

2019 Crop Protection Guide for Tree Fruits in Washington

WASHINGTON STATE UNIVERSITY EXTENSION • EB0419



Important Phone Numbers

Report a Pesticide Illness	Washington Poison Center	800-222-1222
Report Hazardous Material and Oil Spills	Washington State Department of Ecology	
	Southwest Regional Office	360-407-6300
	Northwest Regional Office	425-649-7000
	Central Regional Office	509-575-2490
	Eastern Regional Office	509-329-3400
WSU Extension, Tree Fruits	North Central Washington (Tianna DuPont)	509-663-8181 ext. 211
	Columbia Basin (Karen Lewis)	509-754-2011 ext. 4313
	Yakima County (Mike Bush)	509-574-1600
	South Central Washington (Gwen-Alyn Hoheisel)	509-786-5609
	Tree Fruit Research & Extension Center—Wenatchee	509-663-8181
	Irrigated Agriculture Research & Extension Center—Prosser	509-786-2226
WSDA Pesticide Licensing, Registration, Compliance and Disposal	WSDA Pesticide Management Division—Statewide	877-301-4555
	WSDA Pesticide Licensing and Recertification—Statewide	877-301-4555
	WSDA Pesticide Licensing and Recertification—Local number for Olympia area callers	360-902-1937
	WSDA Pesticide Licensing and Recertification—Local number for Yakima area callers	509-249-6925
	WSDA Registration Services Program, Olympia Office	360-902-2025
	WSDA Pesticide Compliance Program, Olympia Office	360-902-2040
	WSDA Organic Food Program, Olympia Office	360-902-1805
	WSDA Waste Pesticide Program, Olympia Office	360-902-2056
Pesticide Container Recycling	Agri-Plas, Inc.	509-457-3850
Workplace Safety and Health Information	Washington State Department of Labor & Industries	800-423-7233
	Washington State Department of Health, Pesticide Program	877-485-7316
	Washington State Department of Labor & Industries, Cholinesterase Monitoring Rule	360-902-5666
Horticultural Pest and Disease Boards	Adams County	509-488-2862
	Benton County	509-786-5609
	Franklin County	509-545-3580
	Chelan-Douglas Counties	509-667-6677
	Grant County	509-754-2011 ext. 4313
	Kittitas County	509-962-7507
	Klickitat County	509-773-5817
	Okanogan County	509-322-1286
	Skagit County	360-428-4270
	Walla Walla County	509-524-2685
	Whatcom County	360-354-1337
Apiary (Honey Bee) Registration	WSDA Plant Protection Division, Olympia Office	360-902-2070

Cover photos, clockwise from top left: apple bloom; apricots in Royal City WA; cherries in Cashmere WA; Cashmere valley; Cosmic Crisp® apple. Photos by Tianna DuPont, Chris Strohm, WSU.

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STOP

This guide replaces earlier editions.
Do not use after 2019.

POISON EMERGENCY

Call 911 for pesticide emergencies or the appropriate contact below.

Human Poisoning (Washington Poison Center):
1-800-222-1222; <http://www.wapc.org/>

ASPCA Animal Poison Control Center: 1-888-426-4435
(\$65.00 credit card fee); <http://www.aspca.org/pet-care/poison-control/>

Pet Poison Helpline: 1-855-764-7661 (\$49.00 credit card fee); <http://www.petpoisonhelpline.com/>

Pesticide Labels

YOU ARE REQUIRED BY LAW TO FOLLOW THE LABEL.
It is a legal document. Always read the label before using any pesticide. The grower and the licensed pesticide applicator are responsible for safe pesticide use.

Trade Names

Trade (brand) names are provided for your reference only. No discrimination is intended, and other pesticides labeled for the crop having the same active ingredient may be suitable. No endorsement is implied.

