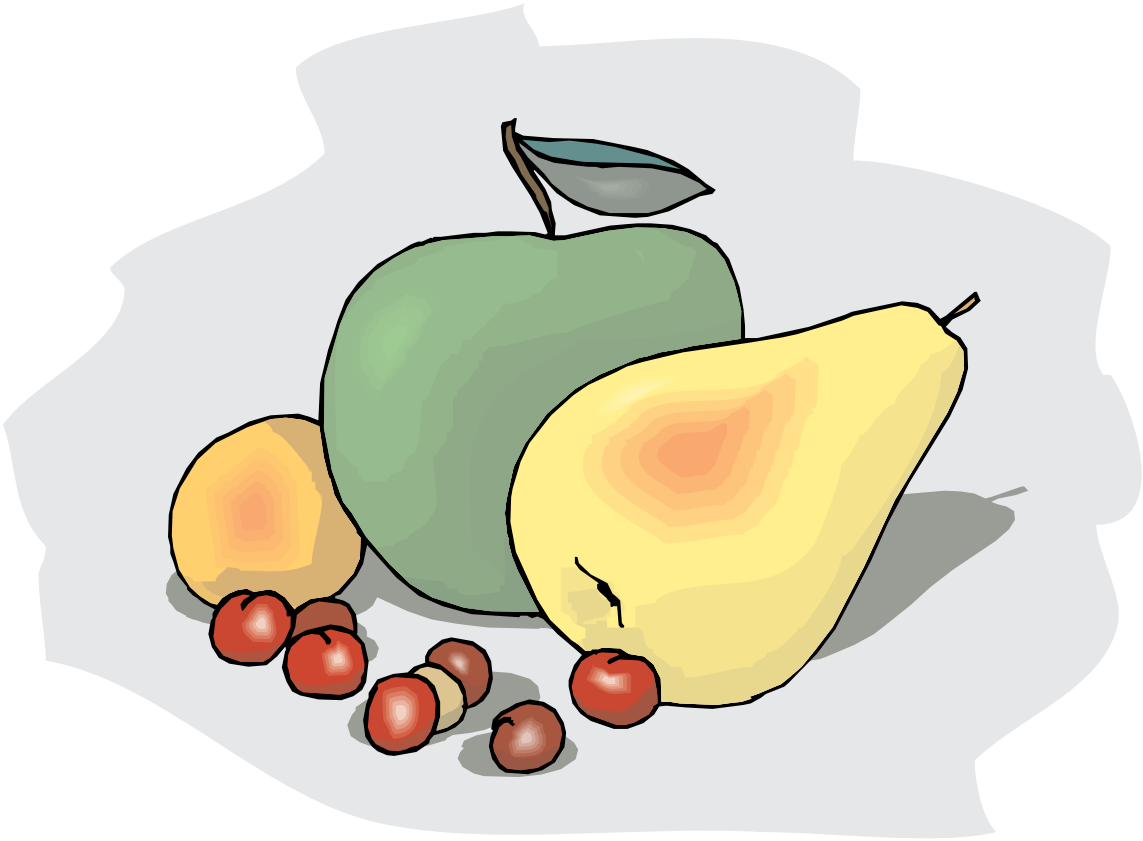
2017 Pest Management Guide

FOR TREE FRUITS IN THE MID-COLUMBIA AREA

Hood River • The Dalles • White Salmon



CAUTION!
Pesticides must be used as directed on the label.
Read and follow the label when applying pesticides.

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For information on pest management in peaches, see the *Peach Pest Management Guide for Oregon* (EM 8419), updated annually and available online in the Oregon State University Extension catalog at https://catalog.extension.oregonstate.edu/em8419

For more information, including information on bioregulator sprays, see the *Crop Protection Guide for Tree Fruits in Washington* (EB 0419) available online by searching the Washington State University Extension catalog at https://pubs.wsu.edu/

Safe and effective use of pesticides

The primary purpose of this pest management guide is to provide fruit growers with up-to-date information on registered pesticide uses considered to be effective for controlling insect pests, mite pests, and diseases, when applied at the listed rates and timings. Pesticide use is one element of integrated pest management programs. See pages 2-9 for additional information on pesticide stewardship and integrated pest management resources.

Providing comprehensive information on safe and effective use of pesticides is beyond the scope of this publication. Pesticide users should refer to the product label for basic information on permitted uses and hazards associated with specific pesticides. The label specifies the minimum requirements for personal protective equipment (PPE). The potential for applicator exposure is generally higher for airblast sprayer application. Consider using additional PPE beyond what is specified on the label when making airblast applications. The National Pesticide Applicator Certification Core Manual (http://www.ipmnet.org/tim/Pesticide_Ed/NationalCoreManual.pdf) provides a complete guide to safe handling and use of pesticides. For state-specific pesticide applicator information, see the Oregon Core Manual Addendum, which discusses the major areas of Oregon pesticide laws and regulations (http://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/PesticideAddendum.pdf).

Emergency response for pesticide exposure and spills

For **any** **pesticide exposure emergency** dial 911.

First aid for exposure is indicated on the pesticide label.

For information on **poison emergency treatment** call the National Poison Center Poison Help Line at 1-800-222-1222.

For emergency information related to **pesticide spills** contact the Oregon Emergency Response System at 1-800-452-0311.

Non-emergency information

- General pesticide information—The National Pesticide Information Center provides objective, science-based information about pesticides and pesticide-related topics.
  Visit http://npic.orst.edu/index.html
  or call 1-800-858-7378.
- Pesticide licensing and regulation—The Oregon Department of Agriculture regulates most aspects of pesticide use in the State of Oregon. For information about ODA pesticide related programs:
  Visit http://www.oregon.gov/ODA/programs/Pesticides/Pages/AboutPesticides.aspx
  or call 503-986-4635.
- Worker protection—The Federal Worker Protection Standard for Agricultural Pesticides (WPS) protects agricultural workers from pesticide exposure at work. The Oregon Occupational Safety and Health Administration is the state agency responsible for administering the WPS in Oregon. For information on WPS requirements for employers:
  Visit http://www.orosha.org/subjects/worker_protection_standard.html
  or call 1-800-922-2689.
- Pesticide waste—The Oregon Department of Environmental Quality regulates the disposal of pesticide waste in the State of Oregon. For information on managing and disposing of pesticide wastes:
  Visit http://www.deq.state.or.us/lq/hw/pesticide.htm
  or call 503-229-5263.

The Tricounty Hazardous Waste and Recycling Program conducts periodic collection events for unused pesticides in Hood River, Sherman, and Wasco counties.
For program information:

Visit http://www.tricountyrecycle.com/managing-my-materials/hazardous-waste/agricultural-chemical-waste
or call 541-506-2632.

Most area chemical distributers offer plastic pesticide container recycling. For information on container preparation, contact your chemical supplier.

Trade and common names of fungicides, insecticides, and miticides used in the Mid-Columbia region, and restricted-entry intervals (REI)

FUNGICIDES AND BACTERICIDES		
Trade Name	**Common Name**	**REI**
Actigard	acibenzolar S-methyl	12 hr
Agri-mycin	streptomycin	12 hr
Aliette	fosetyl-Al	12 hr
Aprovia	benzovindiflupyr	12 hr
Bac-Master	streptomycin	12 hr
BlightBan	biological	12 hr
Bloomtime Biological	biological	4 hr
Bravo Weather Stik	chlorothalonil	12 hr
Cabrio 20EG	pyraclostrobin	12 hr
Captan	captan	1 day
Champ	copper hydroxide	2 days
C-O-C-S	copper oxychloride	1 day
Dithane	mancozeb	1 day
Dodine	dodine	2 days
Echo 720	chlorothalonil	12 hr
Elevate	fenhexamid	12 hr
Firewall	streptomycin	12 hr
FlameOut	oxytetracycline	12 hr
Flint	trifloxystrobin	12 hr
Focus SC	fenarimol	1 day
Fontelis	penthiopyrad	12 hr
Gem 500SC	trifloxystrobin	12 hr
horticultural mineral oil (HMO)	petroleum or paraffinic oil	4 hr
Indar	fenbuconazole	12 hr
Inspire Super	difenconazole plus cyrodinil	12 hr
Kaligreen	bicarbonate	4 hr
Kocide	copper hydroxide	2 days
lime sulfur	calcium polysulfate	2 days
Luna Sensation	fluopyram plus trifloxystrobin	12 hr
Luna Tranquility	fluopyram plus pyrimethanil	12 hr
Manzate	mancozeb	1 day
Merivon	fluxapyroxad plus pyraclostrobin	12 hr
Mycoshield	oxytetracycline	12 hr
Nordox	copper oxide	12 hr
Omega 500	fluazinam	2 days
Penncozeb	mancozeb	1 day
Polyram	metiram	1 day
Pristine	pyraclostrobin plus boscalid	12 hr
Procure	triflumizole	12 hr
PropiMax	propiconazole	1 day
Quash	metconazole	12 hr
Quintec	quinoxyfen	12 hr
Rally	myclobutanil	1 day
Ridomil	metalaxyl	2 days
Rovral	iprodione	1 day
sulfur	sulfur	1 day
Syllit	dodine	2 days
Tebucon	tebuconazole	12 hr
Tilt	propiconazole	12 hr
Topguard	flutriafol	12 hr
Topsin M WSB	thiophanate-methyl	2 days
Vangard 75WG	cyprodinil	12 hr
Vivando	metrafenone	12 hr
Ziram	ziram	2 days

INSECTICIDES		
Trade Name	**Common Name**	**REI**
Actara	thiamethoxam	12 hr
Agri-Mek	abamectin	12 hr
Altacor	rynaxypyr	4 hr
Ambush	permethrin	12 hr
Assail	acetamiprid	12 hr
Avaunt	indoxacarb	12 hr
Aza-Direct	azadirachtin	4 hr
Bacillus thuringiensis	*Bacillus thuringiensis*	4 hr
Baythroid	beta-cyfluthrin	12 hr
Belay	clothianidin	12 hr
Carbaryl	carbaryl	12 hr
Carpovirusine	codling moth granulosis virus	4 hr
Centaur	buprofezin	12 hr
Chlorpyrifos	chlorpyrifos	4 days
Couraze	imidacloprid	12 hr
Cyd-X	codling moth granulosis virus	4 hr
Cygon	dimethoate	2 days
Cythion	malathion	12 hr
Danitol	fenpropathrin	1 day
Defend	dimethoate	2 days
Delegate	spinetoram	4 hr
Diazinon	diazinon	4 days
Dimilin	diflubenzuron	12 hr
Entrust	spinosad	4 hr
Esteem	pyriproxyfen	12 hr
Exirel	cyantraniliprole	12 hr
horticultural mineral oil (HMO)	petroleum or paraffinic oil	4 hr
Imidacloprid	imidacloprid	12 hr
Imidan	phosmet	3 days
Intrepid	methoxyfenozide	4 hr
Lambda-cyhalothrin	lambda-cyhalothrin	1 day
Lorsban	chlorpyrifos	4 days
Malathion	malathion	12 hr
Neemix	azadirachtin	4 hr
Proclaim	emamectin benzoate	12 hr
Rimon	novaluron	12 hr
Sevin	carbaryl	12 hr
Success	spinosad	4 hr
Surround	kaolin clay	1 day
Sivanto	flupyradifurone	4 hr
Ultor	spirotetramat	1 day
Virosoft	codling moth granulosis virus	4 hr

MITICIDES		
Trade Name	**Common Name**	**REI**
Acramite	bifenazate	12 hr
Apollo	clofentezine	12 hr
Envidor	spirodiclofen	12 hr
FujiMite	fenpyroximate	12 hr
horticultural mineral oil (HMO)	petroleum or paraffinic oil	4 hr
Kanemite	acequinocyl	12 hr
Kelthane	dicofol	2 days
Magister	fenazaquin	12 hr
Nealta	cyflumetofen	12 hr
Nexter	pyridaben	12 hr
Onager	hexythiazox	12 hr
Savey	hexythiazox	12 hr
Zeal	etoxazole	12 hr

Orchard pest management

Integrated Pest Management (IPM) principles are being used successfully in Pacific Northwest orchards to manage insects, mites, diseases, and other pests. These research-based techniques provide effective monitoring methods and management practices for sustained and economical control of pests, while minimizing damage to beneficial organisms. Improved health and minimal environmental impact are benefits often cited in IPM-managed orchards using reduced pesticide programs.

The comprehensive reference, *Orchard Pest Management: A Resource Book for the Pacific Northwest*, 1993, edited by Beers, Brunner, Willet, and Warner, was produced by research and Extension personnel from the tristate region. It serves as OSU's guide to effective IPM principles for managing insect and mite pests in the state. We recommend its use in conjunction with the numerous regional OSU Extension Service Orchard Pest Management Guides produced and/or distributed in the different tree fruit districts of the state. It addresses key elements of IPM for controlling pests, including prevention, monitoring, indicating "action levels" or pest densities at which to apply controls, and effective alternative strategies based on current knowledge. Although designed for the commercial orchard, many principles and control considerations apply to noncommercial trees. This resource is now available on the Internet: http://jenny.tfrec.wsu.edu/opm/.

Cherry fruit fly control area order and Integrated Pest Management

This pest control district is intended to protect the commercial cherry industry from the Western cherry fruit fly (CFF). The presence of just one maggot is sufficient to reject a lot of cherries delivered to the processor. Area-wide suppression of this pest is the most effective way to minimize risk to the industry.

In recognition of the IPM act of 1991 as defined and mandated by ORS 634.655, whereby the Oregon Department of Agriculture is required to follow IPM principles in fulfilling its pest control responsibilities, the following: (1) addresses a source of information for obtaining and selecting elements of IPM that can be used successfully in tree fruit production in Oregon, and (2) provides acceptable cherry fruit fly management techniques that comply with the intent of OAR 603-52-150 to protect the commercial cherry industry within the control order zone.

Commercial cherry growers base CFF management on predicted emergence of overwintering adult flies from the soil using a degree-day model and/or the appearance of the first flies trapped in "sticky" traps within or near the orchard. Sometimes a "sentinel" tree or area known to be infested with CFF is used to determine first emergence with sticky traps. The most suitable insecticide for a given operation is selected from this guide and applied to the trees beginning no later than seven days after CFF emergence. Depending upon the insecticide chosen, repeat applications may be necessary to ensure no maggots infest the fruit. Postharvest insecticide applications often are necessary in commercial orchards because of fruits left on trees, the long flight period of CFF, and the short residual nature of most insecticides used. Tree height and canopy influence effectiveness of sprays. Shorter trees pruned to open canopy interiors allow for more effective coverage and penetration. Evaluation of commercial CFF control programs is based on fruit inspections at receiving plants, by ODA officials, and at port of entry for exported fruit.

Noncommercial cherry trees should be managed in the same manner in regard to CFF control. General-use insecticides presented in this guide can be used and timed as above.

Methods other than insecticidal sprays that can be used are designed to prevent the presence of fruit when egg-laying flies are present. These include (1) tree removal, (2) removal of all bloom from trees, and (3) removal and proper disposal of fruit before CFF emergence.

Dilutions for wettable powder and liquid products

	Quantity of material for indicated quantity of water*			
Type of material	**100 gallons**	**5 gallons**	**3 gallons**	**1 gallon**
Wettable powder	5 lb	4 oz	2.4 oz	0.8 oz
	4 lb	3.2 oz	1.92 oz	0.64 oz
	3 lb	2.4 oz	1.44 oz	0.48 oz
	2 lb	1.6 oz	0.96 oz	0.32 oz
	1 lb	0.8 oz	0.48 oz	0.16 oz
	0.5 lb	0.4 oz	0.24 oz	0.08 oz
Liquid products	5 gal	1 qt	1 pt, 3 oz	6.5 oz
	4 gal	1 pt, 9 oz	15 oz	5 oz
	3 gal	1 pt, 3 oz	11.5 oz	7.5 Tbl
	2 gal	13 oz	7.5 oz	5 Tbl
	1 gal	6.5 oz	4 oz	2.5 Tbl
	1 qt	10 tsp	2 Tbl	2 tsp
	1 pt	5 tsp	1 Tbl	1 tsp

*The weight per volume of dry formulated products varies. To ensure accurate dilutions, measure these products by weight only.

Pesticide stewardship

Responsible use of pesticides can help protect bees from pesticide poisoning, protect natural resources such as fish and other aquatic organisms, and avoid resistance development. Information on each of these topics is included below.

Bees—Some pesticides used in orchards are highly toxic to bees. To avoid damage to bees, follow label instructions for protecting bees. For a quick guide to protecting bees from pesticides, see page 4. For detailed information on pesticide toxicity to bees and practices for preventing bee poisoning, see *How to Reduce Bee Poisoning from Pesticides* (PNW 591) in the Oregon State University Extension catalog at https://catalog.extension.oregonstate.edu/pnw591.

Buffers—Many pesticide labels now have specifc buffer requirements for use near surface water. To avoid damage to fish and other aquatic organisms, follow label instructions for buffers and drift reduction. Additional information is included below; see "Suggested best management practices for orchard spraying." Additionally, in the Pacific Northwest, mandatory buffers are required for certain pesticide active ingredients when used near certain fish-bearing streams. For specific reqirements, see: http://www.oregon.gov/ODA/programs/Pesticides/Water/Pages/Buffers.aspx.

Surface water—Some pesticides are toxic to fish or other aquatic organisms important for healthy stream ecosystems. To avoid damage to fish and other aquatic organisms, follow label instructions for avoiding surface water contamination. Additional information is included below; see "Suggested best management practices for orchard spraying."

Suggested best management practices for orchard spraying

The OSU Extension Service is working with the Columbia Gorge Fruit Growers, local packing houses, and chemical suppliers to help protect our water resources while ensuring the continued availability of chemical crop protection tools. The following practices should help minimize the possibility of pesticides and herbicides entering our waterways. You should review your operations and consider adjusting your practices as necessary to follow these recommendations.

These practices are most appropriate for orchards located in **sensitive areas** (those within 100 ft of open surface water, including creeks, streams, irrigation ditches, farm ponds, etc.). While these spray practices are recommended specifically for orchards near open surface waters, they may help minimize the possibility of pesticides entering other sensitive areas such as schools, residential areas, and public roads. Season-specific (e.g., prebloom and postbloom) recommendations are not made in this guide. Specific suggestions for pre- and postbloom control programs for orchards in sensitive areas will be provided in Extension Service newsletters.

Cultural practices

- Maintain at least 20 ft between orchards and waterways, including streams, ditches, drainageways, and ponds.
- Reduce runoff that might contain pesticides by planting and maintaining cover crops to increase water penetration and intercept runoff.
- Establish windbreaks between orchards and sensitive areas.

Mixing and loading

- Mix and load sprayers in areas where runoff to surface water cannot occur. Maintain an air gap between filler pipes and sprayers to reduce backflow.
- Rinse pesticide containers when filling sprayers and mix rinsate back into the spray tank. Store rinsed plastic containers away from waterways and recycle; do not burn.
- Do not overfill sprayers. Use antifoaming agents to reduce the risk.
- Apply spray tank rinse water back into the orchard; do not drain it in one spot.
- Clean up spills immediately. Have spill-adsorbent material (cat litter, sawdust, etc.) available when mixing and loading.

Maintenance and calibration

- Maintain and service equipment on a regular basis to avoid leaks, especially valves and hoses.
- Calibrate sprayers to avoid overapplication and reduce drift.

Application

- Minimize drift to waterways by increasing droplet size, using drift retardant, and avoiding application in high winds.
- Turn off nozzles at the end of each tree row.
- Make all efforts to eliminate drift near the edge of the orchard. When spraying rows parallel to sensitive areas, spray only the outside of the outer two rows. Spray inwards at a lower speed for improved coverage.
- When spraying rows perpendicular to sensitive areas, turn off nozzles two to three trees from the end of each row. Then return and spray the last two to three trees inwards at a lower speed.
- Apply dormant sprays with at least 200 gallons of water per acre for increased droplet size and reduced drift.
- Spray sensitive areas in the lowest wind conditions. When winds die down, move to these areas before finishing the rest of the block.

The Columbia Gorge Fruit Growers and OSU-MCAREC have produced the *Best Management Practices for Pesticide Use Grower Handbook*. It is available online at: http://community.gorge.net/hrgsa/bmpproject.html.

Bee hazard of pesticides for pears, apples, and cherries

This table provides a quick reference for protecting bees from pesticides commonly used in fruit production. This information is adapted from *How to Reduce Bee Poisoning from Pesticides* (PNW 591) in the Oregon State University Extension catalog at https://catalog.extension.oregonstate.edu/pnw591. Refer to that publication for more information. **MATERIALS ARE LISTED ALPHABETICALLY BY PRODUCT NAME.**

Trade name	Active ingredient	Bee hazard[1]
Acramite 50WS	bifenazate	x (U)
Actara 25WDG	thiamethoxam	xx (7-14 days)
Actigard	acibenzolar-S-methyl	-
Agri-mek 0.15EC	abamectin	xx (8 hr)
Agri-mycin	streptomycin	-
Aliette	fosetyl-Al	-
Altacor 35WDG	chlorantraniliprole	-
Apollo 4SC	clofentezine	-
Aprovia	benzovindiflupyr	-
Assail 70WP	acetamiprid	x (U)
Avaunt 30DG	indoxacarb	xx (U)
Aza-Direct	azadiractin	-
Bacillus thuringiensis (B.t.)	*Bacillus thuringiensis* ssp. *kurstaki*	-
Baythroid XL	beta-cyfluthrin	xx (>1 day)
Belay 2.13EC	clothianidin	xx (5 days)
Beleaf 50SG	flonicamid	-
BlightBan	biological	-
Bloomtime Biological	biological	-
Bravo	chlorothalonil	-
Cabrio EG	pyraclostrobin	-
Captan	captan	-
Centaur 70W	buprofezin	-
Champ	copper hydroxide	-
C-O-C-S	copper oxychloride	-
Cyd-X	CM granulosis virus	-
Danitol 2.4EC	fenpropathrin	xx (1 day)
Delegate 25WG	spinetoram	x (3 hr)
Diazinon 50W	diazinon	xx (2 days)
Dimethoate 2.67EC	dimethoate	xx (1-3.5 days)
Dimethoate 4EC	dimethoate	xx (1-3.5 days)

Trade name	Active ingredient	Bee hazard
Dimilin 2L	diflubenzuron	-
Dithane	mancozeb	-
Echo 720	chlorothalonil	-
Elevate	fenhexamid	-
Entrust 80W	spinosad	x (≤1 day)
Envidor 2SC	spirodiclofen	x
Epi-Mek 0.15EC	abamectin	xx (8 hr)
Esteem 35WP	pyriproxyfen	-
Ethrel	ethephon	-
Exirel	cyantraniliprole	x (U)
Flint	trifloxystrobin	-
Fontelis	penthiopyrad	-
Fruitone N	nathphalene acetic acid	-
FujiMite 5EC	fenpyroximate	-
Gem 500SC	trifloxystrobin	-
Horticultural mineral oil	petroleum or paraffinic oil	x (<3 hr)
Imidacloprid	imidacloprid	xx (>1 day)
Imidan 70W	phosmet	xx (>3 days)
Indar	fenbuconazole	-
Inspire Super	difenoconazole plus cyprodinil	-
Intrepid 2F	methoxyfenozide	-
Kaligreen	bicarbonate	-
Kanemite 15SC	acequinocyl	-
Kasumin	kasugamycin hydrochloride	-
Kelthane	dicofol	-
Kocide	copper hydroxide	-
K-Salt Fruit Fix 200	nathphalene acetic acid	-
K-Salt Fruit Fix 800	nathphalene acetic acid	-
Lambda-Cy	lambda-cyhalothrin	xx (>1 day)
Lime sulfur	calcium polysulfate	-

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Bee hazard of pesticides for pears, apples, and cherries (continued)

Trade name	Active ingredient	Bee hazard
Lime sulfur	lime sulfur/calcium polysulfide	-
Lorsban 4E	chlorpyrifos	xx (4-6 days)
Luna Sensation	fluopyram plus trifloxystrobin	-
Luna Tranquility	fluopyram plus pyrimethanil	-
Magister SC	fenazaquin	xx
Malathion 8EC	malathion	xx (2-6 hr)
Malathion ULV	malathion	xx (5.5 days)
Manzate	mancozeb	-
Merivon	fluxapyroxad plus pyraclostrobin	-
M-Pede	potassium salts of fatty acids	-
Mycoshield	oxytetracycline	-
Nealta	cyflumetofen	-
Neemix	azadiractin	-
Nexter 75WSB	pyridaben	xx (<2 hr)
Nordox	copper oxide	-
Omega 500	fluazinam	-
Omite 30WS	propargite	-
Onager 1EC	hexythiazox	-
Penncozeb	mancozeb	-
Pristine	pyraclostrobin plus boscalid	-
Proaxis 0.5L	gamma-cyhalothrin	xx (U)
Proclaim 5SG	emamectin benzoate	xx (>1 day)
Procure	triflumizole	-
PropiMax	propiconazole	-
Quash	metconazole	-
Quintec	quinoxyfen	-

Trade name	Active ingredient	Bee hazard
Rally	myclobutanil	-
Ridomil	metalaxyl	-
Rimon 0.83EC	novaluron	x (U)
Rovral	iprodione	-
Rubigan	fenarimol	-
Savey 50DF	hexythiazox	-
Sevin 4F	carbaryl	xx (3-7 days)
Sivanto	flupyradifurone	x (U)
Success 2F	spinosad	x (≤1 day)
Sulfur	sulfur, dry flowable	-
Sulfur	sulfur	-
Supracide 2E	methidathion	xx (1-3 days)
Surround WP	kaolin clay	-
Syllit	dodine	-
Tebucon	tebuconazole	-
Tilt	propiconazole	-
Topguard	flutriafol	-
Topsin M	thiophanate-methyl	-
Ultor 1.25L	spirotetramat	x (U)
Vangard 75WG	cyprodinil	-
Vendex 50WP	fenbutatin oxide	-
Vivando	metrafenone	-
Warrior	lambda-cyhalothrin	xx (>1 day)
Zeal 72WDG	etoxazole	-
Ziram	ziram	-

[1]Bee hazard rating system:

- = No bee hazard identified on label.

x = Toxic to bees, see label for specific hazard; residual toxicity is listed in parentheses.

xx = Highly toxic to bees, see label for specific hazard; residual toxicity is listed in parentheses.

