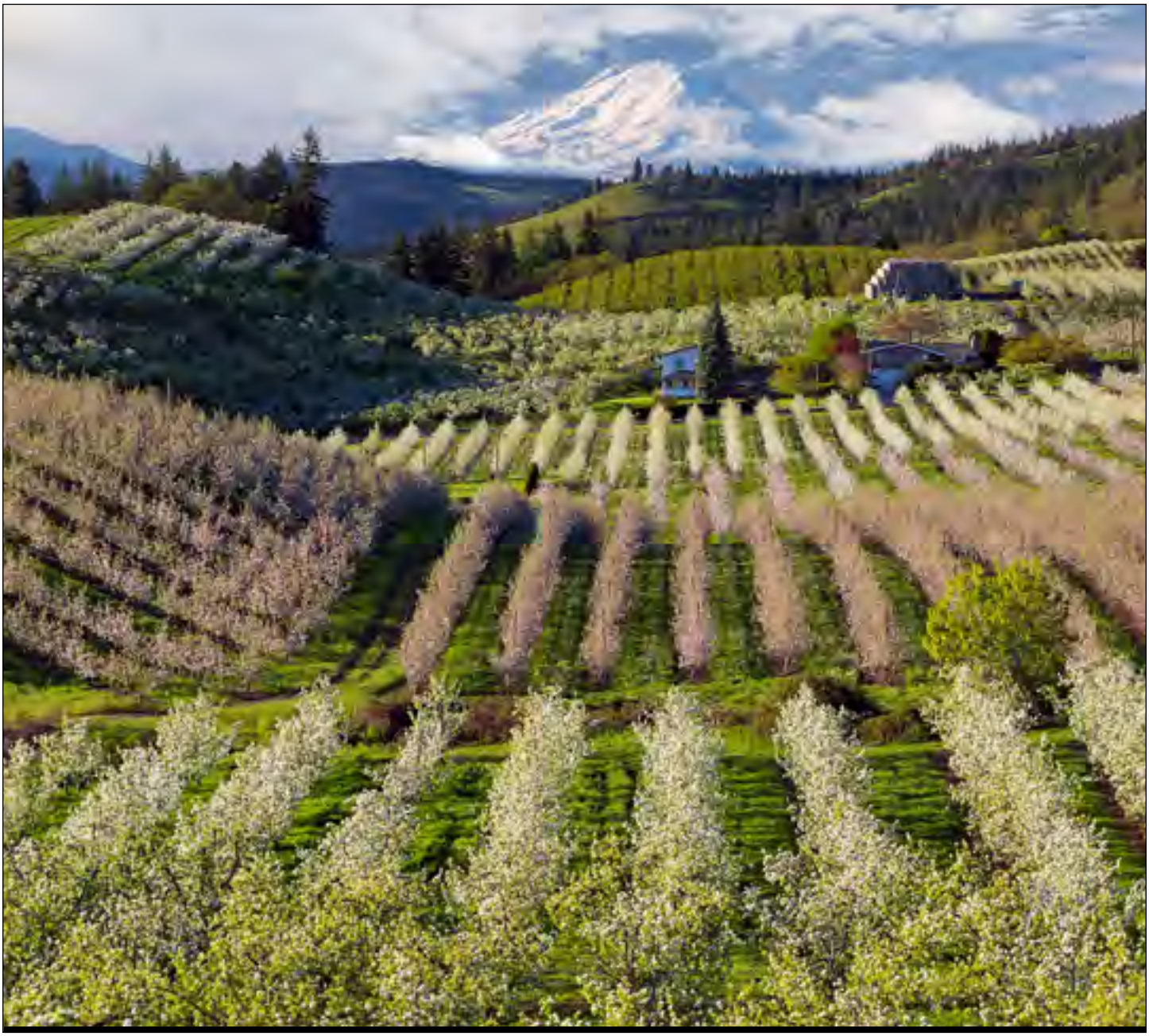
OREGON STATE UNIVERSITY EXTENSION SERVICE

2026 Pest management guide for TREE FRUITS

HOOD RIVER • THE DALLES • WHITE SALMON • ROGUE VALLEY • UMATILLA COUNTY



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Oregon State University

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Safe and effective use of pesticides

The purpose of this pest management guide is to provide fruit growers with up-to-date information on registered pesticide uses 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.

Providing comprehensive information on safe and effective use of pesticides is beyond the scope of this publication. Refer to product labels for basic information on permitted uses and hazards associated with specific pesticides. The labels specify the minimum requirements for personal protective equipment. The potential for applicator exposure is generally higher for airblast sprayer application. Consider using additional protective equipment beyond what is specified on the label when making airblast applications. See the National Pesticide Applicator Certification Core Manual, https://www.oregon.gov/oda/Documents/Publications/PesticidesPARC/PesticideApplicatorCoreManual.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 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. Visit https://www.oregon.gov/oda/pesticides/licensing/Pages/default.aspx or call 503-986-4635.
- **Worker protection —** The federal Worker Protection Standard for Agricultural Pesticides 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 osha.oregon.gov/Pages/topics/worker-protection-standard.aspx 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. 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. Visit www.tricountyrecycle.com/managing-my-materials/hazardous-waste or call 541-506-2632. Most area chemical distributors offer plastic pesticide container recycling. For information on container preparation, contact your chemical supplier.

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For information on pest management in peaches, see the *Pest management guide for peaches*, https://extension.oregonstate.edu/catalog/pub/em-8419-2023-pest-management-guide-peaches

For more information, including information on bioregulator sprays, see the *Crop Protection Guide for Tree Fruits in Washington*, EB 0419, https://cpg.treefruit.wsu.edu/.

Trade and common names of pesticides, with restricted-entry intervals

Fungicides and bactericides

Trade name	Common name	REI
Actigard	acibenzolar S-methyl	12 hr
Agri-mycin	streptomycin	12 hr
Aliette	aluminum tris	12 hr
Aprovia	benzovindiflupyr	12 hr
BlightBan	biological	12 hr
Blossom Protect	*Aureobasidium pullulans*	4 hr
Bravo	chlorothalonil	12 hr
Cabrio 20EG	pyraclostrobin	12 hr
Captan	captan	1 day
Cevya	mefentrifluconazole	12 hr
Champ	copper hydroxide	2 days
Cinnerate	cinnamon oil	0 hr
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
Fireline	oxytetracycline	12 hr
Firewall	streptomycin	12 hr
Flint	trifloxystrobin	12 hr
Fontelis	penthiopyrad	12 hr
Gatten	flutianil	4 hr
Gem 500SC	trifloxystrobin	12 hr
horticultural mineral oil	petroleum or paraffinic oil	4 hr
Indar	fenbuconazole	12 hr
Inspire	difenconazole	12 hr
Inspire Super	difenconazole plus cyprodinil	12 hr
Kaligreen	bicarbonate	4 hr
Kasumin		12 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
Miravis	pydiflumetofen	12h
Mycoshield	oxytetracycline	12 hr
Nordox	copper oxide	12 hr
Omega 500	fluazinam	2 days
Penncozeb	mancozeb	1 day
Ph-D/Oso	polyoxin D zinc salt	4 h
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
Serenade	*Bacillus subtilis* strain QTS 713	4 hr
Sullfur	sulfur	1 day
Syllit	dodine	2 days
Tebucon	tebuconazole	12 hr
Tesaris	fluxapyroxad	12 hr
Theia	*Bacillus subtilis*	4 hr
Tilt	propiconazole	1 day
TopGuard	flutriafol	12 hr
Topsin M WSB	thiophanate-methyl	2 days
Torino	cyflufenamid	4 hr
Vangard 75WG	cyprodinil	12 hr
Vivando	metrafenone	12 hr
Ziram		

Insecticides

Actara	thiamethoxam	12 hr
Agri-Mek	abamectin	13 hr
Altacor	chlorantraniliprole	14 hr
Assail	acetamiprid	16 hr
Asana	esfenvalerate	17 hr
Avaunt	indoxacarb	18 hr
Aza-Direct	azadirachtin	19 hr
Bacillus thuringiensis	*Bacillus thuringiensis*	4 hr
Belay	clothianidin	12 hr
Bexar	tolfenpyrad	12 hr
Carbaryl	carbaryl	12 hr
Centaur	buprofezin	12 hr
Celite	diatomaceous earth	-
Chlorpyrifos	chlorpyrifos	4 days
Cinnerate	cinnamon oil	4 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
Entrust	spinosad	4 hr
Esteem	pyriproxyfen	12 hr
Exirel	cyantraniliprole	12 hr
horticultural mineral oil	paraffinic oil	4 hr
Imidacloprid	imidacloprid	12 hr
Imidan	phosmet	3 days
Intrepid	methoxyfenozide	4 hr
Lambda-cyhalothrin	lambda-cyhalothrin	1 day
Malathion	malathion	12 hr
Neemix	azadirachtin	4 hr
Proclaim	emamectin benzoate	12 hr
Rimon	novaluron	12 hr
Sevin	carbaryl	12 hr
Sivanto	flupyradifurone	4 hr
Success	spinosad	4 hr
Surround	kaolin clay	1 day
Ultor	spirotetramat	1 day
Venerate	*Burkholderia* spp.	4 hr
Virosoft	codling moth granulosis virus	4 hr
Warrior II	lambda-cyhalothrin	1 day
Zivalgo	Plinazolin	12 hr

Miticides

Acramite	bifenazate	12 hr
Apollo	clofentezine	12 hr
Envidor	spirodiclofen	12 hr
FujiMite	fenpyroximate	12 hr
horticultural mineral oil	paraffinic oil	4 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

Herbicides

2,4-D amine	2,4-D	2 day
Aim	carfentrazone-ethyl	12 hr
Alion	indaziflam	12 hr
Casoron	dichlobenil	12 hr
Fusilade	fluazifop-p-butyl	12 hr
glyphosate	glyphosate	4 or 12 hr
Goal	oxyflourfen	1 day
Gramoxone	paraquat	1 day
Karmex	diuron	12 hr
Kerb	pronamide	1 day
Matrix	rimsulfuron	4 hr
Pindar	oxyflourfen+penoxsulam	24 hr
Poast	sethoxydim	12 hr
Princep	simazine	12 hr
Prowl	pendimethalin	1 day
Rely	glufosinate-ammonium	12 hr
Sandea	halosulfuron	12 hr
Select	clethodim	1 day
Sinbar	terbacil	12 hr
Solicam	norflurazon	12 hr
Stinger	clopyralid	12 hr
Suppress	caprylic acid + capric acid	1 day
Surflan	oryzalin	1 day
Treevix	saflufenacil	12 hr
Trellis	isoxaben	12 hr
Venue	pyraflufen ethyl	12 hr

Orchard pest management

Integrated Pest Management principles are being used successfully in Pacific Northwest orchards to manage weeds, diseases, insects, mites 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*, 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 orchard pest management guides produced 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 available at http://treefruit.wsu.edu/crop-protection/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. 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:

- Addresses a source of information for obtaining and selecting elements of IPM that can be used successfully in tree fruit production in Oregon.
- 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 tree removal, removal of all bloom from trees, and 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.

Extension publications

For more details on pest management, see the following publications from the OSU Extension Catalog, available at https://catalog.extension.oregonstate.edu. Some materials are available in Spanish.

- *Bee protection protocol for Western specialty seed crops certification*, EM 9353
- *Farm safety series*, PNW 512
- *Living on the land: Attracting birds of prey for rodent control*, EC 1641
- *Preventing water contamination and pesticide drift: A checklist for pesticide applicators*, EM 8964
- *Spotted-wing drosophila, relative rankings and seasonal strategies for insecticide use*, EM 9360
- *A detailed guide for testing fruit for the presence of spotted wing drosophila (SWD)*, EM 9096
- *Identifying Serious virus and phytoplasma symptoms on your cherry orchard*, EM 9372
- *Getting ahead of X-disease*, EM 9362
- *Understanding and preventing sweet cherry fruit cracking*, EM 9227
- *Sweet cherry rootstocks for the Pacific Northwest*, PNW 619
- *Brown marmorated stink bug*, EM 9054

Best management practices for orchard spraying

OSU Extension 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. 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 feet 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 (such as prebloom and postbloom) recommendations are not made in this guide. Specific suggestions for pre- and postbloom control programs for orchards in sensitive areas is provided in Extension newsletters.

Cultural practices

- Maintain at least 20 feet 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-absorbent 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 annually to avoid overapplication and reduce drift.
- Check nozzles and ensure they are not worn out.

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.

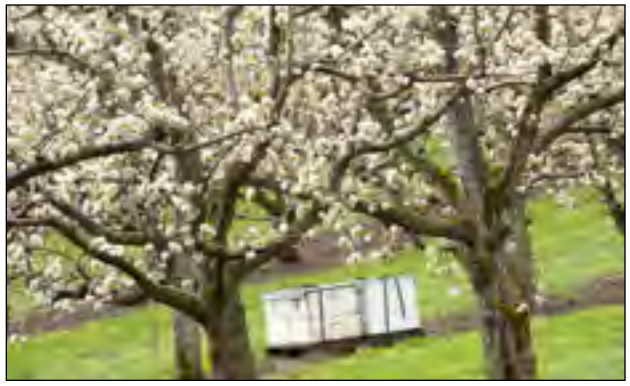

Photo: Lynn Ketcham, © Oregon State University

Beehives in a pear orchard at the OSU Mid-Columbia Agriculture Research and Extension Center in Hood River.

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. Exposure is highest when trees are in bloom, or when native plant communities surrounding orchards are in bloom. Whenever possible, apply insecticides and fungicides outside of the bloom period, or restrict sprays to evenings. While fungicides are not acutely toxic to bees, they have been associated with chronic effects on bees. During full bloom, choose to apply any fungicides in the evening. For detailed information on pesticide toxicity to bees and practices for preventing bee poisoning, see *How to Reduce Bee Poisoning from Pesticides*, PNW 591, catalog.extension.oregonstate.edu/pnw591.

Buffers — Many pesticide labels now have specific buffer requirements for use near surface water. To avoid damage to fish and other aquatic organisms, follow label instructions for buffers and drift reduction. In the Pacific Northwest, mandatory buffers are required for certain pesticide active ingredients when used near certain fish-bearing streams. For specific requirements, see 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.

Bee hazard of pesticides for pears, apples and cherries

Quick reference for protecting bees from pesticides commonly used in fruit production. Adapted from *How to reduce bee poisoning from pesticides*, PNW 591, https://extension.oregonstate.edu/catalog/pub/pnw-591-how-reduce-bee-poisoning-pesticides. Materials are listed alphabetically.

Trade name	Active ingredient	Bee hazard
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, Firewall	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	-
Bexar	tolfenpyrad	x
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)
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	-
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	-
Lime sulfur	lime sulfur/calcium polysulfide	-
Lorsban 4E	chlorpyrifos	xx (4-6 days)
Luna Sensation	fluopyram plus rifloxystrobin	-
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, Fireline	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	-
Proclaim 5SG	emamectin benzoate	xx (>1 day)
Procure	triflumizole	-
PropiMax	propiconazole	-
Quash	metconazole	-
Quintec	quinoxyfen	-
Rally	myclobutanil	
Ridomil	metalaxyl	
Rimon 0.83EC	novaluron	
Rovral	iprodione	
Rubigan	fenarimol	

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.

Managing insecticide resistance: When reliable tools lose their effectiveness

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 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.

Producers in Oregon's fruit-growing regions have firsthand experience with resistance development and its consequences. For instance, in the early 1950s codling moth developed resistance to DDT after six to eight 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 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

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. 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, 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

A grower who wants to take an active part in managing resistance should adopt an integrated pest management, or 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 (such as an 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 and the apple rust mite. Information in this table was obtained from the *Crop Protection Guide for Tree Fruits in Washington*, EB 0419, http://cpg.treefruit.wsu.edu, and other sources including the Orchard Presticide Effects on Natural Enemies Database, https://enhancedbc.tfrec.wsu.edu/opened/.