Pesticide Information

- National Pesticide Information Center
1-800-858-7378, 6:30 a.m. to 4:30 p.m. Pacific Time. EXTOXNET (EXTension TOxicology NETwork) <http://npic.orst.edu>
- Washington State Department of Agriculture, Olympia, Washington 1-877-301-4555. <http://agr.wa.gov/PestFert/Pesticides>
- WSU's Washington State Pest Management Resource Service (WSPRS) <http://ext100.wsu.edu/wsprs/>

Crop Protection Guide Contributors

Crop Protection Guide Coordinator

Tianna DuPont

Entomology

Elizabeth H. Beers
Louis Nottingham

Plant Pathology

Gary Grove
Achour Amiri
Tianna DuPont

Regulations & Safety

Catherine Daniels

Environmental Protectants

Tory Schmidt

Bioregulators

Tory Schmidt

Washington State Department of Agriculture

Joel Kangiser
Michael Klaus

Editor

Lagene Taylor

Design

Gerald Steffen

Web Services

Wendy Jones

Attention: The law requires that pesticides be used as the label directs. Uses against pests not named on the label and lower application rates are permissible unless specifically prohibited on the label. Where a disparity exists between the rate suggested per 100 gallons and the rate per acre, do not exceed the rate listed on the label. If a conflict is apparent between label directions and the uses suggested in this publication, consult your Extension office.

New pesticide registrations and special labels often are made available after publication.

Current and WSDA approved pesticide labels are available to the public on the WSU Pesticide Information Center Online website at <http://cru66.cahe.wsu.edu/LabelTolerance.html>.

This guide could not have been prepared without the valuable contributions of numerous faculty in the WSU Departments of entomology, plant pathology, and horticulture, tree fruit Extension agents, WSDA and USDA personnel, and industry representatives.

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Online only, see cpg.treefruit.wsu.edu and http://treefruit.wsu.edu/orchard-management/soils-nutrition/	
Pesticide Intervals and Impacts Tables (REI, PHI)	
Online only, see cpg.treefruit.wsu.edu	

Apple Programs

Major Insects

Aphid eggs, woolly apple aphid

Natural enemies can be effective on aphids. When 20% of colonies have predators a pesticide application may be delayed or eliminated. Use of pesticides with low toxicity to predators will increase biological control. Product recommendations will be effective on apple aphid, apple grain aphid, and rosy apple aphid, but less so on woolly apple aphid.

Apple rust mite

Apple rust mite feeds on plant foliage, and in very high numbers, can cause shoots to stop growth prematurely. However, in low to moderate numbers, it is generally regarded as an important and positive part of integrated mite management. Predatory mites can eat apple rust mites when spider mites (a more damaging pest) are scarce, and sustain their populations through the season. Choose pesticides that cause minimal harm to apple rust mite unless 1) populations become very high or 2) large early season populations occur on sensitive cultivars where fruit russetting can occur, such as 'Golden Delicious'.

Brown marmorated stink bug

Brown marmorated stink bug (BMSB) is a relatively recent invasive pest from Asia, first found in Washington in 2010. Populations are generally higher west of the Cascades, but are expanding in eastern Washington. The highest concentrations are located in urban landscapes, where suitable hosts are present, but we can expect expansion into agricultural areas in the future. Growers should be alert for the presence of BMSB in their orchards, but the number of orchards affected in 2019 should be very limited. As broad-spectrum, disruptive pesticides are the only short-term control option, do NOT apply sprays for this pest until you have verified it is causing damage in your orchard.

Campylomma

Campylomma is a sporadic pest of apple, and primarily a beneficial insect (pear psylla predator) on pear. It overwinters in the egg stage on the tree, and emerges just before and during bloom of apple. Large populations require control as soon as they are detected; earlier

sprays will do a better job of preventing fruit damage. Pay attention to label restrictions of bloom applications to protect pollinators. Petal-fall sprays will kill nymphs, but prevent little if any fruit damage.

Codling moth

Codling moth is the key pest of pome fruits in the PNW. In general, apples are more susceptible than pears, and fruits with softer flesh are more susceptible to attack. The increasing frequency of a third generation (two have been the norm historically) means that growers must be vigilant throughout the growing season, and be aware of phenology (See WSU Decision Aid system). Codling moth has a long history of becoming resistant to insecticides, thus rotation of materials with different modes of action (MOA) is highly recommended. Avoid using the same MOA against consecutive generation to minimize this danger. The MOA for each material is listed in the Tables. Pheromone mating disruption was registered in 1990, and has since been widely adopted in Washington. Use of mating disruption is now considered the foundation of an IPM program. Supplementing mating disruption with insecticides may be necessary depending on pressure, and using pheromone traps for monitoring populations will prevent unnecessary applications. Detailed recommendations on pheromone placement and timing of sprays is available.

