	Brown rot blossom blight	Captan, chlorothalonil, or thiophanate-methyl. Spray once per week, from first showing pink through petal fall.
Prepink and petal fall	Leafrollers	Neem or spinosad
One week after blossom petals fall and/or at shucksplit ¹	Shothole	Captan or chlorothalonil
Early June	• Peach twig borer	Spinosad. Pheromone traps can be used to time sprays.
Summer spray (early July and again 3 weeks later)	Peachtree borer	Endosulfan or spinosad. Spray trunk and lower limbs, allowing solution to puddle around base of tree. Do not spray fruit. Pheromone traps can be used to time sprays. Young trees are especially susceptible to injury from peachtree borers.
Fruit set to harvest	Brown rot	Regularly remove and destroy any fallen or rotted fruit prior to harvest.
Fourteen to 21 days before picking	Western spotted cucumber beetles Brown rot Earwigs	Carbaryl (western Oregon only) Sulfur, captan, or thiophanate-methyl Carbaryl. Spray trunk and base of tree thoroughly.
Autumn or early winter when leaves begin to fall	• Shothole and leaf curl	Chlorothalonil or lime sulfur
Anytime before bud break	Brown rot	Remove and destroy any rotted or mummified fruit remaining in or around the tree.

Choose one timing for leaf curl and shothole in arid areas; use all timings in the Willamette Valley.

Pears

Time of application	Insect or disease	Materials or practices
Late winter (dormant)	Scab and other diseases Pseudomonas blight Scale, aphid, pear psylla, and mite eggs	Proper pruning to open trees and improve air circulation. Remove and burn diseased branches and fallen leaves. Also remove any mummified fruit left in the tree. Fixed copper before buds open Dormant oil
Prepink (before pink bloom shows)	<ul style="list-style-type: none"> • Scab only • Blister mites • Pear psylla 	Lime sulfur or thiophanate-methyl Lime sulfur Endosulfan, kaolin, or permethrin
Pink (just before blossoms open)	<ul style="list-style-type: none"> • Scab and powdery mildew 	Lime sulfur or thiophanate-methyl
Petal fall	<ul style="list-style-type: none"> • Scab and powdery mildew Aphids 	Lime sulfur or thiophanate-methyl Endosulfan, neem, or insecticidal soap. May require two sprays about 10 days apart.
Spring (especially after main bloom)	Fire blight (not common in the Willamette Valley)	Remove and destroy infected branches. Make cuts 12 inches below infected branches. Disinfect pruning tools between cuts with shellac thinner (70% ethyl alcohol) or 10% bleach. Remove late blooms when noticed. Difficult to control. Antibiotics are labeled but difficult to use properly.
Summer to harvest	Pseudomonas blight (for Asian pears) <ul style="list-style-type: none"> • Codling moth Spider mites San Jose scale crawlers Pear psylla Aphids	Summer pruning will help reduce branch dieback caused by this disease. To be effective, insecticide coverage must be maintained whenever fruit and moths are present. Applications every 7–14 days may be necessary, especially near commercial orchards. Kaolin and esfenvalerate are registered for homeowner use. Pheromone traps can be used to accurately time the first spray. HMO or insecticidal soap HMO Endosulfan, neem, insecticidal soap, or kaolin Endosulfan, neem, or insecticidal soap. May require two sprays about 10 days apart.
Postharvest (in fall after all fruit is harvested)	Blister mites, pear rust mites	Endosulfan
Leaf fall	Scab	Rake and dispose of leaves by burning, burying, or completely composting. Do not use as a mulch near the orchard.

Cherries

Time of application	Insect or disease	Materials or practices
Late winter (dormant)	Aphid and mite eggs, scale and leafrollers	Dormant oil
Bloom stages (first showing pink to petal fall)	Brown rot blossom blight	Captan, chlorothalonil, or thiophanate-methyl. Spray once or twice during early bloom.
Petal fall stage	Aphids	<i>Beauveria bassiana</i> , insecticidal soap, malathion, or neem
	Leafrollers	<i>Bt</i> or spinosad. Spray after bloom to prevent accidental poisoning of bees during the pollination period.
	Cherry leaf spot and brown rot	Captan, chlorothalonil, or myclobutanil
Shucksplit ¹	Cherry leaf spot and brown rot	Captan, chlorothalonil, or myclobutanil
	Powdery mildew (a problem east of the Cascades)	Myclobutanil, oils (HMO or botanical), or sulfur
Early summer when fruit flies emerge (about Memorial Day)	• Cherry fruit fly	Malathion, rotenone, or spinosad. Applications may need to be repeated at 7- to 14-day intervals. Traps can be used to properly time treatments.
	Powdery mildew (a problem east of the Cascades)	Myclobutanil, oils (HMO or botanical), or sulfur
Summer (if pests appear)	Aphids, spider mites	<i>Beauveria bassiana</i> or insecticidal soap
	Aphids only	Neem or malathion
One to 2 weeks before harvest (only if rain is likely)	Brown rot fruit rot	Sulfur or thiophanate-methyl
After harvest during dry weather	Bacterial canker and/or Cytospora	Can cause branch dieback. Remove and destroy infected wood.
Leaf fall	Leaf spot	Rake and destroy fallen leaves. Do not use as a mulch near the orchard.
	Brown rot	Remove and destroy any mummified fruit in or around trees.