U = Length of residual toxicity is unknown.

Note: Residual toxicity of pesticides to bees may vary with formulation and application rate, and may be prolonged by slow drying conditions.

Insecticide resistance management

Causes of pest control failures

Pest control failures in the field can have many causes. Often, they are related to the spray application itself. A grower may have chosen a pesticide that is ineffective against a specific pest and is not appropriate for the intended purpose. Even if the correct pesticide was used, the rate may have been too low to be effective, or the spray application may have been made at a less-than-optimal time. Other causes of poor control may be related to problems with the spraying equipment, spraying operation, or weather conditions (such as wind and rain during and after the application) that resulted in insufficient spray coverage of the tree canopy. One cause of pest control failures, which is more difficult to diagnose, is the development of resistance to a pesticide.

Resistance development

When a pesticide fails to provide control in the field and other causes for the control failure have been ruled out, resistance development is likely. Resistance manifests itself in the field by the inability to achieve control of pests at rates that previously were effective. Resistance development is a genetic phenomenon, and it occurs when pest populations are exposed repeatedly (over many generations) to the same pesticide or to groups of chemically related pesticides. Through selection, pest populations lose their susceptibility to a pesticide and become resistant. Depending on the pest species involved and the intensity of selection, resistance may develop very rapidly, as in the case of spider mites, or more slowly, as in the case of codling moth. Often, selection with one type of pesticide confers resistance to others of similar chemistry. This is called cross-resistance.

Fruit growers in the Mid-Columbia area have first-hand experience with resistance development and its consequences. For instance, in the early 1950s codling moth developed resistance to DDT after 6 to 8 years of continuous use. Guthion, at one time an all-purpose pesticide for insect and mite control on tree fruits, became ineffective against spider mites and pear psylla only a few years after it was introduced in the 1960s. Development of resistance in pear psylla to pyrethroid insecticides and in spider mites to organotin miticides provides more recent examples of resistance episodes. The practical outcome of resistance development is that growers lose control tools that previously were effective.

How to cope with insecticide resistance development in a proactive way

Fortunately, growers can do something about resistance development and prevent or at least delay it in the field by adopting resistance management strategies. Growers are the ones who make pest control choices and decide how pesticides are used in their orchards. Therefore, through their actions they directly influence the speed and intensity of resistance development in the field. A grower who uses pesticides conservatively and applies them sparingly likely will have fewer resistance problems than a grower who does the opposite.

Insecticide use strategies for resistance management

An important principle in resistance management is the concept of moderation in order to reduce selection pressure from pesticides and extend their effective field life. In practical terms, this means reducing overall chemical use by:

- Using the lowest effective rate of pesticides when appropriate
- Using higher treatment thresholds to reduce the frequency of applications
- Using pesticides with shorter residual activity to avoid selection over several generations
- Treating only those areas in an orchard where the pest density has exceeded the economic threshold

A common method of trying to overcome resistance is to use high rates of a pesticide. Most likely, a **high-dose strategy rarely works** and only accelerates resistance development. Use of high rates also is detrimental to natural enemies and the environment and is not compatible with IPM programs.

Rather than resorting to the use of higher rates, growers should **alternate pesticide chemistries with different modes of action** and follow the pesticide use recommendations outlined above. The term *mode of action* refers to the way a pesticide kills a target pest, and it varies greatly among available pesticides. Many insecticides used in tree fruits, such as organophosphates, carbamates, neonicotinoids, and pyrethroids, are nerve poisons. Others, such as insect growth regulators, interfere with the hormonal control of insect development. Some have a physical mode of action such as horticultural mineral oil (HMO), which kills by suffocation, or kaolin clay, which disrupts soft insect membranes, leading to dehydration. Microbial insecticides, such as the codling moth granulosis virus, provide control by causing disease in a population. There also are behavioral control methods such as mating disruption, which provide control by interfering with the reproductive behavior of certain insect pests. Growers should have some knowledge of how different pest control tactics work in order to build an effective resistance management program.

Resistance management as part of IPM in tree fruits

A grower who wants to take an active part in managing resistance should adopt an integrated pest management (IPM) program:

- Use alternatives to chemical pesticides whenever possible.
- Reduce the frequency of pesticide applications to a minimum.
- Make appropriate pesticide choices based on their mode of action and potential for resistance development.

Experience has shown that the risk for resistance development depends on the mode of action of a pesticide or pest control tactic. Pest control tactics such as biological control, cultural controls, microbial agents, and tactics with a behavioral (mating disruption) or physical (i.e., HMO) mode of action have a lower resistance risk and should be given preference in a seasonal IPM program. Chemical pesticides that act as nerve poisons or interfere with the hormonal regulation of insect development are much more prone to resistance development and should be used with moderation to preserve their field life.

Resistance management begins with the individual grower. However, it is most effective when resistance management approaches are adopted on an area-wide scale and used by the majority of growers in an area.

In summary, resistance management is most successful where growers monitor pests, use treatment thresholds and avoid prophylactic treatments, and take advantage of a range of nonchemical control tactics. IPM is the ultimate resistance management strategy for preserving valuable pesticides for managing key pests. Avoiding the loss of control tools due to resistance is every grower's responsibility. In an age when few new pesticides are being registered, loss of a pesticide can be a serious problem threatening the ability of growers to maintain adequate control and produce a high-quality, blemish-free crop.

Natural enemy impact guide for tree fruit pesticides

This table is a guide to the relative impact of commonly applied pesticides on natural enemies that are important components of an integrated pest management program on tree fruits. Use it in conjunction with the pest control program for each fruit crop. These programs give recommended rates and timing of sprays. The impact of some pesticides on natural enemies may vary considerably with the history of use in a given orchard. This is especially true relative to the effect on the western predatory mite (WPM) and the apple rust mite (ARM). Information in this table was obtained from the *Crop Protection Guide for Tree Fruits in Washington* (EB 0419) and other sources. Additional information on pesticide effects on natural enemies is available at: http://enhancedbc.tfrec.wsu.edu/PE.html.

			Relative impact rating[1]						
Compound	**Trade name**	**Rate/acre**	**WPM[2]**	**ARM[3]**	***Colpoclypeus florus*[4]**	***Pnigalio flavipes*[4]**	**Coccinellids[5]**	**Lacewing**	**Mirids[6]**
abamectin	Agri-Mek	10-20 oz	H[7]	H[7]	M[7]	L	M[7]	–	H
acetamiprid	Assail 70WP	3.4 oz	M-H[11]	L	H	-	M	M	H
azadirachtin	Neemix 4.5%	7 oz	–	–	L	–	L	–	–
azinphos-methyl	Guthion Solupak	2 lb	L	L	H	L	H	–	H
Bacillus thuringiensis (B.t.)	Deliver, Dipel, Javelin	1-2 lb	L	L	L	L	L	–	L
bifenzate	Acramite 50WS	0.75-1 lb	L	–	–	–	–	–	–
buprofezine	Centaur 70WDG	34.5 oz	–	–	–	–	–	–	–
carbaryl	Sevin 50WP	2 lb	M-H	L-M	H	L	H	L	–
chlorpyrifos	Lorsban 4E	2-4 pt	L-M	L	H	H	H	–	–
chlorpyrifos	Lorsban 50WP	3 lb	L-M	L	H	H	H	L	–
clofentezine	Apollo 50SC	4-8 oz	L	L	–	–	–	–	L
codling moth granulosis virus	Carpovirusine, Cyd-X	13.5 oz 3 oz	L	L	L	L	L	L	L
diazinon	Diazinon 50WP	4 lb	L	L	H	–	H	–	–
diflubenzuron	Dimilin 2L	12-48 oz	–	–	H	–	L	–	–
dimethoate	Dimethoate 2.67EC	3-6 pt	L-M	L	H	–	H	–	–
endosulfan	Thionex 50W	3 lb	L	M-H	M	M	M-H	L	–
esfenvalerate	Asana 0.66EC	1 pt	H	L	M	M-H	–	L	H
etoxazole	Zeal 72WSP	2-3 oz	L-M	–	–	–	–	–	–
fatty acids (soap)	M-Pede	1-2% v/v	M[7]	M[7]	–	–	L	L	–
fenbutatin-oxide	Vendex 50WP	1.5 lb	M	H	L	–	L	–	–
fenpropathrin	Danitol 2.4EC	20 oz	H	–	–	–	–	–	H
formetanate hydrochloride	Carzol 92SP	1.5 lb	M-H	M-H	H	–	L	–	–
hexythiazox	Onager 1EC	16-24 oz	L	L	–	–	–	–	L
horticultural mineral oil	–	1-2% v/v	M[7,8]	L[8]	L	L	L	L	L
imidacloprid	Provado 1.6F	4-8 oz	L[9]	L[9]	M-H[7]	–	M	M-H	H
indoxacarb	Avaunt 30DG	5-6 oz	L[10]	L[10]	–	–	–	–	–
kaolin	Surround WP	50 lb	M-H	–	–	M	M-H[5]	–	–
lime sulfur	–	6 gal	M-H	H	–	–	–	–	–
methomyl	Lannate 1.8L	2 pt	H	L	–	–	–	–	–
methomyl	Lannate 90SP	0.5 lb	H	L	–	–	–	–	–
methoxyfenozide	Intrepid 2F	10 oz	L	L	L	L	L	L	L
novaluron	Rimon 0.83EC	30-50 oz	M-H[11]	–	[12]	–	H	H[13]	H
oxamyl	Vydate 2L	2-4 pt	M-H	–	H	L-M	M	L	–
permethrin	Ambush 2EC	20 oz	H	L	M	–	–	–	H
permethrin	Pounce 25WP	12.8-25.6 oz	H	L	M	–	–	–	H
phosmet	Imidan 70WP	3-5.33 lb	L	L	H	L	H	L	H
pyridaben	Nexter 75WSB	4.4-7 oz	M	H	M-H	–	–	–	M
pyriproxyfen	Esteem 35WP	4-5 oz	L	L	M	–	M-H	L	M
rynaxypyr	Altacor 35WDG	3-4.5 oz	L	–	–	–	H	H	L
spinetoran	Delegate 25WG	4.5-7 oz	M-H[14]	–	–	–	–	M-H	H
spinosad	Success 2L	6-10 oz	M	–	M-H	H	L	L	L
spirotetramat	Ultor 1.25SC	10-14 oz	L	–	–	–	–	–	–
thiacloprid	Calypso 4F	2-8 oz	[11]	L	–	–	–	–	H
thiamethoxam	Actara 25WDG	5.5 oz	L[9]	L[9]	–	–	–	–	H
wettable sulfur 92%	sulfur	15-20 lb	M-H	–	–	–	–	L	M

[1] Rating system: L = low impact; M = moderate impact; H = high impact; – = no data available.
[2] WPM = western predatory mite, *Typhlodromus occidentalis.*
[3] ARM = apple rust mite, *Aculus schlechtendali.* Although ARM is a plant-feeding species, it is very useful in maintaining populations of WPM.
[4] *C. florus* is a wasp parasitoid of leafrollers; *P. flavipes* is a wasp parasitoid of western tentiform leafminer.
[5] Coccinellid data based on bioassays of late instar larvae of *Harmonia axyridis, Hippodamia convergens,* and *Coccinella transversoguttata.* Kaolin data based on bioassays using *Stethorus punctum.*
[6] *Deraeocoris brevis.*
[7] Overall negative impact is reduced due to short residual activity.
[8] Spray volume may be important in determining toxicity.
[9] Preliminary data based on field trials of four cover sprays.
[10] Preliminary data based on field trials with a single application.
[11] The use of these materials has been associated with mite problems, although the effect is inconsistent and the mechanism is unknown.
[12] 100% mortality/sterility was caused by exposure to novaluron.
[13] Novaluron has little or no acute toxicity to lacewing eggs, larvae, or adults; however, this material caused a near-complete shutdown of egg hatch from exposed adults.
[14] While this material is toxic to WPM, it is also slightly miticidal, and thus may not cause flare-ups of mites.

Spotts model for estimating pear scab infection periods

Average temperature (°F) during leaf wetness	Minimum hours of leaf wetness required for infection
45	25
46	22
48	19
50	17
52	15
54	13
55	12
57	12
59	11
61	11
63	10
64	10
66	10
68	10
70	10
72	10
73	10
75	10

In the fall, examine all leaves on 10 shoots on each of 10 trees located throughout the orchard. If you find fewer than 6 leaves with scab, the overall risk from scab is low enough to skip the first fungicide spray at pink. The end of ascospore infection season occurs after the first rain following the accumulation of 1,620 degree-days from budswell.

Twelve steps to manage bacterial canker of sweet cherry

Dr. Robert A. Spotts, OSU Mid-Columbia Agricultural Research and Extension Center, Hood River, OR

Pseudomonas syringae, which causes bacterial canker, is a major bacterial pathogen of young sweet cherry trees. Often, 10 to 20 percent of the trees in new orchards are killed by *P. syringae* within 5 years of planting. Control must integrate several techniques, including the following:

1. Do not interplant new trees with old trees, which are major sources of *P. syringae*.
2. Keep irrigation water off the part of the trees above ground as much as possible for the first 2 or 3 years after planting. Consider withholding water in late summer so trees will "harden off" and not be as susceptible to low temperature injury in early winter.
3. Avoid all types of injury—mechanical, insect, frost. Paint all trunks white with latex paint to prevent winter injury. Adding copper to the paint is probably of little benefit.
4. Some studies show less bacterial canker when pruning is delayed until spring, even as late as after flowering in May. Less disease also occurs when summer pruning is used. Prune only during dry weather if possible.
5. Remove branches and trees killed by *P. syringae* from the orchard and destroy them.
6. Mazzard F12-1 is one of the most resistant rootstocks. Resistance of new rootstocks is unknown at this time, but trees on Mazzard may have an advantage over trees on size-controlling rootstocks. Sweet cherry scion cultivars generally are susceptible.
7. Locate the orchard in an area less likely to be affected by frost and slow drying conditions.
8. Provide optimal soil conditions for growth of cherries, including attention to pH and nutrition. Application of excess nitrogen, especially late in the growing season, will promote late-season growth that is susceptible to low temperature injury in early winter, followed by bacterial infection.
9. Control weeds, especially grasses. They often support large populations of *P. syringae*. Clover and vetch ground covers support lower populations. Consider clean cultivation of row middles for the first 3 years.
10. Application of fixed copper products or Bordeaux 12-12-100 is no longer recommended. In recent research trials, these treatments resulted in higher damage than that in untreated controls.
11. Test for and control plant pathogenic nematodes before planting, if needed. High populations of ring nematode have been associated with more bacterial canker.
12. In the Parkdale area, plant trees in May rather than April.

Apple scab infection

Approximate hours of wetness at indicated temperatures required for leaf scab infection, and days required for lesions to appear.

Average temperature (°F)	Hours of wetness required for infection[a]			Days required for lesions to appear[b]
	From primary or secondary inoculum			
	Light	Moderate	Heavy	
78	13	17	26	—
77	11	14	21	—
76	9.5	12	19	—
63-75	9	12	18	10
62	9	12	19	10
61	9	13	20	10
60	9.5	13	20	11
59	10	13	21	12
58	10	14	21	12
57	10	14	22	13
56	11	15	22	13
55	11	16	24	14
54	11.5	16	24	14
53	12	17	25	15
52	12	18	26	15
51	13	18	27	16
50	14	19	29	16
49	14.5	20	30	17
48	15	20	30	17
47	15	23	35	—
46	16	24	37	—
45	17	26	40	—
44	19	28	43	—
43	21	30	47	—
42	23	33	50	—
41	26	37	53	—
40	29	41	56	—
39	33	45	60	—
38	37	50	64	—
37	41	55	68	—
33-36	48	72	96	—

From W.D. Mills, Cornell University

[a] Leaves remain wet for varying lengths of time after the rain stops, depending on conditions. Add together wetting periods from intermittent showers. Other states such as Michigan add together any wet periods with less than 8 hours dry time between them. Determine average temperature for the period from hourly readings. Lesions may not be apparent for 2-4 weeks.

[b] Days required for conidia to appear once infection has been established. No further wetting is required. For this column, daily maximum and minimum temperatures are adequate for determining the average.

Internet resources for plant protection in the Mid-Columbia area

Information regarding plant protection is available from OSU and other sources. Weather data and pest models for the Mid-Columbia region may be accessed through websites managed by the OSU Integrated Plant Protection Center (http://uspest.org/hr/) and the Columbia Gorge Fruit Growers (http://www.ifpnet.com/).

Pacific Northwest Insect Management Handbook: http://pnwhandbooks.org/insect/

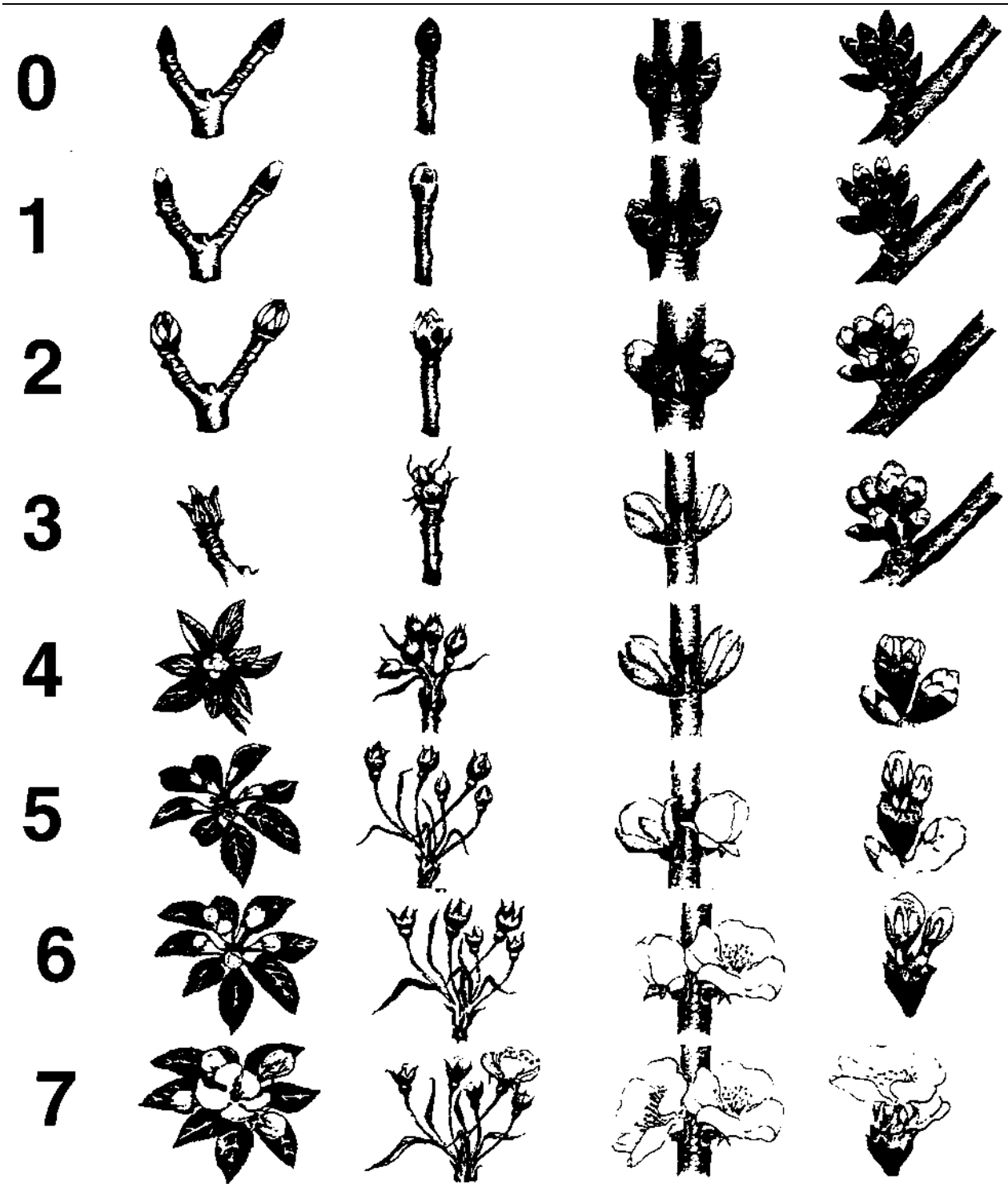
Pacific Northwest Plant Disease Management Handbook: http://pnwhandbooks.org/plantdisease/

Pacific Northwest Weed Management Handbook: http://pnwhandbooks.org/weed/

Orchard Pest Management Online: Online edition of the 1993 comprehensive reference *Orchard Pest Management: A Resource Book for the Pacific Northwest*: http://jenny.tfrec.wsu.edu/opm/

Enhancing Western Orchard Biological Control: New information from research focused on enhancing biological control in western apple, pear, and walnut orchards including pesticide effects on natural enemies: http://enhancedbc.tfrec.wsu.edu/

Bud development chart



Courtesy Washington State University Extension

2017 Mid-Columbia pest control program for pears

Application rates in the tables are based on the amount of product to apply per acre. For some products, the label requires minimum and/or maximum recommendations for spray volume (the amount of water to use per acre when spraying). Good coverage depends on many factors, including the type of application equipment, spray volume, tree phenology, tree height, row width, target pest, tractor speed, and chemical rate per acre used. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

PEARS

Dormant (Stage 0) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Pear blister mite	Pear psylla adults and eggs#	Pear rust mite	Scale insects	Restricted-entry interval (REI) / Preharvest interval (PHI)	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Horticultural mineral oil (HMO) Generic	-	-	4-6 gal	-	-	4 h / -	-	-	Apply just before egg deposition. Do not exceed 8 gal/acre oil prebloom.	x	-	x
HMO + one of the following	-	4-6 gal	4-6 gal	4-6 gal	4-6 gal	4 h / -	-	-	Do not exceed 8 gal/acre oil prebloom.	x	-	x
Danitol 2.4EC** RUP	3	-	16-21 oz	-	16-21 oz	1 d / 14 d	2.66 pt	-	-	xx	x	x
Lambda-cyhalothrin 1EC** RUP: Generic	3	-	2.56-5.12 oz	-	2.56-5.12 oz	1 d / 21 d	1.6 pt	-	-	xx	x	x
Lime sulfur (calcium polysulfide 29%) Generic	M2	10 gal	10 gal	10 gal	-	2 d / -	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-
Lime Sulfur Ultra (calcium polysulfide 27%) Generic	M2	2-3 gal	2-3 gal	2-3 gal	-	2 d / -	46 gal	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	x
Sulfur (dry flowable) (elemental sulfur 80%) Generic	M2	15-20 lb	15-20 lb	15-20 lb	-	1 d / -	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-

continues on next page

PEARS

CONTINUED: Dormant (Stage 0) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Pear blister mite	Pear psylla adults and eggs#	Pear rust mite	Scale insects	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
HMO + one of the following (continued)	-	4-6 gal	4-6 gal	4-6 gal	4-6 gal	4 h / -	-	-	Do not exceed 8 gal/acre oil prebloom.	x	-	x
Sulfur (flowable) Generic	M2	1-2 gal	1-2 gal	1-2 gal	-	1 d / -	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-
Warrior II EC** RUP; Generic	3	-	1.3-2.5 oz	-	1.3-2.5 oz	1 d / 21 d	12.8 oz	-	-	xx	x	x
Surround WP	-	-	50-100 lb	-	-	1 d / 0	-	-	Apply in 200 gal of water at beginning of pear psylla egg laying. Maintain coverage until bloom with additional applications to prevent egg laying.	-	-	-