Lacanobia fruitworm

Control sprays should be applied by 1230–1250 degree-days, when only about 10% of the larvae are in their 4th instar. This time represents the best opportunity to control *L. subjuncta* with a single insecticide application. During the second generation, 10% of 4th instar is estimated at 3050 degree-days. The best timing for an insecticide application against larvae of the second generation is at 3050 degree-days, but no later than 3150 degree-days.

Leafrollers (*Pandemis*, *Obliquebanded*)

Pre-bloom applications of pesticides can be effective and will also conserve natural enemies for leafroller and biological control agents of other pests, such as aphids. If treatments for leafrollers were applied at pink and/or bloom, sampling to determine the density of surviving leafrollers should be completed prior to deciding to apply additional controls at this timing. Most products listed act primarily as stomach poisons versus direct contact to residues, therefore, complete coverage is very important to achieve maximal control. Repeating an application of

any product should be based on the leafroller population surviving previous treatments. Use the leafroller models on the WSU Decision Aid System (<https://decisionaid.systems>) for the optimum timing.

Rosy apple aphid

Starting at pre-pink monitor 5–10 trees from each block in sensitive varieties. Treatment is justified when more than one cluster per tree is infested. Sprays become progressively less effective as the season advances and leaves curl.

San Jose scale

San Jose scale can be a minor pest if adequately controlled, or escalate into a major problem if not. It primarily infests the trunk and limbs, but scale crawlers will settle on the fruit. Damage to this season's crop may become serious, but ultimately the infestation of wood may cause death of limbs or the entire tree. Oil plus an organophosphate in the delayed dormant spray provide control; if the organophosphate is omitted (oil only), monitor the trees carefully and add one of the listed materials if scale become numerous.

Shothole borer

Good sanitation (removing large wood prunings and woodpiles from the orchard) is the best management tactic. Insecticides are only effective against adults. Beetles begin flying in late April and are active through May. The second generation flight begins in late July or early August. Yellow sticky traps placed on orchard borders will detect adult beetle activity. Spraying the border trees (rows) with high water volumes will protect the remainder of the orchard in many situations where external sources are the primary problem.

Western tentiform leafminer

For best results against leafminer, use an adjuvant with abamectin and spinosad. See labels for specific adjuvant recommendations.

White apple leafhopper

Adults fly from late May until frost. Monitor nymphs on the underside of leaves. Egg parasitoid *Anagrus* spp. attacks overwintering and summer eggs. Only control this indirect pest when necessary. Carbaryl, if used for apple thinning, is also a very effective leafhopper material but the canopy spray technique may not provide adequate coverage for leafhopper control.

Woolly apple aphid

Woolly apple aphid has proven to be one of the most difficult of the aphid pests to control in recent years. The broad-spectrum organophosphates used in previous

years are no longer used, and relatively few effective materials remain. This aphid is attacked by many predators (syrphid larvae, lady beetles, lacewings, and earwigs) and a parasitoid, *Aphelinus mali*. These natural enemies may provide control under some circumstances, but biological control may be easily disrupted. Avoid using disruptive pesticides if possible, and if necessary, treat with one of the effective insecticides. See tables.

Major Diseases

Apple mildew

Apple and pear powdery mildew is caused by the same fungal species *Podosphaera leucotricha* which overwinters in dormant apple buds, whereas its survival in pear is still unknown. When infected buds break in spring, the fungus produces spores that are rain and wind-spread to infect freshly emerged leaves which are highly susceptible to powdery mildew. Germination and infections are optimal at temperatures between 60°F and 78°F. Wetness plays a marginal role. The fungus then continues with multi-cycle infections through spring and early summer until the productions of new leaves and shoots cease. The fungus is slowed down by the rising temperature (above 82°F) as summer progresses. Infection resumes in fall where the pathogen overwinters as ascospores (sexual form) or infected buds. Under high disease pressure and mild summer conditions, the fungus can cause russetting on fruits and therefore reduce quality. While no cultivar is immune, cultivars like Granny Smith, Honeycrisp, Idared and Crimson Crisp are highly susceptible, whereas Golden Delicious is susceptible and Fuji, Gala and Red Delicious are the least susceptible. Mildew management should start before bud break and at green tip stage (to reduce spread of new inoculum) with sulfur-based products and continue every 10 to 14 days until the production of new shoots cease. Fungicides from FRAC groups 3, 7, 11 and 19 are effective and SHOULD be ROTATED throughout the season. In growing regions where scab is a problem, spray programs used to control the latter will control powdery mildew as well. In organic orchards, sulfur, potassium bicarbonate, and some biopesticides usually provide a good level of control.