			Relative impact rating[1]						
Compound	**Trade name**	**Rate/acre**	**Western predatory mite[2]**	**Apple rust mite[3]**	**Colpoclypeus florus[4]**	**Pnigalio flavipes[4]**	**Coccinellids[5]**	**Lacewing**	**Mirids[6]**
abamectin	Agri-Mek	10-20 oz	High[7]	High[7]	Med[7]	Low	Med[7]	–	High
acetamiprid	Assail 70WP	3.4 oz	Med-High[11]	Low	High	-	Med	Med	High
azadirachtin	Neemix 4.5%	7 oz	–	–	Low	–	Low	–	–
Bacillus thuringiensis (B.t.)	Deliver, Dipel, Javelin	1-2 lb	Low	Low	Low	Low	Low	–	Low
bifenzate	Acramite 50WS	0.75-1 lb	Low	–	–	–	–	–	–
buprofezine	Centaur DG	34.5 oz	–	–	–	–	–	–	–
carbaryl	Sevin 50WP	2 lb	Med-High	Low-Med	High	Low	High	Low	–
clofentezine	Apollo 50SC	4-8 oz	Low	Low	–	–	–	–	Low
codling moth granulosis virus	Carpovirusine	13.5 oz	Low	Low	Low	Low	Low	Low	Low
Cydia pomonella granulovirus	Cyd-X	1-6 oz	-	-	-	-	-	-	-
diazinon	Diazinon 50WP	4 lb	Low	Low	High	–	High	–	–
diflubenzuron	Dimilin 2L	12-48 oz	–	–	High	–	Low	–	–
dimethoate	Dimethoate 2.67EC	3-6 pt	Low-Med	Low	High	–	High	–	–
endosulfan	Thionex 50W	3 lb	Low	Med-High	Med	Med	Med-High	Low	–
esfenvalerate	Asana 0.66EC	1 pt	High	Low	Med	Med-High	–	Low	High
etoxazole	Zeal 72WSP	2-3 oz	Low-Med	–	–	–	–	–	–
fatty acids (soap)	M-Pede	1-2% v/v	Med[7]	Med[7]	–	–	Low	Low	–
fenbutatin-oxide	Vendex 50WP	1.5 lb	Med	High	Low	–	Low	–	–
fenpropathrin	Danitol 2.4EC	20 oz	High	-	–	–	–	–	High

CONTINUED ON PAGE 9

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.

Natural enemy impact guide, continued

Compound	Trade name	Rate/acre	Relative impact rating[1]						
			Western predatory mite[2]	Apple rust mite[3]	Colpoclypeus florus[4]	Pnigalio flavipes[4]	Coccinellids[5]	Lacewing	Mirids[6]
hexythiazox	Onager 1EC	16-24 oz	Low	Low	–	–	–	–	Low
horticultural mineral oil	–	1-2% v/v	Med[7,8]	Low[8]	Low	Low	Low	Low	Low
imidacloprid	Provado 1.6F	4-8 oz	Low[9]	Low[9]	Med-High[7]	–	Med	Med-High	High
indoxacarb	Avaunt 30DG	5-6 oz	Low[10]	Low[10]	–	–	–	–	–
kaolin	Surround WP	50 lb	Med-High	-	-	Med	Med-High[5]	–	–
lime sulfur	–	6 gal	Med-High	High	–	–	–	–	–
methomyl	Lannate 1.8L	2 pt	High	Low	–	–	-	–	–
methomyl	Lannate 90SP	0.5 lb	High	Low	–	–	–	–	–
methoxyfenozide	Intrepid 2F	10 oz	Low	Low	Low	Low	Low	Low	Low
novaluron	Rimon 0.83EC	30-50 oz	Med-High[11]	–	–[12]	–	High	High[13]	High
oxamyl	Vydate 2L	2-4 pt	Med-High	–	High	Low-Med	Med	Low	–
permethrin	Ambush 2EC	20 oz	High	Low	Med	–	–	-	High
permethrin	Pounce 25WP	12.8-25.6 oz	High	Low	Med	–	–	–	High
phosmet	Imidan 70WP	3-5.33 lb	Low	Low	High	Low	High	Low	High
pyridaben	Nexter 75WSB	4.4-7 oz	Med	High	Med-High	–	–	–	Med
pyriproxyfen	Esteem 35WP	4-5 oz	Low	Low	Med	–	Med-High	Low	Med
wettable sulfur 92%	sulfur	15-20 lb	Med-High	–	–	–	–	Low	Med
pyriproxyfen	Esteem 35WP	4-5 oz	Low	Low	Med	–	Med-High	Low	Med
spinetoram	Delegate	6.7 oz	High	-	High	-	Low	High	Med
wettable sulfur 92%	sulfur	15-20 lb	Med-High	–	–	–	–	Low	Med

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.
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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 required for infection	Minimum hours of leaf wetness
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

Robert A. Spotts

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 five 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 two or three 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. Consider a delay in pruning. 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. Use a resistant rootstock. Mazzard F12-1 is one of the most resistant. 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. Site 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 three 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 was recorded 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.

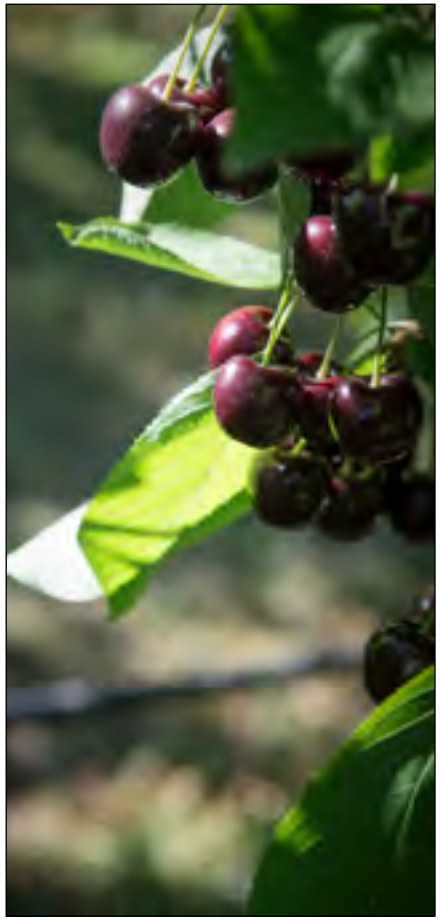

Photo: Lynn Ketcham, © Oregon State University

Control weeds and provide optimal soil conditions for young cherry trees to help prevent infection of *Pseudomonas synringae*, a bacterial pathogen.

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] from primary or secondary inoculum			Days required for lesions to appear[b]
	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.

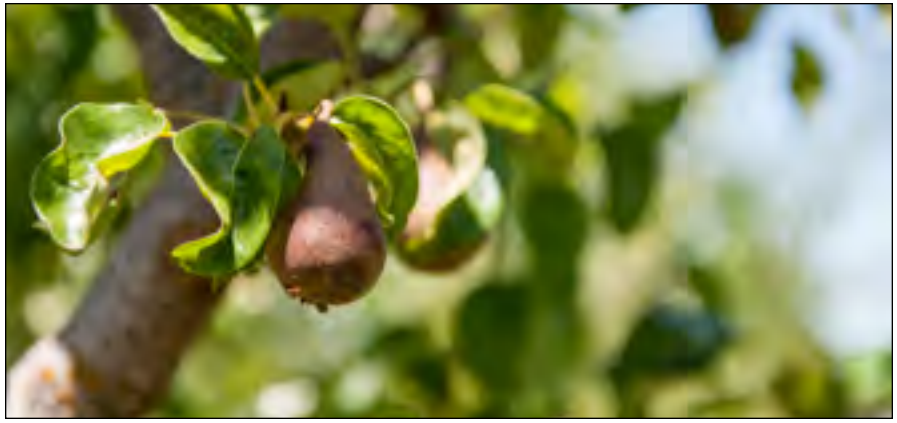

Photo: Stephen Ward, © Oregon State University

Online resources for protecting plants

Information regarding plant protection is available from OSU and other sources:

Weather data and pest models: Access information for the Mid-Columbia region through websites managed by the OSU Integrated Plant Protection Center (uspest.org/hr/) and the Columbia Gorge Fruit Growers (cgfg.org).

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

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

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

Orchard Pest Management Online: Online edition of the comprehensive reference *Orchard Pest Management: A Resource Book for the Pacific Northwest:* https://treefruit.wsu.edu/crop-protection/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/

AgWeatherNet: https://weather.wsu.edu/

Decision Aid System Science for Crop Management: https://decisionaid.systems/

Stages of bud development

	Apple	Pear	Peach/apricot	Cherry/plum
0				
1				
2				
3				

	Apple	Pear	Peach/apricot	Cherry/plum
4				
5				
6				
7				

Illustrations: University of Kentucky Extension

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.

STAGE 0: Dormant, insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	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 6)	Buffers (see page 6)	Surface water (see page 6)
Horticultural mineral oil, generic	-	-	4-6 gal	-	-	4 h	-	-	Apply just before egg deposition. Do not exceed 8 gal/ acre oil prebloom.	x	-	x
HMO plus 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
Celite 610	-	-	40-70 lb	-	-	0 h/0 d	-	-	Apply no more than once per week. Adjuvant may improve control.	x	-	x
Danitol 2.4EC**, RUP	3	-	16-21 oz	-	16-21 oz	1 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 27%-29%), generic	M2	Rates vary; see label	Rates vary; see label	Rates vary; see label	-	2 d	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	x
Malathion 5EC	1B	1-2pts	1-2 pts	1-2 pts	-	12 h/1 d	2 pts	2	Injury may occur on Bosc under certain conditions	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.	-	-	-
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	3	-	1.3-2.5 oz	-	1.3-2.5 oz	1 d/21 d	12.8 oz	-	-	xx	x	x
Surround	-	-	50-100 lb	-	-	1 d	-	-	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 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. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

STAGE 0: Dormant, codling moth mating disruption *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Manufacturers' label rate**	**REI/PHI**	**Maximum amount/acre/ year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Checkmate CM-XL 2.0	-	120-200 cards	0 d/-	-	-	Other products are available, but experience is limited with those products. Monitor moth activity with CM-DA combo lures or 10X pheromone lures. Be sure to place the lures in the top 1/3 of the tree. 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/-	-	-		-	-	-
Cidetrak		400 pieces	0 d/-				-	-	-
Isomate C Plus	-	400 ties	0 d/-	-	-		-	-	-
Isomate CM Flex	-	400 twin tubes	0 d/-	-	-		-	-	-
Isomate CTT	-	100–200 ties	0 d/-	-	-		-	-	-
Nomate CM	-	300–400 spirals	0 d/-	-	-		-	-	-
Nomate CM Smart Release		1–2 puffers	0 d/-				-	-	-

Mating disruption

Female codling moths produce pheromone that enables males to find them when they are ready to mate. Synthetic pheromone dispensers placed in the orchard prevent males from finding females, disrupting their ability to mate. Codling moth mating disruption should be the foundation of any pear or apple IPM program. Mating disruption works best when moth populations are kept low, when orchard blocks are large (more than 10 acres) or when the mating disruption is applied across a wide area. Passive dispensers (hand-applied) of pheromone mating disruption applied at 400 dispensers per acre can reduce mating by 80%. Research has shown that codling moth is disrupted competitively —it is a numbers game, with 400 point sources per acre being the optimal number of dispensers. There is little benefit to adding more than 400 dispensers per acre, and cutting the rate below 400, with moderate codling moth pressure, will result in increased fruit injury.

Aerosol emitters actively release large amounts of pheromone into the orchard, creating large pheromone plumes that disrupt males over long distances. Despite the large quantity of pheromone being released, aerosol emitters still disrupt codling moth competitively. In managed orchards, with moderate codling moth pressure, emitters should be applied at the recommended rate of 1–2 dispensers per acre. Aerosol emitters can reduce the reliability of monitoring traps downwind of emitters, even with 10x lures. Place monitoring traps upwind or well away from aerosol emitters to avoid false negatives in monitoring traps. When applying aerosol emitters, consider wind direction, topography, neighboring orchards and codling moth pressure. Hand-applied dispensers can protect the perimeters of blocks treated with aerosol emitters.

Monitoring

Place lure-baited delta traps with sticky card liners in the top third of trees, away from mating disruption and with both ends of the trap accessible (not blocked by leaves). In disrupted orchards, use a combination of lures. Use the standard CM L2 lures in disrupted orchards to measure effectiveness of treatment; you should expect to catch zero moths with these lures. Using the 10x lures will allow you to get catch data under mating disruption and provide a measure of the population. Current action thresholds were developed based on catch in CM L2 baited traps (in orchards not under mating disruption), not the more attractive 10x lures. Using action thresholds developed with CM L2 lures, when using 10x lures, will result in conservative decisions. (Sprays may be applied too frequently.) Other lures are available with additional compounds such as pear ester and acetic acid. These are reported to increase catch of males and even catch female moths. More research is needed to understand how catch data from these new lures translates into management decisions. But any catch data can be informative, so all these lures can be useful.

STAGES 1–2: Delayed dormant, insects and mites *Amount per acre*

Apply before bud scales drop to minimize injury

Product and formulation	Resistance management group	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 6)	Buffers (see page 6)	Surface water (see page 6)
Celite 610	UNE	40-70 lbs	40-70 lbs	-	40-70 lbs	40-70 lbs	40-70 lbs	-	-		700 lbs.					
Centaur DG	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.	-	-	-
Cinnerate	UNE	32-64 oz	-	-	-	32-64 oz	32-64 oz	25-45 oz		0 h/0h	-	-	Do not mix with Bordeaux mixture or apply when temperatures exceed 90°F.			
Surround	UNE	-	-	-	-	-	50-100 lb	-	-	1 d/0 d	-		Apply in 200 gal of water			
HMO plus 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. Use the 2/3-1/3 calibration 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/14d	2.66 pt	-	-	xx	x	x
Delegate 25WG	5	-	-	4.5-7 oz	-	-	6-7 oz	-	-	4 h	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	8 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	Sterilizes but does not control adult populations	-	-	x
Malathion	1B	-	-	-	-	-	-	-	-	-	-	-	-			
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 27%-29%), generic	M2	-	-	-	-	Rates vary, see label	Rates vary, see label	Rates vary, see label	-	2 d/-	-	-	HMO + sulfur will also provide 70-80% control of pear psylla adults.	-	-	-
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	3	1.3-2.5 oz	w-	-	1.3-2.5 oz	-	1.3-2.5 oz	-	1.3-2.5 oz	1 d/21d	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. 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.

STAGES 1–2: Delayed dormant, diseases *Efficacy rating and amount per acre*

Apply before bud scales drop to minimize injury.

Product and formulation	**Resistance management group (see page 7)**	**Fire blight**	**Pseudomonas blossom blast**	**REI/PHI**	**Maximum amount/acre/ year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Horticultural mineral oil (HMO)	-	4-6 gal	4-6 gal	4 h/-	-	-	Do not exceed 8 gal/acre oil prebloom.	x	-	x
HMO + fixed copper	M1	F/16 lb	16 lb	2 d/-	-	-	See label for product-specific REI. See footnote 5, page 35.	-	-	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.

STAGES 3–5: Cluster bud through pink, insects and mites *Amount per acre*

Product and formulation	Resistance management group	Aphids	Grape mealybug	Green fruit worm	Leafrollers#	Lygus bug	Pear psylla#	Pear psylla adults#	Pear rust mite	San Jose scale	Spider mites#	Stink bugs	Thrips	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Agri-Mek	6	-	-	-	-	-	-	-	2.25-4.25 oz	-	-	-	-	12 h/28 d					
	Highly toxic to bees. See label for specific precautions. Apply in combination with oil at 0.25–1% of spray volume. Increasing the volume of oil can increase the chance of fruit marking. Alternate Agri-Mek with other available acaricides as a resistance management strategy.																		
Altacor 35WDG	28	-	-	-	3-4.5 oz	-	-	-	-	-	-	-	-	4 h/5 d	9 oz	4	-	-	x
	Use 100-200 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
	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.																		
Aza-Direct	UN	16-67.2 oz			16-67.2 oz		16-67.2 oz	16-67.2 oz	16-67.2 oz	16-67.2 oz	16-67.2 oz		16-67.2 oz	4 h/0 d	-	-	x	x	xx
	Do not apply after the pink stage of flowering. Water pH should be between 5.5 and 6.5. Do not apply more than 24 oz per acre for Comice varieties, including Gem.																		
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.																		
Bexar	21A	-	-	-	-	-	/	-	21-27 oz	-	-	-	-	12 h/14 d	54 oz	2	xx	x	xx
	Highly toxic to bees. See label for specific precautions. Highly toxic to fish and aquatic invertebrates. See label for specific precautions. Consult with packer before applying.																		
Celite 610		40–70 lb	40–70 lb	-	40–70 lb	-	40–70 lb	40–70 lb	-	-	-	-	-	-	-	-	-	-	-
Cinnerate	-	16-64 oz	-	-	-	-	32-64 oz	32-64 oz	32-64 oz	25-45 oz	13-32 oz	-	-	4 h/0 d	-	-	-	-	x
	Do not mix with Captan or Bordeaux mixture. Can cause marking on Comice.																		
Centaur DG	16	-	34.5 oz	-	-	-	34.5 oz	-	-	34.5 oz	-	-	-	12 h/14 d	69 oz	2	-	-	-
	Use caution with oil. Consider jar testing.																		
Danitol 2.4EC**, RUP	3	-	-	-	-	-	-	16-21 oz	-	-	-	-	-	1 d/14 d	2.66 pt	-	xx	x	x
	Highly toxic to bees. See label for specific precautions.																		
Delegate 25WG	5	-	-	-	4.5-7 oz	-	6-7 oz	-	-	-	-	-	4.5-7 oz	4 h/7 d	28 oz	4	x	-	x
	Toxic to bees. See label for specific precautions. Adjuvant may improve control.																		
Entrust 2SC	5	-	-	-	6-10 oz	-	-	-	-	-	-	-	6-10 oz	4 h/7 d	29 oz	4	x	-	x
	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
	Toxic to bees. See label for specific precautions. Adjuvant may improve control.																		