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

** Pyrethroid: pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

PEARS

Delayed Dormant (Stages 1 and 2: Apply before bud scales drop to minimize injury.) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	European red mite	Grape mealybug	Leafrollers#	Lygus bug	Pear blister mite	Pear psylla#	Pear rust mite	Scale insects	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Centaur 70WDG	16	-	34.5-46 oz	-	-	-	34.5-46 oz	-	34.5-46 oz	12 h / 14 d	69 oz	2	Do not tank-mix with oil. Ground application only.	-	-	-
Horticultural mineral oil (HMO) + one of the following	-	4-6 gal Do not exceed 8 gal/acre oil prebloom. If scale is a problem, increase gallonage. Calibrate to discharge 2/3 of volume out of top 1/3 of sprayer. The 2/3-1/3 calibration should be used for all sprayers and all applications.								4 h / -	-	-	-	x	-	x
Danitol 2.4EC** RUP	3	16-21 oz	-	-	16-21 oz	-	16-21 oz	-	16-21 oz	1 d / 14 d	2.66 pt	-	-	xx	x	x
Delegate 25WG	5	-	-	4.5-7 oz	-	-	6-7 oz	-	-	4 h / 7 d	28 oz	4	Adjuvant may improve control.	x	-	x
Diazinon 50WP RUP; Generic	1B	-	4 lb	4 lb	4 lb	-	-	-	4 lb	4 d / 21 d	4 lb	2	Closed cab required. One dormant and one in-season foliar application allowed.	xx	x	x
Esteem 35WP Generic	7C	-	-	4-5 oz	-	-	4-5 oz	-	4-5 oz	12 h / 45 d	10 oz	2	Will not control pear psylla adults.	-	-	x
Lambda-cyhalothrin 1EC** RUP: Generic	3	2.6-5.1 oz	-	-	2.6-5.1 oz	-	2.6-5.1 oz	-	2.6-5.1 oz	1 d / 21 d	-	-	-	xx	x	x
Lime sulfur (calcium polysulfide 29%) Generic	M2	-	-	-	-	10 gal	10 gal	10 gal	-	2 d / -	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-
Lime Sulfur Ultra (calcium polysulfide 27%) Generic	M2	-	-	-	-	2-3 gal	2-3 gal	2-3 gal	-	2 d / -	46 gal	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	x
Lorsban 4E (chlorpyrifos) RUP; Generic	1B	-	2 qt	2 qt	2 qt	-	-	-	2 qt	4 d / prebloom	2 qt	1	-	xx	x	x
Sulfur (dry flowable) (elemental sulfur 80%) Generic	M2	-	-	-	-	15-20 lb	15-20 lb	15-20 lb	-	1 d / -	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-
Warrior II EC** RUP; Generic	3	1.3-2.5 oz	-	-	1.3-2.5 oz	-	1.3-2.5 oz	-	1.3-2.5 oz	1 d / 21 d	12.8 oz	-	-	xx	x	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

**Pyrethroid: pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroids conservatively to maintain effectiveness as long as possible.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

PEARS

Delayed Dormant (Stages 1 and 2: Apply before bud scales drop to minimize injury.) - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Fire blight	Pseudomonas blossom blast	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Horticultural mineral oil (HMO) +	-	4-6 gal	4-6 gal	4 h / -	-	-	Do not exceed 8 gal/acre oil prebloom.	x	-	x
Fixed copper (50-53%)	M1	F 16 lb	16 lb	2 d / -	-	-	See label for product-specific REI. See footnote 5, page 31.	-	-	x

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

**Resistant pathogens will lower the effectiveness of these materials.

PEARS

Cluster Bud through Pink (Stages 3, 4, and 5) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Grape mealybug	Green fruit worm	Leafrollers#	Lygus bug	Pear psylla#	Pear psylla adults#	Pear rust mite	San Jose scale	Spider mites#	Stinkbug	Thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Altacor 35WDG	28	-	-	-	3-4.5 oz	-	-	-	-	-	-	-	-	4 h / 5 d	9 oz	4	-	-	x
	Remarks:	Use 100 to 200 gal/acre water.																	
Assail 70WP	4A	1.1-3.4 oz	1.1-3.4 oz	-	-	-	1.1-3.4 oz	-	-	-	-	-	-	12 h / 7 d	13.5 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.																	
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	-	Rates vary, see label	-	-	-	-	-	-	-	-	4 h / 0 d	-	-	-	-	-
	Remarks:	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.																	
Centaur 70WDG	16	-	34.5 oz	-	-	-	34.5 oz	-	-	34.5 oz	-	-	-	12 h / 14 d	69 oz	2	-	-	-
	Remarks:	Do not tank-mix with oil. Ground application only.																	
Danitol 2.4EC** RUP	3	-	-	-	-	-	-	16-21 oz	-	-	-	-	-	1 d / 14 d	2.66 pt	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.																	
Delegate 25WG	5	-	-	-	4.5-7 oz	-	6-7 oz	-	-	-	-	-	-	4 h / 7 d	28 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Adjuvant may improve control.																	
Entrust 2SC	5	-	-	-	6-10 oz	-	-	-	-	-	-	-	-	4 h / 7 d	29 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.																	
Entrust 80WP	5	-	-	-	2-3 oz	-	-	-	-	-	-	-	-	4 h / 7 d	9 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.																	
Envidor 2SC	23	-	-	-	-	-	-	-	18 oz	-	18 oz	-	-	12 h / 7 d	18 oz	1	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Adjuvant may improve control.																	
Esteem 35WP Generic	7C	-	-	-	4-5 oz	-	4-5 oz	-	-	4-5 oz	-	-	-	12 h / 45 d	10 oz	2	-	-	x
	Remarks:	Apply as overwintering leafroller larvae become active. Will provide leafroller suppression as part of a season-long program.																	
Exirel 0.83SE	28	-	-	-	13.5-20.5 oz	-	20.5 oz	-	-	-	-	-	20.5 oz	12 h / 3 d	61 oz	-	x	x	x
	Remarks:	Toxic to bees. See label for specific precautions. For pear psylla and thrips use with an adjuvant. Provides suppression only of thrips. Do not exceed 3 applications per generation of target pest.																	

continues on next page

PEARS

CONTINUED: Cluster Bud through Pink (Stages 3, 4, and 5) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Grape mealybug	Green fruit worm	Leafrollers#	Lygus bug	Pear psylla#	Pear psylla adults#	Pear rust mite	San Jose scale	Spider mites#	Stinkbug	Thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
FujiMite 5EC	21A	-	-	-	-	-	2 pt	-	2 pt	-	2 pt	-	-	12 h / 14 d	2 pt	2	-	x	x
	Remarks:	To avoid resistance development, do not rotate with Nexter.																	
Intrepid 2F	18	-	-	-	16 oz	-	-	-	-	-	-	-	-	4 h / 14 d	64 oz	-	-	x	x
	Remarks:	Make 1-2 applications against overwintering generation larvae, depending on pest pressure.																	
Lambda-cyhalothrin 1EC** RUP: Generic	3	-	-	-	-	-	-	2.56-5.12 oz	-	-	-	-	-	1 d / 21 d	1.6 pt	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.																	
Nexter 75WSB	21A	-	-	-	-	-	10-16 oz	-	4.4-9.9 oz	-	9.9 oz	-	-	12 h / 7 d	16 oz	1	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. To avoid resistance development, do not rotate with FujiMite. 16-oz rate is allowed for pear psylla under 24 (c) SLN label until 12/31/19.																	
Proclaim 5SG RUP	6	-	-	3.2-4.8 oz	3.2-4.8 oz	-	3.2-4.8 oz	-	-	-	-	-	-	12 h / 14 d	14.4 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only.																	
Rimon 0.83EC	15	-	-	-	-	-	20-30 oz	-	-	-	-	-	-	12 h / 14 d	96 oz	2	x	x	x
	Remarks:	Toxic to bees. See label for specific precautions. For codling moth, apply 50 to 75 degree-days after biofix. Do not apply after pear turndown as fruit injury may occur.																	
Sivanto	4D	-	-	-	-	-	10.5-14 oz	-	-	-	-	-	-	4 h / 14 d	28 oz	-	-	-	x
Success 2L	5	-	-	-	6-10 oz	-	-	-	-	-	-	-	-	4 h / 7 d	29 oz	-	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.																	
Surround WP	-	-	-	-	-	-	50-100 lb	-	-	-	-	-	-	1 d / 0 d	-	-	-	-	-
	Remarks:	Apply in 200 gal of water.																	
Warrior II EC** RUP; Generic	3	-	-	-	-	-	-	1.3-2.5 oz	-	-	-	-	-	1 d / 21 d	12.8 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.																	

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

**Pyrethroid: pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

PEARS

Cluster Bud through Pink (Stages 3, 4, and 5) - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew see footnote 1, page 31.	Scab see footnote 1, page 31.	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Check with your packing house before using this material. Do not apply more than 2 sequential applications.	-	x	x
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Mancozeb 75 DF Generic	M3	-	E 3 or 6 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 4, page 31.	-	-	x
Merivon	7 +11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31. Do not use with EC formulations, methylated seed oil, or horticultural mineral oil.	-	-	x
Pristine	7 +11	E 14.5-18.5 oz	G-E** 14.5-18.5 oz	12 h / 0 d	74 oz	4	If planning to use Prisitne as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMOs. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Syllit FL	U12	-	G* 3 pt	2 d / 7 d	9 pt	3	Tank-mix with another fungicide from a different resistance management group.	-	-	x
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	x	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

PEARS

Bloom – *Codling moth mating disruption (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Codling moth	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Checkmate CM-XL 1000	-	120-200 ties	0 d / -	-	-	Other products are available, but experience is limited with those products. If pest pressure is high, combine with one or more insecticide applications against the first generation. Treat with insecticides against the second generation if pressure remains high. If lower application rates are used, supplemental treatment with insecticides may be necessary.	-	-	-
Checkmate Puffer CM-O	-	1-2 puffers	0 d / -	-	-		-	-	-
Isomate C Plus	-	400 ties	0 d / -	-	-		-	-	-
Isomate CM Flex	-	400 ties	0 d / -	-	-		-	-	-
Isomate CM Mist	-	1-2 puffers	0 d / -	-	-		-	-	-
Isomate CTT	-	200 ties	0 d / -	-	-		-	-	-
Nomate CM	-	300-400 ties	0 d / -	-	-		-	-	-

PEARS

Bloom - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Fire blight##	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actigard 50WG	21	see label	12 h / 60 d	12.8 oz	-	For foliar application, tank mix with antibiotic. Can also be used to treat cut surfaces when cutting blight infections. See label for treatment schedules and corresponding use rates.	-	-	x
Agrimycin 17 (streptomycin) Generic	25	P-E** / 28.8 oz	12 h / 30 d	-	-	Extensive resistance to streptomycin has been found throughout the Mid-Columbia area. Tank-mix with full rate of oxytetracyclene and make only one application per season. Do not exceed 1 lb/100 gal of water. 2-year shelf life.	-	-	-
BlightBan A506	biological	P-G / 5-7 oz	4 h / -	-	-	Use the 5-oz rate in 50-150 gal/acre and the 7-oz rate in 200-300 gal/acre. Use at 20% bloom and again at 50% bloom. Works best at the beginning of an infection period. Do not use with terramycin or copper-based products. Allow at least 5 days between applications of this product and terramycin. Must be integrated with other fire blight control tactics. The addition of chelated iron as Sequestrene 138 at 1 lb/100 gal water in a tank mix with BlightBan improves disease control over BlightBan alone. This is a safe and legal use; however, it would remove the registrant from any legal/financial responsibility. ***Do not use straight iron sulfate in the tank mix, as that use will burn flowers and russet fruit.***	-	-	-
Bloomtime Biological FD	biological	P-G / 0.33-0.44 lb	4 h / -	-	-	Use at 15 to 20% bloom and again at full bloom to petal fall. Do not apply after fruit set. Do not use with terramycin or copper-based products. Allow at least 7 days between applications of this product and terramycin. The unformulated active ingredient works well. This product alone will not control fire blight and must be integrated into a regular antibiotic schedule.	-	-	-
Kasumin 2L	24	G / 64 oz	12 h / 90 d	256 oz	4	Do not use alternate tree-row application method. Do not apply after petal fall. Do not apply to orchards fertilized with manure.	-	-	-
Mycoshield (oxytetracycline) Generic	41	F-G / 8 or 16 oz	12 h / 60 d	5 lb	5	Apply at the rate of 8 oz in 50 gal or 16 oz in 100 gal of water. Do not use higher gallonages because the effectiveness of terramycin is reduced.	-	-	-
Serenade Opti	44	F-G / 14-20 oz	4 h / 0 d	-	-	Use like an antibiotic, late in bloom period, rather than like a biological early in bloom.	-	-	-

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

**Resistant pathogens will lower the effectiveness of these bactericides.

For best results, use predictive model (CougarBlight) to time applications. See page 9.

PEARS

Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Grape mealybug	Leafrollers#	Pear leaf curling midge	Pear psylla#	Pear rust mite	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Acramite 50WS	UN	-	-	-	-	-	-	0.75-1 lb	12 h / 7 d	-	1	Toxic to bees. See label for specific precautions.	x	-	x
Agri-Mek 0.15EC RUP, Generic	6	-	-	-	16-20 oz	16-20 oz	-	16-20 oz	12 h / 28 d	40 oz	2	Highly toxic to bees. See label for specific precautions. Apply in combination with oil at 0.25% of spray volume. Alternate Agri-Mek with other available acaricides as a resistance management strategy.	xx	x	x
+ Horticultural mineral oil (HMO)	-	-	-	-	1 gal	1 gal	1 gal	1 gal	4 h / -	-	-	Toxic to bees. See label for specific precautions. Higher rates of oil when used in combination with Agri-Mek can mark the fruit, especially Anjou and Bartlett.	x	-	x
Altacor 35WDG	28	-	3-4.5 oz	-	-	-	-	-	4 h / 5 d	9 oz	4	Use 100 to 200 gal/acre water.	-	-	x
Apollo 4SC	10A	-	-	-	-	-	-	4-8 oz	12 h / 21 d	-	1	Ground application only. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	x	x
Assail 70WP	4A	1.7-3.4 oz	-	-	1.7-3.4 oz	-	-	-	12 h / 7 d	13.5 oz	4	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Aza-Direct	UN	-	-	-	1-3.5 pt	-	-	-	4 h / 0 d	-	-	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.	-	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	Rates vary; see label	-	-	-	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.	-	-	-
Centaur 70WDG	16	34.5 oz	-	-	34.5 oz	-	34.5 oz	-	12 h / 14 d	69 oz	2	Do not tank-mix with oil. Ground application only.	-	-	-
Delegate 25WG	5	-	4.5-7 oz	-	6-7 oz	-	-	-	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Diazinon 50WP RUP; Generic	1B	4 lb	-	-	-	-	-	-	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required. One dormant and one in-season foliar application allowed.	xx	x	x
Entrust 2SC	5	-	6-10 oz	-	-	-	-	-	4 h / 7 d	29 oz	4	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x

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PEARS

CONTINUED: Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Grape mealybug	Leafrollers#	Pear leaf curling midge	Pear psylla#	Pear rust mite	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Entrust 80WP	5	-	2-3 oz	-	-	-	-	-	4 h / 7 d	9 oz	4	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Envidor 2SC	23	-	-	-	-	16-18 oz	-	16-18 oz	12 h / 7 d	18 oz	1	Toxic to bees. See label for specific precautions.	x	-	x
Esteem 35WP Generic	7C	-	4-5 oz	-	4-5 oz	-	4-5 oz	-	12 h / 45 d	10 oz	2	Will provide leafroller suppression as part of a season-long program.	-	-	x
Exirel 0.83SE	28	-	10-17 oz	-	13.5-20.5 oz	-	-	-	12 h / 3 d	61 oz	-	Toxic to bees. See label for specific precautions. For pear psylla use with an adjuvant. Do not exceed 3 applications per generation of target pest.	x	x	x
FujiMite 5EC	21A	-	-	-	2 pt	2 pt	-	2 pt	12 h / 14 d	2 pt	2	To avoid resistance development, do not rotate with Nexter.	-	x	x
Imidacloprid 2F Generic	4A	16 oz	-	-	16 oz	-	-	-	12 h / 7 d	32 oz	-	Highly toxic to bees. See label for specific precautions. Do not apply prebloom, or during bloom, or when bees are actively foraging.	xx	x	x
Intrepid 2F	18	-	16 oz	-	-	-	-	-	4 h / 14 d	64 oz	-	Make 1-2 applications against overwintering generation larvae, depending on pest pressure.	-	x	x
Kanemite 15SC	20B	-	-	-	-	-	-	21-31 oz	12 h / 14 d	62 oz	2	-	-	x	x
Nealta 1.67SC	25	-	-	-	-	-	-	13.7 oz	12 h / 7 d	27.4 oz	-	Do not make more than one application before using an effective miticide with a diferent mode of action.	-	-	-
Neemix Generic	UN	-	-	-	4-16 oz	-	-	-	4 h / 0 d	-	-	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.	-	-	x
Nexter 75WSB	21A	-	-	-	10-16 oz	5.2-10.67 oz	-	9.9 oz	12 h / 7 or 28 d	16 oz	1	Highly toxic to bees. See label for specific precautions. Effective against European red mite and pear rust mite. Good coverage essential. Results for McDaniel and twospotted spider mites are inconsistent. To avoid resistance development, do not rotate with FujiMite. 16-oz rate is allowed for pear psylla under 24 (c) SLN label until December 31, 2019. PHI for 16 oz rate is 28 days.	xx	x	x
Onager 1EC	10A	-	-	-	-	-	-	16-24 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Proclaim 5SG RUP	6	-	3.2-4.8 oz	-	-	-	-	-	12 h / 14 d	14.4 oz	-	Highly toxic to bees. See label for specific precautions. May provide pear psylla suppression at this timing. See label for restricted activities. Ground application only.	xx	x	x

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PEARS

CONTINUED: Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Grape mealybug	Leafrollers#	Pear leaf curling midge	Pear psylla#	Pear rust mite	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Rimon 0.83EC	15	-	-	-	20-32 oz	-	-	-	12 h / 14 d	96 oz	2	Toxic to bees. See label for specific precautions. For codling moth, apply 50-75 degree-days after biofix. Do not apply after pear turndown, as fruit injury may occur.	x	x	x
Savey 50DF	10A	-	-	-	-	-	-	4-6 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Sivanto	4D	-	-	-	10.5-14 oz	-	-	-	4 h / 14 d	28 oz	-	-	-	-	x
Success 2L	5	-	6-10 oz	-	-	-	-	-	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications/year for leafroller control.	x	-	x
Ultor 1.25SC	23	-	-	-	-	-	10-14 oz	-	1 d / 7 d	40 oz	-	Toxic to bees. See label for specific precautions. Do not apply before petal fall. Surfactant is required; see label.	x	-	x
Zeal 72 WSP	10B	-	-	-	-	-	-	2-3 oz	12 h / 14 d	3 oz	1	Primarily ovicidal/larvicidal.	-	-	x

RUP = restricted use pesticide.
Generic = other materials with the same active ingredient are available.
#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

PEARS

Petal Fall - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Bulls-eye rot	Powdery mildew see footnote 1, page 31.	Scab see footnote 1, page 31.	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	-	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	-	E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Fontelis 1.67SC	7	-	G** 16-20 oz	G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Inspire Super	3 + 9	-	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Check with your packing house before using this material. Do not apply more than 2 sequential applications.	-	x	x
Luna Sensation	7 + 11	-	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Mancozeb 75 DF Generic	M3	P* 3 lb	-	E 3 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 4, page 31.	-	-	x
Merivon	7 +11	-	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31. Do not use with EC formulations, methylated seed oil, or horticultural mineral oil.	-	-	x
Pristine	7 +11	-	E 14.5-18.5 oz	G-E** 14.5-18.5 oz	12 h / 0 d	74 oz	4	If planning to use Prisitne as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMOs. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Procure 480SC	3	-	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Syllit FL	U12	-	-	G* 3 pt	2 d / 7 d	9 pt	3	Tank-mix with another fungicide from a different resistance management group.	-	-	x
Topguard	3	-	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	x	x
Ziram 76DF	M3	F 6 lb	-	F 6 lb	2 d / 14 d	32 lb	-	See footnote 3, page 31.	-	-	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

PEARS

Post-petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Codling moth	Grape mealybug	Pear psylla#	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actara 25WDG	4A	-	5.5 oz	5.5 oz	-	-	12 h / 14 or 35 d	16.5 oz	-	Highly toxic to bees. See label for specific precautions and REI.	xx	x	x
Agri-Mek 0.15EC + RUP, Generic	6	-	-	16-20 oz	-	16-20 oz	12 h / 28 d	40 oz	2	Highly toxic to bees. See label for specific precautions. See above under Petal Fall. Apply in combination with oil at 0.25% of spray volume.	xx	x	x
Horticultural mineral oil (HMO) Generic	-	-	-	1 gal	1 gal	1 gal	4 h / -	-	-	Toxic to bees. See label for specific precautions. Higher rates of oil when used in combination with Agri-Mek can mark the fruit, especially Anjou and Bartlett.	x	-	x
Altacor 35WDG	28	3-4.5 oz	-	-	-	-	4 h / 5 d	9 oz	4	Use 100 to 200 gal/acre water. Application at beginning of egg laying (50 to 100 degree-days after biofix) may allow delayed application of first cover targeting codling moth larvae to 350 degree-days.	-	-	x
Aza-Direct Generic	UN	-	-	1-3.5 pt			4 h / 0 d	-	-	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.	-	-	x
Exirel 0.83SE	28	10-17 oz	-	13.5-20 oz	-	-	12 h / 3 d	61 oz	-	Toxic to bees. See label for specific precautions. For codling moth make first application prior to egg hatch. For pear psylla use with an adjuvant. Do not exceed 3 applications per generation of target pest.	x	x	x
Intrepid 2F	18	16 oz[S]	-	-	-	-	4 h / 14 d	64 oz	-	Application at beginning of egg laying (50 to 100 degree-days after biofix) may allow delayed application of first cover targeting codling moth larvae to 350 degree-days.	-	x	x
Nealta 1.67SC	25	-	-	-	-	13.7 oz	12 h / 7 d	27.4 oz	-	Do not make more than one application before using an effective miticide with a diferent mode of action.	-	-	-
Neemix Generic	UN	-	-	4-16 oz	-	-	4 h / 0 d	-	-	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.	-	-	x
Rimon 0.83EC	15	20-32 oz	-	20-32 oz	-	-	12 h / 14 d	96 oz	2	Toxic to bees. See label for specific precautions. Do not apply after pear turndown, as fruit injury may occur. For codling moth, apply 50 to 75 degree-days after biofix. Application at beginning of egg laying (50 to 100 degree-days after biofix) may allow delayed application of first cover targeting codling moth larvae to 350 degree-days.	x	x	x
Ultor 1.25SC	23	-	-	10-14 oz	10-14 oz	-	1 d / 7 d	40 oz	-	Toxic to bees. See label for specific precautions. Do not apply before petal fall. Surfactant is required. See label.	x	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

[S]Suppressive; use in low-pressure situations in conjunction with other codling moth control measures.