Apple scab

Scab, caused by the fungus *Venturia inaequalis*, is a major disease of pome fruit in many growing regions, especially those with high rainfall. Symptoms are gray-brown to blackish lesions on leaves and fruit. Scab risk is low under arid conditions in Central Washington. However, some microclimates in the north of the state can be conducive to scab and therefore, management is recommended. Where scab is a problem, the fungus

overwinter in fallen leaves, therefore, leaf removal/incorporation will reduce inoculum for the following season. Scab is effectively controlled by the same fungicides sprayed for apple powdery mildew including fungicides from FRAC groups 3, 7 and 11.

Botrytis of Apple and Pear

Botrytis is the second most important apple fruit disease and can be the most important disease affecting pear as shown in recent statewide and regional surveys in the Pacific Northwest. Flowers of both crops are susceptible to Botrytis infections which persist through the growing season until harvest. Botrytis infections remain dormant until storage where the fungus causes Gray Mold with symptoms becoming visible after a few months in storage. Afterward, the fungus can spread to healthy fruit. Temperatures between 64°F and 78°F are optimal for infections. Because infections occur EXCLUSIVELY in the orchard, it is important to start management as early as possible. Delayed management will fail to control infections that started weeks or months before harvest. The fungus is ubiquitous and overwinters on mummified fruit left on trees and fallen leaves. Good sanitation practices will reduce inoculum loads but because of the explosive nature of this disease, fungicide applications are necessary to achieve good control. At bloom time and during spring, fungicides from FRAC groups 7, 9 and 11, used to control apple powdery mildew or scab, will be effective against Botrytis if resistance is absent. Fungicides from FRAC 3 have a limited efficacy against Botrytis infections. As fruit mature, they become more susceptible to Botrytis. Late season management is especially important for cultivars picked after mid-September in WA when wet, disease conducive weather is more likely. Preharvest applications and ROTATIONS of fungicides from the FRAC groups 1, 7, 11 and 19 control Botrytis. Tank-mixture of single-site fungicide with Ziram or captan will increase efficacy and delay the selection for resistant populations. **IMPORTANT:** Botrytis cinerea is the MOST RISKY fungus when it comes to fungicide resistance as the fungus can develop resistance to multiple fungicide simultaneously. Remember this aspect when spraying for other diseases such as powdery mildew, as the same fungicides sprayed early in the season can select for resistant Botrytis populations which will persist throughout the season and to the storage rooms resulting in limited efficacy of eventual postharvest treatment by the grower.

Bull's eye rot

Bull's eye rot is a major disease of apple and pear. The disease can be caused by four different fungal species from the genus *Neofabraea*. The main species causing Bull's eye rot of apple in eastern Washington is *N.*

perennans, whereas *N. malicorticis* was reported to be predominant in western Washington. It infects fruit and causes cankers on trees where it overwinters until conditions become favorable in the following spring to start new infections. Fruit are infected exclusively in orchards but bull's eye rot symptoms are only seen after several months in cold storage. Therefore, preharvest management is key to reducing decay rates in the packinghouse. Prune cankered branches to reduce the inoculum load and use fungicide applications prior to harvest to control. Ziram applied within two weeks before harvest is recommended for control of Bull's eye rot in the Pacific Northwest. Topsin-M is ONLY recommended under wet conditions and for cultivars, such as Golden Delicious, Pinata, Fuji and Granny Smith, more susceptible to bull's eye rot. Frequent sprays may increase risks of resistance development to Mertect, a fungicide from the same group as Topsin-M (1) used after harvest. Tank-mixtures of Ziram with other single-site fungicides are recommended to increase efficacy and reduced risks of fungicide resistance development.