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. 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.

CONTINUED ON PAGE 18

STAGES 3–5: Cluster bud through pink, insects and mites *Amount per acre • Continued from page 17*

Product and formulation	Resistance management group	Aphids	Grape mealybug	Green fruit worm	Leafrollers#	Lygus bug	Pear psylla#	Pear psylla adults#	Pear rust mite	San Jose scale	Spider mites#	Stink bugs	Thrips	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Esteem 35WP, generic	7C	-	-	-	4-5 oz	-	4-5 oz	-	-	4-5 oz	-	-	-	12 h/45 d	10 oz	2	-	-	x
	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
	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.																		
FujiMite 5EC	21A	-	-	-	-	-	2 pt	-	2 pt	-	2 pt	-	-	12 h/14 d	2 pt	2	-	x	x
	To avoid resistance development, do not rotate with Nexter.																		
Intrepid 2F	18	-	-	-	16 oz	-	-	-	-	-	-	-	-	4 h/14 d	64 oz	-	-	x	x
	Make 1-2 applications against overwintering generation larvae, depending on pest pressure.																		
Nexter 75 WSB generic	21A	-	-	-	-	-		10.67-16 oz	4.4-9.9 oz	-	9.9 oz	-	-	12 h/7d	9.9 oz	1	xx	x	x
Nexter SC	21A						17-25 fl. oz		11-17 fl. Oz		11-17 fl.oz			12 h/7 d	25 fl. Oz.	1	xx	x	x
	Highly toxic to bees. See label for specific precautions. To avoid resistance development, do not rotate with FujiMite. 25-oz rate is allowed for pear psylla under 24 (c) SLN label until 12/31/27.																		
Penncozeb 75DF		-	-	-	-	-	8 lb	-	-	-	-	-	-	24 h/77 d	24 lb	3	-	-	x
	24 (c) special local needs registration valid until Dec. 31, 2025.																		
Rimon 0.83EC	15	-	-	-	-	-	20-30 oz	-	-	-	-	-	-	12 h/14 d	96 oz	2	x	x	x
	Toxic to bees. See label for specific precautions. 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	-	-	-	-	-	-	-	6-10 oz	4 h/7 d	29 oz	-	x	-	x
	Toxic to bees. See label for specific precautions. Do not exceed 3 applications for leafroller control per year.																		
Surround	-	-	-	-	-	-	50-100 lb	-	-	-	-	-	-	1 d/0 d	-	-	-	-	-
	Apply in 200 gal of water.																		

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. 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.

STAGES 3–5: Cluster bud through pink, diseases *Efficacy rating and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 32)	**Scab** (see footnote 1, page 32)	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Aprovia	7	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30d	28 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than two sequential applications.	-	x	x
Cevya	3	G**/5 oz	G**/4-5 oz	12 h/0 d	15 oz	3	Number of applications depends on rate. Do not apply more than 2 sequential applications or with HMO. See footnote 6, page 32.			
Cinnerate	BM03	F/16-64 oz	F/16-64 oz	0 h/0 d	-	-	Can cause marking on Comice pears. Do not mix with Captan or Bordeaux mixture.			
Flint Extra	11	E**/2.5-2.9 oz	G**/2.5-2.9 oz	12 h/14 d	10.4 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 32.	-	-	x
Fontelis	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	3–5	Number of applications depends on rate. Do not apply more than two sequential applications or with HMO. See footnote 6, page 32.	-	-	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 32. Some mancozeb products have a higher rate allowed for suppression of pear psylla.	**-**	**-**	**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 32. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Miravis	7	3.4 oz	3.4 oz	12 h/30 d	13.6 oz	4	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.			
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 Pristine as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMO. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 32.	-	-	x
Procure 480SC, generic	3	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rhyme	3	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group. Can be used through drip or microsprinkler systems. TopGuard (same AI) is also registered.	-	x	x
Syllit, generic	U12	-	G*/3 pt	2 d/7 d	9 pt	3	Tank-mix with another fungicide from a different resistance management group.	-	-	x
Tesaris	7	E/3.5–4.5 oz	E**/4.5 oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 32. Do not use with EC formulations, methylated seed oil or HMOs. Talk to packing house about fungicides used for botrytis control.			
Torino	U6	G-E/6.8 oz	-	4 h/14 d	6.8 oz	1	-	-	-	x

BLOOM: Diseases *Amount per acre*

Product and formulation	Resistance management group (page 7)	Fire blight##	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Actigard 50WG	P 01	See label	12 h/60 d	12.8	-	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.	-	-	-
Blossom Protect	NC	F-G/1.25 lb	4 h/0 d	-	-	To accelerate the propagation of Aureobasidium pullulans in the flower, the addition of Buffer Protect NT to the mixture is beneficial. Apply the spray mixture while maintaining agitation. Use the prepared Blossom Protect Spray mixture within 8 hours after tank-mixing. Apply Blossom Protect to thoroughly wet the blossoms and foliage. For susceptible pome fruit varieties, the product may contribute to russeting when applied during late blossom and wet conditions. Cool, wet weather conditions can increase the potential for russeting.	-	-	-
Cueva	M 01	F-G/0.5-1 gal	4 h/-	102 gal	-	Do not exceed the 1.0 gallon of product/100 gallons water use rate. Do not reapply within 5 days during the bloom and growing stages. May cause marking of susceptible pear varities. If possible, time applications so that 12 h of dry weather follow application.	-	-	xx
Mycoshield (oxytetracycline), generic	41	F-G/1.0 lb	12 h/60 d	10 lb	10	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 oxytetracycline is reduced.	-	-	-
Agri-mycin 50 (streptomycin). generic	25	P-E**/8-16 oz	12 h/30 d	-	-	Extensive resistance to streptomycin has been found throughout the Mid-Columbia area. Tank-mix with full rate of oxytetracycline and make only one application per season. Do not exceed 1 lb/100 gal of water. 2-year shelf life.	-	-	-
Kasumin 2L	24	G/64 oz	12 h/90 d	256 oz	4	Do not use alternate tree-row application method. Tank-mix with full rate of oxytetracycline and make only one application per season. Do not apply after petal fall. Do not apply to orchards fertilized with manure.	-	-	-
Previsto	M 01	F-G/2-4 qt	48 h/	212 quarts	-	May cause marking of susceptible pear varities. Do not tank mix with pesticides, nutrients, or adjuvents. Do not apply during slow drying conditions.	-	-	xx
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 33 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 10.

PETAL FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	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 6)	Buffers (see page 6)	Surface water (see page 6)
Acramite 50WS, generic	UN	-	-	-	-	-	-	0.75-1 lb	12 h/7 d	-	1	Toxic to bees. See label for specific precautions.	x	-	x
Agri-Mek 0.15, RUP, generic	6	-	-	-	Rates vary; see label	Rates vary; see label	Rates vary; see label	Rates vary; see label	12 h/28 d	40 oz	2	Highly toxic to bees. See label for specific precautions. Apply in combination with oil at 0.25-1% of spray volume. Increasing the volume of oil can increase the chance of fruit marking. Alternate Agri-Mek with other available acaricides as a resistance management strategy. Rates vary; see label.	xx	x	x
Altacor 35WDG	28	-	3-4.5 oz	-	-	-	-	-	4 h/5 d	9 oz	4		-	-	x
Apollo 4SC	10A	-	-	-	-	-	-	4-8 oz	12 h/21d	-	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.	-	-	-
Bexar	21A	-	-	-	21-27 oz	21-27 oz	-	-	12 h/14 d	54 oz	2	Highly toxic to bees. See label for specific precautions. Highly toxic to fish and aquatic invertebrates. See label for specific precautions.	xx	x	xx
Centaur DG	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.	-	-	-
Cinnerate	-	-	-	-	32-50 oz	32-50 oz	32-50 oz	13-32 oz	4 h/0 d	-	-	Do not mix Cinnerate with Captan or Bordeaux mixture. Can cause marking on Comice.	-	-	x
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	8 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

RUP = restricted use pesticide; Generic = other materials with the same active ingredient are available
#Pest has a history of developing resistance. Resistance management practices (alternating control chemistry, careful use of products, and use of biological control where feasible) strongly recommended.
S = Suppressive only

PETAL FALL: Insects and mites *Amount per acre • Continued from page 22*

Product and formulation	Resistance management group (see page 7)	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 6)	Buffers (see page 6)	Surface water (see page 6)
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 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	2	Do not make more than one application before using an effective miticide with a different mode of action.	-	-	-
Nexter SC	21A				17-25 fl. oz	11-17 fl. Oz		11-17 fl. Oz	12 h/7 d	25 fl. oz.	1	Highly toxic to bees. See label for specific precautions. To avoid resistance development, do not rotate with FujiMite. 25-oz rate is allowed for pear psylla under 24 (c) SLN label until 12/31/27.			
Nexter 75WSB, generic	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. 17–25-oz rate is allowed for pear psylla under 24 (c) SLN label until December 31, 2027. PHI for 16 oz rate is 28 days.	xx	x	x
Onager 1EC, generic	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**
Penncozeb 75DF		-	-	-	8 lb	-	-	-	24 h/77 d	24 lb	3	-	-	-	x

RUP = restricted use pesticide; Generic = other materials with the same active ingredient are available
#Pest has a history of developing resistance. Resistance management practices (alternating control chemistry, careful use of products, and use of biological control where feasible) strongly recommended.
S = Suppressive only

PETAL FALL: Insects and mites *Amount per acre Continued from page 22*

Product and formulation	**Resistance management group** (see page 7)	**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 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
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, generic	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	8-14 oz	-	8-14 oz[S]	12-14 oz	8-14 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. Second application two weeks after the first application.	x	-	x
Venerate XC	-	-	-	-	64-128 oz	-	64-128 oz	64-128 oz	4 h/0 d	-	-				
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
#Pest has a history of developing resistance. Resistance management practices (alternating control chemistry, careful use of products, and use of biological control where feasible) strongly recommended.
S = Suppressive only

PETAL FALL: Diseases *Efficacy rating* and amount per acre*

Product and formulation	Resistance management group (See page 7)	Bulls-eye rot	Botrytis	Powdery mildew. (See footnote 1, page 32)	Scab (See footnote 1, page 32)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Aprovia	7	-	G**/5.5-7 oz	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30 d	28 oz	4	When used for scab, tank-mix with another fungicide from different resistance management group. Do not apply more than 2 sequential applications. Talk to packing house about fungicides for botrytis control.	-	x	x
Ceveya	3	-	-	G**/5 oz	G**/4-5 oz	12 h/0 d	15 oz	3	When used for scab, tank-mix with another fungicide from different resistance management group. Do not apply more than 2 sequential applications. Talk to packing house about fungicides for botrytis control.	-	x	x
Flint Extra	11	-	E**/2.5-2.9 oz	E**/2.5-2.9 oz	G*/2.5-2.9 oz	12 h/14 d	10.4 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 32. Talk to packing house about fungicides used for botrytis control.	-	-	x
Fontelis	7	-	G**/5.5-7 oz	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	4.2-5.8 oz	12 h/14 d	21 oz	3-5	Maximum number of applications per year: 5 (at 4.2 fl oz/acre of Luna Sensation) or 3 (at 5.8 fl oz/acre).	-	-	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 32. Some mancozeb products have a higher rate allowed for suppression of pear psylla.	-	-	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 HMO.	-	-	x
Miravis	7	-	F-G/3.4 oz	G/3.4 oz	F-G/3.4 oz	12 h/30 d	13.6 oz	4	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. Talk to packing house about fungicides used for botrytis control.	-	-	x
Pristine	7 +11	G/14.5-18.5 oz	G**/14.5-18.5 oz	E/14.5-18.5 oz	G-E**/14.5-18.5 oz	12 h/0 d	74 oz	4	If planning to use Pristine as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMO. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 32.	-	-	x
Procure, generic	3	-	-	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Rhyme	3	-	-	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group. Can be applied through micro and drip irrigation systems.	-	x	x
Syllit, generic	U12	-	-	-	G*/3 pt	2 d/7 d	9 pt	3	Tank-mix with another fungicide from a different resistance management group.	-	-	x
Tesaris	7	-	E/3.5-4.5 oz	E/4.5 oz	E**/4.5 oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 32. Do not use with EC formulations, methylated seed oil, or HMOs. Talk to packing house about fungicides used for botrytis control.	-	-	x
Torino	U6	-	-	G-E/6.8 oz	-	4 h/14 d	6.8 oz	1	-	-	-	x
Ziram 76DF	M3	F/6 lb	-	-	F/6 lb	2 d/14 d	24.2 lb	4	See footnote 3, page 32.	-	-	x

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 fungicides.

POST-PETAL FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Codling moth	Grape mealybug	Pear psylla#	San Jose scale	Spider mites#	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
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, RUP, Generic	6	-	-	2.25-4.25 oz	-	2.25-4.25 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 0.25-1% of spray volume. Increased oil volume increases the chance of fruit marking. Rates vary; see label.	xx	x	x
Altacor 35WDG	28	3-4.5 oz	-	-	-	-	4 h/5 d	9 oz	4	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
Cinnerate	-	-	-	32-50 oz	32-50 oz	32-50 oz	4 h/0 d	-	-	Do not mix with Captan or Bordeaux mixture.	-	-	x
Ecotec Plus	-	-	1-4 pt	1-4 pt	1-4 pt	1-4 pt	0 h/0 d	-	-	Use with adjuvants	x	-	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	-	-	-	-	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
Magister													
Rimon 0.83EC	15	20-32 oz	-	20-32 oz	-	-	12 h/14 d	64 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 50-75 degree-days after biofix. Application at beginning of egg laying (50-100 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	-	8-14 oz	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
Venerate XC	-	-	-	64-128 oz	64-128 oz	64-128 oz	4 h/0 d	-	-		-	-	x
Zeal 72 WSP	**10B**												

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.

POST-PETAL FALL: Diseases *Efficacy rating• and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Botrytis**	**Powdery mildew** (see footnote 1, page 32)	**Scab** (see footnote 1, page 32)	**REI/PHI**	**Maximum amount/acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Aprovia	7	G**/5.5-7 oz.	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30 d	28 oz	-	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not apply more than 4 sequential applications.	-	x	x
Flint Extra	11	-	E**/2.5-2.9 oz	E**/2.5-2.9 oz	12 h/ 14 d	10.4 oz	4		-	-	x
Fontelis 1.67SC	7	G**/16-20 oz	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	G**/5-5.8 oz	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 or with HMO. See footnote 6, page 32.	-	-	x
Mancozeb 75 DF, generic	M3	-	-	E/3 lb	1 d/77 d	21 lb	-	See label for treatment schedules and corresponding use rates. See footnote 4, page 32.	-	-	x
Merivon	7 +11	F-G/3.4 oz	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 32. Do not use with EC formulations, methylated seed oil, or HMO.	-	-	x
Pristine	7 +11	G/14.5-18.5 oz	E/14.5-18.5 oz	G-E**/14.5-18.5 oz	12 h/0 d	74 oz	4	If planning to use Pristine as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMO. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 32.	-	-	x
Procure 480SC, generic	3	-	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 oz	4	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
Rhyme	3	-	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	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.