PEARS

Post-petal Fall - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew see footnote 1, page 31.	Scab see footnote 1, page 31.	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Focus SC Generic	3	E** 9-12 oz	G** 9-12 oz	1 d / 30 d	48 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Check with your packing house before using this material. Do not apply more than 2 sequential applications.	-	x	x
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Mancozeb 75 DF Generic	M3	-	E 3 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 4, page 31.	-	-	x
Merivon	7 +11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31. Do not use with EC formulations, methylated seed oil, or horticultural mineral oil.	-	-	x
Pristine	7 +11	E 14.5-18.5 oz	G-E** 14.5-18.5 oz	12 h / 0 d	74 oz	4	If planning to use Prisitne as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMOs. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Syllit FL	U12	-	G* 3 pt	2 d / 7 d	9 pt	3	Tank-mix with another fungicide from a different resistance management group.	-	-	x
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	x	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

PEARS

Late Spring and Summer Cover Sprays - *Insects & Mites (amount per acre). See footnote 2, page 31.*

Product and formulation	Resistance management group (see page 6)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Acramite 50WS	UN	-	-	-	-	-	-	-	0.75-1 lb	-	12 h / 7 d	-	1	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions.														
Actara 25WDG	4A	4.5 oz	-	5.5 oz	-	5.5 oz	-	-	-	-	12 h / 14 or 35 d	16.5 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions and REI.														
Agri-Mek 0.15EC RUP, Generic	6	-	-	-	-	16-20 oz	16-20 oz	-	16-20 oz	-	12 h / 28 d	40 oz	2	xx	x	x
+ Horticultural mineral oil (HMO) Generic	-	-	-	-	-	1 gal	1 gal	-	1 gal	-	4 h / -	-	-	x	-	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Effectiveness of Agri-Mek diminishes in late season. Use up to second cover (late June). Alternate Agri-Mek with other available acaricides as a resistance management strategy. Apply in combination with HMO at 0.25% of spray volume. Higher rates of HMO when used in combination with Agri-Mek can mark the fruit, especially Anjou and Bartlett.														
Altacor 35WDG	28	-	3-4.5 oz	-	3-4.5 oz	-	-	-	-	-	4 h / 5 d	9 oz	4	-	-	x
	Remarks:	Use 100 to 200 gal/acre water.														
Apollo 4SC	10A	-	-	-	-	-	-	-	4-8 oz	-	12 h / 21 d	-	1	-	x	x
	Remarks:	Ground application only. Do not use any combination of Apollo, Onager, and Savey in the same growing season.														
Assail 70WP	4A	1.1-1.7 oz	3.4 oz	1.7-3.4 oz	-	1.7-3.4 oz	-	-	-	-	12 h / 7 d	13.5 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.														
Avaunt 30 DG	22	-	5-6 oz[S]	-	-	-	-	-	-	-	12 h / 28 d	24 oz	4	xx	-	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Apply in spray volume of 200 gal/acre or less.														
Aza-Direct Generic	UN	-	-	-	-	1-3.5 pt	-	-	-	-	4 h / 0 d	-	-	-	-	x
	Remarks:	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.														
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	-	Rates vary, see label	-	-	-	-	-	4 h / 0 d	-	-	-	-	-
	Remarks:	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.														

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PEARS

CONTINUED: Late Spring and Summer Cover Sprays - *Insects & Mites (amount per acre). See footnote 2, page 31.*

Product and formulation	Resistance management group (see page 6)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Belay 2.13SC	4A	4-6 oz	12 oz[S]	6 oz	6-12 oz	6-12 oz	-	6-12 oz	-	4-6 oz	12 h / 7 d	12 oz	-	xx	-	x
	Remarks:	Highly toxic to bees. See label for specific precautions.														
Centaur 70WDG	16	-	-	34.5 oz	-	34.5 oz	-	34.5 oz	-	-	12 h / 14 d	69 oz	2	-	-	-
	Remarks:	Do not tank-mix with oil. Ground application only. For scale crawlers, apply at first crawler emergence.														
Codling moth granulosis virus (Carpovirusine, Cyd-X+ Nufilm-17, Virosoft CP4)	-	-	Rates vary, see label[S]	-	-	-	-	-	-	-	See label	-	-	-	-	-
	Remarks:	Granulosis virus applications will cause high larval mortality, but some superficial fruit damage (stings) may occur. Thorough coverage is necessary. Make first application at beginning of egg hatch and repeat at interval indicated on label to maintain control.														
Danitol 2.4EC RUP	3	-	-	-	-	-	-	-	-	16-21 oz	1 d / 14 d	2.66 pt	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.														
Delegate 25WG	5	-	6-7 oz	-	4.5-7 oz	6-7 oz	-	-	-	-	4 h / 7 d	28 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions.														
Diazinon 50WP RUP; Generic	1B	-	4 lb	4 lb	-	-	-	4 lb	-	-	4 d / 21 d	4 lb	2	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Closed cab required. One dormant and one in-season foliar application allowed. Packing house may require longer PHI.														
Entrust 2SC	5	-	6-10 oz[S]	-	6-10 oz	-	-	-	-	-	4 h / 7 d	29 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Entrust 80WP	5	-	2-3 oz[S]	-	2-3 oz	-	-	-	-	-	4 h / 7 d	9 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Envidor 2SC	23	-	-	-	-	-	16-18 oz	-	16-18 oz	-	12 h / 7 d	18 oz	1	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions.														
Esteem 35WP Generic	7C	-	4-5 oz	-	4-5 oz[S]	4-5 oz	-	4-5 oz	-	-	12 h / 45 d	10 oz	2	-	-	x
	Remarks:	For scale crawlers, apply at beginning of emergence. HMO improves performance. Will provide leafroller suppression as part of a season-long program.														

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PEARS

CONTINUED: Late Spring and Summer Cover Sprays - *Insects & Mites (amount per acre). See footnote 2, page 31.*

Product and formulation	Resistance management group (see page 6)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Exirel 0.83SE	28	-	10-17 oz	-	10-17 oz	13.5-20.5 oz	-	-	-	-	12 h / 3 d	61 oz	-	x	x	x
	Remarks:	Toxic to bees. See label for specific precautions. For codling moth make the first application prior to egg hatch. For pear psylla use with an adjuvant. Do not exceed 3 applications per generation of target pest.														
FujiMite 5EC	21A	-	-	-	-	2 pt	2 pt	-	2 pt	-	12 h / 14 d	2 pt	2	-	x	x
	Remarks:	To avoid resistance development, do not rotate with Nexter.														
Imidacloprid 2F Generic	4A	6.4 oz	-	16 oz	-	16 oz	-	-	-	-	12 h / 7 d	32 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.														
Intrepid 2F	18	-	16 oz[S]	-	16 oz	-	-	-	-	-	4 h / 14 d	64 oz	-	-	x	x
	Remarks:	See label for application timing.														
Kanemite 15SC	20B	-	-	-	-	-	-	-	21-31 oz	-	12 h / 14 d	62 oz	2	-	x	x
Nealta 1.67SC	25	-	-	-	-	-	-	-	13.7 oz	-	12 h / 7 d	27.4 oz	-	-	-	-
	Remarks:	Will not control rust mites. Do not make more than one application before using an effective miticide with a diferent mode of action.														
Neemix Generic	UN	-	-	-	-	4-16 oz	-	-	-	-	4 h / 0 d	-	-	-	-	x
	Remarks:	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.														
Nexter 75WSB	21A	-	-	-	-	-	9.9 oz	-	9.9 oz	-	12 h / 7 d	16 oz	1	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Effective against European red mite and pear rust mite. Good coverage essential. Results for McDaniel and twospotted spider mites have been inconsistent. To avoid resistance development, do not rotate with FujiMite.														
Onager 1EC	10A	-	-	-	-	-	-	-	16-24 oz	-	12 h / 28 d	-	1	-	-	x
	Remarks:	Do not use any combination of Apollo, Onager, and Savey in the same growing season.														
Proclaim 5SG RUP	6	-	-	-	3.2-4.8 oz	-	-	-	-	-	12 h / 14 d	14.4 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. May provide pear psylla suppression at this timing. See label for restricted activities. Ground application only.														

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PEARS

CONTINUED: Late Spring and Summer Cover Sprays - *Insects & Mites (amount per acre). See footnote 2, page 31.*

Product and formulation	Resistance management group (see page 6)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Savey 50DF	10A	-	-	-	-	-	-	-	4-6 oz	-	12 h / 28 d	-	1	-	-	x
	Remarks:	Do not use any combination of Apollo, Onager, and Savey in the same growing season.														
Success 2L	5	-	6-10 oz[S]	-	6-10 oz	-	-	-	-	-	4 h / 7 d	29 oz	-	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Ultor 1.25SC	23	-	-	-	-	10-14 oz	-	10-14 oz	-	-	1 d / 7 d	40 oz	-	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not apply before petal fall. Surfactant is required; see label.														
Zeal 72 WSP	10B	-	-	-	-	-	-	-	2-3 oz	-	12 h / 14 d	3 oz	1	-	-	x
	Remarks:	Primarily ovicidal/larvicidal.														

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

[S]Suppressive; use in low-pressure situations in conjunction with other codling moth control measures.

PEARS

Preharvest - *Diseases (efficacy rating* and amount per acre)*

Contact your packing house before choosing one of these materials.

Product and formulation	Resistance management group (see page 6)	Storage rots	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Merivon	7 + 11	F-G* 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 31. Do not use with EC formulations, methylated seed oil, or horticultural mineral oil.	-	-	x
Pristine	7 + 11	F-G 14.5-18.5 oz	12 h / 0 d	74 oz	4	If used earlier in season, consider using a preharvest fungicide from a different resistance management group - see page 34. Do not use with HMOs. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 31.	-	-	x
Topsin M 70WSB Generic	1	G 1 lb	2 d / 1 d	4 lb	-	The resistance risk of Topsin is high. We suggest using alternative products this year if Topsin was used last year for management of storage rots.	-	-	x
Ziram 76DF	M3	F-G 6 lb	2 d / 14 d	32 lb	-	See footnote 3, page 31.	-	-	x

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control. See page 34 for ratings of fungicides and bactericides for other pear diseases.

Note: Nutra-phos 24 applied prior to harvest as a foliar nutrient (15 lb/acre; 3.75 lb/100 gal) has shown significant incidental reductions in blue mold in Anjou pears. Nutra-phos 24 is not a pesticide; therefore, we cannot recommend its use for storage rot control.

PEARS

Postharvest: September 15-October 15 - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Pear blister mite	Pear psylla	Pear rust mite	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Horticultural mineral oil (HMO) + one of the following	-	3-4 gal	3-4 gal	3-4 gal	4 h / -	-	-	-	x	-	x
Lime sulfur (calcium polysulfide 29%) Generic	M2	10 gal	10 gal	10 gal	2 d / -	-	-	Widespread use (>80% of area) of postharvest HMO plus sulfur sprays will result in area-wide suppression of overwintering pear psylla populations. Sulfur sprays are most effective when temperatures will exceed 60°F after application.	-	-	-
Lime Sulfur Ultra (calcium polysulfide 27%) Generic	M2	2-3 gal	2-3 gal	2-3 gal	2 d / -	46 gal	-		-	-	x
Sulfur (dry flowable) (elemental sulfur 80%) Generic	M2	15-20 lb	15-20 lb	15-20 lb	1 d / -	-	-		-	-	-

Generic = other materials and other formulations with the same active ingredient are available.

FOOTNOTES (Spray tips and cautions)

1. Lime sulfur may be used for scab and mildew control on Bosc and Bartlett pears if a lime sulfur and oil dormant spray was applied and if temperatures remain below 90°F. Do not use lime sulfur on Anjou and Comice pears between the dormant and postharvest sprays.
   It should be recognized that although lime sulfur and other sulfur materials are relatively low in cost, they are not without limitations. The use of sulfurs may result in phytotoxicity when temperatures exceed 90°F following application.
2. ***Use caution when mixing wettable powders with emulsifiable materials. Certain combinations may not be physically compatible and/or may cause phytotoxicity.***
3. Ziram may cause irritation of eyes, nose, throat, and skin.
4. Do not combine the 6-lb prebloom or 3-lb all-season mancozeb schedule. See labels for details. There are several manufacturers of mancozeb with different trade names and formulations.
5. Delayed dormant applications may help manage fungicide resistant scab isolates. Do not use copper-based products on Anjou, Comice, or Forelle pears past delayed dormant. Fixed copper products include trade names such as Badge, Champ, C-O-C-S, Copper-Count-N, Cuprofix, Kocide, Nordox, and Nu-Cop.
6. Do not exceed 4 total applications per season of any class 11 fungicide or any combination of these fungicides, such as Luna Sensation, Flint, Merivon, or Pristine.

Relative efficacy guide for pesticides used on pear—prebloom

This table is intended as a guideline to the relative efficacy of pesticides against a certain pest. Use it in conjunction with the Pest Control Program for Pears, which gives recommended rates and timing of sprays. The information in this table is based on research conducted at the WSU Wenatchee Tree Fruit Research and Extension Center and at the OSU Mid-Columbia Agricultural Research and Extension Center and local experience. Susceptibility may vary from one area to another.

			Pests												
Common name	**Trade name**	**Rate/acre**	**PP**	**CM**	**GMB**	**SJS**	**GAA**	**ERM**	**PRM**	**TSM**	**THR**	**LEP**	**SB**	**LB**	**LR**
Insect growth regulators															
methoxyfenozide	Intrepid 2F	8-16 oz	–	–	–	–	–	–	–	–	–	x	–	–	3-4
novaluron	Rimon 0.83EC	32-50 oz	3	–	–	–	–	–	1-2	–	–	–	–	–	–
pyriproxyfen	Esteem 35WP	4-5 oz	3	–	–	3-4	–	–	–	–	–	–	–	–	3
Nicotinoids															
acetamiprid	Assail 70WP	1-3.4 oz	2-3	–	3-4	–	–	–	–	–	–	–	x	x	–
clothianidin	Belay 2.13EC	6-12 oz	2-3	–	x	x	3-4	–	–	–	–	–	x	x	–
thiamethoxam	Actara 25WDG	4.5 oz	2-3	–	x	–	3-4	–	–	–	–	–	x	x	–
Organophosphates															
chlorpyrifos	Lorsban 4E	4 pt	–	–	3-4	x	x	–	–	–	–	4	x	x	3-4
oil + chlorpyrifos	oil + Lorsban 4E	6 gal + 2 qt	2-3	–	3	4	3	3-4	x	–	–	2	2-3	2-3	3-4
oil + diazinon	oil + diazinon 50WP	6 gal + 4 lb	2-3	–	3	4	3	3	2	–	–	2	2-3	2-3	x
Pyrethroids															
esfenvalerate	Asana 0.66EC	1 pt	1-4 *a*	–	–	–	–	–	–	–	x	x	4	4	x
fenpropathrin	Danitol 2.4EC	16-21.3 oz	1-4 *a*	–	–	–	–	–	–	–	x	x	4	4	x
lambdacyhalothrin	Warrior IIEC	1.28-2.56 oz	1-4 *a*	–	–	–	–	–	–	–	–	4	4	4	x
Pyridazinones															
pyridaben	Nexter 75WSB	7 oz	2-3	–	1-2	–	–	4	3	2-4	x	–	x	x	–
Others															
azadirachtin	Aza-Direct 1.2%L	32 oz	2-3	–	1	–	–	–	–	–	–	–	–	–	–
Bacillus thuringiensis	Deliver, Dipel, Javelin	1-2 lb	–	–	–	–	–	–	–	–	–	–	–	–	3-4
HMO (horticultural mineral oil)		4-6 gal	2-3	–	–	3	–	3-4	2	–	–	–	–	–	x
kaolin	Surround	50 lb	3	–	x	–	1-2	1-2	1-2	–	x	x	–	–	3
spinosad	Success 2L	6-10 oz	–	–	–	–	x	–	x	–	3-4	x	–	–	4
spirodiclofen	Envidor 2SC	16-18 oz	–	–	–	–	–	4	4	4	–	–	–	–	–

Rating system: 4 = excellent control; 3 = acceptable in low-pressure situations; 2 = suppression activity only; 1 = poor control; – = inappropriate for this pest or at this time; x = no data available.

[a]Resistance is present in many areas.

PP = Pear psylla; CM = Codling moth; GMB = Grape mealybug; SJS = San Jose scale; GAA = Green apple aphid; ERM = European red mite; PRM = Pear rust mite; TSM = Twospotted spider mite and McDaniel spider mite; THR = Thrips; LEP = Cutworm, Armyworm, and Fall webworm; SB = Stink bug; LB = Lygus bug; LR = Leafroller.

Relative efficacy guide for pesticides used on pear—postbloom

Use this table in conjunction with the Pest Control Program for Pears. Table is based on research at the WSU Wenatchee Tree Fruit Research and Extension Center and the OSU Mid-Columbia Agricultural Research and Extension Center and local experience. Susceptibility may vary from one area to another.

Common name	Trade name	Rate/acre	Pests												
			PP	CM	GMB	SJS	GAA	ERM	PRM	TSM	THR	LEP	SB	LB	LR
Carboxamides															
hexythiazox	Savey 50DF	3-6 oz	–	–	–	–	–	2-4 [a]	1	2-4	–	–	–	–	–
	Onager 1 EC	16-24 oz	–	–	–	–	–	2-4 [a]	1	2-4	–	–	–	–	–
Carboxylic acid esters															
bifenazate	Acramite 50WS	0.75-1 lb	–	–	–	–	–	3-4	–	4	–	–	–	x	x
Glycosides															
abamectin	Agri-Mek 0.15EC	16-20 oz	2-3	–	–	–	–	2	4	2	–	–	–	–	–
Insect growth regulators															
buprofezin	Centaur 70WDG	34.5 oz	3	–	3-4	3-4	–	–	–	–	–	–	–	–	–
methoxyfenozide	Intrepid 2F	16 oz	–	2	–	–	–	–	–	–	–	–	–	x	3-4
pyriproxyfen	Esteem 35WP	4-5 oz	2	3	1	3-4	–	–	–	–	–	–	–	–	3
Microbials															
Bacillus thuringiensis	Deliver, Dipel, Javelin	varies	–	–	–	–	–	–	–	–	–	x	–	–	3-4
codling moth granulosis virus	Carpovirusine	13.5 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–
	Cyd-X	3 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–
	Virosoft	8 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–
Nicotinoids															
acetamiprid	Assail 70WP	1-3.4 oz	2-3	3-4	3	–	3-4	–	–	–	–	–	x	x	2
clothianidin	Belay 2.13EC	3-6 oz	2-3	1	3-4	x	4	–	–	–	–	–	x	x	x
imidacloprid	Provado 1.6F	15-20 oz	2-3	–	3-4	x	3-4	–	–	–	–	–	–	–	–
	Couraze 1.6F	15-20 oz	2-3	–	3-4	x	3-4	–	–	–	–	–	–	–	–
thiacloprid	Calypso 4F	2-8 oz	2-3	3-4	3-4	x	3-4	–	–	–	–	–	–	–	2
thiamethoxam	Actara 25WDG	4.5 oz	2-3	–	3-4	x	3-4	–	–	–	–	–	x	x	–
Oxadiazines															
indoxacarb	Avaunt 30DG	5-6 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–
Pyrethroids															
deltamethrin	Delta Gold 1.5 EC	0.9-1.9 oz	–	3-4	x	x	x	–	–	–	x	4	4	4	x
fenpropathrin	Danitol 2.4EC	20 oz	–	3-4	x	x	x	x	x	x	x	x	4	4	x
lambdacyhalothrin	Warrior II EC	1.28-2.56 oz	–	3-4	x	x	x	–	–	–	x	4	4	4	x
Pyridazinones															
fenpyroximate	FujiMite 5EC	32 oz	2-3	–	x	–	–	4	3-4	4	–	–	–	–	–
pyridaben	Nexter 75WSB	4.4-16 oz	2-3	–	x	–	–	4	3	2-3	–	–	–	–	–
Quinoline															
acequinocyl	Kanemite 15SC	21-31 oz	–	–	–	–	–	4	x	4	–	–	–	–	–
Tetrazines															
clofentezine	Apollo 50SC	4-8 oz	–	–	–	–	–	2-4	1	2-4	–	–	–	–	–
Others															
azadirachtin	Aza-Direct 1.2%L	32 oz	3	1	1	–	–	–	–	–	–	–	–	–	–
cyantraniliprole	Exirel	10-20.5 oz	3	4	–	–	–	–	–	–	–	–	–	–	4
cyflumetofen	Nealta	13.7 oz	–	–	–	–	–	–	–	3-4	–	–	–	–	–
etoxazole	Zeal 72WSP	2-3 oz	–	–	–	–	–	3-4	–	3-4	–	–	–	–	–
kaolin	Surround WP	50 lb	3-4	2-3	x	x	x	1-2	1-2	1-2	–	–	x	x	x
rynaxypyr	Altacor 35WDG	3-4.5 oz	–	4	–	–	–	–	–	–	–	–	–	–	4
spinetoram	Delegate 25WG	4.5-7 oz	3	4	–	–	–	–	–	–	–	–	–	–	4
spinosad	Entrust 80WP	2-3 oz	1	2-3	–	–	–	–	–	–	3-4	–	–	–	4
	Success 2L	6-10 oz	–	2-3	–	–	–	–	–	–	3-4	–	–	–	4
spirodiclofen	Envidor 2SC	16-18 oz	x	x	x	x	x	3-4	3-4	3-4	x	x	x	x	x
spirotetramat	Ultor 1.25SC	10-14 oz	2-3	–	–	–	–	–	–	–	–	–	–	–	–

Rating system: 4 = excellent control; 3 = acceptable in low-pressure situations; 2 = suppression only; 1 = poor control; – = inappropriate for this pest or at this time; x = no data available.

[a]Recommended for prebloom use.

PP = Pear psylla; CM = Codling moth; GMB = Grape mealybug; SJS = San Jose scale; GAA = Green apple aphid; ERM = European red mite; PRM = Pear rust mite; TSM = Twospotted spider mite and McDaniel spider mite; THR = Thrips; LEP = Cutworm, Armyworm, and Fall webworm; SB = Stink bug; LB = Lygus bug; LR = Leafroller.

Effectiveness of fungicides and bactericides for control of pear diseases*

Jay W. Pscheidt, Bob Spotts, David Sugar, and Ken Johnson, Oregon State University

Fungicide or bactericide	Fungicide group	Pear scab	Powdery mildew	Bull's eye rot	Storage rots	Fire blight
Actigard	21	None	None	None	None	Suppression
Aprovia	7	Good**	Good**	None	None	None
BlightBan	Not classified	??	??	??	??	Poor-fair
Bloomtime Biological	Not classified	None	None	None	None	Poor-good
copper-based products	M1	??	??(Fair)	Poor	??	Fair
Flint	11	Excellent**	Excellent**	Fair	??	None
Focus	3	Good**	Excellent**	??	??	None
Fontelis	7	Good**	Good**	??	??	None
horticultural mineral oils	Not classified	??	Good	??	??	None
Inspire Super	3 + 9	Good**	Good**	??	??	None
Kasumin	24	None	None	None	None	Good**
lime sulfur	M2	Good	Fair	??	??	None
Luna Sensation	7 + 11	Good-excellent	Excellent	??	Possible	None
mancozeb products	M3	Good	None	Poor	??	None
Merivon	7 + 11	Excellent**	Excellent	??	Fair-good	None
oxytetracycline	41	None	None	None	None	Fair-good**
Pristine	7 + 11	Good-excellent**	Excellent	Good	Fair-good	None
Procure	3	Good**	Excellent**	??	??	None
Scala	9	Fair-good	None	??	??	None
Serenade Opti	44	??	Fair	??	??	Fair-good
streptomycin	25	None	None	None	None	Poor-excellent**
sulfur	M2	Fair	Good	??	??	None
Syllit	U12	Excellent**	None	??	??	None
Topguard	3	Good**	Good-excellent**	??	??	None
Topsin M	1	Good**	Good**	Excellent	Good	None
Ziram	M3	Fair	None	Fair	Fair-good	None

*These ratings are relative rankings based on full application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions. Possible ratings for disease control include none, poor, fair, good, or excellent. ?? = no information available.

**Resistant pathogens will lower the effectiveness of this fungicide.

Follow the "Rules" for fungicide stewardship:

Rotate or mix fungicides of different chemical groups.
Use labeled rates.
Limit total number of applications.
Educate yourself about fungicide activity, mode of action, and class—as well as resistance management practices.
Start a fungicide program with multisite mode of action materials.

2017 Mid-Columbia pest control program for apples

Application rates in the tables are based on the amount of product to apply per acre. For some products, the label requires minimum and/or maximum recommendations for spray volume (the amount of water to use per acre when spraying). Good coverage depends on many factors, including the type of application equipment, spray volume, tree phenology, tree height, row width, target pest, tractor speed, and chemical rate per acre used. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

APPLES

Delayed Dormant (Stages 1 and 2: Apply before bud scales drop to minimize injury.) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	European red mite eggs	Leafrollers#	Scale insects	Restricted-entry interval (REI) / Preharvest interval (PHI)	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Apollo 4SC	10A	-	4-8 oz	-	-	12 h / 45 d	-	1	Ground application only. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	x	x
Centaur 70WDG	16	-	-	-	34.5 oz	12 h / 14 d	34.5 oz	1	Do not tank-mix with oil. Ground application only.	-	-	-
Horticultural mineral oil (HMO) Generic	-	4-8 gal	4-8 gal	-	4-8 gal	4 h / -	-	-		x	-	x
HMO + one of the following	-	4-8 gal	4-8 gal	4-8 gal	4-8 gal	4 h / -	-	-	-	x	-	x
Diazinon 50WP RUP; Generic	1B	3-4 lb	3-4 lb	3-4 lb	3-4 lb	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required; see label for permitted exceptions. Two applications allowed—one dormant and one postbloom or two postbloom.	xx	x	x
Esteem 35WP Generic	7C	-	-	4-5 oz	4-5 oz	12 h / 45 d	10 oz	2	Will provide leafroller suppression as part of a season-long program. Use with 4-6 gal/acre HMO.	-	-	x
Lime sulfur (calcium polysulfide 29%) Generic	M2	5-10 gal	5-10 gal	-	5-10 gal	2 d / -	-	-	-	-	-	-
Lime Sulfur Ultra (calcium polysulfide 27%) Generic	M2	2-3 gal	2-3 gal	-	2-3 gal	2 d / -	46 gal	-	-	-	-	x
Lorsban 4E (chlorpyrifos) RUP; Generic	1B	2 qt	2 qt	2 qt	2 qt	4 d / prebloom	2 qt	1	Highly toxic to bees. See label for specific precautions. Apply at stage 2 for leafroller control.	xx	x	x

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APPLES

CONTINUED: Delayed Dormant (Stages 1 and 2: Apply before bud scales drop to minimize injury.) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	European red mite eggs	Leafrollers#	Scale insects	Restricted-entry interval (REI) / Preharvest interval (PHI)	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Onager 1EC	10A	-	12-24 oz	-	-	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Savey 50DF	10A	-	3-6 oz	-	-	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

APPLES

Delayed Dormant (Stages 1 and 2: Apply before bud scales drop to minimize injury.) - *Diseases (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Crown rot and collar rot (rare)	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Ridomil Gold SL	4	Rate based on tree size, see label.	2 d / -	-	-	Needs rain or irrigation to move material into root zone. Labeled as a soil drench.	-	-	-

See also postharvest controls on page 55.