Fire blight

There is a risk of fire blight infection any time there are flowers on the tree, the weather is warm, and wetting occurs. Watch for and protect secondary blossoms during the three weeks after petal fall, which is the most common time of fire blight infection. **Early bloom.** Apply biologicals (Blossom Protect) during early bloom. If fire blight was in the orchard last year apply two applications of the biological. Reapply biological a second time if lime sulfur was applied (Lime sulfur is antimicrobial and kills biological). **Full bloom to petal fall.** Watch the model. If an infection event occurs, apply an antibiotic as soon as possible, but within 24 hours of infection (usually wetting of flowers). Repeated antibiotic sprays may be necessary during extended high or extreme risk periods. Best results are obtained when applied within 24-hour window before flower wetting during a high infection risk period. Beneficial only for flower infection prevention. Product used must contact the interior of the flowers in sufficient water and approved wetting agent to completely wet the interior. One pound of any 17% oxytetracycline product per 100 gallons gives a 200 ppm solution. Kasugamycin is another effective antibiotic. Applications of less than 100 gal/A can be effective on small trees if flower interiors are well covered, but do not drop the ppm below 200 (oxytetracycline). Application by ground equipment on each row is highly recommended. Application of antibiotics by aircraft is not recommended. Many fire blight bacteria in the Pacific Northwest are resistant to streptomycin, another registered antibiotic. **Organic.** **Prebloom.** Fixed copper sanitation if fire blight was in the orchard last year. **Early bloom.** Lime sulfur plus

oil. One to two applications of biologicals (Blossom Protect). Reapply biologicals after lime sulfur which is antimicrobial. Depending on the cultivar russet risk and the CougarBlight model risk follow with *Bacillus subtilis* (Serenade Optimum) (most fruit safe) every 2–5 days during flower/petal fall or copper hydroxide/octanoate (Cueva/Previsto) every 5 to 6 days (This option is less fruit safe for russet).

Speck rot

Speck rot is an emerging disease in the Pacific Northwest and has been recently reported in Europe and Chile. It is caused by the fungus *Phacidopycnis washingtonensis* that infects fruit exclusively in the orchard. Although its epidemiology is still not fully understood, the primary source of inoculum in the PNW is thought to be crab apple pollinizers which are very susceptible to the disease. Interestingly, the disease has been reported in other regions where the Manchurian crab apple species are not used. Mummies and dead shoots left on trees from the previous season are the main source of inoculum to infect commercial apple fruit. Therefore, pruning and mummy removal will significantly reduce the inoculum load. Fungicides from FRAC groups 1 and 3 are effective when reduced sensitivity or resistance is absent in the orchard. Both active ingredients of Pristine are not effective against Speck rot. Because the exact time of infections is still unknown, sprays that start a month prior to harvest are recommended.

Summer Rots

In addition to the major diseases described separately, other fungal fruit infections starting in the orchard can cause storage rots. **Alternaria Disease:** A dark-brown to black infection caused by *Alternaria alternata* (and

other spp.) is ubiquitous in most orchards. Infections, usually sporadic, may become frequent when sanitation is not observed or when wet conditions occur for an extended period. The fungus infects flowers at bloom but can also infect fruit through the calyx end or wounds. Floral infections can result in moldy-core disease later in storage. **Sphaeropsis Disease.** A sporadic emerging disease cause by the fungus *Sphaeropsis pyriputrescens* infects fruits in the orchard and develops stem and calyx end rots in storage. The fungus overwinters on cankers and twig die-back. Prune diseased branches to help reduce inoculum. Pruning symptomatic crab apples is particularly important. Although this disease can be sporadic, it is still quarantined in many export countries and its identification in entry ports will result in fruit lot rejection. **Lambertella disease.** This disease was recently reported in the Pacific Northwest and, therefore, is considered as quarantine pathogen. Infections are caused by the fungus *L. corni-maris*, which has been isolated from mummies of other fruit crops in the past but its disease cycle in apple is still unknown. The disease develops yellow mycelium that cover the fruit, but symptoms are only observed after several months of storage. Recent studies have shown that fungicides from FRAC group 1 are not effective against Lambertella, whereas fungicides from FRAC groups 7 and 11 have only moderate efficacy. Until further research has shown which other preharvest fungicides are effective, it is recommended to apply a fungicide from FRAC group 9 or 12 postharvest, as these were found to be the most effective. The fungus requires a wound on the cuticle to cause an infection, therefore, reducing damages and punctures at harvest will reduce infection risks. The possibility of infections occurring through the calyx- or stem-ends is still unknown.