LATE SPRING AND SUMMER COVER SPRAYS: Insects and mites *Amount per acre; see footnote 2, page 31.*

Product and formulation	Resistance management group (see page 7)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs (for brown marmorated stink bug, see page 38)	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Acramite 50WS, generic	UN	-	-	-	-	-	-	-	0.75-1 lb	-	12 h/7 d	-	1	x	-	x
	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
	Highly toxic to bees. See label for specific precautions and REI.															
Agri-Mek, RUP, generic	6	-	-	-	-	16-20 oz	16-20 oz	-	16-20 oz	-	12 h/28 d	40 oz	2	xx	x	x
Agri-Mek + horticultural mineral oil (HMO), generic	-	-	-	-	-	1 gal	1 gal	-	1 gal	-	4 h/-	-	-	x	-	x
	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 0.25-1% 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
	Use 100-200 gal/acre water.															
Apollo 4SC	10A	-	-	-	-	-	-	-	4-8 oz	-	12 h/21 d	-	1	-	x	x
	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
	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	-	-	-	-	-	-	-	12 h/28 d	24 oz	4	xx	-	x
	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
	DO NOT USE ON COMICE OR RELATED PEAR VARIETIES.															
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.															
Belay 2.13SC	4A	4-6 oz	12 ozS	6 oz	6-12 oz	6-12 oz	-	6-12 oz	-	4-6 oz	12 h/7 d	12 oz	-	xx	-	x
	Suppresive to codling moth. Highly toxic to bees. See label for specific precautions.															
Bexar	21A	-	-	-	-	21-77 oz	21-77 oz	-	-	-	12 h/14 d	54 oz	2	xx	x	xx
	Highly toxic to bees. See label for specific precautions. Highly toxic to fish and aquatic invertebrates. See label for specific precautions.															
Celite 610	-	40-70 lbs	-	40-70 lbs	-	40-70 lbs	-	-	-	-	0 h/0 d	-	-	-	-	-
	Apply no more than once per week. Adjuvant may improve control.															

RUP = restricted use pesticide. | Generic = other materials with the same active ingredient are available.

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

#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.

LATE SPRING AND SUMMER COVER SPRAYS: Insects and mites *Amount per acre; see footnote 2, page 31. Continued from page 28*

Product and formulation	Resistance management group (see page 7)	Aphids	Codling moth	Grape mealybug	Leafrollers#	Pear psylla#	Pear rust mite	San Jose scale crawlers	Spider mites#	Stink bugs (for brown marmorated stink bug, see page 38)	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Centaur DG	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. For scale crawlers, apply at first crawler emergence.															
Cinnerate	-	-	-	-	-	32-50 oz	32-50 oz	25-32 oz	13-32 oz	-	4 h/0 d	-	-	-	-	x
	Do not mix with Captan or Bordeaux mixtures.															
Codling moth granulosis virus (Cyd-X, Cyd-X HP, Madex HP, Madex XLV, Virosoft CP4)	-	-	Rates vary; see labels	-	-	-	-	-	-	-	See label	-	-	-	-	-
	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	-	4.5-7 oz	6-7 oz	-	-	-	-	4 h/7 d	28 oz	4	x	-	x
	Toxic to bees. See label for specific precautions.															
Diazinon 50WP, RUP; generic	1B	-	4 lb	4 lb	-	-	-	4 lb	-	-	4 d/21 d	8 lb	2	xx	x	x
	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.															
EcoTec Plus	-	1-4 pts	-	-	-	1-4 pts	1-4 pts	-	1-4 pts	-	0 h/0 d	-	-	-	-	-
Entrust 2SC	5	-	6-10 ozS	-	6-10 oz	-	-	-	-	-	4 h/7 d	29 oz	4	x	-	x
	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
	Toxic to bees. See label for specific precautions.															
Esteem 35WP, generic	7C	-	4-5 oz	-	4-5 ozS	4-5 oz	-	4-5 oz	-	-	12 h/45 d	10 oz	2	-	-	x
	For scale crawlers, apply at beginning of emergence. HMO improves performance. Will provide leafroller suppression as part of a season-long program.															
Exirel 0.83SE	28	-	10-17 oz	-	10-17 oz	13.5-20.5 oz	-	-	-	-	12 h/3 d	61 oz	-	x	x	x
	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
	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
	Highly toxic to bees. See label for specific precautions.															

RUP = restricted use pesticide. | Generic = other materials with the same active ingredient are available.

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

#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.

LATE SPRING AND SUMMER COVER SPRAYS: Insects and mites *Amount per acre; see footnote 2, page 31. Continued from page 29*

Product and formulation	**Resistance management group** (see page 7)	**Aphids**	**Codling moth**	**Grape mealybug**	**Leafrollers#**	**Pear psylla#**	**Pear rust mite**	**San Jose scale crawlers**	**Spider mites#**	**Stink bugs** (for brown marmorated stink bug, see page 38)	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/ year**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Intrepid 2F	18	-	16 oz	-	16 oz	-	-	-	-	-	4 h/14 d	64 oz	-	-	x	x
	Suppresive for codling moth. 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	2	-	-	-
	Will not control rust mites. Do not make more than one application before using an effective miticide with a different mode of action.															
Onager 1EC. generic	10A	-	-	-	-	-	-	-	16-24 oz	-	12 h/28 d	-	1	-	-	x
	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
	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.															
Savey 50DF, generic	10A	-	-	-	-	-	-	-	4-6 oz	-	12 h/28 d	-	1	-	-	x
	Do not use any combination of Apollo, Onager and Savey in the same growing season.															
Success 2L	5	-	6-10 ozS	-	6-10 oz	-	-	-	-	-	4 h/7 d	29 oz	-	x	-	x
	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.															
Surround	-	-	-	25-100 lb	25-100 lb	25-100 lb	25-100 lb	-	-	-	1 d/0 d	-	-	-	-	-
	Apply in 200 gal. of water.															
Ultor 1.25SC	23	8-14 oz	-	8-14 oz	-	8-14 oz	8-14 oz	8-14 oz	-	-	1 d/7 d	40 oz	-	x	-	x
	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
	Primarily ovicidal/larvicidal.															

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. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.
#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.

PREHARVEST: Diseases *Efficacy rating and amount per acre*

Product and formulation	Resistance management group (see page 7)	Storage rots	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Inspire Super	3+9	Good/12 oz	12 h/14 d	60 oz	5	Do not apply more than 2 sequential applications	-	-	x
Merivon	7 + 11	Fair to good/ 4-5.5 oz	12 h/0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 32. Do not use with EC formulations, methylated seed oil, or HMO.	-	-	x
Pristine	7 + 11	Fair to good/ 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 HMO. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 32.	-	-	x
Syllit FL	U12	Good control for bullseye rot/3 pts	2 d/7 d	9 pts	3	Tank-mix with another fungicide from a different resistance managment group.	-	-	x
Topsin M 70WSB, generic	1	Good/1 lb	2 d/1 d	4 lb	4	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	Fair to good/6 lb	2 d/14 d	24.2 lb	4	See footnote 3, page 32.	-	-	x

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.
Contact your packing house before choosing one of these materials.

POSTHARVEST: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Pear blister mite	Pear psylla	Pear rust mite	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
Horticultural mineral oil + one of the following	-	3-4 gal	3-4 gal	3-4 gal	4 h/-	-	-		x	-	x
HMO + lime sulfur (calcium polysulfide 27%-29%), generic	M2	Rates vary; see label	Rates vary; see label	Rates vary; see label	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.	-	-	-
HMO+ sulfur (dry flowable) (elemental sulfur 80%), generic	M2	15-20 lb	15-20 lb	15-20 lb	1 d/-	-	-		-	-	x
Surround	-	-	100 lb	-	1 d/0 h	-	-	Apply Surround as late in the fall as possible for reduced oviposition of pear psylla the next spring. Use a spreader-sticker adjuvant.			

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 powdery 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. 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 or may cause phytotoxicity.
3. Ziram may cause irritation of eyes, nose, throat and skin even after the REI/PHI is met.
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 copper-based applications may help manage fungicide resistant scab isolates. Do not use fixed 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, Cuprofix, Kocide, Nordox and Nu-Cop.
6. Do not exceed 2 total applications per season of any class 11 fungicide or any combination of these medium- to high-risk 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**	**Pear psylla**	**Codling moth**	**Grape mealybug**	**San Jose scale**	**Green apple aphid**	**European red mite**	**Pear rust mite**	**Twospotted spider mite and McDaniel spider mite**	**Thrips**	**Cutworm, armyworm and fall webworm**	**Lygus bug**	**Leafroller**
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	–
clothianidin	Belay 2.13EC	6-12 oz	2-3	–	x	x	3-4	–	–	–	–	–	x	–
thiamethoxam	Actara 25WDG	4.5 oz	2-3	–	x	–	3-4	–	–	–	–	–	x	–
Organophosphates														
oil + diazinon	oil + diazinon 50WP	6 gal + 4 lb	2-3	–	3	4	3	3	2	–	–	2	2-3	x
Pyrethroids														
esfenvalerate	Asana 0.66EC	1 pt	1-3[a]	–	–	–	–	–	–	–	x	x	4	x
fenpropathrin	Danitol 2.4EC	16-21.3 oz	1-3[a]	–	–	–	–	–	–	–	x	x	4	x
lambdacyhalothrin	Warrior IIEC	1.28-2.56 oz	1-3[a]	–	–	–	–	–	–	–	–	4	4	x
Pyridazinones														
pyridaben	Nexter 75WSB	7 oz	2-3	–	1-2	–	–	4	3	2-4	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
spinetoram	Delegate		3	–	–	–	–	–	–	–	4	–	–	4
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 present in many areas

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.

			PESTS											
Common name	**Trade name**	**Rate/acre**	**Pear psylla**	**Codling moth**	**Grape mealybug**	**San Jose scale**	**Green apple aphid**	**European red mite**	**Pear rust mite**	**Twospotted spider mite and McDaniel spider mite**	**Thrips**	**Cutworm, armyworm and fall webworm**	**Lygus bug**	**Leafroller**
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 DG	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	–	1-2	–	–	–	–	–	–	–	–	–	–
	Madex	3 oz		2-3	-	-	-	-	-	-	-	-	-	-
	Virosoft	8 oz	–	2-3	–	–	–	–	–	–	–	–	–	–
Neonicotinoids														
acetamiprid	Assail 70WP	1-3.4 oz	2-3	3-4	3	–	3-4	–	–	*	–	–	x	2
clothianidin	Belay 2.13EC	3-6 oz	2-3	1	3-4	x	4	–	–	*	–	–	x	x
imidacloprid	Provado 1.6F	15-20 oz	2-3	–	3-4	x	3-4	–	–	*	–	–	–	–
thiamethoxam	Actara 25WDG	4.5 oz	2-3	–	3-4	x	3-4	–	–	*	–	–	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	x
fenpropathrin	Danitol 2.4EC	20 oz	–	3-4	x	x	x	x	x	x	x	x	4	x

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.
*May increase spider mite activity.

CONTINUED ON PAGE 35

Relative efficacy guide for pesticides used on pear, postbloom, continued

Continued from page 34

			PESTS											
Common name	**Trade name**	**Rate/acre**	**Pear psylla**	**Codling moth**	**Grape mealybug**	**San Jose scale**	**Green apple aphid**	**European red mite**	**Pear rust mite**	**Twospotted spider mite and McDaniel spider mite**	**Thrips**	**Cutworm, armyworm and fall webworm**	**Lygus bug**	**Leafroller**
lambda cyhalothrin	Warrior II EC	1.28-2.56 oz	–	3-4	x	x	x	–	–	–	x	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	1-3	2-3	x	x	x	1-2	1-2	1-2	–	–	x	x
chlorantraniliprole	Altacor 35WDG	3-4.5 oz	–	4	–	–	–	–	–	–	–	–	–	4
spinetoram	Delegate 25WG	4.5-7 oz	3	4	–	–	–	–	–	*	–	–	–	4
spinosad	Entrust SC	2-3 oz	1	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
spirotetramat	Ultor 1.25SC	12-14 oz	2-3	–	–	–	–	3-4	–	–	–	–	–	–

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.
*May increase spider mite activity.

Follow the 'RULES' for fungicide stewardship

- **R**otate or mix fungicides of different chemical groups.
- **U**se labeled rates.
- **L**imit total number of applications.
- **E**ducate yourself about fungicide activity, mode of action, and class—as well as resistance management practices.
- **S**tart a fungicide program with multisite mode of action materials.

Effectiveness of fungicides and bactericides for control of pear diseases

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.

Fungicide or bactericide	FRAC group	Properties	Pear scab	Powdery mildew	Bull's eye rot	Storage rots	Fire blight
Actigard	21	Activator of plant defense	None	None	None	None	Suppression
Aprovia	7	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	None	None	None
BlightBan	Bio-1	Protectant	??	??	??	??	Poor-fair
Blossom Protect	BMO1	Bactericidal	None	None	None	None	Fair-good
Cevya	3	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Excellent**	??	??	None
Cinnerate	BMO1	Fungicidal, insecticidal	Fair	Fair to good	**??**	**??**	**None**
Copper-based products	M1	Broad spectrum of activity, Bac, fungicidal, protectant	??	Fair??	Poor	??	Fair
Dodine	U12	Broad spectrum of activity, fungicidal, protectant	Excellent**	None	??	Good	None
Flint extra	11	Broad spectrum of activity, fungicidal, protectant, locally systemic	Good**	Good**	Fair	??	None
Fontelis	7	Broad spectrum of activity, fungicidal, protectant	Good**	Good**	??	??	None
horticultural mineral oils	Not classified	Eradicant, fungicidal, insecticidal, protectant	??	Good	??	??	None
Kasumin	24	Bac, protectant	None	None	None	None	Good**
lime sulfur	M2	Fungicidal, insecticidal, protectant, vapor active	Good	Fair	??	??	None
mancozeb products	M3	Broad spectrum activity, fungicidal, protectant	Good	None	Poor	??	None
Miravis	7	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	None	None	None
oxytetracycline	41	Bac	None	None	None	None	Fair-good**
Oso	19	Fungicidal	Suppression	Good	None	Good	None
Procure	3	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	??	??	None
Rhyme/TopGuard	3	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good**	Good-excellent**	??	Good	None
Serenade Opti	44	Fungicidal, protectant	??	Fair	??	??	Fair-good
streptomycin	25	Bac, protectant	None	None	None	None	Poor-excellent**
sulfur	M2	Fungicidal, insecticidal, protectant, vapor active	Fair	Good	??	??	None
Tesaris	7	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	None	None	None
Topsin M	1	Broad spectrum of activity, curative, fungicidal, locally systemic	Fair**	Good**	Excellent	Good	None
Torino	U6	Fungicidal, protectant	??	Good-excellent	??	??	None
Ziram	M3	Broad spectrum of activity, fungicidal, protectant	Fair	None	Fair	Fair-good	None
Combination products							
Inspire Super	3 + 9	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	??	Good	None
Luna Sensation	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good-excellent	Excellent	??	Possible	None
Merivon	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Excellent**	Excellent	??	Fair-good	None
Pristine	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good-excellent**	Excellent	Good	Fair-good	None

?? = no information available. **Resistant pathogens will lower the effectiveness of this fungicide.

Pear herbicide schedule

			Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
		REI/PHI (days)	Pre-bloom			Bloom	Spring-summer			Harvest			Fall	
Soil-active herbicides														
dichlobenil (Casoron CS)		12 h/30												
diuron (generic)	Apply in winter as single application or split	12 h/-												
indaziflam (Alion)	No rain or irrigation within 48 hours of application	12 h/14												
isoxaben (Trellis SC)		12 h/NB												
norflurazon (Solicam DF)		12 h/60												
oryzalin (Surflam)	Needs rainfall	24 h/-												
pendimethalin (Prowl H20)	Anytime after harvest; dormant, spring	1 d/60												
pronamide (Kerb SC)	In fall after harvest but before soil freezes	1 d/-												
Soil and foliar active														
halosulfuron (Sandea)	Target yellow nutsedge 3” tall	12 h/1												
mesotrione (Motif)		12 h/30												
oxyflourfen (Goal 2XL)	Dormant/from bloom to 14 days before harvest	1 d/60												
oxyfluorfen + penoxsulam (Pindar GT)		1 d/60												
rimsulfuron (Matrix)		4 h/21												
simazine (generic)		12 h/14												
Contact/translocated herbicices														
2,4-D (generic)		2 d/60												
carfentrazone (Aim Ec)	All year; avoid spotting on fruit	12 h/3												
clethodim (generic)	Anytime grass weeds are actively growing	24 h/NB												
clopyralid (Stinger)	Target Canada thistle before bolting	12 h/30												
fluazifop (generic)	Anytime grass weeds are actively growing	/NB												
glufosinate (generic)	Performance improved when air temp > 78F	12 h/14												
glyphosate (generic)	Do not apply when green foliage is in the spray zone	4 or 12 h/3												
paraquat (generic)		1 d/1												
pyraflufen (Venue)	Postharvest, dormant	12 h/0												
saflufenacil (Treevix)		12 h/7												
sethoxoydim (generic)	Anytime grass weeds are actively growing	/14												

Brown marmorated stink bug

Brown marmorated stink bug was first detected in the Hood River area in 2012 near downtown Hood River. Since then it has spread throughout the Hood River Valley, and in 2017 it caused economic damage in several area pear orchards. Due to the relatively recent introduction of BMSB to North America and Oregon, integrated management programs are still being developed. For information on BMSB biology, life cycle, potential crop damage, monitoring and control, see www.stopbmsb.org. The list below is adapted from that publication and includes insecticides registered for use on pear, apple and cherry in Oregon that have shown efficacy on BMSB in laboratory and/or field trials conducted elsewhere. Limited local experience exists with some of these products at timings and rates most effective for BMSB control. Follow all label restrictions and precautions.