APPLES

Prepink (Stages 3 and 4) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Green fruit worm	Leafrollers#**	Rosy apple aphids	Sucking bugs	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Altacor 35WDG	28	2.5-4.5 oz	2.5-4.5 oz	-	-	4 h / 5 d	9 oz	4	Use higher rates for leafrollers. Use 100 to 200 gal/acre water.	-	-	x
Delegate 25WG	5	4.5-7 oz	4.5-7 oz	-	-	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions. Adjuvant may improve control.	x	-	x
Diazinon 50WP RUP; Generic	1B	4 lb	4 lb	4 lb	4 lb	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required; see label for permitted exceptions. Two applications allowed: 1 dormant and 1 postbloom or 2 postbloom.	xx	x	x
Entrust 2SC	5	6-10 oz	6-10 oz	-	-	4 h / 7 d	29 oz	4	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Entrust 80WP	5	2-3 oz	2-3 oz	-	-	4 h / 7 d	9 oz	4	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Lorsban 50W RUP; Generic	1B	3 lb	3 lb	3 lb	3 lb	4 d / prebloom	-	8	Highly toxic to bees. See label for specific precautions. Do not apply after bloom. May be detrimental to predatory mites at this timing.	xx	x	x
Proclaim 5SG RUP	6	3.2-4.8 oz	3.2-4.8 oz	-	-	12 h / 14 d	14.4 oz	-	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only.	xx	x	x
Success 2L	5	6-10 oz	6-10 oz	-	-	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

**Petal fall timing gives best leafroller control for bloom-time spray application.

APPLES

Prepink (Stages 3 and 4) - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 1, page 55	Scab, see footnote 1, page 55	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	G-E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	F-G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Indar 2F	3	E** 6-8 oz	G** 6-8 oz	12 h / 14 d	32 oz	4	Addition of a wetting agent is helpful.	-	x	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Do not apply more than 2 sequential applications.	-	x	x
Kaligreen Generic	-	S-F 2-3 lb	-	4 h / 1 d	-	-	Do not mix with acidifying agents.	-	-	-
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Mancozeb 75DF Generic	M3	-	E 3 or 6 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates.	-	-	x
Merivon 2.09SC	7 + 11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55. Do not use with EC formulated products.	-	-	x
Omega 500F	29	-	G 10-13.8 oz	2 d / 28 d	8.6 pts	10	-	-	x	x
Pristine	7 +11	E 14.5-18.5 oz	G-E 14.5-18.5 oz	12 h / 0 d	74 oz	4	Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rally 40WSP	3	F-G** 5-10 oz	G** 5-10 oz	1 d / 14 d	5 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 9, page 55.	-	-	-

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APPLES

CONTINUED: Prepink (Stages 3 and 4) - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 1, page 55	Scab, see footnote 1, page 55	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Syllit FL	U12	-	G** 1.5 pt	2 d / 7 d	-	2	Tank-mix with another fungicide from a different resistance management group. See footnote 2, page 55.	-	-	x
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Ziram 76DF	M3	-	F 6 lb	2 d / 14 d	32 lb	-	See footnote 5, page 55.	-	-	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, S = slight control. See page 58 for ratings of fungicides for other apple diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

APPLES

Pink (Stages 5 and 6) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Leafrollers#	Rust mite	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Altacor 35WDG	28	-	3-4.5 oz	-	-	-	4 h / 5 d	9 oz	4	Use 100 to 200 gal/acre water.	-	-	x
Apollo 4SC	10A	-	-	-	-	4-8 oz	12 h / 45 d	-	1	Ground application only. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	x	x
Assail 70WP	4A	1.1-1.7 oz	-	-	-	-	12 h / 7 d	13.5 oz	4	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	Rates vary, see label	-	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.	-	-	-
Centaur 70WDG	16	-	-	-	34.5 oz	-	12 h / 14 d	34.5 oz	1	Do not tank-mix with oil. Ground application only.	-	-	-
Delegate 25WG	5	-	4.5-7 oz	-	-	-	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	-	6-10 oz	-	-	-	4 h / 7 d	29 oz	4	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x
Entrust 80WP	5	-	2-3 oz	-	-	-	4 h / 7 d	9 oz	4	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x
Envidor 2SC	23	-	-	16-18 oz	-	16-18 oz	12 h / 7 d	18 oz	1	Toxic to bees. See label for specific precautions.	x	-	x
Esteem 35WP Generic	7C	-	4-5 oz	-	4-5 oz	-	12 h / 45 d	10 oz	2	Will provide leafroller suppression as part of a season-long program.	-	-	x
FujiMite 5EC	21A	-	-	2 pt	-	2 pt	12 h / 14 d	2 pt	2	To avoid resistance development, do not rotate with Nexter.	-	x	x
Intrepid 2F	18	-	16 oz	-	-	-	4 h / 14 d	64 oz	-	Make 1-2 applications against overwintering generation larvae, depending on pest pressure.	-	x	x
Kanemite 15SC	20B	-	-	-	-	21-31 oz	12 h / 14 d	62 oz	2	-	-	x	x
Onager 1EC	10A	-	-	-	-	16-24 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x

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APPLES

CONTINUED: Pink (Stages 5 and 6) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Leafrollers#	Rust mite	San Jose scale	Spider mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Proclaim 5SG RUP	6	-	3.2-4.8 oz	-	-	-	12 h / 14 d	14.4 oz	-	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only.	xx	x	x
Savey 50DF	10A	-	-	-	-	3-6 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Success 2L	5	-	6-10 oz	-	-	-	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x
Zeal 72 WSP	10B	-	-	-	-	2-3 oz	12 h / 14 d	3 oz	1	Primarily ovicidal/larvicidal.	-	-	x

RUP = restricted use pesticide.
Generic = other materials with the same active ingredient are available.
#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

APPLES

Pink (Stages 5 and 6) – *Codling moth mating disruption (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Codling moth	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Checkmate CM-XL 1000	-	120-200 ties	0 d / -	-	-	Other products are available, but experience is limited with those products. If pest pressure is high, combine with one or more insecticide applications against the first generation. Treat with insecticides against the second generation if pressure remains high. If lower application rates are used, supplemental treatment with insecticides may be necessary.	-	-	-
Checkmate Puffer CM-O	-	1-2 puffers	0 d / -	-	-		-	-	-
Isomate C Plus	-	400 ties	0 d / -	-	-		-	-	-
Isomate CM Flex	-	400 ties	0 d / -	-	-		-	-	-
Isomate CM Mist	-	1-2 puffers	0 d / -	-	-		-	-	-
Isomate CTT	-	200 ties	0 d / -	-	-		-	-	-
Nomate CM	-	300-400 ties	0 d / -	-	-		-	-	-

APPLES

Pink (Stages 5 and 6) - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 1, page 55	Scab, see footnote 1, page 55	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	G-E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	F-G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Indar 2F	3	E** 6-8 oz	G** 6-8 oz	12 h / 14 d	32 oz	4	Addition of a wetting agent is helpful.	-	x	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Do not apply more than 2 sequential applications.	-	x	x
Kaligreen Generic	-	S-F 2-3 lb	-	4 h / 1 d	-	-	Do not mix with acidifying agents.	-	-	-
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Mancozeb 75DF Generic	M3	-	E 3 or 6 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 6, page 55.	-	-	x
Merivon 2.09SC	7 + 11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55. Do not use with EC formulated products.	-	-	x
Omega 500F	29	-	G 10-13.8 oz	2 d / 28 d	8.6 pts	10	-	-	x	x
Pristine	7 +11	E 14.5-18.5 oz	G-E 14.5-18.5 oz	12 h / 0 d	74 oz	4	Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rally 40WSP	3	F-G** 5-10 oz	G** 5-10 oz	1 d / 14 d	5 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 9, page 55.	-	-	-
Syllit FL	U12	-	G** 1.5 pt	2 d / 7 d	-	2	Tank-mix with another fungicide from a different resistance management group. See footnote 2, page 55.	-	-	x
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Ziram 76DF	M3	-	F 6 lb	2 d / 14 d	32 lb	-	See footnote 5, page 55.	-	-	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, S = slight control. See page 58 for ratings of fungicides for other apple diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

APPLES

Early through full bloom - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Leafrollers#	Thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Delegate 25WG	5	4.5-7 oz	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	6-10 oz	6-10 oz	4 h / 7 d	29 oz	4	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x
Entrust 80WP	5	2-3 oz	2-3 oz	4 h / 7 d	9 oz	4	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x
Success 2L	5	6-10 oz	6-10 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	x

RUP = restricted use pesticide.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

APPLES

Bloom - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Fire blight##	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actigard 50WG	21	see label	12 h / 60 d	12.8 oz	-	For foliar application, tank mix with antibiotic. Can also be used to treat cut surfaces when cutting blight infections. See label for treatment schedules and corresponding use rates.	-	-	x
Agrimycin 17 (streptomycin) Generic	25	P-E** / 28.8 oz	12 h / 50 d	-	-	Extensive resistance to streptomycin has been found throughout the Mid-Columbia area. Tank-mix with full rate of oxytetracyclene and make only one application per season. Do not exceed 1 lb/100 gal of water. 2-year shelf life.	-	-	-
BlightBan A506	biological	P-G / 5-7 oz	4 h / -	-	-	Use the 5-oz rate in 50-150 gal/acre and the 7-oz rate in 200-300 gal/acre. Use at 20% bloom and again at 50% bloom. Works best at the beginning of an infection period. Do not use with terramycin or copper-based products. Allow at least 5 days between applications of this product and terramycin. Must be integrated with other fire blight control tactics. The addition of chelated iron as Sequestrene 138 at 1 lb/100 gal water in a tank mix with BlightBan improves disease control over BlightBan alone. This is a safe and legal use; however, it would remove the registrant from any legal/financial responsibility. *Do not use straight iron sulfate in the tank mix, as that use will burn flowers and russet fruit.*	-	-	-
Bloomtime Biological FD	biological	P-G / 0.33-0.44 lb	4 h / -	-	-	Use at 15 to 20% bloom and again at full bloom to petal fall. Do not apply after fruit set. Do not use with terramycin or copper-based products. Allow at least 7 days between applications of this product and terramycin. The unformulated active ingredient works well. This product alone will not control fire blight and must be integrated into a regular antibiotic schedule.	-	-	-
Blossom Protect	biological	1.25 lb	4 h / -	-	-	The addition of Buffer Protect at 8.75 lb/acre may improve disease control. Use at 15 to 20% bloom and again at full bloom to petal fall. May enhance russeting on some cultivars when applied late bloom. Use in conjunction with other control tactics such as thorough sanitation and antibiotics.	-	x	-
Kasumin 2L	24	G / 64 oz	12 h / 90 d	256 oz	4	Do not apply more than 2 sequential applications. Do not use alternate tree-row application method. Do not apply after petal fall. Do not apply to orchards fertilized with manure.	-	-	-
Mycoshield (terramycin) Generic	41	F-G / 8 or 16 oz	12 h / 60 d	5 lb	5	Apply at the rate of 8 oz in 50 gal or 16 oz in 100 gal of water. Do not use higher gallonages because the effectiveness of terramycin is reduced.	-	-	-
Serenade Opti	44	F-G / 20 oz	4 h / 0 d	-	-	Use like an antibiotic, late in bloom period rather than like a biological early in bloom.	-	-	-

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, P = poor control.

**Resistant pathogens will lower the effectiveness of these bactericides.

For best results, use predictive model (CougarBlight) to time applications. See page 9.

APPLES

Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Leafrollers#**	San Jose scale	Tentiform leafminer#	Thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Altacor 35WDG	28	2.5-4.5 oz	-	2.5-4.5 oz	-	4 h / 5 d	9 oz	4	Use higher rates for leafrollers. Use 100 to 200 gal/acre water.	-	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	Rates vary; see label	-	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.	-	-	-
Delegate 25WG	5	4.5-7 oz	-	4.5-7 oz	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	6-10 oz	-	6-10 oz	6-10 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Entrust 80WP	5	2-3 oz	-	2-3 oz	2-3 oz	4 h / 7 d	9 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Esteem 35WP Generic	7C	4-5 oz	4-5 oz	4-5 oz	-	12 h / 45 d	10 oz	2	Will provide leafroller suppression as part of a season-long program.	-	-	x
Exirel 0.83SE	28	10-17 oz		10-17 oz	20.5 oz	12 h / 3 d	61 oz	-	Toxic to bees. See label for specific precautions. For thrips, provides suppression only, use with an adjuvant. Do not exceed 3 applications per generation of target pest.	x	x	x
Intrepid 2F	18	16 oz	-	-	-	4 h / 14 d	64 oz	-	Make 1-2 applications against overwintering generation larvae, depending on pest pressure.	-	x	x
Proclaim 5SG RUP	6	3.2-4.8 oz	-	3.2-4.8 oz	-	12 h / 14 d	14.4 oz	-	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only.	xx	x	x
Success 2L	5	6-10 oz	-	4-10 oz	6-10 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x

RUP = restricted use pesticide.
Generic = other materials with the same active ingredient are available.
#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.
**Petal fall timing gives best control for bloom-time spray application.

APPLES

Petal Fall - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 1, page 55	Scab, see footnote 1, page 55	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	G-E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	F-G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Indar 2F	3	E** 6-8 oz	G** 6-8 oz	12 h / 14 d	32 oz	4	Addition of a wetting agent is helpful.	-	x	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Do not apply more than 2 sequential applications.	-	x	x
Kaligreen Generic	-	S-F 2-3 lb	-	4 h / 1 d	-	-	Do not mix with acidifying agents.	-	-	-
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Mancozeb 75DF Generic	M3	-	E 3 or 6 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 6, page 55.	-	-	x
Merivon 2.09SC	7 + 11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55. Do not use with EC formulated products.	-	-	x
Omega 500F	29	-	G 10-13.8 oz	2 d / 28 d	8.6 pts	10	-	-	x	x
Pristine	7 +11	E 14.5-18.5 oz	G-E 14.5-18.5 oz	12 h / 0 d	74 oz	4	Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rally 40WSP	3	F-G** 5-10 oz	G** 5-10 oz	1 d / 14 d	5 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 9, page 55.	-	-	-
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Ziram 76DF	M3	-	F 6 lb	2 d / 14 d	32 lb	-	See footnote 5, page 55.	-	-	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, S = slight control. See page 58 for ratings of fungicides for other apple diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

APPLES

Ten Days to Two Weeks After Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	San Jose scale	Tentiform leafminer[#]	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Agri-Mek 0.15EC RUP, Generic	6	-	10-20 oz	12 h / 28 d	40 oz	2	Highly toxic to bees. See label for specific precautions. Do Apply from petal fall until 6 weeks after petal fall in combination with oil at 0.25% of spray volume. Higher rates of oil volume used in combination with Agri-Mek may mark the fruit.	xx	x	x
Altacor 35WDG	28	-	2.5-4 oz	4 h / 5 d	9 oz	4	Use 100 to 200 gal/acre water.	-	-	x
Assail 70WP	4A	-	1.1 oz	12 h / 7 d	13.5 oz	4	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Belay 2.13SC	4A	-	6 oz	12 h / 7 d	12 oz	-	Highly toxic to bees. See label for specific precautions.	xx	-	x
Delegate 25WG	5	-	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	-	4-10 oz	4 h / 7 d	29 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 80WP	5	-	1.5-3 oz	4 h / 7 d	9 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Esteem 35WP Generic	7C	4-5 oz	4-5 oz	12 h / 45 d	10 oz	2	Will provide leafroller suppression as part of a season-long program.	-	-	x
Exirel 0.83SE	28	-	10-17 oz	12 h / 3 d	61 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per generation of target pest.	x	x	x
Proclaim 5SG RUP	6	-	3.2-4.8 oz	12 h / 14 d	14.4 oz	-	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only.	xx	x	x
Success 2L	5	-	4-10 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.	x	-	x
Ultor 1.25SC	23	10-14 oz	-	1 d / 7 d	40 oz	-	Highly toxic to bees. See label for specific precautions. Do not apply before petal fall. Surfactant is required; see label.	xx	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

[#]This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

APPLES

Ten Days to Two Weeks After Petal Fall - *Diseases (efficacy rating* and amount per acre)*

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 1, page 55	Scab, see footnote 1, page 55	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Aprovia	7	G** 5.5-7 oz	G** 5.5-7 oz	12 h / 30 d	27.6 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Flint 50WG	11	G-E** 2-2.5 oz	E** 2-2.5 oz	12 h / 14 d	11 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Fontelis 1.67SC	7	G** 16-20 oz	F-G** 16-20 oz	12 h / 28 d	61 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.	-	-	x
Indar 2F	3	E** 6-8 oz	G** 6-8 oz	12 h / 14 d	32 oz	4	Addition of a wetting agent is helpful.	-	x	x
Inspire Super	3 + 9	E 12 oz	G 12 oz	12 h / 14 d	60 oz	5	Do not apply more than 2 sequential applications.	-	x	x
Kaligreen Generic	-	S-F 2-3 lb	-	4 h / 1 d	-	-	Do not mix with acidifying agents.	-	-	-
Luna Sensation	7 + 11	E 5-5.8 oz	E** 4-5.8 oz	12 h / 14 d	21 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Mancozeb 75DF Generic	M3	-	E 3 or 6 lb	1 d / 77 d	21 or 24 lb	-	See label for treatment schedules and corresponding use rates. See footnote 6, page 55.	-	-	x
Merivon 2.09SC	7 + 11	E 4-5.5 oz	E** 4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55. Do not use with EC formulated products.	-	-	x
Omega 500F	29	-	G 10-13.8 oz	2 d / 28 d	8.6 pts	10	-	-	x	x
Pristine	7 +11	E 14.5-18.5 oz	G-E 14.5-18.5 oz	12 h / 0 d	74 oz	4	Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 55.	-	-	x
Procure 480SC	3	E** 8-16 oz	G** 8-16 oz	12 h / 14 d	64 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rally 40WSP	3	F-G** 5-10 oz	G** 5-10 oz	1 d / 14 d	5 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 9, page 55.	-	-	-
Topguard	3	G** 8-12 oz	E** 8-12 oz	12 h / 14 d	52 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Ziram 76DF	M3	-	F 6 lb	2 d / 14 d	32 lb	-	See footnote 5, page 55.	-	-	x

Generic = other materials with the same active ingredient are available.

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, S = slight control. See page 58 for ratings of fungicides for other apple diseases.

**Resistant pathogens will lower the effectiveness of these fungicides.

APPLES

Late Spring and Summer Cover Sprays - *Insects (amount per acre). See footnotes 3 and 4, page 55.*

Product and formulation	Resistance management group (see page 6)	Aphids	Apple maggot	Codling moth	Leafhoppers	Leafrollers#	San Jose scale crawlers	Tarnished plant bug	Tentiform leafminer#	Wooly apple aphid	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actara 25WDG	4A	2-2.75 oz	-	-	2-2.75 oz	-	-	-	4.5-5.5 oz	-	12 h / 14 or 35 d	16.5 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Increase PHI to 35 days if application is over 2.75 oz.														
Altacor 35WDG	28	-	-	3-4.5 oz	-	3-4.5 oz	-	-	2.5-4 oz	-	4 h / 5 d	9 oz	4	-	-	x
	Remarks:	Use 100 to 200 gal/acre water.														
Assail 70WP	4A	1.1-1.7 oz	3.4 oz	3.4 oz	1.1-1.7 oz	-	-	-	1.1-1.7 oz	-	12 h / 7 d	13.5 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.														
Avaunt 30DG	22	-	-	5-6 oz[S]	5-6 oz	-	-	5-6 oz	-	-	12 h / 14 d	24 oz	4	xx	-	x
	Remarks:	Highly toxic to bees. See label for specific precautions. Apply in spray volume of 200 gal/acre or less.														
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	-	-	Rates vary, see label	-	-	-	-	4 h / 0 d	-	-	-	-	-
	Remarks:	Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.														
Belay 2.13SC	4A	4-6 oz	6 oz	6-12 oz[S]	4-6 oz	-	-	4-6 oz	6 oz	-	12 h / 7 d	12 oz	-	xx	-	x
	Remarks:	Highly toxic to bees. See label for specific precautions.														
Centaur 70WDG	16	-	-	-	34.5 oz	-	34.5 oz	-	-	-	12 h / 14 d	34.5 oz	1	-	-	-
	Remarks:	Do not tank-mix with oil. Ground application only. For scale crawlers, apply at first crawler emergence.														
Codling moth granulosis virus (Carpovirusine, Cyd-X+ Nufilm-17, Virosoft CP4)	-	-	-	Rates vary, see label[S]	-	-	-	-	-	-	See label	-	-	-	-	-
	Remarks:	Granulosis virus applications will cause high larval mortality, but some superficial fruit damage (stings) may occur. Thorough coverage is necessary. Make first application at beginning of egg hatch and repeat at interval indicated on label to maintain control.														
Delegate 25WG	5	-	6-7 oz	6-7 oz	-	4.5-7 oz	-	-	4.5-7 oz	-	4 h / 7 d	28 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions.														
Diazinon 50WP RUP; Generic	1B	-	-	-	-	-	-	-	-	4 lb	4 d / 21 d	-	2	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions. May also control scale crawlers. Closed cab required; see label for permitted exceptions. Two applications allowed—1 dormant and 1 postbloom or 2 postbloom. Packing house may require longer PHI.														

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APPLES

CONTINUED: Late Spring and Summer Cover Sprays – *Insects (amount per acre). See footnotes 3 and 4, page 55.*

Product and formulation	Resistance management group (see page 6)	Aphids	Apple maggot	Codling moth	Leafhoppers	Leafrollers#	San Jose scale crawlers	Tarnished plant bug	Tentiform leafminer#	Wooly apple aphid	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Entrust 2SC	5	-	-	6-10 oz[S]	-	6-10 oz	-	-	4-10 oz	-	4 h / 7 d	29 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Entrust 80WP	5	-	-	2-3 oz[S]	-	2-3 oz	-	-	1.5-3 oz	-	4 h / 7 d	9 oz	4	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Esteem 35WP Generic	7C	-	-	4-5 oz[S]	-	-	4-5 oz	-	4-5 oz	-	12 h / 45 d	10 oz	2	-	-	x
	Remarks:	For codling moth, the addition of 1% oil has been shown to increase activity. See label for application timing. For scale crawlers, apply at beginning of emergence. Oil improves performance. Will provide leafroller suppression as part of a season-long program.														
Exirel 0.83SE	28	-	-	10-17 oz	10-17 oz	10-17 oz	-	-	10-17 oz	-	12 h / 3 d	61 oz	-	x	x	x
	Remarks:	Toxic to bees. See label for specific precautions. For codling moth, make the first application prior to egg hatch. For leafroller, make the first application just prior to or at the beginning of egg hatch. Do not exceed 3 applications per generation of target pest.														
Imidacloprid 2F Generic	4A	6.4 oz	-	-	3.2-6.4 oz	-	-	-	6.4 oz	-	12 h / 7 d	32 oz	-	xx	x	x
	Remarks:	Highly toxic to bees. See label for specific precautions.														
Intrepid 2F	18	-	-	16 oz[S]	-	16 oz	-	-	-	-	4 h / 14 d	64 oz	-	-	x	x
	Remarks:	See label for application timing.														
Proclaim 5SG RUP	6	-	-	4.8 oz[S]	-	3.2-4.8 oz	-	-	3.2-4.8 oz	-	12 h / 14 d	14.4 oz	-	xx	x	
	Remarks:	Highly toxic to bees. See label for specific precautions. See label for restricted activities. Ground application only. For codling moth, use only one application targeting the first spray timing.														
Rimon 0.83EC	15	-	-	30-50 oz	-	-	-	-	-	-	12 h / 14 d	150 oz	4	x	x	x
	Remarks:	Toxic to bees. See label for specific precautions. Can be applied with up to 0.25% HMO.														