Spray Schedule

Dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
San Jose scale	petroleum oil- dormant petroleum oil- dormant	1.5 % v/v	12 h	none listed		4	Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Delayed dormant

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	benzovindiflupyr Aprovia	7 fl oz	12 h	30 d	7	3	Do not follow Aprovia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	cyprodinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9, 3	3	Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this product or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
	fluopyram + trifloxystrobin Luna Sensation	5-5.8 fl oz	12 h	14 d	7, 11	4	Luna Sensation contains a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
	flutriafol Topguard	8-12 fl oz	12 h	14 d	3	4	Topguard is a FRAC group 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. Topguard may cause a mild phytotoxicity on Braeburn apple leaves.

TABLE CONTINUED

Delayed dormant (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	Sovran is a FRAC 11 fungicide and should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	This material is toxic to pest and predatory mites; destroying apple rust mites, the alternate prey of predatory mites, may predispose the orchard to later spider mite problems. [Organic]
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Rally is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	3	Do not use at temperature above 75°F and at bloom.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	3	The efficacy level will depend on the absence of resistant populations from the orchard. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides. This limitation is inclusive of all FRAC group 11 fungicides labeled for use on pome fruits.
	triflumazole Trionic 4SC	16 fl oz	12 h	14 d	3	4	Trionic is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Delayed dormant (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
Apple scab	benzovindiflypyr Aprovia	7 fl oz	12 h	30 d	7	2	
	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	Do not use captan on pink through blossom stages. When possible, tank-mix captan with other single-site fungicides to help reduce fungicide resistance development.
	cyprodinil + difenoconazole Inspire Super	12 fl oz	12 h	14 d	9,3	3	Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this products or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
	fluopyram + trifloxystrobin Luna Sensation	4-5.8 fl oz	12 h	14 d	7, 11	NR	Do not use before or after Fontelis to minimize fungicide resistance development in FRAC group 7. Luna Sensation contains an active ingredient similar to the one in Flint or Sovran. Do not follow-up Luna with either product.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	This material is toxic to pest and predatory mites; destroying apple root mites, the alternate prey of predatory mites, may predispose the orchard to later spider mite problems. Organic
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	NR	
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.

TABLE CONTINUED

Delayed dormant (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab (continued)	triflumizole Procure 480SC ziram Ziram 76DF	8-16 fl oz See label	12 h 14 d	3 M3	NR NR		
Fire blight	Copper Oxychloride + Copper Hydroxide 28% Metallic Copper Copper Oxychloride + Copper Hydroxide 28% Metallic Copper	5-6 lb	48 h	none listed	M1	NR	Organic
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Aphid eggs, woolly apple aphid	chlorpyrifos + petroleum oil-dormant Lorsban Advanced + petroleum oil-dormant	4 pt 1.5 % v/v	4 d	none listed	1B	4	Apply chlorpyrifos at half-inch green. If using with oil, liquid formulations are preferred. Do not make more than one application of chlorpyrifos per year. For more information regarding the use of oil see "Horticultural Mineral Oils" in the Special Programs section.
Cutworms	chlorpyrifos Lorsban Advanced	See Label	4 d	none listed	1B	4	Apply at half-inch green. If using with oil, liquid formulations are preferred. Do not make more than one application of chlorpyrifos per year.
	chlorpyrifos Lorsban 75WG	See Label	4 d	none listed	1B	4	Apply at half-inch green. If using with oil, liquid formulations are preferred. Do not make more than one application of chlorpyrifos per year.
	indoxacarb Avault 30DG	See label	12 h	14 d	22A	4	
	methoxyfenozide Intrepid 2F	See label	4 h	14 d	18A	NR	
European red mite	petroleum oil-dormant petroleum oil-dormant	1.5 % v/v	12 h	none listed	3-4		Oil is indispensable for an integrated mite control program. Organic
Grape mealybug	chlorpyrifos + petroleum oil-dormant Lorsban Advanced + petroleum oil-dormant	4 pt 1-1.5 % v/v	4 d	none listed	1B	4	Apply at half-inch green. If using with oil, liquid formulations are preferred. Do not make more than one application of chlorpyrifos per year.
	diazinon + petroleum oil-dormant Diazinon 50W + petroleum oil-dormant	4 lb 1-1.5 % v/v	4 d	21 d	1B	3	Oil is indispensable for an integrated mite control program. For more information refer to the Special Programs page "Horticultural Mineral Oils".
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed	4		Oil is indispensable for an integrated mite control program. Organic
Leafrollers (Pandemis)	chlorpyrifos Lorsban 75WG	1.33-2.67 lb	4 d	none listed	1B	3	Do not make more than one application of chlorpyrifos per year.
	chlorpyrifos Lorsban Advanced	3-4 pt	4 d	none listed	1B	3-4	Do not make more than one application of chlorpyrifos per year.