Product name	Active ingredient	Resistance management group	Preharvest interval (days)			Relative efficacy**
			Apple	Pear	Cherry	
Actara	thiamethoxam	4A	35	35	14	Excellent
Admire Pro, Alias, Wrangler	imidacloprid	4A	7	7	0	Supression — good
Assail 70 WP	acetamiprid	4A	7	7	7	Good
Aza-Direct	azadirachtin	UN	0	0	0	Good
Baythroid XL, RUP	beta-cyfluthrin	3A	7	7	7	Excellent
Belay	clothianidin	4A	7	7	nr	Good
Bifenture, Brigade, Sniper, RUP	bifenthrin	3A	nr	14	nr	Unknown
Danitol, RUP	fenpropathrin	3A	14	14	3	Excellent
Declare, Proaxis, RUP	gamma-cyhalothrin	3A	21	21	14	Unknown
Endigo, RUP	lambda-cyhalothrin + thiamethoxam	3A + 4A	35	35	14	Excellent
Lannate, RUP	methomyl	1A	14	nr	nr	Excellent
Leverage 360,RUP	beta-cyfluthrin + imidacloprid	3A + 4A	7	7	7	Excellent
Mustang Maxx, RUP	zeta-cypermethrin	3A	14	14	14	Excellent
Surround*	kaolin clay	NA	0	0	0	Supression — good
Tombstone, RUP	cyfluthrin	3A	7	7	7	Unknown
Warrior II, Lambda-Cy, Silencer, RUP	lambda-cyhalothrin	3A	21	21	14	Excellent

RUP = restricted use pesticide
*Suppression only
** Adopted from Wilson, J., L. Gut, M. Grieshop, W. Shane (2020), *Managing Brown Marmorated Stink Bug in Michigan Orchards.* Michigan State University
nr = not registered for crop

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.

STAGE 0: Dormant, codling moth mating disruption *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Manufacturers' recommended rate**	**REI/PHI**	**Maximum amount/acre/ year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Checkmate CM-XL 2.0	-	120-200 cards	0 d/-	-	-	Other products are available, but experience is limited with those products. Monitor moth activity with CM-DA combo lures or 10X pheromone lures. Be sure to place the lures in the top 1/3 of the tree. 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/-	-	-		-	-	-
Cidetrak		400 pieces	0 d/-				-	-	-
Isomate C Plus	-	400 ties	0 d/-	-	-		-	-	-
Isomate CM Flex	-	400 twin tubes	0 d/-	-	-		-	-	-
Isomate CTT	-	100–200 ties	0 d/-	-	-		-	-	-
Nomate CM	-	300–400 spirals	0 d/-	-	-		-	-	-
Nomate CM Smart Release		1–2 puffers	0 d/-				-	-	-

Mating disruption

Female codling moths produce pheromone that enables males to find them when they are ready to mate. Synthetic pheromone dispensers placed in the orchard prevent males from finding females, disrupting their ability to mate. Codling moth mating disruption should be the foundation of any pear or apple IPM program. Mating disruption works best when moth populations are kept low, when orchard blocks are large (more than 10 acres) or when the mating disruption is applied across a wide area. Passive dispensers (hand-applied) of pheromone mating disruption applied at 400 dispensers per acre can reduce mating by 80%. Research has shown that codling moth is disrupted competitively —it is a numbers game, with 400 point sources per acre being the optimal number of dispensers. There is little benefit to adding more than 400 dispensers per acre, and cutting the rate below 400, with moderate codling moth pressure, will result in increased fruit injury.

Aerosol emitters actively release large amounts of pheromone into the orchard, creating large pheromone plumes that disrupt males over long distances. Despite the large quantity of pheromone being released, aerosol emitters still disrupt codling moth competitively. In managed orchards, with moderate codling moth pressure, emitters should be applied at the recommended rate of 1–2 dispensers per acre. Aerosol emitters can reduce the reliability of monitoring traps downwind of emitters, even with 10x lures. Place monitoring traps upwind or well away from aerosol emitters to avoid false negatives in monitoring traps. When applying aerosol emitters, consider wind direction, topography, neighboring orchards and codling moth pressure. Hand-applied dispensers can protect the perimeters of blocks treated with aerosol emitters.

Monitoring

Place lure-baited delta traps with sticky card liners in the top third of trees, away from mating disruption and with both ends of the trap accessible (not blocked by leaves). In disrupted orchards, use a combination of lures. Use the standard CM L2 lures in disrupted orchards to measure effectiveness of treatment; you should expect to catch zero moths with these lures. Using the 10x lures will allow you to get catch data under mating disruption and provide a measure of the population. Current action thresholds were developed based on catch in CM L2 baited traps (in orchards not under mating disruption), not the more attractive 10x lures. Using action thresholds developed with CM L2 lures, when using 10x lures, will result in conservative decisions. (Sprays may be applied too frequently.) Other lures are available with additional compounds such as pear ester and acetic acid. These are reported to increase catch of males and even catch female moths. More research is needed to understand how catch data from these new lures translates into management decisions. But any catch data can be informative, so all these lures can be useful.

STAGES 1–2: Delayed dormant, insects and mites *Amount per acre*

Apply before bud scales drop to minimize injury.

Product and formulation	Resistance management group (see page 7)	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 6)	Buffers (see page 6)	Surface water (see page 6)
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 DG	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	8 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 27%-29%), generic	M2	Rates vary; see label	Rates vary; see label	-	Rates vary; see label	2 d/-	-	-	-	-	-	-
Onager 1EC, generic	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, generic	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.

STAGES 1–2: Delayed dormant, diseases *Amount per acre*

Apply before bud scales drop to minimize injury.

Product and formulation	Resistance management group (see page 7)	Crown rot and collar rot (rare)	REI/PHI	Maximum amount per acre per year	Maximum applications per year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
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 54.

STAGES 3–4: Prepink, insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Green fruit worm	Leafrollers# **	Rosy apple aphids	Sucking bugs	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 6)	Buffers (see page 6)	Surface water (see page 6)
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.	-	-	x
Cinnerate	BM03	16-64 oz	-	16-64 oz	16-64 oz	0 h/0 d	-	-	Do not mix with Captan or Bordeaux mixture.			
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	8 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
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
Transform WG	4C	-	-	0.75-2.75 oz	-	1 d/7 d	8.5 oz	4	Toxic to bees.	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.
**Petal fall timing gives best leafroller control for bloom-time spray application.

STAGES 3–4: Prepink, diseases *Efficacy rating• and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 56)	**Scab** (see footnote 1, page 56)	**REI/PHI**	**Maximum amount/acre/ year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Aprovia	7	G**/5.5-7 oz	G**/5.5-7 oz	12 h /30 d	28 oz	4	Tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications.	-	x	x
Cevya	3	G**/5 fl oz	G**/4-5 fl oz	12 h/ 0 d	15 oz	3	-	x	x	x
Cinnerate	BM03	16-64 fl oz	16-64 fl oz	0 h /0 d	-	-	Do not mix with Captan of Bordeaux mixture.			
Excalia	7	3-4 oz	3-4 oz	12 h /4 d	8 oz	2	Tank-mix with another fungicide from a different resistance management group. Do not use past petal fall. Use a non-oil based adjuvant.	-	-	x
Flint Extra	11	G-E**/2.5-2.9 oz	E**/2.5-2.9 oz	12 h/ 14 d	10.4 oz	4	Tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 56.	-	-	x
Fontelis	7	G**/16-20 oz	F-G**/16-20 oz	12 h/ 28 d	61 oz	-	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
Gatten	U13	G**/6-8 fl oz	-	12 h/ 14 d	32 oz	4	Not registered for pears. Gatten may cause phytotoxicity to pears. Use caution when spraying apples near pears.	-	-	x
Indar 2F	3	E**/6-8 oz	G**/6-8 oz	12 h/ 14 d	32 oz	4	Tank-mix with another fungicide from a different resistance management group. 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 or with HMO. See footnotes 7 and 8, page 56.	-	-	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 56. Do not use with EC formulated products.	-	-	x
Miravis	7	3.4 oz	3.4 oz	12 h/ 30 d	13.6 oz	4	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
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 56.	-	-	x
Procure, generic	3	E**/8-16 oz	G**/8-16 oz	12 h/ 14 d	56 oz	4	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 56.	-	-	-

STAGES 3–4: Prepink, diseases *Efficacy rating• and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 56)	**Scab** (see footnote 1, page 56)	**REI/PHI**	**Maximum amount/acre/ year**	**Maximum applications/ year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
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 56.	-	-	x
Rhyme	3	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group. Also registered as TopGuard.	-	-	x
Tersaris	7	E/3.5-4.5 oz	E**/4.5 oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 56. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Torino	U6	G-E/6.8 oz	-	4 h/14 d	6.8 oz	1	-	-	-	x
Ziram 76DF	M3	-	F/6 lb	2 d/14 d	32 lb	-	See footnote 5, page 56.	-	-	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.

STAGES 5–6: Pink, insects and mites *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Aphids**	**Leafrollers#**	**Rust mite**	**San Jose scale**	**Spider mites#**	**REI/PHI**	**Maximum amount/acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Altacor 35WDG	28	-	3-4.5 oz	-	-	-	4 h/5 d	9 oz	4	Use 100-200 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.	-	-	-
Beleaf 50 SG	29	02.0-2.8 oz	-	-	-	-	12 h/21 d	8.4 oz	3	Use LOWER RATE for building populations and use HIGHER RATE for greater populations and/or dense foliage.	-	-	x
Centaur DG	16	-	-	-	34.5 oz	-	12 h /14 d	34.5 oz	1	Do not tank-mix with oil. Ground application only.	-	-	-
Closer SC	4C	1.5-2.75 OZ	-	-	-		12 h/ 7 d	17 oz	4		xx	-	xx
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
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	For in-season control, make first application in cover sprays when scale crawlers first emerge. Will provide leafroller suppression as a 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
Nexter 75WSB, generic	21	-	-	5.2 oz	-	6.6-10.6 oz	12 h/25 d	10.67 oz	1	Highly toxic to bees. See label for specific precautions. To avoid resistance development, do not rotate with FujiMite.	xx	x	x
Onager 1EC, generic	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. See label for restricted activities. Ground application only.	xx	x	x
Savey 50DF, generic	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
Transform WG	4C	0.75-2.75 oz	-	-	0.75-2.75 oz	-	24 h/7 d	8.5 oz	4	Do not apply at any time between 3 days prior to bloom and until after petal fall. Use higher rates for wolly apples aphids. High Rates for Scale suppression only.	x	-	xx
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.

STAGES 5–6: Pink, codling moth mating disruption *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Manufacturers' recommended rate**	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 6)	**Buffers** (see page 6)	**Surface water** (see page 6)
Checkmate CM-XL 1000	-	120-200 ties	0 d/-	-	-	Other products are available, but experience is limited with those products. Monitor moth activity with CM-DA combo lures or 10X pheromone lures. Be sure to place lures in the top one-third of the tree. 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/-	-	-		-	-	-
CIDETRAK	-	400 ties	0 d/-	-	-		**-**	**-**	**-**
Isomate C Plus	-	400 ties	0 d/-	-	-		-	-	-
Isomate CM Flex	-	400 ties	0 d/-	-	-		-	-	-
Isomate CM Mist	-	1-2 misters	0 d/-	-	-		-	-	-
Isomate CTT	-	200 ties	0 d/-	-	-		-	-	-
Nomate CM	-	300-400 ties	0 d/-	-	-		-	-	-

STAGES 5–7: Pink through full bloom, diseases *Efficacy rating* and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 56)	**Scab** (see footnote 1, page 56)	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5)	**Surface water** (see page 5)
Aprovia	7	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30 d	28 oz	4	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
Cevya	3	G**/5 fl oz	G**/4-5 FL OZ	12 h/0 d	15 oz	3	-	x	x	x
Cinnerate	BM03	F/16-64 oz	F/16-64 oz	0 h/0 d	-	-				
Excalia	7	3-4 oz	3-4 oz	12 h/4 d	4		Do not use past petal fall. Use a non-oil based adjuvant. Tank-mix with another fungicide from a different resistance management group	-	-	x
Flint Extra	11	E**/2.5-2.9 oz	G**/2.5-2.9 oz	12 h/14 d	10.4 oz	4	Tank-mix with another fungicide from a different resistance management group. Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 56.	-	-	x
Fontelis	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
Gatten	U13	G**/6-8 fl oz	-	12 h/14 d	32 oz	4	Not registered for pears. Gatten may cause phytotoxicity to pears. Use caution when spraying apples near pears.	-	-	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. Tank-mix with another fungicide from a different resistance management group	-	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 or with HMO. See footnotes 7 and 8, page 56.	-	-	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 56.	-	-	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 56. Do not use with EC formulated products.	-	-	x
Miravis	7	3.4 oz	3.4 oz	12 h/ 30 d	13.6 oz	4	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	-	-	-
Omega 500F	29	-	G/10-13.8 oz	2 d/28 d	8.6 pts	10	-	-	x	x
PH-D/OSO	19	6.2 oz	6.2 oz	4 h/ 0 d	37.2 oz	6	Alternate with fungicides that have different modes of action.	-	-	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 56.	-	-	x
Procure, generic	3	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 oz	4	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 56.	-	-	-

STAGES 5–7: Pink through full bloom, diseases *Efficacy rating* and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 56)	**Scab** (see footnote 1, page 56)	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5)	**Surface water** (see page 5)
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 56.	-	-	x
Rhyme	3	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Tesaris	7	E/4.5 oz	4.5oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 75. Do not use with EC formulations, methylated seed oil, or HMOs.			
Torino	U6	G-E/5.5-6.8 oz	-	4 h/14 d	6.8 oz	1	-	-	-	x
Ziram 76DF	M3	-	F/6 lb	2 d/14 d	32 lb	-	See footnote 5, page 56.	-	-	x

EARLY THROUGH FULL BLOOM: Insects and mites *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Leafrollers#**	**Thrips**	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5))	**Surface water** (see page 5)
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. Early through full bloom timing may be the best timing for thrips control. 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 2SC	5	6-10 oz	6-10 oz	4 h/7 d	29 oz	4	Toxic to bees. See label for specific precautions. Early through full bloom timing may be the best timing for thrips control. 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. Early through full bloom timing may be the best timing for thrips control. Petal fall timing gives best leafroller control for bloom-time spray application. Do not exceed 3 applications for leafroller control per year.	x	-	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.

BLOOM: Fire blight *Efficacy rating* and amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Fire blight##**	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5)	**Surface water** (see page 5)
Actigard 50WG	P01	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
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 such 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.	-	-	-
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	-
Cueva	M01	F-G/0.5-1 gal	4 h/-	102 gal	-	"Do not exceed the 1.0 gallon of product/100 gallons water use rate. Do not reapply within 5 days during the bloom and growing stages. May cause marking of susceptible pear varieties. If possible, time applications so that 12 h of dry weather follow application."	-	-	x
Fire Blight									
Mycoshield (oxytetracycline), generic	41	F-G/8 or 16 oz	12 h/60 d	9 lb	6	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 oxytetracycline is reduced.	-	-	-
Agromycin 50 (streptomycin), generic	25	P-E**/8-16 oz	12 h/50 d	-	-	Extensive resistance to streptomycin has been found throughout the Mid-Columbia area. Tank-mix with full rate of oxytetracycline and make only one application per season. Do not exceed 1 lb/100 gal of water. 2-year shelf life.	-	-	-
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.	-	-	-
Previsto	M01	F-G/2-4 QT	48 h/0 d	-	-	"May cause marking of susceptible pear varities. Do not tank mix with pesticides, nutrients or adjuvents. Do not apply during slow drying conditions."			
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 10.