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APPLES

CONTINUED: Late Spring and Summer Cover Sprays – *Insects (amount per acre). See footnotes 3 and 4, page 55.*

Product and formulation	Resistance management group (see page 6)	Aphids	Apple maggot	Codling moth	Leafhoppers	Leafrollers[#]	San Jose scale crawlers	Tarnished plant bug	Tentiform leafminer[#]	Wooly apple aphid	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Success 2L	5	-	-	6-10 oz[S]	-	6-10 oz	-	-	4-10 oz	-	4 h / 7 d	29 oz	-	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.														
Ultor 1.25SC	23	10-14 oz	-	-	-	-	10-14 oz	-	-	10-14 oz	1 d / 7 d	40 oz	-	x	-	x
	Remarks:	Toxic to bees. See label for specific precautions. Do not apply *until after* petal fall. Surfactant is required; see label.														

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

[#]This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

[S]Suppressive; use in low-pressure situations in conjunction with other codling moth control measures.

APPLES

Late Spring and Summer Cover Sprays - *Mites (amount per acre). See footnotes 3 and 4, page 55.*

Product and formulation	Resistance management group (see page 6)	Mites#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Acramite 50WS	UN	0.75-1 lb	12 h / 7 d	-	1	Toxic to bees. See label for specific precautions. Will not control rust mites.	x	-	x
Apollo 4SC	10A	4-8 oz	12 h / 45 d	-	1	Ground application only. Will not control rust mites. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	x	x
Envidor 2SC	23	16-18 oz	12 h / 7 d	18 oz	1	Toxic to bees. See label for specific precautions.	x	-	x
FujiMite 5EC	21A	2 pt	12 h / 14 d	2 pt	2	To avoid resistance development, do not rotate with Nexter.	-	x	x
Kanemite 15SC	20B	21-31 oz	12 h / 14 d	62 oz	2	Will not control rust mites. Ground application only.	-	x	x
Nealta 1.67SC	25	13.7 oz	12 h / 7 d	27.4 oz	-	Will not control rust mites. Do not make more than one application before using an effective miticide with a diferent mode of action.	-	-	-
Nexter 75WSB	21A	4.4-10.6 oz	12 h / 25 d	10.67 oz	1	Highly toxic to bees. See label for specific precautions. For European red mite and apple rust mite only, use up to 5.2 oz/acre. Results for McDaniels and twospotted spider mites have been inconsistent. Ground application only. To avoid resistance development, do not rotate with FujiMite.	xx	x	x
Onager 1EC	10A	16-24 oz	12 h / 28 d	-	1	Will not control rust mites. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Savey 50DF	10A	3-6 oz	12 h / 28 d	-	1	Will not control rust mites. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Zeal 72WSP	10B	2-3 oz	12 h / 14 d	3 oz	1	Will not control rust mites. Primarily ovicidal/larvicidal.	-	-	x

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

APPLES

Preharvest - *Diseases (amount per acre)*

Contact your packing house before choosing one of these materials.

Product and formulation	Resistance management group (see page 6)	Storage rots	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Captan 80WDG	M4	3.75 lb	1 d / 0 d	40 lb	-	Captan may cause phytotoxicity to pears. Use caution when spraying apples near pears.	-	-	x
Merivon	7 + 11	4-5.5 oz	12 h / 0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 8, page 55. Do not use with EC formulations, methylated seed oil, or horticultural mineral oil.	-	-	x
Pristine	7 +11	14.5-18.5 oz	12 h / 0 d	74 oz	4	Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 8, page 55.	-	-	x
Topsin M 70WSB Generic	1	0.75-1 lb	2 d / 1 d	4 lb	-	The resistance risk of Topsin is high. We suggest using alternative products this year if Topsin was used last year for management of storage rots.	-	-	x
Ziram 76DF	M3	6 lb	2 d / 14 d	32 lb	-	See footnote 5, page 55.	-	-	x

Generic = other materials with the same active ingredient are available.

APPLES

Postharvest: September 15-October 15 - *Diseases (amount per acre)*										
Product and formulation	Resistance management group (see page 6)	Anthracnose	Crown & collar rot (rare)	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Fixed copper (50-53%) +	M1	16-20 lb	-	2 d / -	-	-	See label for product-specific REI. See footnote 10, below.	-	-	x
Horticultural mineral oil	-	1 gal	-	4 h / -	-	-	-	x	-	x
Aliette WDG	33	-	2.5-5 lb	12 h / 14 d	20 lb	-	Use when there is significant foliage on the tree. Do not use with copper-based pesticides.	-	-	x
Fosphite Generic	33	-	1-3 qt	4 h / -	-	-	Use when there is significant foliage on the tree. Do not use with copper-based pesticides.	-	-	-
Ridomil Gold SL	4	-	Rate based on tree size, see label.	2 d / -	-	-	Rain or irrigation needed to move material into root zone. Apply Ridomil before growth begins in the spring or in the fall after harvest. Soil crown drench only.	-	-	-

FOOTNOTES (Spray tips and cautions)

1. Lime sulfur, if applied alone, may be substituted for other fungicides for scab and powdery mildew control on apples if a lime sulfur and oil dormant spray was applied, and if temperatures remain below 90°F. It should be recognized that although lime sulfur and other sulfur materials are relatively low in cost, they are not without limitations. The use of sulfur may result in phytotoxicity when temperatures exceed 90°F following application.
2. **Caution**—prolonged humidity or slow drying conditions following the application of dodine may result in fruit russet. DO NOT APPLY SYLLIT DURING POOR DRYING CONDITIONS.
3. Do not apply oil sprays during the growing season within 45 days of a sulfur application.
4. Caution is advised when mixing emulsifiable concentrates with other formulations. Incompatibility and/or phytotoxicity may occur.
5. Ziram may cause irritation of eyes, nose, throat, and skin.
6. Do not combine the 6-lb prebloom or 3-lb all-season mancozeb schedule. See labels for details. There are several manufacturers of mancozeb with different trade names and formulations.
7. Apple scab forecasting is useful when spring rains become less frequent and drier weather prevails. Several materials can be applied within a certain time limit after the *start* of an infection period. Class 11 materials such as Flint or Pristine claim long kickback activity. These claims are doubtful, and actual kickback activity may be shorter. These materials are best used **prior** to infection periods.
8. Do not exceed 4 total applications per year of any class 11 fungicide or any combination of these fungicides such as Flint, Luna Sensation, Merivon, or Pristine.
9. Growers have noticed that Rally does not control powdery mildew as well at 5 oz/acre as it did in the past. Higher rates and resistance management (rotation or tank-mixing with materials in other fungicide groups) are recommended.
10. Fixed copper products include trade names such as Badge, Champ, C-O-C-S, Copper-Count-N, Cuprofix, Kocide, Nordox, and Nu-Cop.

Effectiveness of fungicides for control of apple diseases*

Fungicide	Fungicide group	Apple scab	Powdery mildew	Bull's eye rot
Aprovia	7	Fair-good	Slight	??
Captan	M4	Excellent	None	Good
Flint	11	Excellent**	Good-excellent**	Slight-fair
Fontelis	7	Fair-good**	Good**	??
Horticultural mineral oil (HMO)	Not classified	??	Good	??
Indar	3	Good**	Excellent**	??
Inspire Super	3 + 9	Good	Excellent**	??
Kaligreen	Not classified	None	Slight-fair	??
Lime sulfur	M2	Excellent	Good	??
Luna Sensation	7 + 11	Excellent**	Excellent	??
Luna Tranquility	7 + 9	Good-excellent**	Excellent	??
Mancozeb	M3	Good-excellent	None	Slight-fair
Merivon	7 + 11	Excellent**	Excellent	??
Omega 500F	29	Very good	Slight	??
Polyram	M3	Excellent	None	??
Pristine	7 + 11	Good-excellent**	Excellent	Good
Procure	3	Good**	Excellent**	Fair-good
Rally	3	Good**	Fair-good**	??
Sulfur	M2	Fair	Good	??
Syllit	U12	Good**	None	??
Topguard	3	Good**	Excellent**	??
Topsin M	1	Fair**	Fair-good**	Excellent
Vangard	9	Fair**	None	??
Ziram	M3	Fair	None	Fair-good

*These ratings are relative rankings based on labeled application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions. ?? = no information available.

**Resistant pathogens will lower the effectiveness of these fungicides.

Follow the "Rules" for fungicide stewardship:

Rotate or mix fungicides of different chemical groups.
Use labeled rates.
Limit total number of applications.
Educate yourself about fungicide activity, mode of action, and class—as well as resistance management practices.
Start a fungicide program with multisite mode of action materials.

2017 Mid-Columbia pest control program for cherries

Application rates in the tables are based on the amount of product to apply per acre. For some products, the label requires minimum and/or maximum recommendations for spray volume (the amount of water to use per acre when spraying). Good coverage depends upon many factors, including the type of application equipment, spray volume, tree phenology, tree height, row width, target pest, tractor speed, and the chemical rate per acre used. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

CHERRIES

Dormant or Delayed Dormant (Stages 0, 1, 2, and 3) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Leafrollers#	Mites	Scale insects	Restricted-entry interval (REI) / Preharvest interval (PHI)	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Centaur 70WDG	16	-	-	-	34.5-46 oz	12 h / 14 d	69 oz	2	Do not tank-mix with oil. Ground application only.	-	-	-
Horticultural mineral oil (HMO) Generic	-	6-8 gal	-	6-8 gal	6-8 gal	4 h / -	-	-	-	x	-	x
HMO + one of the following	-	6-8 gal	6-8 gal	6-8 gal	6-8 gal	4 h / -	-	-	-	x	-	x
Diazinon 50WP RUP; Generic	1B	4 lb	4 lb	4 lb	4 lb	4 d / 21 d	4 lb	2	Do not exceed 6 gal oil. Closed cab required. One dormant and one in-season foliar application allowed.	xx	x	x
Esteem 35WP Generic	7C	-	4-5 oz	-	4-5 oz	12 h / 14 d	15 oz	3	-	-	-	x
Lorsban 4E (chlorpyrifos) RUP; Generic	1B	4 pt	4 pt	4 pt	4 pt	4 d / prebloom	4 pt	1	Prebloom use only.	xx	x	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#Stage 3 is best for leafroller control. This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Popcorn (Stages 4 and 5) - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Black cherry aphid	Budmoth	Leafrollers#	Mineola moth	Syneta beetle	Thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Altacor 35WDG	28	-	-	2-4 oz	-	-	-	4 h / 10 d	9 oz	3	For best results, use 100 to 150 gal/acre water.	-	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	Rates vary, see label	-	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays are needed. Apply sprays 14-21 days apart.	-	-	-
Delegate 25WG	5	-	-	4.5-7 oz	-	-	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions. Addition of adjuvant may improve thrips control.	x	-	x
Diazinon 50WP RUP; Generic	1B	4 lb	4 lb	4 lb	4 lb	4 lb	4 lb	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required. One dormant and one in-season foliar application allowed.	xx	x	x
Entrust 2SC	5	-	-	4-8 oz	-	-	4-8 oz	4 h / 7 d**	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Entrust 80WP	5	-	-	1.25-2.5 oz	-	-	1.25-2.5 oz	4 h / 7 d**	9 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Intrepid 2F	18	-	-	8-16 oz	-	-	-	4 h / 7 d	64 oz	-	-	-	x	x
Success 2L	5	-	-	4-8 oz	-	-	4-8 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Addition of adjuvant may improve thrips control.	x	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Popcorn through Full Bloom (Stages 4 through 7) - *Diseases (amount per acre)*

Multiple applications may be necessary in higher rainfall areas or during wet conditions.

Product and formulation	Resistance management group (see page 6)	Brown rot	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Bravo Weather Stik (chlorothalonil) Generic	M5	3-4.1 pt	12 h / -	20.5 pt	-	Do not apply later than shuck split.	-	x	x
Cabrio 20EG	11	9.5 oz	12 h / 0 d	47.5 oz	-	Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Elevate 50WDG	17	1-1.5 lb	12 h / 0 d	6 lb	-	Do not apply more than 2 sequential applications.	-	-	x
Fontelis 1.67SC	7	14-20 oz	12 h / 0 d	61 oz	-	Do not apply more than 2 sequential applications.	-	-	x
Indar 2F	3	6 oz	12 h / 0 d	48 oz	8	-	-	x	x
Luna Sensation	7 + 11	5-7.6 oz	12 h / 1 d	11.2 oz	-	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Merivon 2.09SC	7 + 11	4-6.7 oz	12 h / 0 d	20.1 oz	3	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71. See label for information on use of adjuvants.	-	-	x
Pristine	7 +11	10.5-14.5 oz	12 h / 0 d	72.5 oz	5	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Procure 480SC	3	10-16 oz	12 h / 1 d	96 oz	-	-	-	-	x
Quash 50WDG	3	2.5-3.5 oz	12 h / 14 d	12 oz	3	Do not apply more than 2 sequential applications.	-	-	x
Rally 40WSP	3	2.5-6 oz	1 d / 0 d	3.25 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 71.	-	-	-
Tebucon 45DF (tebuconazole) Generic	3	4-8 oz	5 d / 0 d	48 oz	-	Other products with same active ingredient may have less restrictive REIs; check specific product label.	-	x	x
Topguard	3	14 oz	12 h / 7 d	56 oz	4	-	-	-	-
Ziram 76DF	M3	5-6 lb	2 d / 30 d	30 lb	-	See footnote 2, page 71. Rate based on 300 gal/acre.	-	-	x

Generic = other materials with the same active ingredient are available.

CHERRIES

Petal Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Aphids	Leafrollers#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actara 25WDG	4A	3-4 oz	-	12 h / 14 d	11 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Altacor 35WDG	28	-	2-4 oz	4 h / 10 d	9 oz	3	For best results, use 100 to 150 gal/acre water.	-	-	x
Assail 70WP	4A	1.1-2.3 oz	-	12 h / 7 d	13.6 oz	4	Toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	Rates vary, see label	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays are needed. Apply sprays 14-21 days apart.	-	-	-
Delegate 25WG	5	-	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	-	4-8 oz	4 h / 7 d**	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Entrust 80WP	5	-	1.25-2.5 oz	4 h / 7 d**	9 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Imidacloprid 2F Generic	4A	3.2-6.4 oz	-	12 h / 7 d	32 oz	-	Highly toxic to bees. See label for specific precautions. Do not apply prebloom, or during bloom, or when bees are actively foraging. Repeated applications may cause spider mite buildup.	xx	x	x
Intrepid 2F	18	-	8-16 oz	4 h / 7 d	64 oz	-	-	-	x	x
Success 2L	5	-	4-8 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions.	x	-	x

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Shuck Fall - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Leafhoppers	Leafrollers#	San Jose scale	Tentiform leafminer#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actara 25WDG	4A	2-2.75 oz	-	-	-	12 h / 14 d	11 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Altacor 35WDG	28	-	3-4.5 oz	-	-	4 h / 10 d	9 oz	4	Use 100 to 200 gal/acre water.	-	-	x
Assail 70WP	4A	1.1-2.3 oz	-	-	1.9 oz	12 h / 7 d	13.6 oz	4	Toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	Rates vary, see label	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays are needed. Apply sprays 14-21 days apart.	-	-	-
Delegate 25WG	5	-	4.5-7 oz	-	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions.	x	-	x
Entrust 2SC	5	-	4-8 oz	-	4-8 oz	4 h / 7 d**	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Entrust 80WP	5	-	1.25-2.5 oz	-	1.25-2.5 oz	4 h / 7 d**	9 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Imidacloprid 2F Generic	4A	3.2-6.4 oz	-	-	-	12 h / 7 d	32 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Intrepid 2F	18	-	8-16 oz	-	-	4 h / 7 d	64 oz	-	-	-	x	x
Sevin 4F (carbaryl) Generic	1A	1.5-2 qt	-	-	-	12 h / 3 d	15 qt	3	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. May cause phytotoxicity.	xx	x	x
Success 2L	5	-	4-8 oz	-	4-8 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Research results indicate petal fall spray gives best leafroller control.	x	-	x
Ultor 1.25SC	23	-	-	10-14 oz	-	1 d / 7 d	24 oz	-	Toxic to bees. See label for specific precautions. Do not apply *until after* petal fall. Surfactant is required.	x	-	x

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Shuck Fall - *Diseases (amount per acre)*

Fungicide applications at regular intervals from shuck fall through harvest will be necessary for control of powdery mildew.

Product and formulation	Resistance management group (see page 6)	Powdery mildew, see footnote 4, page 71	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Cabrio 20EG	11	9.5 oz	12 h / 0 d	47.5 oz	-	Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Fontelis 1.67SC	7	14-20 oz	12 h / 0 d	61 oz	-	Do not apply more than 2 sequential applications.	-	-	x
Gem 500SC	11	2-3.8 oz	12 h / 1 d	15.2 oz	4	Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Horticultural mineral oil (HMO) Generic	-	1-2% vol. (See label)	4 h / -	-	-	Do not use after pit hardening. Necrotic foliage may result if applied within 2 weeks of any sulfur application.	x	-	x
Luna Sensation	7 + 11	5-7.6 oz	12 h / 1 d	11.2 oz	-	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Merivon 2.09SC	7 + 11	4-6.7 oz	12 h / 0 d	20.1 oz	3	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71. See label for information on use of adjuvants.	-	-	x
Pristine	7 +11	10.5-14.5 oz	12 h / 0 d	72.5 oz	5	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Procure 480SC	3	10-16 oz	12 h / 1 d	96 oz	-	See footnote 4, page 71.	-	-	x
Quash 50WDG	3	3.5-4 oz	12 h / 14 d	12 oz	3	Do not apply more than 2 sequential applications. See footnote 4, page 71.	-	-	x
Quintec	13	7 oz	12 h / 7 d	35 oz	5	A surfactant is not required when Quintec is used alone. A nonionic surfactant is preferred if needed for tank mixes.	-	-	x
Rally 40WSP	3	6 oz	1 d / 0 d	3.25 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 71.	-	-	-
Sulfur DF	M2	10-15 lb	1 d / 1 d	-	-	Temperature 90°F or above following sulfur application may result in injury. A second application 2-3 weeks after shuck fall may be necessary to aid in fruit protection.	-	-	-
Tebucon 45DF (tebuconazole) Generic	3	8 oz	5 d / 0 d	48 oz	-	Other products with same active ingredient may have less restrictive REIs; check specific product label. Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 71.	-	x	x
Tilt (propiconazole) Generic	3	4 oz	12 h / 0 d	20 oz	-	Smaller, deeper green leaves and smaller fruit have been measured on trees treated multiple times during the growing season. See footnote 4, page 71.	-	-	x
Topguard	3	14 oz	12 h / 7 d	56 oz	4	-	-	-	-
Topsin M 70WSB Generic	1	1-1.5 lb	2 d / 1 d	4 lb	-	To prevent resistance development, tank-mix with another fungicide, use only once per season, and rotate with other chemistries.	-	-	x
Vivando	U8	15.4 oz	12 h / 7 d	30.8 oz	2	Do not mix with HMO.	-	-	x

Generic = other materials with the same active ingredient are available.

CHERRIES

Late Spring through Preharvest - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Cherry fruit fly	Spotted wing Drosophila*	Leafrollers#	Shothole borer	Spider mites#	Tentiform leafminer#	Western flower thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Acramite 50WS	UN	-	-	-	-	0.75-1.0 lb	-	-	12 h / 3 d	-	1	Toxic to bees. See label for specific precautions.	x	-	x
Actara 25WDG	4A	4.5-5.5 oz	-	-	-	-	-	-	12 h / 14 d	11 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Altacor 35WDG	28	-	-	2-4 oz	-	-	-	-	4 h / 10 d	9 oz	3	For best results, use 100 to 150 gal/acre water.	-	-	x
Assail 70WP	4A	2.3-3.4 oz	-	-	-	-	-	-	12 h / 7 d	13.6 oz	4	Toxic to bees. See label for specific precautions. For scale crawlers, apply at beginning of emergence. Repeated applications may cause spider mite buildup. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	Rates vary, see label	-	-	-	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays are needed. Apply sprays 14-21 days apart.	-	-	-
Baythroid XL RUP	3	2.4-2.8 oz	2.4-2.8 oz	2.4-2.8 oz	-	-	-	-	12 h / 7 d	5.6 oz	-	Highly toxic to bees. See label for specific precautions. Check with your packing house before using this product. May disrupt IPM programs. 14 day minimum spray interval.	xx	x	x
Danitol 2.4EC RUP	3	10.6-21.3 oz	10.6-21.3 oz	10.6-21.3 oz	-	-	-	-	1 d / 3 d	42.6 oz	-	Highly toxic to bees. See label for specific precautions. Check with your packing house before using this product. May disrupt IPM programs. 10 day minimum spray interval.	xx	x	x
Delegate 25WG	5	4.5 oz	4.5-7 oz	4.5-7 oz	-	-	4.5-7 oz	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. Addition of adjuvant may improve thrips control.	x	-	x
Diazinon 50WP RUP; Generic	1B	4 lb	4 lb	-	-	-	-	-	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required. Apply at beginning of crawler emergence. One dormant and one in-season foliar application allowed.	xx	x	x

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CHERRIES

CONTINUED: Late Spring through Preharvest - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Cherry fruit fly	Spotted wing Drosophila*	Leafrollers#	Shothole borer	Spider mites#	Tentiform leafminer#	Western flower thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Dimethoate 4E Generic	1B	2.66 pt	2.66 pt	-	-	-	-	-	10 or 14 d / See label / 21 d	2.66 pt	-	Highly toxic to bees. See label for specific precautions. For cherry fruit fly, make a single application within 7 days of adult fly emergence in area. High label rates can cause phytotoxicity ranging from marginal leaf burn to defoliation, especially in hot weather. *Note:* Do not use on cherries to be marketed in Taiwan.	xx	x	x
Entrust 2SC	5	4-8 oz	4-6.4 oz	4-8 oz	-	-	4-8 oz	4-8 oz	4 h / 7 d**	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Entrust 80WP	5	1.25-2.5 oz	1.9-2 oz	1.25-2.5 oz	-	-	1.25-2.5 oz	1.25-2.5 oz	4 h / 7 d**	9 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Envidor 2SC	23	-	-	-	-	16-18 oz	-	-	12 h / 7 d	18 oz	1	Toxic to bees. See label for specific precautions.	x	-	x
Exirel 0.83SE	28	10-17 oz	13.5-20.5 oz	10-20.5 oz					12 h / 3 d	61 oz	-	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per generation of target pest. See label for timing and tank- mixing precautions.	x	x	x
GF-120	5	20 oz	-	-	-	-	-	-	4 h / 0 d	-	-	Apply every 7 days, with first application immediately after first emergence. For ATV applications, apply in 0.8-1 gal/acre water using a D2 nozzle with core removed. Apply at 6 to 7 mph with the listed rate and nozzle size. See label for proper dilutions. Do not use for spotted wing Drosophila control.	-	-	x

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CHERRIES

CONTINUED: Late Spring through Preharvest - *Insects & Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Cherry fruit fly	Spotted wing Drosophila*	Leafrollers#	Shothole borer	Spider mites#	Tentiform leafminer#	Western flower thrips	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Imidacloprid 2F Generic	4A	4.8-6.4 oz	-	-	-	-	-	-	12 h / 7 d	32 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Intrepid 2F	18	-	-	8-16 oz	-	-	-	-	4 h / 7 d	64 oz	-	-	-	x	x
Lambda-cyhalothrin 1EC RUP: Generic	3	2.6-5.1 oz	2.6-5.1 oz	2.6-5.1 oz	-	-	-	-	1 d / 14 d	25.6 oz	-	Highly toxic to bees. See label for specific precautions. Check with your packing house before using this product. May disrupt IPM programs.	xx	x	x
Malathion ULV Generic	1B	12-16 oz	16 oz	-	-	-	-	-	12 h / 1 d	-	4	Highly toxic to bees. See label for specific precautions. Not a stand-alone product for spotted wing Drosophila control. Do not use sequential sprays for spotted wing Drosophila control. Minimum 7-day retreatment interval.	xx	x	x
Sevin 4F (carbaryl) Generic	1A	1.5-2 qt	2-3 qt	-	-	-	-	-	12 h / 3 d	14 qt	3	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. May cause phytotoxicity. Minimum 7-day retreatment interval.	xx	x	x
Success 2L	5	4-8 oz	6-8 oz	4-8 oz	-	-	4-8 oz	4-8 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests.	x	-	x
Zeal 72WSP	10B	-	-	-	-	2-3 oz	-	-	12 h / 7 d	3 oz	1	Primarily ovicidal/larvicidal.	-	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

*Insecticides recommended for management of spotted wing Drosophila are based on preliminary information and may change after additional research is conducted.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Late Spring through Preharvest - *Diseases (amount per acre)*

Fungicide applications at regular intervals from shuck fall through harvest will be necessary for control of powdery mildew.