TABLE CONTINUED

Delayed dormant (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Lygus and stink bugs	chlorpyrifos Lorsban Advanced	4 pt	4 d	none listed	1B	3	Do not make more than one application of chlorpyrifos per year.
	chlorpyrifos Lorsban 75WG	2.67 lb	4 d	none listed	1B	3	Do not make more than one application of chlorpyrifos per year.
San Jose scale	chlorpyrifos + petroleum oil-dormant Lorsban Advanced + petroleum oil-dormant	1-1.5 % v/v	4 d	none listed	1B	4	Apply at half-inch green. If using with oil, liquid formulations are preferred. Do not make more than one application of chlorpyrifos per year.
	methidathion + petroleum oil-dormant Supracide 2E + petroleum oil-dormant	3 qt 1-1.5 % v/v	3 d	none listed	1B	NR	
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		4	Organic
	pyriproxyfen + petroleum oil-dormant Esteem 35WP + petroleum oil-dormant	4-5 oz 1-1.5 % v/v	12 h	45 d	7C	1	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Prepink

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	Organic
	cyprodinil + difenoconazole Inspire Super	12 fl oz	12 h	14 d	9,3	3	Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this product or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.

TABLE CONTINUED

Prepink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	fluopyram + trifloxystrobin Luna Sensation	5-5.8 fl oz	12 h	14 d	7, 11	4	Luna Sensation contains a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
	flutriafol Topguard	8-12 fl oz	12 h	14 d	3	4	Topguard is a FRAC group 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	4	Sovran is a FRAC 11 fungicide and should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See Label	48 h	none listed	NR		This material is toxic to pest and predatory mites; destroying apple rust mites, the alternate prey of predatory mites, may predispose the orchard to later spider mite problems. [Organic]
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Rally is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make more than two sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	tebuconazole + trifloxystrobin Adamant 50W/G	4-5 oz	12 h	75 d	3, 11	4	Apply one Group 3 Fungicide at the same growth stage.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	4	The efficacy level will depend on the absence of resistant populations from the orchard. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides. This limitation is inclusive of all FRAC group 11 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Prepink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
Apple scab	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	Do not use captan on pink through blossom stages. When possible, tank-mix captan with other single-site fungicides to help reduce fungicide resistance development.
	cyprodinil + difenoconazole Inspire Super	12 fl oz	12 h	14 d	9,3	NR	Inspire Super and Vangard 75WG are from the same chemical group. Use one of the ONLY. These two products should not be used in rotation.
	fluopyram + trifloxystrobin Luna Sensation	4-5.8 fl oz	12 h	14 d	7,11	NR	Luna Sensation and Fontelis are from the same chemical group (7). Apply one of them ONLY at the same growth stage.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See Label	48 h	none listed		NR	This material is toxic to pest and predatory mites; destroying apple rust mites, the alternate prey of predatory mites, may predispose the orchard to later spider mite problems. <u>Organic</u>
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Luna Sensation are from the same chemical group (7). Apply one of them ONLY at the same growth stage.
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	