PETAL FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Leafrollers#**	San Jose scale	Tentiform leafminer#	Thrips	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Altacor 35WDG	28	2.5-4.5 oz	-	2.5-4 oz	-	4 h/5 d	9 oz	4	Use higher rates for leafrollers.	-	-	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	3	Toxic to bees. See label for specific precautions. Do not exceed 4 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	For control in-season, make application in cover spray when scale crawlers first emerge. 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

P = 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.

PETAL FALL: Diseases *Efficacy rating* and amount per acre*

Product and formulation	Resistance management group (see page 7)	Powdery mildew (see footnote 1, page 56)	Scab (see footnote 1, page 56)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Aprovia	7	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30 d	28 oz	4	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
Cevya	3	G**/5 oz	G**/ 3-5 oz	12 h/0 d	15 oz	5		-	-	xx
Excalia	7	3.4 oz	3.4 oz	12 h/ 4 d	8 oz	2	Do not apply past petal fall. Use non-oil based adjuvants.	-	-	x
Flint Extra	11	G-E**/2.5-2.9 oz	G**/2.5-2.9 oz	12 h/14 d	10.4 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 56.	-	-	x
Fontelis	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
Gatten	U13	G**/6-8 fl oz	-	12 h/14 d	32 oz	4	Not registered for pears. Gatten may cause phytotoxicity to pears. Use caution when spraying apples near pears.	-	-	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	-	P-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 or with HMO. See footnotes 7 and 8, page 56.	-	-	x
Mancozeb 75DF, generic	M3	-	E/3 lb	1 d/77 d	21 lb	-	See label for treatment schedules and corresponding use rates. See footnote 6, page 56.	-	-	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 56. Do not use with EC formulated products.	-	-	x
Miravis	7	3.4 oz	3.4 oz	12 h/ 30 d	13.6 oz	4	When used for scab, tank mix with fungicides from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.			
Omega 500F	29	-	G/10-13.8 oz	2 d/28 d	8.6 pts	10	-	-	x	x
PH-D/OSO	19	6.2 oz	6.2 oz	4 h/ 0 d	37.2 oz	6	Alternate with fungicides that have different modes of action.	-	-	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 56.	-	-	x
Procure 480SC, generic	3	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 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 56.	-	-	-
Rhyme	3	G**/4-6 oz	E**/6.5 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Tesaris	7	E**/3.5-4.5 oz	E/4.5 oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 56. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Torino	U6	G-E/5.5-6.8 oz	-	4 h/14 d	6.8 oz	1	-	-	-	x
Ziram 76DF	M3	-	F/6 lb	2 d/14 d	32 lb	-	See footnote 5, page 56.	-	-	x

*Efficacy ratings: E = excellent, G = good, M = moderate, F = fair, S = slight control. See page 56 for ratings of fungicides for other apple diseases.
**Resistant pathogens will lower the effectiveness of these fungicides.

10 DAYS TO 2 WEEKS AFTER PETAL FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	San Jose scale	Tentiform leafminer#	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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. 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		-	-	x
Assail 70WP	4A	3.4 oz	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. The 3.4-oz application rate can be used to suppress scale.	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
Esteem 35WP, generic	7C	4-5 oz	4-5 oz	12 h/45 d	10 oz	2	For control in-season, make application in cover spray when scale crawlers first emerge.	-	-	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	8-14 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.

10 DAYS TO 2 WEEKS AFTER PETAL FALL: Diseases *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 1, page 56)	**Scab** (see footnote 1, page 57)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	**Bees** (see page 5)	**Buffers (see** page 5)	**Surface water** (see page 5)
Aprovia	7	G**/5.5-7 oz	G**/5.5-7 oz	12 h/30 d	28 oz	4	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
Cevya	3	G**/5 oz	G**/ 3-5 oz	12 h/0 d	15 oz	5	-	-	-	xx
Excalia	7	3.4 oz	3.4 oz	12 h/ 4 d	8 oz	2	Do not apply past petal fall. Use non-oil based adjuvants. Tank-mix with another fungicide from a different resistance management group. Do not use past petal fall. Use a non-oil-based adjuvant.	-	-	x
Flint Extra	11	G-E**/2.5-2.9 oz	G**/2.5-2.9 oz	12 h/14 d	10.4 oz	4	Do not apply more than 2 sequential applications. See footnotes 7 and 8, page 56. Tank-mix with another fungicide from a different resistance management group	-	-	x
Fontelis	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
Gatten	U13	G**/6-8 fl oz	-	12 h/14 d	32 oz	4	Not registered for pears. Gatten may cause phytotoxicity to pears. Use caution when spraying apples near pears.	-	-	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 or with HMO. See footnotes 7 and 8, page 56.	-	-	x
Mancozeb 75DF, generic	M3	-	E/3 lb	1 d/77 d	21 lb	-	See label for treatment schedules and corresponding use rates. See footnote 6, page 56.	-	-	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 56. Do not use with EC formulated products.	-	-	x
Miravis	7	3.4 oz	3.4 oz	12 h/30 d	13.6 oz	4	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.	-	-	-
Omega 500F	29	-	G/10-13.8 oz	2 d/28 d	8.6 pts	10	-	-	x	x
PH-D/OSO	19	6.2 oz	6.2 oz	4 h/ 0 d	37.2 oz	6	Alternate with fungicides that have different modes of actiuon.	-	-	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 Pristine as preharvest fungicide for storage rot control, consider not using earlier in season. Do not use with HMO. Use with adjuvant of choice. Do not apply more than 2 sequential applications. See footnote 6, page 56.	-	-	x
Procure, generic	3	E**/8-16 oz	G**/8-16 oz	12 h/14 d	56 oz	4	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 56.	-	-	-
Rhyme	3	G**/4-6oz	E**/6.5oz	12 h/14 d	26 oz	2	When used for scab, tank-mix with another fungicide from a different resistance management group. Also registered as TopGuard.	-	-	x
Tesaris	7	E**/3.5-4.5 oz	E/4.5 oz	12 H/0 d	18 oz	4	Do not apply more than 2 sequential applications. See footnote 6, page 56. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Ziram 76DF	M3	-	F/6 lb	2 d/14 d	32 lb	-	See footnote 5, page 56.	-	-	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 56 for ratings of fungicides for other apple diseases.
**Resistant pathogens will lower the effectiveness of these fungicides.

LATE SPRING AND SUMMER COVER SPRAYS: Insects *Amount per acre; see footnotes 3 and 4, page 56.*

Product and formulation	Resistance management group (see page 7)	Aphids	Apple maggot	Brown marmorated stink bug (see page 38)	Codling moth	Leafhoppers	Leafrollers#	San Jose scale crawlers	Tarnished plant bug	Tentiform leafminer#	Woolly apple aphid	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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
	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
Assail 70WP	4A	1.1-1.7 oz	3.4 oz	-	3.4 oz	1.1-1.7 oz	-	3.4 oz	-	1.1-1.7 oz	-	12 h/7 d	13.5 oz	4	x	-	x
	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	5-6 oz	-	-	5-6 oz	-	-	12 h/14 d	24 oz	4	xx	-	x
	Suppression of codling moth only. 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	-	-	-	-	-
	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	4-6 oz	-	-	4-6 oz	6 oz	-	12 h/7 d	12 oz	-	xx	-	x
	Suppression of coddling moth only. Highly toxic to bees. See label for specific precautions.																
Centaur DG	16	-	-	-	-	34.5 oz	-	34.5 oz	-	-	-	12 h/14 d	34.5 oz	1	-	-	-
	Do not tank-mix with oil. Ground application only. For scale crawlers, apply at first crawler emergence.																
Codling moth granulosis virus (Cyd-X, Cyd-X HP, Virosoft CP4, Madex HP, Madex XLV)	-	-	-	-	Rates vary; see labels	-	-	-	-	-	-	See label	-	-	-	-	-
	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
	Toxic to bees. See label for specific precautions.																
Diazinon 50WP, RUP, generic	1B	-	-	-	-	-	-	-	-	-	4 lb	4 d/21 d	8 lb	2	xx	x	x
	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.																

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.

CONTINUED ON PAGE 52

LATE SPRING AND SUMMER COVER SPRAYS: Insects *Amount per acre; see footnotes 3 and 4, page 56. Continued from page 53*

Product and formulation	Resistance management group (see page 7)	Aphids	Apple maggot	Brown marmorated stink bug (see page 38)	Codling moth	Leafhoppers	Leafrollers#	San Jose scale crawlers	Tarnished plant bug	Tentiform leafminer#	Woolly apple aphid	REI/PHI	Maximum amount/ acre/year	Maximum applications/ year	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Entrust 2SC	5	-	-		6-10 oz	-	6-10 oz	-	-	4-10 oz	-	4 h/7 d	29 oz	4	x	-	x
	Toxic to bees. See label for specific precautions.																
Esteem 35WP, generic	7C	-	-		4-5 oz	-	-	4-5 oz	-	4-5 oz	-	12 h/45 d	10 oz	2	-	-	x
	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
	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
	Highly toxic to bees. See label for specific precautions.																
Intrepid 2F	18	-	-		16 oz	-	16 oz	-	-	-	-	4 h/14 d	64 oz	-	-	x	x
	See label for application timing. Suppression of codling moth.																
Rimon 0.83EC	15	-	-		30-50 oz	-	-	-	-	-	-	12 h/14 d	150 oz	4	x	x	x
	Toxic to bees. See label for specific precautions. Can be applied with up to 0.25% HMO.																
Success 2L	5	-	6-10 oz		6-10 oz	-	6-10 oz	-	-	4-10 oz	-	4 h/7 d	29 oz	-	x	-	x
	Toxic to bees. See label for specific precautions. Do not exceed 3 applications per year for leafroller control.																
Ultor 1.25SC	23	8-14 oz	-	-	-	-	-	8-14 oz	-	-	8-14 oz	1 d/7 d	40 oz	-	x	-	x
	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.

LATE SPRING AND SUMMER COVER SPRAYS: Mites *Amount per acre*

See footnotes 3 and 4, page 56.

Product and formulation	Resistance management group (see page 7)	Mites#	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Acramite 50WS, generic	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	2	Will not control rust mites. Do not make more than one application before using an effective miticide with a different mode of action.	-	-	-
Nexter 75WSB, generic	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, generic	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, generic	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

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.

PREHARVEST: Diseases *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Storage rots	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Captan 80WDG	M4	F-G/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	F-G/4-5.5 oz	12 h/0 d	22 oz	4	Do not apply more than 2 sequential applications. See footnote 8, page 56. Do not use with EC formulations, methylated seed oil or HMO.	-	-	x
Pristine	7 + 11	F-G/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 56.	-	-	x
Topsin M 70WSB, generic	1	G/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	F-G/6 lb	2 d/14 d	32 lb	-	See footnote 5, page 56.	-	-	x

Contact your packing house before choosing one of these materials.

POSTHARVEST: Diseases *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Anthracnose	Crown & collar rot (rare)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Fixed copper (50-53%) +	M1	16-20 lb	-	2 d/-	-	-	See label for product-specific REI. See footnote 10, page 56.	-	-	x
Fixed copper + horticultural mineral oil (HMO)	-	1 gal	-	4 h/-	-	-	-	x	-	x
Aliette WDG	P7	-	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	P7	-	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.	-	-	-

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

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. 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 DODINE DURING POOR DRYING CONDITIONS.
3. Do not apply oil sprays during the growing season within 45 days of a sulfur application.
4. Use caution 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 four 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.

Follow the 'RULES' for fungicide stewardship

- **R**otate or mix fungicides of different chemical groups.
- **U**se labeled rates.
- **L**imit total number of applications.
- **E**ducate yourself about fungicide activity, mode of action, and class—as well as resistance management practices.
- **S**tart a fungicide program with multisite mode of action materials.

Effectiveness of fungicides for control of apple diseases

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.

Fungicide	Fungicide group	Properties	Apple scab	Powdery mildew	Bull's eye rot	Fireblight
Actigard	21	Activator of plant defense	None	None	None	Suppression
Aprovia	7	Broad spectrum of activity, fungicidal, protectant	Fair-good	Poor-fair	??	None
BlightBan	Bio-1	Protectant	??	??	??	Poor-Fair
Captan	M4	Broad spectrum of activity, fungicidal, protectant	Good-excellent	None	Good	None
Cevya	3	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Excellent**	??	None
Cinnerate	BM03	Fungicidal, insecticidal	??	Good	Good	??
Copper-based products	M1	Broad spectrum of activity, Bac, fungicidal, protectant	??	Fair??	Poor	Fair
Dodine	U12	Broad spectrum of activity, fungicidal, protectant	Excellent**	None	??	None
Flint	11	Broad spectrum of activity, fungicidal, locally systemic, protectant	Good*	Good-excellent**	Poor-fair	None
Fontelis	7	Broad spectrum of activity, fungicidal, protectant	Fair-good**	Good**	??	None
Gatten	U13	Narrow spectrum, fungicidal	None	Good**	None	None
Horticultural mineral oil (HMO)	Not classified	Eradicant, fungicidal, insecticidal, protectant	??	Good	??	None
Indar	3	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good**	Good**	??	None
Kaligreen	Not classified	Eradicant, broad to narrow spectrum of activity	None	Poor-fair	??	None
Kasumin	24	Bac, protectant	None	None	None	Good**
Lime sulfur	M2	Fungicidal, insecticidal, protectant, vapor active	Good-excellent	Good	??	None
Mancozeb	M3	Broad spectrum of activity, fungicidal, protectant	Good	None	??	None
Miravis	7	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	None	None
Omega 500F	29	Fungicidal, protectant	Good	Poor	??	None
oxytetracycline	41	Bac	None	None	None	Fair-Good**
Polyram	M3	Broad spectrum of activity, fungicidal, protectant	Good	None	??	None
Procure	3	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good**	Good**	Poor-fair	None
Rally	3	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good**	Fair-good**	??	None
Rhyme/TopGuard	3	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good**	Good**	??	None
Serenade Opti	44	Fungicidal, protectant	??	Fair	??	Fair-Good
streptomycin	25	Bac, protectant	None	None	None	Poor-excellent**
Sulfur	M2	Fungicidal, insecticidal, protectant, vapor active	Fair	Good	??	None
Tesaris	7	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Good**	None	None
Topsin M	1	Broad spectrum of activity, curative, fungicidal, locally systemic	Fair**	Fair-good**	Excellent**	None
Torino	U6	Fungicidal, protectant	None	Good-excellent	??	None
Vangard	9	Curative, fungistatic, locally systemic, narrow spectrum of activity, protectant	Fair**	None	??	None

Effectiveness of fungicides for control of apple diseases

Ziram	M3	Broad spectrum of activity, fungicidal, protectant	Fair	None	??	None
Combination products						
Inspire Super	3 + 9	Broad to narrow spectrum of activity, curative, fungicidal, locally systemic, protectant	Good	Excellent**	??	None
Luna Sensation	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good-excellent**	Excellent	??	None
Luna Tranquility	7 + 9	Fungicidal, narrow spectrum of activity, protectant	Good**	Excellent	??	None
Merivon	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good-excellent**	Excellent	??	None
Pristine	7 + 11	Broad to narrow spectrum of activity, fungicidal, locally systemic, protectant	Good**	Excellent**	??	None

?? = no information available. **Resistant pathogens will lower the effectiveness of these fungicides.