Contact your packing house before choosing any of these products to ensure compliance with export restrictions.

Product and formulation	Resistance management group (see page 6)	Brown rot	Powdery mildew, see footnote 4, page 71	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Cabrio 20EG	11	9.5 oz	9.5 oz	12 h / 0 d	47.5 oz	-	Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Elevate 50WDG	17	1-1.5 lb	-	12 h / 0 d	6 lb	-	Do not apply more than 2 sequential applications.	-	-	x
Fontelis 1.67SC	7	14-20 oz	14-20 oz	12 h / 0 d	61 oz	-	Do not apply more than 2 sequential applications.	-	-	x
Gem 500SC	11	-	2-3.8 oz	12 h / 1 d	15.2 oz	4	Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Horticultural mineral oil (HMO) Generic	-	-	1-2% vol. (See label)	4 h / -	-	-	Do not use after pit hardening. Necrotic foliage may result if applied within 2 weeks of any sulfur application.	x	-	x
Indar 2F	3	6 oz	-	12 h / 0 d	48 oz	8	See footnote 4, page 71.	-	x	x
Kaligreen Generic	-	-	2.5-3 lb	4 h / 1 d	-	-	Do not mix with acidifying agents.	-	-	-
Luna Sensation	7 + 11	5-7.6 oz	5-7.6 oz	12 h / 1 d	11.2 oz	-	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Merivon 2.09SC	7 + 11	4-6.7 oz	4-6.7 oz	12 h / 0 d	20.1 oz	3	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71. See label for information on use of adjuvants.	-	-	x
Pristine	7 +11	10.5-14.5 oz	10.5-14.5 oz	12 h / 0 d	72.5 oz	5	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications. See footnote 3, page 71.	-	-	x
Procure 480SC	3	10-16 oz	10-16 oz	12 h / 1 d	96 oz	-	See footnote 4, page 71.	-	-	x
Quash 50WDG	3	-	3.5-4 oz	12 h / 14 d	12 oz	3	Do not apply more than 2 sequential applications. See footnote 4, page 71.	-	-	x
Quintec	13	-	7 oz	12 h / 7 d	35 oz	5	A surfactant is not required when Quintec is used alone. A nonionic surfactant is preferred if needed for tank mixes.	-	-	x
Rally 40WSP	3	6 oz	2.5-6 oz	1 d / 0 d	3.25 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 71.	-	-	-

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CHERRIES

CONTINUED: Late Spring through Preharvest - *Diseases (amount per acre)*

Fungicide applications at regular intervals from shuck fall through harvest will be necessary for control of powdery mildew.

Contact your packing house before choosing any of these products to ensure compliance with export restrictions.

Product and formulation	Resistance management group (see page 6)	Brown rot	Powdery mildew, see footnote 4, page 71	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Sulfur DF	M2	10-15 lb	10-15 lb	1 d / 1 d	-	-	Temperature 90°F or above following sulfur application may result in injury.	-	-	-
Tilt (propiconazole) Generic	3	4 oz	4 oz	12 h / 0 d	20 oz	-	Smaller, deeper green leaves and smaller fruit have been measured on trees treated multiple times during the growing season. See footnote 4, page 71.	-	-	x
Tebucon 45DF (tebuconazole) Generic	3	8 oz	8 oz	5 d / 0 d	48 oz	-	Other products with same active ingredient may have less restrictive REIs; check specific product label. Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 71.	-	x	x
Topguard	3	14 oz	14 oz	12 h / 7 d	56 oz	4	-	-	-	-
Topsin M 70WSB Generic	1	1-1.5 lb	1-1.5 lb	2 d / 1 d	4 lb	-	To prevent resistance development, tank-mix with another fungicide from a different fungicide group, use only once per season, and rotate with other chemistries.	-	-	x
Vivando	U8	-	15.4 oz	12 h / 7 d	30.8 oz	2	Do not mix with HMO.	-	-	x

Generic = other materials and formulations with the same active ingredient are available.

CHERRIES

Preharvest - *Birds*

Product and formulation	Birds	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Methyl anthranilate (Avian Migrate)	Rates vary, see label	-	-	-	Best if used as part of integrated program including scare devices such as cannons and distress alarms. Check with your packing house for recommended PHI.	-	-	-

CHERRIES

Postharvest – *Insects (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Cherry fruit fly, see footnote 1, page 71	Pear slug**	Redhumped caterpillar	Tentiform leafminer#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Actara 25WDG	4A	4.5-5.5 oz	4.5-5.5 oz	-	-	12 h / 14 d	11 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Assail 70WP	4A	2.3-3.4 oz	2.3-3.4 oz	-	-	12 h / 7 d	13.6 oz	4	Toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites.	x	-	x
Bacillus thuringiensis (B.t.) Generic	11B2	-	-	Rates vary; see label	-	4 h / 0 d	-	-	Apply when temperatures will exceed 60°F. For effective control, 2 or 3 sprays are needed. Apply sprays 14-21 days apart.	-	-	-
Delegate 25WG	5	4.5 oz	4.5 oz	4.5-7 oz	4.5-7 oz	4 h / 7 d	28 oz	4	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests.	x	-	x
Diazinon 50WP RUP	1B	4 lb	4 lb	-	-	4 d / 21 d	4 lb	2	Highly toxic to bees. See label for specific precautions. Closed cab required. Apply at beginning of crawler emergence. One dormant and one in-season foliar application allowed.	xx	x	x
Dimethoate 4E Generic	1B	2.66 pt	2.66 pt	-	-	10-14 d / 21 d	2.66 pt	-	Highly toxic to bees. See label for specific precautions. High label rates can cause phytotoxicity ranging from marginal leaf burn to defoliation, especially in hot weather.	xx	x	x
Entrust 2SC	5	4-8 oz	4-8 oz	4-8 oz	4-8 oz	4 h / 7 d**	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x
Entrust 80WP	5	1.25-2.5 oz	1.25-2.5 oz	1.25-2.5 oz	1.25-2.5 oz	4 h / 7 d**	9 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests. *Note:* For spotted wing Drosophila, 24-(c) registration allows 3-day PHI. See label and supplemental label for application restrictions.	x	-	x

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CHERRIES

CONTINUED: Postharvest - *Insects (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Cherry fruit fly, see footnote 1, page 71	Pear slug**	Redhumped caterpillar	Tentiform leafminer#	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
GF-120	5	20 oz	-	-	-	4 h / 0 d	-	-	Apply every 7 days, with first application immediately after first emergence. For ATV applications, apply in 0.8-1 gal/acre water using a D2 nozzle with core removed. Apply at 6 to 7 mph with the listed rate and nozzle size. See label for proper dilutions.	-	-	x
Imidacloprid 2F Generic	4A	4.8-6.4 oz	3.2-6.4 oz	-	-	12 h / 7 d	32 oz	-	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup.	xx	x	x
Intrepid 2F	18	-	-	8-16 oz	-	4 h / 7 d	64 oz	-	-	-	x	x
Sevin 4F (carbaryl) Generic	1A	1.5-2 qt	1.5-2 qt	-	-	12 h / 3 d	15 qt	3	Highly toxic to bees. See label for specific precautions. Repeated applications may cause spider mite buildup. May cause phytotoxicity.	xx	x	x
Success 2L	5	4-8 oz	4-8 oz	4-8 oz	4-8 oz	4 h / 7 d	29 oz	-	Toxic to bees. See label for specific precautions. Repeated applications for cherry fruit fly may increase resistance in other pests.	x	-	x

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

#This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

**Postharvest cherry fruit fly spray will generally control pear slug.

CHERRIES

Postharvest – *Mites (amount per acre)*

Product and formulation	Resistance management group (see page 6)	Rust mites	Spider mites[#]	REI / PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Acramite 50WS	UN	-	0.75-1.0 lb	12 h / 3 d	-	1	Toxic to bees. See label for specific precautions.	x	-	x
Agri-Mek 0.15EC RUP, Generic	6	-	10-20 oz	12 h / 21 d	40 oz	2	Highly toxic to bees. See label for specific precautions. Use with HMO or nonionic surfactant. See label for rates.	xx	x	x
Apollo 4SC	10A	-	4-8 oz	12 h / 21 d	-	-	Ground application only. Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	x	x
Envidor 2SC	23	16-18 oz	16-18 oz	12 h / 7 d	18 oz	1	Toxic to bees. See label for specific precautions.	x	-	x
Horticultural mineral oil (HMO)	-	1-2 gal	1-2 gal	4 h / -	-	-	Necrotic foliage may result if applied within 2 weeks of any sulfur application.	x	-	x
Magister SC	21	-	24-36 oz	12 h / 3 d	36 oz	1	Highly toxic to bees. See label for specific precautions. May provide suppression of powdery mildew.	xx	-	x
Nexter 75WSB	21A	5.2-10.6 oz	5.2-10.6 oz	12 h / 300 d	10.6 oz	2	Highly toxic to bees. See label for specific precautions. Ground application only.	xx	x	x
Onager 1EC	10A	-	24 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Savey 50DF	10A	-	3-6 oz	12 h / 28 d	-	1	Do not use any combination of Apollo, Onager, and Savey in the same growing season.	-	-	x
Zeal 72WSP	10B	-	2-3 oz	12 h / 7 d	3 oz	1	Primarily ovicidal/larvicidal.	-	-	x

[#]This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

CHERRIES

Postharvest - *Diseases (amount per acre)*									
Product and formulation	**Resistance management group (see page 6)**	**Powdery mildew, see footnote 4, next page**	**REI / PHI**	**Maximum amount/acre/year**	**Maximum applications/year**	**Remarks**	**Bees (see page 4)**	**Buffers (see page 3)**	**Surface water (see page 3)**
Horticultural mineral oil	**-**	**1-2%**	**4 h / -**	**-**	**-**	**Apply within 30 days after harvest; 7-10 days is optimum. Necrotic foliage may result if applied within 2 weeks of any sulfur application.**	**x**	**-**	**x**

FOOTNOTES (Spray tips and cautions)

1. *Cherry fruit fly only: information for spotted wing Drosophila (SWD) is still being developed; see pages 63-65 for materials considered effective for SWD.*
   A. Apply first spray when flies emerge; notice usually is mailed to growers.
   B. The estimated days of protection for the recommended materials are as follows:
   Actara .....10 days
   Assail .....10 days
   Baythroid…….. 10 days
   Danitol…….. 10 days
   Delegate .....10 days
   Diazinon .....10 days
   Dimethoate*.....21 days
   GF-120 .....7 days
   Imidacloprid .....10 days
   Malathion .....7 days
   Lambda-cyhalothrin .....10 days
   Sevin 4F (carbaryl)*.....7 days
   Success, Entrust.....7 days
   * May cause phytotoxicity on some cultivars.
   C. Precipitation can affect residual activity. Check with Extension agent or field representative concerning advisability of reapplication after rain.
2. Ziram may cause irritation of eyes, nose, throat, and skin.
3. Class 11 fungicides (Cabrio, Gem, Pristine) are best used before symptoms of disease, such as powdery mildew, develop. To delay or prevent the development of resistant pathogens, alternate class 11 fungicide applications with materials having different modes of activity. Most class 11 fungicides are limited to 2 sequential applications and 4 total applications of any combination of these fungicides during the year.
4. To delay or prevent the development of fungicide-resistant strains of powdery mildew, alternate or tank-mix fungicides with different modes of action for powdery mildew. Resistance has been detected in group 3 fungicides in the Mid-Columbia area. Higher rates and resistance management (rotation with materials in other fungicide groups) are recommended. See table on next page.

Effectiveness of fungicides and bactericides for control of cherry diseases*

Fungicide	Fungicide group	Properties	Brown rot		Powdery mildew	Shothole	Bacterial canker
			Blossom blight	Fruit rot			
Abound	11	B, F, Ls, P	Good	Good	Excellent**	Fair to good	Not effective
Bravo	M5	B, F, P	Good to fair	Not registered	Not effective	Good	Not effective
Cabrio	11	B, F, Ls, P	Good	Good	Excellent**	??	Not effective
Captan	M4	B, F, P	Good	Good	Not effective	Good to excellent	Not effective
Copper-based products	M1	B, Bact, F, P	Slight	Not registered	Slight	Good	Not effective
Echo 720	M5	B, F, P	Good to fair	Not registered	Not effective	Good	Not effective
Elevate	17	F, N, P	Good to excellent	Good to excellent	Not effective	??	Not effective
Fontelis	7	B, F, P	Good to excellent	Good to excellent	Good	Good	Not effective
Gem	11	B, F, Ls, P	Good	Fair to good	Excellent**	??	Not effective
Indar	3	B-N, C, F, Ls, P	Excellent**	Excellent**	Slight**	??	Not effective
Horticultural mineral oil (HMO)	Not classified	E, F, I, P	??	??	Good to excellent	??	??
Kaligreen	Bicarbonate	E, B-N	??	??	Poor to slight	??	??
Luna Sensation	7 + 11	B, F, Ls, P	Good to excellent	Good to excellent	Excellent**	??	Not effective
Magister	Not classified	F	??	??	Good	??	??
Merivon	7 + 11	B, F, Ls, P	Good to excellent	Good to excellent	Excellent**	??	Not effective
Pristine	7 + 11	B, F, Ls, P	Good	Good	Good **	??	Not effective
Procure	3	B-N, C, F, Ls, P	Good	??	Good**	??	Not effective
Quash	3	B-N, C, F, Ls, P	Good to excellent	Good	Good**	??	Not effective
Quilt	11 + 3	B-N, C, F, Ls, P	Good to excellent	Good to excellent	Excellent**	??	Not effective
Quintec	13	N, F, P	Not effective	Not effective	Good	Not effective	Not effective
Rally	3	B-N, C, F, Ls, P	Good to fair	Good to fair	Fair**	Slight	Not effective
Rovral	2	B-N, F, Ls, P	Excellent**	Not registered	Not effective	Fair to good	Not effective
Sulfur	M2	F, I, P, V	Fair	Fair	Good	Not effective	Not effective
Syllit	U12	B, F, P	??	Slight	Not effective	??	None to slight
Tebucon	3	B-N, C, F, Ls, P	Good to excellent	Good to excellent	Fair to good**	??	Not effective
Tilt	3	B-N, C, F, Ls, P	Good to excellent	Good to excellent	Fair to good**	Slight	Not effective
Topsin M	1	B, C, F, Ls	Good**	Good**	Fair to good**	Not effective	Not effective
Topguard	3	B-N, C, F, Ls, P	Good	Good	Good	??	Not effective
Vivando	U8	??	Not effective	Not effective	Fair to good	Not effective	Not effective
Ziram	M3	B, F, P	Slight	Slight	Not effective	Good to excellent	Not effective

*These ratings are relative rankings based on labeled application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions.

**Resistant pathogens will lower the effectiveness of these fungicides.

Properties: B = broad spectrum activity; Bact = bactericidal; B-N = broad to narrow spectrum of activity; C = curative; DMI = demethylation-inhibiting; E = eradicant; F = fungicidal; Fs = fungistatic; I = insecticidal; Ls = locally systemic; N = narrow spectrum of activity; P = protectant; V = vapor active; ?? = unknown.

Quick guide to herbicides for pears, apples, and cherries

This table provides a quick reference to herbicides registered for these crops. This information is adapted from the Pacific Northwest Weed Management Handbook: https://pnwhandbooks.org/sites/pnwhandbooks/files/weed/contentpdf/pdfs/treefruit-quickguide-table.pdf. Refer to that publication for more information. **MATERIALS ARE LISTED ALPHABETICALLY.**

Products that persist in the soil and are soil active

Product and formulation	Mode of action (MOA)	Pear	Apple	Cherry	Broadleaf weeds	Grass weeds	Restricted-entry interval (REI)	Preharvest interval (PHI)	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Alion 1.67 SC	29	x	x	x	++	+	12 hr	14 d	Minimum establishment 3 years.	-	x	x
Casoron 4G & 1.4CS	20	x	x	x	++	++	12 hr	-	Minimum establishment 4G 4 weeks, 1.4CS 1 year.	-	-	-
Karmex 80DF Generic	7	x	x	nr	+	+	12 hr	-	Do not treat trees on full-dwarf rootstock; minimum establishment 1 year.	-	-	-
Kerb 35.6SC	3	x	x	x	+	++	1 d	-	Minimum establishment 6 to 12 months.	-	-	-
Princep 90WDG Generic	5	x	x	24c	++	+	12 hr	apple 150 d	Minimum establishment pear and apple 1 year, cherry 2 years.	-	-	x
Prowl H20 3.8AS	3	x	x	x	+	++	1 d	60 d	EC is non-bearing only.	-	x	x
Solicam 78.6DF	12	x	x	x	++	+	12 hr	60 d	Minimum establishment pear and cherry 18 months.	-	-	-
Surflan Generic	3	x	x	x	++	++	1 d	-	-	-	-	x
Trellis SC	21	NB	NB	NB	++	-	12 hr	-	-	-	-	-

Products that persist in the soil and have both soil and foliar activity

Product and formulation	MOA	Pear	Apple	Cherry	Broadleaf weeds	Grass weeds	REI	PHI	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
Goal 2XL 2EC Generic	14	x	x	x	++	+	1 d	-	Postharvest or dormant only.	-	x	x
Matrix SG Generic	2				++	+	4 hr	pear and apple 7 d cherry 14 d	Minimum establishment 1 year.	-	-	-
Pindar GT	2 + 14	x	x	x	++	+	24 hr	60 d	Minimum establishment 4 years.	-	x	x
Sandea 75DF	2	x	x	nr	++	+	12 hr	14 d	Minimum establishment 1 year.	-	-	-

continues on next page

Products with contact or systemic activity

Product and formulation	MOA	Pear	Apple	Cherry	Broadleaf weeds	Grass weeds	REI	PHI	Remarks	Bees (see page 4)	Buffers (see page 3)	Surface water (see page 3)
2,4-D amine Generic	4	x	x	x	++	- -	2 d	pear and apple 14 d cherry 40 d	Minimum establishment 1 year. Use caution near vineyards due to high sensitivity of grapevines.	-	-	x
Aim 2EC	14	x	x	x	++	- -	12 hr	3 d	Avoid contacting green bark or foliage.	-	-	x
Fusilade DX	1	NB	NB	x	- -	+	12 hr	14 d	Avoid contacting foliage.	-	x	x
glyphosate Generic	9	x	x	x	++	++	4 or 12 hr	pear and apple 1 d cherry 17 d	Avoid contacting green bark or foliage.	-	-	-
Gramoxone RUP; Generic	22	x	x	x	++	++	1 d	cherry 28 d	Avoid contacting green bark or foliage.	-	-	-
Poast	1	x	x	nr	- -	++	12 hr	14 d	-	-	-	x
Reglone	22	NB	NB	NB	++	++	1 d	-	-	-	-	-
Rely 280	10	x	x	x	++	+	12 hr	14 d	Avoid contacting green bark or foliage.	-	-	-
Sandea 75DF	2	x	x	nr	++	+	12 hr	14 d	Minimum establishment 1 year.	-	-	-
Select Max	1	NB	NB	NB	-	++	1 d	-	-	-	-	-
Sinbar 80WDG	5	nr	NB	NB	++	+	12 hr	apple 60 d	-	-	-	-
Stinger	4	nr	nr	x	++	- -	12 hr	30 d	-	-	-	-
Treevix 70WDG	14	x	x	nr	++	- -	12 hr	0 d	Avoid contacting green bark or foliage; minimum establishment 1 year.	-	-	-
Venue	14	x	x	x	++	- -	12 hr	0 d	Avoid contacting green bark or foliage.	-	-	x
Weed Pharm 20% acetic acid	-	x	x	x	+	+	2 d	-	Use hooded or shielded sprayer.	-	-	x

NB = registered for nonbearing orchards only; preharvest interval 365 days.

nr = product is not registered for crop.

RUP = restricted use pesticide.

Generic = other materials with the same active ingredient are available.

x = product is registered for crop.

+ = controls some weed species in group.

++ = controls many weed species in group.

- - = controls few or no weed species in group.

Nutrient sprays

Soil and leaf analysis

Soil pH (acidity or alkalinity) and the levels of certain mineral elements can be determined by submitting soil samples for analysis. Mineral analysis of leaf samples taken in August may be helpful in assessing tree nutrient status. An annual soil and leaf analysis is the best way to monitor orchard mineral nutrition status. Leaf and soil analysis can be done by several private labs in the region. EM 8677, *Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis*, is available from the OSU Extension office in your county and on the Web at: http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20037/em8677.pdf.

Tree nutrient needs and foliar fertilization

Trees need large amounts (lb/acre) of certain nutrients every year. These nutrients are referred to as "macronutrients," and include nitrogen, phosphorus, potassium, calcium, and magnesium. Soil-applied fertilizers usually are the best (biologically and economically) way to get macronutrients into the tree. However, foliar fertilization sometimes can be beneficial. When foliar deficiency symptoms are present, nutrient sprays usually are the quickest way to get nutrients into the tree. Under such conditions, foliar sprays function as a "Band-Aid" (or a tourniquet) to keep the tree functioning until soil fertilizers can be applied and the nutrient can be absorbed by the roots. Foliar sprays also can be the best way to get a nutrient into the tree at times when root growth or function is reduced.

Other nutrients such as zinc, copper, iron, boron, and manganese are needed in very small amounts by plants and consequently are referred to as "micronutrients." Often, excess amounts of these nutrients can be toxic to plants. Foliar sprays can be an effective means of getting micronutrients into trees because they deliver a small, set amount of nutrient directly to the tree. Carefully measured and applied micronutrient sprays can help keep trees healthy and avoid toxic levels of these nutrients in the tree.

CAUTION! Foliar sprays can burn/damage tree tissue, including leaves, shoots, buds, **and fruit**. Therefore, use extreme care when deciding whether to use foliar materials between budbreak and harvest to avoid potential crop damage. A good general rule to follow is this: Between dormancy and harvest, avoid foliar feeds unless visible symptoms or lab analysis show a deficiency problem exists. In addition, use dilute sprays. Tissue damage usually occurs when concentrated materials are applied or sprays are concentrated by evaporation on the tissue.

The information presented here has been compiled from a review of information and research from both Washington and Oregon. Climatic and environmental differences between the Mid-Columbia region and other regions of the Pacific Northwest may require further work to determine the effectiveness of spray applications developed in other regions. If you are uncertain about how a particular material will work in a specific orchard, test the material, at the concentration recommended, on a few trees before spraying the entire orchard.

NOTE: Not all fertilizer materials are effective as foliar sprays. Severe tissue damage can occur as a result of foliar applications of some nutrient formulations that are not intended for foliar use. Use caution when applying foliar nutrient sprays between dormancy and harvest.

Nitrogen

Urea sprays are an effective means of getting nitrogen into fruit trees at certain times of the year. These sprays can cause fruit and/or leaf burn. Consequently, foliar urea applications are risky when fruit is present. Such applications should be made only when trees are obviously nitrogen deficient. The Washington spray guide warns against foliar urea application to pear and stone fruits, reporting that they can cause injury. Low urea concentrations should be used when spraying apple trees when crop is present.

Postharvest urea sprays for pear

Concentrated postharvest urea sprays have been shown to be very effective in getting nitrogen into pear and apple fruit buds. Oregon State University researchers Tim Righetti, Anita Azarenko, and David Sugar have shown that postharvest urea treatments increase the length of time that pear blossoms are receptive to pollen, and this may increase fruit set. Research has shown that 10 percent urea solutions (84 lb urea/100 gal water) badly burn leaves. Urea solutions of 5 percent (42 lb urea/100 gal water) have been shown to be effective without extreme leaf burn. However, some leaf burn is to be expected. Unlike late-season soil nitrogen fertilization, postharvest foliar urea sprays do not seem to significantly increase chances of winter injury to pear. Postharvest urea applications may speed the decomposition of leaves and reduce primary inoculum for scab infections the following season.

NOTE: 1) Biuret is a by-product of urea manufacture and is toxic to plants. To avoid tissue damage, check the label to make sure that the urea material contains **less than 2 percent biuret.**

2) If you tank-mix urea with other materials, it may increase or decrease the effectiveness of the other materials. Urea can reduce the effectiveness of some pesticides and increase the effect of some growth regulators. Urea improves leaf boron uptake, and is recommended as a tank mix for **postharvest** boron applications. Use caution when tank-mixing urea with other materials.