Apricots

Time of application	Insect or disease	Materials or practices
Late winter (dormant)	Scale, mite eggs	Dormant oil
Bloom stages (first showing pink to petal fall)	Brown rot	Captan, chlorothalonil, or thiophanate-methyl
Shucksplit ¹	<ul style="list-style-type: none"> Coryneum blight (Shothole) 	Captan or myclobutanil. Fungicide needed only if rain is expected within 2 weeks.
Summer spray	Peachtree borer	Endosulfan or spinosad. Spray trunk and lower limbs, allowing solution to puddle around base of tree. Do not spray fruit. Pheromone traps can be used to properly time sprays.
Two weeks preharvest	Brown rot	Captan or thiophanate-methyl. Fungicide needed only if rain is forecast.
Fall (before rains begin)	<ul style="list-style-type: none"> Coryneum blight (Shothole) Brown rot 	Chlorothalonil or fixed copper Remove and destroy any rotted or mummified fruit in or around the trees.

Do not use sulfur products on apricots.

Prunes and Plums

Time of application	Insect or disease	Materials or practices
Late winter (dormant)	Aphid and mite eggs, scale Cytospora canker and Pseudomonas	Dormant oil Can cause branch dieback. Remove and destroy infected wood.
Bloom stages (first showing pink to petal fall)	Brown rot blossom blight	Captan, chlorothalonil, or thiophanate-methyl. Spray once or twice during bloom.
Petal fall stage	Aphids Leafrollers Leaf spots and brown rot	<i>Beauveria bassiana</i> , endosulfan, insecticidal soap, or neem <i>Bt</i> , endosulfan, or spinosad. Spray after bloom to prevent accidental poisoning of bees during the pollination period. Captan, chlorothalonil, myclobutanil, or thiophanate-methyl
Shucksplit ¹	Leaf spots and brown rot	Captan, chlorothalonil, myclobutanil, or thiophanate-methyl
Summer spray (early July and 3 weeks later)	Peachtree borer	Endosulfan or permethrin. Spray trunk and lower limbs, allowing solution to puddle around base of tree. Do not spray fruit. Pheromone traps can be used to properly time sprays.
Preharvest	Brown rot	Captan or sulfur if rain is forecast within 1 to 2 weeks of harvest.
Leaf fall	Brown rot	Remove and destroy any rotted or mummified fruit left in or around trees.

Hazelnuts (filberts)

Time of application	Insect or disease	Materials or practices
Dormant period	Eastern filbert blight	Remove and destroy cankers before bud break.
Bud break (and every 2 weeks for four sprays)	Eastern filbert blight	Chlorothalonil (120-day preharvest interval)
Spring (about May 1)	Leafrollers Aphids	<i>Bt</i> , neem, carbaryl, or spinosad Permethrin
Summer (about July 1 and 3 weeks later)	Filbertworm Aphids	Permethrin or carbaryl. Pheromone traps can be used to properly time sprays. Permethrin
August or September (before fall rains)	Bacterial blight	Fixed copper. Only a problem on trees less than 5 years old.

Walnuts

Time of application	Insect or disease	Materials or practices
Early prebloom	Bacterial blight	Fixed copper
Late prebloom	Bacterial blight	Fixed copper
Early postbloom	Bacterial blight	Fixed copper
Mid-July to mid-August	Walnut husk flies	Esfenvalerate or spinosad. Use yellow sticky traps to time spray applications.

Commercial growers **must** control diseases and insect pests of hazelnuts and walnuts. In most instances, it's impractical for homeowners to attempt these control practices on **large** walnut trees.

Notes

¹Shucksplit—shedding of the papery sheath surrounding the small, young fruit shortly after bloom.

- Several Oregon counties have ordinances dealing with backyard fruit tree production that require minimum spray programs to prevent disease/insect spread to commercial orchards. See “Required Spray Programs” (reverse) for information about requirements in specific counties. The sprays denoted with a (•), if applied at the correct time, should meet the requirements of most counties. Check with your local Extension agent if you are not sure.