Apple herbicides

Product and formulation	Mode of action	Apple	Broadleaf weeds	Grass weeds	Restricted-entry interval	Preharvest interval	Remarks	Bees (see page 6)	Bees (see page 6)	Surface water (see page 6)
Products that persist in the soil and are soil-active										
Alion 1.67 SC	29	x	++	+	12 hr	14 d	Minimum establishment 3 years.	-	x	x
Casoron 4G & 1.4CS	20	x	++	++	12 hr	-	Minimum establishment 4G 4 weeks, 1.4CS 1 year.	-	-	-
Karmex 80DF, generic	7	x	+	+	12 hr	-	Do not treat trees on full-dwarf rootstock; minimum establishment 1 year.	-	-	-
Kerb 35.6SC, generic	3	x	+	++	1 d	-	Minimum establishment 6 to 12 months.	-	-	-
Princep 90WDG, generic	5	x	++	+	12 hr	Apple 150 d	Minimum establishment pear and apple 1 year, cherry 2 years.	-	-	x
Prowl H20 3.8AS, generic	3	x	+	++	1 d	60 d	EC is non-bearing only.	-	x	x
Solicam 78.6DF	12	x	++	+	12 hr	60 d	Minimum establishment pear and cherry 18 months.	-	-	-
Surflan,generic	3	x	++	++	1 d	-	-	-	-	x
Trellis SC	21	NB	++	-	12 hr	-	-	-	-	-
Products that persist in the soil and have both soil and foliar activity										
Goal 2XL 2EC, generic	14	x	++	+	1 d	-	Postharvest or dormant only	-	x	x
Matrix SG, generic	2	x	++	+	4 hr	Pear, apple 7 d/cherry 14 d	Minimum establishment 1 year	-	-	-
Pindar GT	2 + 14	x	++	+	24 hr	60 d	Minimum establishment 4 years	-	x	x
Sandea 75DF	2	x	++	+	12 hr	14 d	Minimum establishment 1 year	-	-	-
Products with contact or systemic activity										
2,4-D amine, generic	4	x	++	- -	2 d	Pear, apple 14 d/cherry 40 d	Min. establishment 1 year. Use caution near vineyards due to sensitivity of grapevines.	-	-	x
Aim 2EC	14	x	++	- -	12 hr	3 d	Avoid contacting green bark or foliage.	-	-	x

Apple herbicides

Product and formulation	Mode of action	Apple	Broadleaf weeds	Grass weeds	Restricted-entry interval	Preharvest interval	Remarks	Bees (see page 6)	Bees (see page 6)	Surface water (see page 6)
Fusilade DX	1	NB	- -	+	12 hr	14 d	Avoid contacting foliage.	-	x	x
Glyphosate, generic	9	x	++	++	4 or 12 hr	Pear, apple 1 d/cherry 17 d	Avoid contacting green bark or foliage.	-	-	-
Gramoxone, RUP; generic	22	x	++	++	1 d	Cherry 28 d	Avoid contacting green bark or foliage.	-	-	-
Poast	1	x	- -	++	12 hr	14 d	-	-	-	x
Reglone	22	NB	++	++	1 d	-	-	-	-	-
Rely 280, generic	10	x	++	+	12 hr	14 d	Avoid contacting green bark or foliage.	-	-	-
Select Max	1	NB	-	++	1 d	-	-	-	-	-
Sinbar 80WDG	5	NB	++	+	12 hr	Apple 60 d	-	-	-	-
Treevix 70WDG	14	x	++	- -	12 hr	0 d	Avoid contacting green bark or foliage; minimum establishment 1 year.	-	-	-
Venue	14	x	++	- -	12 hr	0 d	Avoid contacting green bark or foliage.	-	-	x
Weed Pharm 20% acetic acid	-	x	+	+	2 d	-	Use hooded or shielded sprayer.	-	-	x

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.

STAGES 0–3: Dormant or delayed dormant, insects and mites *Amount per acre*

Product and formulation	**Resistance management group** (see page 7)	**Aphids**	**Leafrollers#**	**Mites**	**Scale insects**	**Restricted-entry interval (REI)/ Preharvest interval (PHI)**	**Maximum amount/acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5)	**Surface water** (see page 5)
Centaur DG	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	8 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

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.

STAGES 4–5: Popcorn, insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Black cherry aphid	Budmoth	Leafrollers#	Mineola moth	Syneta beetle	Thrips	Restricted-entry interval (REI) /Preharvest interval (PHI)	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Altacor 35WDG	28	-	-	2-4 oz	-	-	-	4 h/10 d	9 oz	3	-	-	-	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. See label for application restrictions.	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 through 12/31/2027 and allows for a 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. See label for application restrictions.	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.

STAGES 4–7: Popcorn through full bloom, 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 7)	Brown rot	Powdery mildew	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Bravo Weather Stik, 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	9.5 oz	12 h/0 d	47.5 oz	-	Do not apply more than 2 sequential applications. See footnote 3, page 75.	-	-	x
Cevya	3	3-5 oz	5 oz	12 h/0 d	15 oz	3		-	-	x
Cinnerate	BM03	16-64 oz	16-64 oz	0 h/0 d	-	-				
Elevate 50WDG	17	1-1.5 lb	-	12 h/0 d	6 lb	-	Do not apply more than 2 sequential applications.	-	-	x
Fontelis	7	14-20 oz	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 Experience	3 + 7	6-10 fl oz	6-10 fl oz	12 h/0 d	34 fl oz	-	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications.	-	-	x
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 or with HMO. See footnote 3, page 75.	-	-	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 75. See label for information on use of adjuvants.	-	-	x
Miravis	7	3.4-5.1 oz	5.1 oz	12 h/0 d	20.4 oz	4		-	-	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 75.	-	-	x
Procure 480SC, generic	3	10-16 oz	8-16 oz	12 h/1 d	96 oz	-	-	-	-	x
Quash 50WDG	3	2.5-4 oz	3.5-4	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 75.	-	-	-
Rhyme	3	7 oz	-	12 h/7 d	28 oz	4	TopGuard also registered	-	-	-
Tebucon 45DF, generic	3	4-8 oz	8 oz	5 d/0 d	48 oz	-	Other products with same active ingredient may have less restrictive REIs; check specific product label.	-	x	x
Tesaris	7	E/4.5 oz	4.5oz	12 H/0 d	16.8 oz	3	Do not apply more than 2 sequential applications. See footnote 6, page 75. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Ziram 76DF	M3	5-6 lb	-	2 d/30 d	30 lb	-	See footnote 2, page 75. Rate based on 300 gal/acre.	-	-	x

PETAL FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Aphids	Leafrollers#	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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	-	3.0-4.5 oz	4 h/10 d	9 oz	3		-	-	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 and application restrictions.	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) label allows 3-day PHI through 12/31/27. 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 and application restrictions.	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.

SHUCK FALL: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Aphids	Leafhoppers	Leafrollers#	San Jose scale	Spotted wing drosophila*	Tentiform leafminer#	REI/PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (page 5)	Surface water (see page 5)
Actara 25WDG	4A	3-4 oz	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	-	-	-	x
Assail 70WP	4A	1.2-2.3 oz	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, 2–3 sprays are needed. Apply sprays 14–21 days apart.	-	-	-
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. See label for application restrictions.	x	-	x
Entrust 2SC	5	-	-	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 (in effect through 12/31/2027). See label and supplemental label for application restrictions.	x	-	x
Esteem 35WP	7C	-	-	-	4-5 oz	-	-	12 h/14 d	15 oz	3		-	-	x
Imidacloprid 2F, generic	4A	3.2-6.4 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
Mustang Maxx	3	-	-	-	-	4 oz	-	12 h/14 d	24 oz	6		xx	-	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. See label for application restrictions.	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.
*Shuck fall sprays for spotted wing drosophila (SWD) should be used to kill over-wintering females following warm winters. Doing so may allow you to apply fewer early season sprays for SWD. These applications should not be routine.
#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.

SHUCK FALL: Diseases *Amount per acre*

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

Product and formulation	**Resistance management group** (see page 7)	**Powdery mildew** (see footnote 4, page 75)	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees** (see page 5)	**Buffers** (see page 5)	**Surface water** (see page 5)
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 75.	-	-	x
Cevya	3	5 oz	12 h/0 d	15 oz	3		-	-	x
Fontelis 1.67SC	7	14-20 oz	12 h/0 d	61 oz	-	Do not apply more than 2 sequential applications.	-	-	x
Gatten	U13	6-8 fl oz	12 h/3 d	32 oz	4	Gatten may cause phytotoxicity to pears. Use caution when spraying cherries near pears.	-	-	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 75.	-	-	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
Inspire	3	7 oz	12 h/0 d	28 oz	4	Do not apply more than 2 sequential applications. Do not use Inspire Super as it is only registered for tart cherries.	-	-	x
Luna Experience	3 + 7	6-10 fl oz	12 h/0 d	34 fl oz	-	Do not use for brown rot if planning to use for powdery mildew. Do not apply more than 2 sequential applications.	-	-	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 or with HMO. See footnote 3, page 75.	-	-	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 75. See label for information on use of adjuvants.	-	-	x
Miravis	7	5.1 oz	12 h/0 d	20.4 oz	4		-	-	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 75.	-	-	x
Procure 480SC, generic	3	8-16 oz	12 h/1 d	56 oz	4	See footnote 4, page 75.	-	-	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 75.	-	-	x
Quintec	13	8.7 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
Rhyme	3	G**/4-6 oz	12 h/14 d	26 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Sulfur DF, generic	M2	10-15 lb	1 d/1 d	-	-	Temperatures 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, 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 75.	-	x	x
Tesaris	7	E/4.5 oz	12 H/0 d	16.8 oz	3	Do not apply more than 2 sequential applications. See footnote 6, page 75. Do not use with EC formulations, methylated seed oil, or HMOs.	-	-	x
Torino	U6	6-8 oz	4 h/6 d	16	2	-	-	x	x
Vivando	50	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.

LATE SPRING THROUGH PREHARVEST: Insects and mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Cherry fruit fly	Spotted wing drosophila*	Leafrollers#	Spider mites#	Tentiform leafminer#	Western flower thrips	REI/PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Acramite 50WS, generic	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	-	-	3-4.5 oz	-	-	-	4 h/10 d	9 oz	3		-	-	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. 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. See label for application restrictions.	x	-	x
Diazinon 50WP, RUP, generic	1B	4 lb	4 lb	-	-	-	-	4 d/21 d	8 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

CONTINUED ON PAGE 68

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.

LATE SPRING THROUGH PREHARVEST: Insects and mites *Amount per acre* • *Continued from page 67*

Product and formulation	Resistance management group (see page 7)	Cherry fruit fly	Spotted wing drosophila*	Leafrollers#	Spider mites#	Tentiform leafminer#	Western flower thrips	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Dimethoate, 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
Envidor 2SC	23	-	-	-	16-18 oz	-	-	12 h/7d	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 6-7 mph with the listed rate and nozzle size. See label for proper dilutions. Do not use for spotted wing drosophila control.	-	-	x
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

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.

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LATE SPRING THROUGH PREHARVEST: Insects and mites *Amount per acre* • *Continued from page 68*

Product and formulation	Resistance management group (see page 7)	Cherry fruit fly	Spotted wing drosophila*	Leafrollers#	Spider mites#	Tentiform leafminer#	Western flower thrips	REI/PHI	Maximum amount/acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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. See label for application restrictions.	x	-	x
Rimon	15	20-40 oz	-	-	-	-	-	12 h/8 d	150 oz	-	Affects immature insect stages. Minimum 7-day retreatment interval.	-	x	x
Warrior II, RUP	3	-	1.2-2.56 oz	-	-	-	-	1 d/14 d	10.2 oz	-	-	xx	x	xx
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.

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 7)	Brown rot	Powdery mildew (see footnote 4, page 75)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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 75.	-	-	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
Gatten	U13	6-8 fl oz	6-8 fl oz	12 h/3 d	32 oz	4	Gatten may cause phytotoxicity to pears. Use caution when spraying cherries near pears.			
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 75.	-	-	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 75.	-	x	x
Inspire Super	3+9	16-20 oz	16-20 oz	12 h/0 d	80 oz	4	Do not apply more than 2 sequential applications. Do not use Inspire Super as it is only registered for tart cherries.	-	-	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 or with HMO. See footnote 3, page 75.	-	-	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 72. See label for information on use of adjuvants.	-	-	x
Miravis	7	5.1 oz	5.1 oz	12 h/0 d	20.4 oz	4		-	-	x
Ph-D/OSO	19	-	6.2 oz	4 h/0 d	37.2 oz	6	Mix with another fungicide.	-	-	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 75.	-	-	x
Procure 480SC, generic	3	8-16 oz	8-16 oz	12 h/1 d	56 oz	4	See footnote 4, page 75.	-	-	x
Quash 50WDG	3	2.5-4 oz	3.5-4 oz	12 h/14 d	12 oz	3	Do not apply more than 2 sequential applications. See footnote 4, page 75.	-	-	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	2.5-6 oz	6 oz	1 d/0 d	3.25 lb	-	Tank-mix with another fungicide from a different resistance management group. See footnote 4, page 75.	-	-	-

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

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LATE SPRING THROUGH PREHARVEST: Diseases *Amount per acre* • *Continued from page 70*

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 7)	Brown rot	Powdery mildew (see footnote 4, page 75)	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Rhyme	3	7 oz	7 oz	12 h/14 d	28 oz	4	When used for scab, tank-mix with another fungicide from a different resistance management group.	-	-	x
Sulfur DF, generic	M2	10-15 lb	10-15 lb	1 d/1 d	-	-	Temperatures 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 75.	-	-	x
Tebucon 45DF, 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 75.	-	x	x
Topsin M 70WSB, generic	1	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
Torino	U6	--	6-8 oz	4 h/6 d	16	2	-	-	x	x
Vivando	U8	-	15.4 oz	12 h/7 d	30.8 oz	2	Do not mix with HMO.	-	-	x

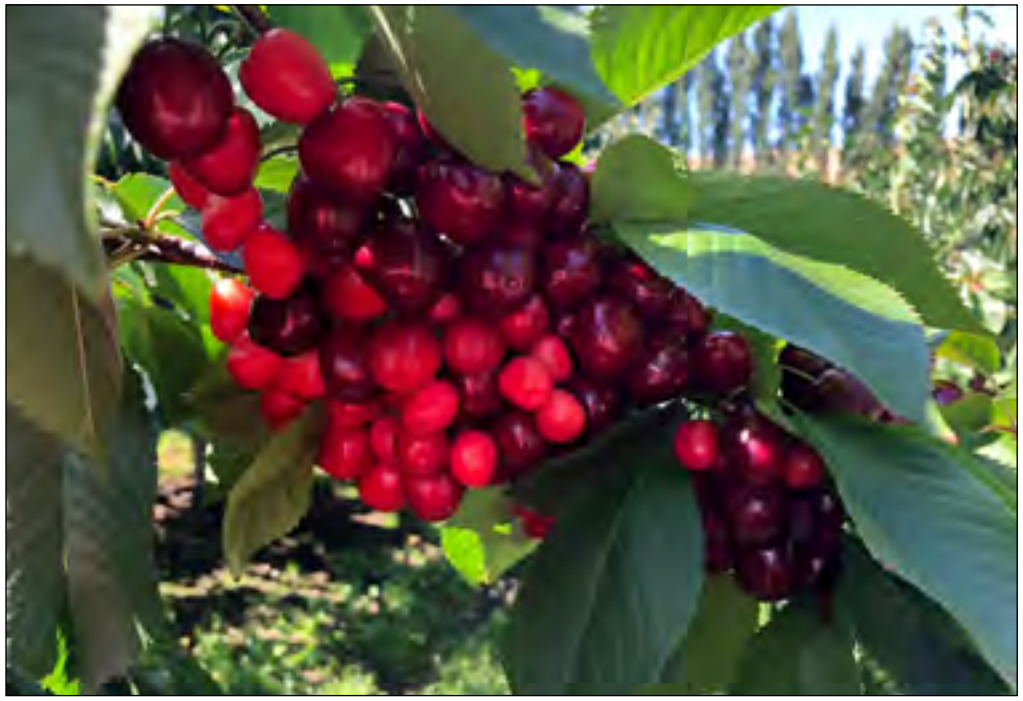
Generic = other materials with the same active ingredient are available.

PREHARVEST: Birds See *Nonlethal Bird Deterrent Strategies: Methods for reducing fruit crop losses in Oregon*, https://catalog.extension.oregonstate.edu/em9286

Product and formulation	Birds	REI/PHI	Maximum amount/acre/ year	Maximum applications/ year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Methyl anthranilate (Avian Migrate)	Rates vary; see label	-	-	-	Best if used as part of an integrated program including scare devices such as cannons and distress alarms. Check with your packing house for recommended PHI.	-	-	-

Little cherry disease scouting

Preharvest through harvest		
Products and formulations	**Little cherry disease scouting**	**Remarks**
Spray paint or flagging tape and a GPS unit or GPS-equipped cellphone	2 weeks preharvest through harvest	Scout your orchard for little cherry disease (x disease and little cherry virus) symptoms such as small, flavorless, pointed, poorly colored fruit. Affected fruit is often confined to a small portion of the tree, such as a single branch. Symptomatic fruit may appear on the same branch as healthy fruit. Mark infected trees in a conspicuous manner, using spray paint or flagging tape. Use your cellphone or a GPS unit to record the location of the tree. This will make the infected tree easier to find and remove in the future.
Postharvest		
Products and formulations	**Little cherry diseases**	**Remarks**
Glyphosate, generic	Some herbicides can be used to kill the roots and root suckers of X disease and little cherry virus-infected trees. In addition, herbicide damage to nearby trees can be used to indicate root grafting. Trees that are root-grafted to infected trees are infected with X disease or little cherry virus, and should also be removed promptly.	There are many glyphosate products (GlyStar, Buccaneer and Envy) that are clearly labeled for cut stump treatment in cherry orchards. For best results, apply herbicide immediately after cutting. Consult your herbicide label and follow appropriate precautions when treating cut stumps.