Fall foliar urea application for sweet cherry

Foliar urea applications during late August to early September have been shown to positively affect sweet cherry winter hardiness, spur tissue nitrogen content, and leaf size the subsequent spring. Leaf area is positively related to fruit size; however, increased fruit size as a result of foliar postharvest urea applications has not been documented. Two applications of low biuret urea are recommended as dilute sprays (in 100 to 200 gal/acre). For each application, apply at a rate of 20 lb actual nitrogen per acre. The first application is made in late August-early September; the second seven days later. Marginal leaf burn may occur following dilute spray applications. Applications are made while leaves are still green and active. Nitrogen is remobilized from the leaf back into the bud or spur as leaves senesce and abscise. Applications made too late (as leaves are changing color) may have reduced effect.

Boron

Boron deficiency can reduce fruit set and produce bark necrosis in apple as well as fruit cork. Fruit cracking is a symptom of boron deficiency. Although trees need boron, it also can be toxic to trees. Thus, both too little and too much boron are a problem in fruit trees. Also, because trees need only a small amount of boron, it is easy to overdo it, especially with soil fertilizer applications. Consequently, it may be best to apply annual foliar boron sprays instead of soil applications. This has been shown to be true in nonirrigated pear orchards, but the idea has not been tested elsewhere.

Tank-mixing urea with boron increases boron uptake in fall applications. As little as 8-9 lb of urea per 100 gallons (1% urea solution) can be used to "carry" boron into the tree.

A number of new boron spray products have been developed in the past few years. Dr. Frank Peryea, Washington State University researcher at the Tree Fruit Research Center in Wenatchee, has done a great deal of work evaluating these new materials. The information that follows is from his work.

All boron products use either boric acid or sodium polyborate as the source of boron. Dr. Peryea has shown that significant differences in tank water pH can result from the use of different boron products. Sodium polyborate will increase the pH of spray tank water unless an acidifier is mixed with the product during manufacturing or in the spray tank. High tank water pH can degrade some pesticides (e.g., Imidan, Captan, Topsin) or plant growth regulators (e.g., Promalin). Boric acid does not dissolve as quickly as sodium polyborate, but doesn't increase tank water pH. Pure boric acid may slightly decrease tank spray water pH. **Regardless of the boron product used, checking tank water pH when tank-mixing with pH-sensitive products is highly recommended.**

NOTE: High boron spray rates and concentrations can deliver excess boron, resulting in **shoot dieback or even tree death**.

Zinc

Zinc deficiencies can reduce leaf size, shoot growth, fruit set, and fruit size. In extreme cases, zinc deficiency shortens the distance between

leaves, and new growth looks like a tuft or rosette formed on branch tips with smaller, sometimes yellowish leaves below. Soil applications are not effective on mature trees. Spray applications are effective, and annual spray applications are most effective.

Several materials are available as zinc foliar materials. Zinc sulfate is effective, but can damage leaves and fruit if concentrated spray material is applied. (Spray oil should not be applied within 30 days of zinc sulfate sprays.) Zinc chelate or organic complex materials also are effective in getting zinc into tree leaves. Some of these products are compatible with oil. Check the label to determine which materials should be used with oil.

Before buds open in the spring (no later than Stage 2) is the most effective time to apply foliar zinc. **Again, do not use zinc sulfate with oil or within 30 days of oil application.** Always check the label to determine whether oil is compatible with a particular zinc material.

Zinc-deficient trees can be treated with foliar sprays during the growing season. These applications can cause russeting in the spring when conditions often are cool and damp. Use low rates on bearing stone fruit. Avoid using zinc sulfate on bearing trees.

Fall foliar zinc applications can be made, but are not as effective as dormant applications. Unlike boron or urea, very little zinc moves out of the leaf before leaf fall. Consequently, after a fall zinc spray, the majority of fertilizer zinc stays in the leaf and ends up on the orchard floor after leaf fall. Some zinc does stay in the tree, but a recent study showed that less than 10 percent of the zinc in Golden Delicious flower clusters was from fall foliar zinc spray applied the previous year. If you use zinc sulfate in the fall, remember that high rates of zinc sulfate material can damage leaves and buds. Zinc chelate materials are less damaging.

Copper

Fruit trees need a very small amount of copper to avoid deficiency. Copper sulfate fungicide sprays are effective means of getting copper into trees. **NOTE**: Copper sulfate can russet Anjou pears. Copper sprays applied to Bosc pears to induce russet may cause fruit cracking.

Magnesium

Magnesium deficiency symptoms have been reported in mature leaves of heavily cropping apple and pear trees. Soil applications of dolomitic limestone are an effective means of correcting magnesium deficiencies. In the case of severe magnesium deficiencies, several materials applied in two different sprays are reported effective.

Calcium

The relationship between calcium sprays, fruit calcium levels, and fruit physiological disorders has not been clearly established in the Mid-Columbia region. In warmer regions of the Pacific Northwest (Yakima, WA and Medford, OR), the use of calcium sprays has been correlated with a reduction in bitter pit (apples), cork spot and alfalfa greening (Anjou pears), or postharvest decay (Bosc pears). Research from Washington suggests that calcium chloride sprays on cherries can reduce fruit softening, postharvest injury, and minor rain cracking. These sprays may also reduce cherry size. Research in the Mid-Columbia region indicated that weekly applications of calcium (0.1 to 0.15% calcium), beginning at 45 days after bloom (approximately pit hardening) and repeated 5 to 6 times, are necessary to increase fruit calcium content and firmness. Applications prior to 45 days after full bloom had no effects on fruit quality. Calcium nitrate and chelated formulas of calcium (0.1 to 0.15% calcium) improved firmness and did not reduce fruit size. Repeated applications of calcium chloride and calcium citrate may reduce fruit size.

NOTE: Foliar calcium chloride applications can russet fruit. The use of concentrated sprays is most likely to mark fruit. Use of dilute calcium sprays and reduced rates are most likely to minimize or avoid leaf burn and fruit marking. Pears are more susceptible to calcium spray damage than apples. Avoid spraying under slow drying conditions (when material is gradually concentrated in local regions of the fruit) and when the temperature is above 80°F.

High potassium application rates can reduce calcium uptake.

Spray program for nutrients

Application rates in these tables are for dilute sprays, generally estimated as 200 to 400 gal/acre. Gallonage requirements vary depending on tree size, shape, and spray equipment. Information from *WSU Crop Protection Guide—Tree Fruits* series is included in the following section.

Nutrient	Possible materials or combinations	Amount per acre	Amount per 100 gallons** (dilute sprays)	Important notes
Dormant spray—apply in spring before buds open				
zinc maintenance	1. zinc chelate or organic complex			1. Follow the label.
	2. zinc sulfate 1.2LC	2-4 gal	0.5-1 gal	
	3. zinc sulfate 36% crystals	6-12 lb	1.5-3 lb	3, 4, 5. Make sure all crystals dissolve. See precautions in text. Oil-free sprays are more effective. Follow label for oil sprays. Follow manufacturer's label.
	4. basic zinc sulfate (dry, 50-52%)	6-12 lb	2 lb (w/ oil) 3 lb (w/o oil)	
	5. basic zinc sulfate (liquid, 20-25%)			
zinc deficiency	1. zinc chelate or organic complex			1. Follow the label.
	2. zinc sulfate 1.2LC	13 gal	3.25 gal	
	3. zinc sulfate 36% crystals	40 lb	10 lb	3. Make sure all crystals dissolve. See precautions in text. Apply without oil.
	4. basic zinc sulfate (dry, 50-52%)	16 lb	4 lb	4. Follow manufacturer's label.
	5. basic zinc sulfate (liquid, 20-25%)	—	—	

*In nonirrigated orchards in the White Salmon-Underwood area, use the deficiency rate.

**Low concentrations, 400 gal/acre, generally are recommended to prevent damage.

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Spray program for nutrients (continued)

Nutrient	Possible materials or combinations	Amount per acre	Amount per 100 gallons** (dilute sprays)	Important notes
Prepink or pink spray				
boron maintenance*	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			1, 2. Apply amount equivalent to 0.5 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
boron deficiency	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			1, 2. Apply amount equivalent to 1 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
Foliage spray—after bloom and before harvest				
boron maintenance*	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			1, 2. Apply amount equivalent to 0.5 lb actual boron per acre. See precautions in text.
boron deficiency	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			1, 2. Apply amount equivalent to 1 lb actual boron per acre. See precautions in text.
calcium (cherry fruit firmness)	1. calcium nitrate 2. chelated calcium products	See label See label	See label See label	1, 2. Five to six applications are needed at weekly intervals (beginning 45 days after bloom) prior to anticipated harvest. See text.
calcium (cherry reduced cracking)	1. calcium chloride 2. calcium nitrate 3. calcium citrate 4. chelated calcium products	8-12 lb See label See label See label	2-3 lb See label See label See label	1, 3. May reduce fruit size. See text.
calcium (alfalfa greening of pears, cork spot of Anjou pear)	1. calcium chloride 2. calcium nitrate 3. calcium citrate 4. chelated calcium products	4 lb See label See label See label	0.5-1 lb See label See label See label	1. Apply in 400-800 gal/acre depending on tree size. Four applications needed from June to August. Can cause fruit injury. See text.
magnesium deficiency	1. magnesium chelate or organic compound 2. magnesium nitrate 13.5% crystals 3. magnesium nitrate 0.4LC 4. calcium nitrate (fertilizer grade) + Epsom salts (magnesium sulfate)	40-80 lb 20-40 lb 6-12 gal 24-48 lb	10-20 lb 5-10 lb 1.5-3 gal 6-12 lb	1. For rates of magnesium chelate, see manufacturer's label. 2. Apply in June. Repeat in July if necessary. Do not apply after August 1.
nitrogen deficiency	1. urea 46% solid 2. urea 20% liquid	2-10 lb 0.5-2.4 gal	0.5-2.5 lb 0.25-0.6 gal	1, 2. Apply only as needed to apples. Can cause injury on pear or stone fruits. See text.
zinc deficiency, nonbearing trees	1. zinc sulfate 36% crystals 2. zinc sulfate 1.2LC 3. basic zinc sulfate (dry, 50-52%) 4. basic zinc sulfate (liquid, 20-25%) 5. zinc chelate or organic complex	6 lb 2 gal 6-12 lb	1.5 lb 0.5 gal 1.5-3 lb	1, 2. Make sure all crystals are dissolved. See precautions in text. Can cause injury, particularly on stone fruits. Follow the label. 3. Follow manufacturer's label for all products. See precautions in text.
zinc deficiency, bearing trees	1. zinc chelate or organic complex			1. See precautions in text. Can cause injury, particularly on stone fruits. Follow the label.

*In nonirrigated orchards in the White Salmon-Underwood area, use the deficiency rate.
**Low concentrations, 400 gal/acre, generally are recommended to prevent damage.

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Spray program for nutrients (continued)

Nutrient	Possible materials or combinations	Amount per acre	Amount per 100 gallons** (dilute sprays)	Important notes
Postharvest spray—apply after harvest and while leaves are still green and active				
boron maintenance*	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			1, 2. Apply amount equivalent to 0.5 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
boron deficiency	1. boric acid (dry or liquid) 2. polyborate (dry or liquid)			Apply amount equivalent to 1 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
nitrogen maintenance	1. urea 46% solid 2. urea 20% liquid	42 lb 10 gal	42 lb 10 gal	Do not apply more than 60 lb/acre. Severe leaf burn can occur.
zinc maintenance	1. zinc chelate or organic complex 2. zinc sulfate 36% crystals 3. zinc sulfate 1.2LC 4. basic zinc sulfate (dry, 50-52%) 5. basic zinc sulfate (liquid, 20-25%)	 6-12 lb 2-4 gal 6-12 lb	 1.5-3 lb 0.5-1 gal 1.5-3 lb	1, 2, 3, 4. Follow the label. 2, 3. Make sure all crystals dissolve. Do not apply before October 1. Do not apply on apricot. 4. Follow manufacturer's label. See precautions in text.
zinc deficiency	1. zinc sulfate 36% crystals 2. zinc sulfate 1.2LC 3. basic zinc sulfate (dry, 50-52%) 4. basic zinc sulfate (liquid, 20-25%) 5. zinc chelate or organic complex	25 lb 8 gal 16 lb	6.25 lb 2 gal 4 lb	1, 2. Make sure all crystals dissolve. Do not apply before October 1. Do not apply on apricot. 3. Follow manufacturer's label. See precautions in text.

*In nonirrigated orchards in the White Salmon-Underwood area, use the deficiency rate.
**Low concentrations, 400 gal/acre, generally are recommended to prevent damage.

Growth regulator sprays

In recent years, local research with plant growth regulators has been limited. Washington State University (WSU) has had an ongoing research program with plant growth regulators. **Current information on the use of plant growth regulator materials is available in the *Crop Protection Guide for Tree Fruits in Washington* (EB 0419)** found online at http://www.tfrec.wsu.edu/pages/cpg/. Because there may be differences in product registration between Oregon and Washington, check with your chemical supplier or local Extension office to make sure that a specific product is labeled for use in Oregon. Local experience with these materials suggests the precautions listed below in addition to those included in the WSU Guide.

Chemical thinning sprays

Results with thinning sprays may be quite variable. This often is due to variations in the weather preceding and following spray applications. Use sufficient spray volume to ensure complete coverage without excessive runoff. Inconsistent results have been obtained when growth regulators are applied in concentrate sprays.

Chemical thinning sprays for apples

1. Apply carbaryl (Sevin) as a thinning spray 15-25 days after bloom. Apply NAA (naphthalene acetic acid) as a thinning spray 14-18 days after bloom. Twenty days after bloom is optimum. During cool springs when growth is slow, fruit size is a better guide for timing sprays than days from full bloom. Ideal time is when fruit is 10-15 mm in diameter.
2. Combinations of carbaryl plus NAA will give increased thinning.
3. A wetting agent must be added to an NAA spray. Use 0.66 pint of Regulaid (a nonionic, water-soluble spreader) per 100 gallons of water when NAA is used alone. Use 0.5 pint of Regulaid per 100 gallons of water when carbaryl plus NAA is used.
4. Carbaryl provides 2 weeks protection against codling moth when used at 1.5 pints per 100 gallons of water. Carbaryl may thin if used in the first cover.
5. Carbaryl is injurious to bees; mow cover crops that are in bloom before applying carbaryl 50WP.
6. Carbaryl may over-thin young trees that have not reached full bearing capacity or that are in solid block plantings with no pollinizers.
7. The total effect of a carbaryl thinning spray cannot be evaluated for 3-4 weeks.
8. Carbaryl *may increase numbers of misshapen fruits that must be hand thinned and may russet Goldens, particularly in low spots.*
9. To determine the parts per million (ppm) spray concentrate in 100 gallons of spray, remember that:
   1 fluid ounce of 50-gram material = 1 ppm
   0.25 fluid ounce of 200-gram material = 1 ppm
10. NAA plus ethephon gives greater thinning and return bloom.

Chemical thinning sprays for pears

Naphthalene acetic acid (Fruitone L, K-Salt Fruit Fix 200)

Naphthalene acetic acid (NAA) is an auxin-type thinning agent used primarily for Bartlett pear.

1. USE 10 PPM NAA RATE IF TREES ARE WEAK. HIGHER RATES POSSIBLY CAUSE ADVANCED MATURITY.
2. Apply 14-18 days after bloom.
3. In solid Bartlett blocks, use the lower rates.
4. Avoid spraying other pear varieties in same block.
5. If weather is very cool, delay application until 21 days following full bloom.
6. Do not use this program in young orchards.
7. Do not use NAA in concentrate sprays.

BA-6 (MaxCel, RiteWay, Exilis Plus)

BA-6 is a cytokinin that promotes cell division in developing fruitlets. It may also result in fruit thinning. BA-6 has been shown to positively affect fruit size when application timing coincides with Bartlett fruit diameter of about 10-15 mm. For optimum results, applications should be made when temperatures exceed 65°F. BA-6 penetration and uptake by leaves has been shown to increase linearly with increasing temperature. Use sufficient spray volume to ensure complete coverage without excessive runoff. Generally, volumes ranging from 100 to 200 gallons per acre with concentrations of 75-200 ppm are recommended (75-200 ppm = 48-128 fluid ounces of Maxcel or RiteWay, and 46-122 fluid ounces Exilis Plus, per 100 gallons). BA-6 is not a substitute for hand thinning. Allow 7-10 days after the first application to observe thinning response. If greater thinning is desired, apply a second application before fruit size exceeds 20 mm. Do not apply closer than 86 days before harvest. Do not apply more than 182 grams of BA-6 annually per acre (308 fluid ounces of MaxCel or RiteWay; 296 fluid ounces of Exilis Plus).

Stop drop sprays

Naphthalene acetic acid (NAA) is the material usually used as a hormone spray for the control of fruit drop in Hood River County. Stop drop sprays should be applied 6 to 8 days prior to harvest (not less than 5 days). Commercial solutions of NAA vary in the amount of actual NAA. The recommended rate will depend on the concentration of active ingredient in a specific product. Use of NAA as a stop drop spray for Anjou pear at a higher rate than that specified on the product label may be permitted under a special local need (SLN) registration (Section 24(c) FIFRA). Check with your fieldman regarding current SLN status for NAA.

Retain (AVG) was registered for use as a stop drop spray on apples and pears in 1997. Consult your fieldman regarding local experience with this product.

Plant growth regulator for apples

Apogee was registered for use on apples in 2000. Consult your fieldman regarding local experience with this product.

Plant growth regulator for cherries and pears

Gibberellic Acid (GA)

OSU trials indicate that application rates of 20 ppm applied around straw color have the greatest efficacy for improving sweet cherry firmness and fruit size. Higher rates may delay harvests due to delayed color development, but have not consistently resulted in improved firmness or size compared to 20 ppm. The response of sweet cherry to GA is a function of the total dose provided (i.e., multiple applications have not improved cherry quality when compared to equivalent doses provided in a single application). Dilute applications (100-400 gal per acre) are recommended. Uniform coverage is critical given the limited transport of GA in plants; greater spray volumes may be required to penetrate large canopies. Application timing coincides with straw color (end of Stage II/beginning of Stage III fruit growth). No differences in fruit quality were observed over a range of varieties tested (i.e., Bing, Skeena, Sweetheart, Lapins, and Staccato). Cherry fruits may be more susceptibile to rain cracking shortly after GA applications. Amounts of GA product needed to prepare specific concentrations of spray solution for two typical GA formulations are provided below in Tables 1 and 2.

Table 1. Fluid ounces of Falgro 4L needed to prepare specific concentration of spray solution depending on spray volume needed for adequate coverage. Do not exceed 48 fluid ounces per acre per season.

Concentration (ppm)	Spray volume			
	100 gpa	200 gpa	300 gpa	400 gpa
10	3.2 oz*	6.4 oz	9.6 oz	12.8 oz
20	6.4 oz	12.8 oz	19.2 oz	25.6 oz
30	9.6 oz	19.2 oz	28.8 oz	38.4 oz

*Fluid ounces of Falgro 4L are equivalent to grams active ingredient of GA.

Table 2. Ounces of ProGibb 40WSG needed to prepare specific concentrations of spray solution depending on spray volume needed for adequate coverage.

Concentration (ppm)	Spray volume			
	100 gpa	200 gpa	300 gpa	400 gpa
10	0.3 oz	0.7 oz	1.0 oz	1.3 oz
20	0.7 oz	1.3 oz	2.0 oz	2.7 oz
30	1.0 oz	2.0 oz	3.0 oz	4.0 oz

Prohexadione-calcium (Apogee)

Limited data exist for the use of Apogee on sweet cherry. Apogee interferes with gibberellin synthesis in plant tissues; hence, it acts to reduce current season shoot elongation and can be used to manage vigor. Previous research (on apple, for which Apogee is labeled, and pear, for which it is currently unlabeled) demonstrated the greatest effect when applied at rates between 125 and 250 ppm*. Application timing is early spring when newly emerged shoots are less than 2 inches in length. Delayed applications to shoots 5 to 6 inches long reduced the effect. Applications are made in dilute concentrations (200-400 gallons per acre) in combination with a non-ionic surfactant (0.1% volume to volume; i.e., 25 fluid ounces per 200 gallons). Addition of spray grade ammonium sulfate (1:1 [w:w] ratio between apogee and ammonium sulfate) is recommended if water source is alkaline. A high concentration of calcium salts has been shown to reduce the activity of Apogee. Multiple applications may be required due to the relatively rapid metabolism of the compound within the plant. It is, therefore, necessary to monitor shoot growth and re-apply once growth resumption occurs. If shoots initially treated with Apogee are not re-treated, shoot regrowth may be excessive. Different cultivars may respond differently and environmental factors contribute to efficacy (vigor of the cultivar/rootstock combination having the greatest influence). Applications that coincide with floral bud induction (early to mid-May) can result in greater flower density, fruit set, and yield the subsequent year. Therefore, caution is required for this application timing on highly productive cultivars prone to over-cropping (i.e., Sweetheart) given the potential for negative effects on fruit size.
*250 ppm = 12 ounces Apogee per 100 gallons spray volume per acre. If using 400 gallons, then 48 ounces per acre. Maximum seasonal use rate is 99 ounces; PHI = 45 days.

AVG (ReTain)

AVG is an ethylene inhibitor used to delay ovule senescence (a process associated with internal ethylene production) and thereby lengthen the effective pollination period of cherry flowers. A longer effective pollination period may result in higher fruit set. Cherry cultivars with short ovule viability (i.e., Regina) are good candidates for annual treatment. Selective applications may improve fruit set of additional cultivars in years where high-stress conditions (high temperatures) are expected during or immediately following flowering. Application rate is 1 pouch (333 grams) in 100 gallons per acre plus 0.1 percent organosilicone adjuvant (12.5 fluid ounces per 100 gallons). Results from trials in the Pacific Northwest indicate that ReTain should be applied between 10 percent and 80 percent of full bloom; however, multiple applications during this period did not improve the response.

AVG can increase fruit set of pear cultivars when applied near bloom. Results from research trials in Oregon support application timings at the end of petal fall, as opposed to earlier developmental stages of bloom as the label recommends. The natural ethylene production of developing pear fruitlets peaks about 14 days after full bloom (dafb), and then declines rapidly to non-detectable levels by about 21 dafb. AVG markedly reduced ethylene production of treated flowers and fruitlets for several days to several weeks after application. Between 2012 and 2015, fruit set was increased in 65 percent of the trials performed in the lower and upper Hood River Valley, but only when applied later than 7 dafb. Similar effects were observed for Anjou and Comice. We are unaware of evaluations using other cultivars. Application rate is between 0.5 and 1 pouch (333 grams) in 100 gallons per acre plus 0.1 percent organosilicone adjuvant (12.5 fluid ounces per 100 gallons). In some cases, fruit set and yield can be markedly increased resulting in reduced fruit size. Return bloom was not affected by petal fall applications. See label for additional information.

Forchlorfenuron (Vini-set)

Vini-set is registered for use on sweet cherries and European pear to increase fruit size. It is a synthetic cytokinin with purported cell division activity; hence, Vini-set is applied early in fruit development when cell multiplication is active. For cherry, the label suggests application timings between bloom and straw color. Research conducted in the Pacific Northwest, however, indicates an increased effect from earlier applications (between open cluster and full bloom). These data are supported by cell anatomy studies which indicate that cell division in sweet cherry is complete approximately 2.5 weeks after bloom, when about 50 percent of the cells of a mature cherry fruit are present in the developing ovary at flowering. Results from multiple trials have been inconsistent. However, when an increase in fruit size was observed, it was generally between 5 and 10 percent (i.e., about 1/2 row size). A slight thinning effect has been observed but not confirmed. Make a single application per year of 20 to 40 fluid ounces per acre (10-15 ppm) in 100 to 200 gallons spray per acre.

For pear, Vini-set is labeled to improve fruit size when applied at 15 to 25 days post-petal fall. Applications earlier in fruit development have resulted in misshapen fruit (pronounced calyx end growth). In 2015, an evaluation of application rates of Vini-set to Anjou trees at about 14-mm fruit size resulted in a significant, rate responsive thinning effect. Crop reduction indirectly resulted in larger fruit. More research is warranted to determine the merit of Vini-set on pear cultivars.

This publication was prepared by: from the Oregon State University Mid-Columbia Agricultural Research and Extension Center—Steve Castagnoli, Extension horticulturist and associate professor, Hood River; Lynn Long, Extension horticulturist and professor, Wasco County; from the Oregon State University North Willamette Research and Extension Center—Nik Wiman, orchard crops Extension specialist; from the Oregon State University Southern Oregon Research and Extension Center—Rick Hilton, senior faculty research assistant II – agricultural entomologist; from the Oregon State University Extension Service—Jay W. Pscheidt, Extension plant pathology specialist and professor; from Oregon State University Department of Horticulture, Ed Peachey, associate professor and senior researcher of weed science.

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