Sweet cherry exhibiting symptoms of little cherry disease in The Dalles.

Photo: Ashley Thompson, © Oregon State University

POSTHARVEST: Insects *Amount per acre*

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

Product and formulation	**Resistance management group** (see page 7)	**Cherry fruit fly** (see footnote 1, page 75)	**Pear slug****	**Leaf hoppers**	**Redhumped caterpillar**	**Tentiform leafminer#**	**REI/PHI**	**Maximum amount/ acre/year**	**Maximum applications/year**	**Remarks**	**Bees (see page 5)**	**Buffers (see page 5)**	**Surface water (see page 5)**
Actara 25WDG	4A	4.5-5.5 oz	2-2.75 oz	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
Asana XL	3	-	2.0-5.8	2.0-5.8	-	-	12 h/14 d	14.5 oz	-		xx	-	xx
Assail 70WP	4A	2.3-3.4 oz	1.1-2.3 oz	1.1-2.3 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.	-	-	-
Diazinon 50WP, RUP	1B	4 lb	-	-	-	-	4 d/21 d	8 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	-	-	-	-	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	-	-	-	-	6-10 oz	4 h/7 d	29 oz	4	-	-	-	-
Imidacloprid 2F, generic	4A	3.2-6.4 oz	3.2-6.4 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	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	-	-	-	-	6-10 oz	4 h/7 d	29 oz	-	-	x	-	x
Warrior II	3	-	-	1.28-2.56 oz	-	-	24 h/14 d	12.8 oz	-	-	xx	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.

POSTHARVEST: Mites *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Spider mites#	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks (see footnotes on page 75)	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Acramite 50WS, generic	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	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, do not rotate with Nextare 75WSB.	-	x	x
Horticultural mineral oil (HMO)	-	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, generic	21A	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. To avoid resistance, do not rotate with FujiMite 5EC.	xx	x	x
Onager 1EC, generic	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, generic	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

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: Diseases *Amount per acre*

Product and formulation	Resistance management group (see page 7)	Powdery mildew	REI/PHI	Maximum amount/ acre/year	Maximum applications/year	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
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 is still being developed; see pages 61-62 and 65-66 for materials considered effective for SWD.

A Apply first spray when flies emerge; notice usually is mailed to growers.

B Estimated days of protection for the recommended materials:

Actara	**10 days**
Assail	**10 days**
Baythroid	**10 days**
Danitol	**10 days**
Delegate	**10 days**
Diazinon	**10 days**
Dimethoate (May cause phytotoxicity on some cultivars.)	**21 days**
GF-120	**7 days**
Imidacloprid	**10 days**
Malathion	**7 days**
Lambda-cyhalothrin	**10 days**
Sevin 4F (carbaryl) (May cause phytotoxicity on some cultivars.)	**7 days**
Success, Entrust	**7 days**

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 FRAC group 11 fungicides (Cabrio, Gem, Merivon, Luna Sensation, 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 groups 3 and 11 fungicides in the Mid-Columbia and Eastern Washington areas. Higher rates and resistance management (rotation with materials in other fungicide groups) are recommended. See table on page 76.

Effectiveness of fungicides and bactericides for control of cherry diseases

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.

Fungicide or bactericide	FRAC group	Properties	BROWN ROT		Powdery mildew	Shothole	Bacterial canker
			Blossom blight	Fruit rot			
Abound	11	Broad spectrum, fungicidal, locally systemic, protectant	Good	Good	Good**	Fair to good	Not effective
Bravo	M5	Broad spectrum, fungicidal, protectant	Good to fair	Not registered	Not effective	Good	Not effective
Cabrio	11	Broad spectrum, fungicidal, locally systemic, protectant	Good	Good	Good**	??	Not effective
Captan	M4	Broad spectrum, fungicidal, protectant	Good	Good	Not effective	Good to excellent	Not effective
Cevya	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good	??	Good**	??	Not effective
Cinnerate	BM03	Fungicidal, insecticidal	??	??	Fair to good	?	??
Copper-based products	M1	Broad spectrum, Bact, fungicidal, protectant	Poor	Not registered	Poor	Good	Not effective
Echo 720	M5	Broad spectrum, fungicidal, protectant	Good to fair	Not registered	Not effective	Good	Not effective
Elevate	17	fungicidal, narrow spectrum, protectant	Good to excellent	Good to excellent	Not effective	??	Not effective
Fontelis	7	Broad spectrum, fungicidal, protectant	Good to excellent	Good to excellent	Good	Good	Not effective
Gatten	U13	Fungicidal, narrow spectrum	???	???	Good	???	Not effective
Gem	11	Broad spectrum, fungicidal, locally systemic, protectant	Good	Fair to good	Fair to good	??	Not effective
Indar	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Excellent**	Excellent**	Poor**	??	Not effective
Inspire	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Fair to good**	Fair to good**	Good**	??	Not effective
HMO	Not classified	Eradicant, fungicidal, insecticidal, protectant	??	??	Good to excellent	??	??
Kaligreen	Bicarbonate	Eradicant, broad to narrow spectrum	??	??	Poor to slight	??	??
Magister	39	Fungicidal	??	??	Good	Not effective	Not effective
Ph-D/OSO	19	Fungicidal	??	??	Fair to good	??	Not effective
Procure	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good	??	Good**	??	Not effective
Quash	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good to excellent	Good	Good**	??	Not effective
Quintec	13	Narrow spectrum, fungicidal, protectant	Not effective	Not effective	Good	Not effective	Not effective
Rally	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good to fair	Good to fair	Fair**	Poor	Not effective
Rhyme/TopGuard	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good	Good	Good	??	Not effective
Rovral	2	Broad to narrow spectrum, fungicidal, locally systemic, protectant	Excellent**	Not registered	Not effective	Fair to good	Not effective
Sulfur	M2	Fungicidal, insecticidal, protectant, vapor active	Fair	Fair to good	Good	Not effective	Not effective
Syllit	U12	Broad spectrum, fungicidal, protectant	??	Poor	Not effective	??	None to slight
Tebucon	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good to excellent	Good to excellent	Fair to good**	??	Not effective
Tesaris	7	Broad spectrum, fungicidal, protectant	Good to excellent	Good to excellent	Good	Good	Not effective
Tilt, generic	3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good to excellent	Good to excellent	Fair**	Poor	Not effective
Torino	U6	fungicidal, protectant	????	????	Good to excellent	???	Not effective
Topsin M	1	Broad spectrum, curative, fungicidal, locally systemic	Good**	Good**	Fair**	Not effective	Not effective
Vivando	50	??	Not effective	Not effective	Fair to good	Not effective	Not effective
Ziram	M3	Broad spectrum, fungicidal, protectant	Slight	Poor	Not effective	Good to excellent	Not effective
Combination products							
Luna Experience	3 + 7	Broad to narrow spectrum, fungicidal, locally systemic, protectant	Good	Good	Good**	??	Not effective
Luna Sensation	7 + 11	Broad spectrum, fungicidal, locally systemic, protectant	Good to excellent	Good to excellent	Excellent**	??	Not effective
Merivon	7 + 11	Broad spectrum, fungicidal, locally systemic, protectant	Good to excellent	Good to excellent	Good to excellent**	??	Not effective
Pristine	7 + 11	Broad spectrum, fungicidal, locally systemic, protectant	Good	Good	Good **	??	Not effective
Quilt Xcel	11 + 3	Broad to narrow spectrum, curative, fungicidal, locally systemic, protectant	Good to excellent	Good to excellent	Excellent**	??	Not effective

?? = no information available. **Resistant pathogens will lower the effectiveness of this fungicide.

Quick guide to cherry herbicides

Product and formulation	Mode of action	Pear	Apple	Cherry	Broadleaf weeds	Grass weeds	Restricted-entry interval	Preharvest interval	Remarks	Bees (see page 5)	Buffers (see page 5)	Surface water (see page 5)
Products that persist in the soil and are soil-active												
Alion	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, generic	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, generic	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												
Goal 2XL 2EC, generic	14	**x**	x	**x**	++	+	1 d	-	Postharvest or dormant only	-	x	x
Matrix SG,generic	2	**x**	x	**x**	++	+	4 hr	Pear, 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	-	-	-
Products with contact or systemic activity												
2,4-D amine, generic	4	x	x	x	++	- -	2 d	Pear, 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, 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, generic	10	x	x	x	++	+	12 hr	14 d	Avoid contacting green bark or foliage.	-	-	-
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

Nutrient sprays

Soil and leaf analysis

A soil test can determine the pH of your soil — the measure of its acidity or alkalinity — and the levels of certain mineral elements. 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. See *Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis*, EM 8677, https://catalog.extension.oregonstate.edu/em8677.

Tree nutrient needs and foliar fertilization

Trees need large amounts (lb/acre) of certain nutrients every year. These nutrients are called macronutrients, and they 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; these are called 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 and damage tree tissue, including leaves, shoots, buds and fruit. Use extreme care when deciding whether to use foliar materials between budbreak and harvest to avoid potential crop damage. Follow this general rule: Between dormancy and harvest, avoid foliar feeds unless visible symptoms or lab analysis show a deficiency. In addition, use diluted 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 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 effectively deliver nitrogen to 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. Use them 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. Use low urea concentrations when spraying apple trees when crop is present.

Postharvest urea sprays for pear

Concentrated postharvest urea sprays have been shown to be 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:

- 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.
- f 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 and 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. Make the first application in late August-early September; apply the second seven days later. Marginal leaf burn may occur after dilute spray applications. Spray 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. Because trees need only a small amount of boron, it is easy to overdo it, especially with soil fertilizer applications. 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.

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Nutrient sprays CONTINUED FROM PAGE 77

A number of boron spray products have been developed in the past few years. 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. 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 (Imidan, Captan or Topsin, for example) or plant growth regulators, such as Promalin. Boric acid does not dissolve as quickly as sodium polyborate, but doesn't increase tank water pH. Pure boric acid may slightly decrease the pH of tank spray water. Regardless of the boron product used, check tank water pH when tank-mixing with pH-sensitive products.

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

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

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 are cool and damp. Use low rates on bearing stone fruit. Avoid using zinc sulfate on bearing trees.

You can apply foliar zinc in fall, but they 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 have been 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, Washington, and Medford, Oregon), 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 five to six 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			
	3. zinc sulfate 36% crystals	2-4 gal	0.5-1 gal	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	1.5-3 lb	
	5. basic zinc sulfate (liquid, 20-25%)	6-12 lb	2 lb (w/ oil), 3 lb (w/o oil)	
Zinc deficiency	1. zinc chelate or organic complex			1. Follow the label.
	2. zinc sulfate 1.2LC			
	3. zinc sulfate 36% crystals	13 gal	3.25 gal	3. Make sure all crystals dissolve. See precautions in text. Apply without oil.
	4. basic zinc sulfate (dry, 50-52%)	40 lb	10 lb	4. Follow manufacturer's label.
	5. basic zinc sulfate (liquid, 20-25%)	16 lb	4 lb	
Prepink or pink spray				
boron maintenance*	1. boric acid (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.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (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.
	2. polyborate (dry or liquid)			
Foliage spray *Apply after bloom and before harvest*				
boron maintenance*	1. boric acid (dry or liquid)			1, 2. Apply amount equivalent to 0.5 lb actual boron per acre. See precautions in text.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (dry or liquid)			1, 2. Apply amount equivalent to 1 lb actual boron per acre. See precautions in text.
	2. polyborate (dry or liquid)			
calcium (cherry fruit firmness)	1. calcium nitrate	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.
	2. chelated calcium products	See label	See label	
calcium (cherry reduced cracking)	1. calcium chloride	8-12 lb	2-3 lb	
	2. calcium nitrate	See label	See label	1, 3. May reduce fruit size. See text.
	3. calcium citrate	See label	See label	
	4. chelated calcium products	See label	See label	
calcium (alfalfa greening of pears, cork spot of Anjou pear)	1. calcium chloride	4 lb	0.5-1 lb	
	2. calcium nitrate	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.
	3. calcium citrate	See label	See label	
	4. chelated calcium products	See label	See label	
magnesium deficiency	1. magnesium chelate or organic compound	40-80 lb	10-20 lb	1. For rates of magnesium chelate, see manufacturer's label.
	2. magnesium nitrate 13.5% crystals	20-40 lb	5-10 lb	2. Apply in June. Repeat in July if necessary. Do not apply after Aug. 1.
	3. magnesium nitrate 0.4LC	6-12 gal	1.5-3 gal	
	4. calcium nitrate (fertilizer grade) + Epsom salts (magnesium sulfate)	24-48 lb	6-12 lb	

*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 from page 79*

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
nitrogen deficiency	1. urea 46% solid	2-10 lb	.5-2.5 lb	1, 2. Apply only as needed to apples. Can cause injury on pear or stone fruits. See text.
	2. urea 20% liquid	0.5-2.4 gal	0.25-0.6 gal	
zinc deficiency, nonbearing trees	1. zinc sulfate 36% crystals	6 lb	1.5 lb	1, 2. Make sure all crystals are dissolved. See precautions in text. Can cause injury, particularly on stone fruits. Follow the label.
	2. zinc sulfate 1.2LC	2 gal	0.5 gal	
	3. basic zinc sulfate (dry, 50-52%)	6-12 lb	1.5-3 lb	3. Follow manufacturer's label for all products. See precautions in text.
	4. basic zinc sulfate (liquid, 20-25%)			
	5. zinc chelate or organic complex			
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.
Postharvest spray *Apply after harvest and while leaves are still green and active*				
boron maintenance*	1. boric acid (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.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (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.
	2. polyborate (dry or liquid)			
nitrogen maintenance	1. urea 46% solid	42 lb	42 lb	Do not apply more than 60 lb/acre. Severe leaf burn can occur.
	2. urea 20% liquid	10 gal	10 gal	
zinc maintenance	1. zinc chelate or organic complex			
	2. zinc sulfate 36% crystals	6-12 lb	1.5-3 lb	1, 2, 3, 4. Follow the label.
	3. zinc sulfate 1.2LC	2-4 gal	0.5-1 gal	2, 3. Make sure all crystals dissolve. Do not apply before Oct. 1. Do not apply on apricot.
	4. basic zinc sulfate (dry, 50-52%)	6-12 lb	1.5-3 lb	4. Follow manufacturer's label. See precautions in text.
	5. basic zinc sulfate (liquid, 20-25%)			
zinc deficiency	1. zinc sulfate 36% crystals	25 lb	6.25 lb	1, 2. Make sure all crystals dissolve. Do not apply before Oct. 1. Do not apply on apricot.
	2. zinc sulfate 1.2LC	8 gal	2 gal	
	3. basic zinc sulfate (dry, 50-52%)	16 lb	4 lb	3. Follow manufacturer's label. See precautions in text.
	4. basic zinc sulfate (liquid, 20-25%)			
	5. zinc chelate or organic complex			

*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 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, treefruit.wsu.edu/crop-protection/opm/crop-protection-guide/. 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 50g material = 1 ppm

   0.25 fluid ounce of 200g 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 to 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 to 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 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 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, or 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 gallons 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 susceptible 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, Kudos)

Note: Kudos is labeled for Anjou pears, apples, and sweet cherries, and Apogee is labelled for apples and sweet cherries. Limited data exist for the use of prohexadione-calcium on sweet cherry. Prohexadione-calcium 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 and pear 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 prohexadione-calcium and ammonium sulfate) is recommended if water source is alkaline. A high concentration of calcium salts has been shown to reduce the activity of prohexadione-calcium. 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 prohexadione-calcium 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). For cherry, 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 or Kudos per 100 gallons spray volume per acre. If using 400 gallons, then 48 ounces per acre.

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 (Splendor)

Forchlorfenuron 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, forchlorfenuron 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, forchlorfenuron 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 forchlorfenuron 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 forchlorfenuron on pear cultivars.

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