TABLE CONTINUED

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Prepink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cutworms	indoxacarb Avtaunt 30DG	See label	12 h	14 d	22A	4	
	methoxyfenozide Intrepid 2F	See label	4 h	14 d	18A	NR	
Grape mealybug	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	NR	
	thiacloprid Calypso 4F	8 fl oz	12 h	30 d	4A	NR	
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kursaki DiPel DF	1-2 lb	4 h	0 d	11B2	3	While too early for Obliquebanded leafrollers, this timing is appropriate for Pandemis. Bt's are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a <u>warm</u> weather pattern, above 65°F, for 3 or more days. <u>organic</u>
Lygus bug, stink bug	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Pink

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	
	benzovindiflupyr Aprovia	5.5-7 fl oz	12 h	30 d	7	3	Do not follow Aprovia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	cypredinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9.3	3	Inspire Super contains cypredinil, an active ingredient similar to the one in Vangard. Do not rotate this products or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
	flutriafol Topguard	8-12 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Sulfotrix	See label	48 h	none listed		NR	Toxic to rust mites, the primary alternate prey of predatory mites. Also toxic to spider mites and predatory mites.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Rally is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Pink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
Apple scab	benzovindifluypyrr Aprovia	5.5-7 fl oz	12 h	30 d	7	3	Do not follow Aprovia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	cyprodinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9,3	3	Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this products or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Sulfotrix	See label	48 h	none listed		NR	Toxic to rust mites, the primary alternate prey of predatory mites. Also toxic to spider mites and predatory mites.
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage. See note for Inspire Super.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Aprovia are from the same chemical group (7). Apply one of them ONLY at the same growth stage.
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	2	Do not use at temperature above 75°F and at bloom.

TABLE CONTINUED

Pink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab (continued)	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	Besides having some activity against scab, Ziram may reduce bull's eye rot inoculum persisting on cankers from the previous season.
Fire blight	Aureobasidium pullulans Blossom Protect	1.25 lb	4h	none listed		4	30 and 80% bloom. Yeasts need 1–2 days before an infection to colonize the flower before bacteria invade to be effective. Organic
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	2 % v/v	48 h	none listed		NR	Early bloom applications plus oil are antimicrobial. 20 and 70% bloom timings. Reapply biologicals after lime sulfur if used.
	Notes: Early bloom. Apply biologicals (Blossom Protect) during early bloom. If fire blight was in the orchard last year apply two applications of the biological. Reapply biological a second time if lime sulfur was applied (Lime sulfur is antimicrobial and kills biologicals).						
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple rust mite	fenbutatin oxide Vende x 50WP	1-1.5 lb	48 h	14 d	12B	3-4	
	spirodiclofen Envidor 2SC	18 fl oz	12 h	7 d	23	NR	
Campylobacteria	acetamiprid Assail 70WP	1.7-3.4 oz	12 h	7 d	4A	NR	Use higher rates for high population numbers.
Coddling moth	CM pheromone dispensers Isomate-C Plus	See label	none listed	none listed		NR	Install dispensers before first flight (prior to bloom) using the full label rate in the top 2 feet of the canopy. When using aerosol emitters borders should be treated with hand-applied dispensers. Organic
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bits are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern, above 65°F, for 3 or more days. Organic
	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	5 d	28	4	
	flubendiamide Belt 4SC	5 fl oz	12 h	14 d	28	4	
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	

TABLE CONTINUED

Pink (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Rosy apple aphid	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	3-4	Use higher rates for high population numbers.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	4	Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
Fire blight	Aureobasidium pullulans Blossom Protect	1.25 lb	4h	none listed		4	30 and 80% bloom. Yeasts need 1–2 days before an infection to colonize the flower before bacteria invade to be effective. Organic
	Bacillus amyloliquefaciens strain D747 Double Nickel 55	See label	4 h	0 d		2	See label and space between rows to select the corresponding rate. Efficacy may vary based on disease pressure. Organic
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	NR	Organic
	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h	0 d	21	NR	For bloom applications: Apply 1–2 oz/A in a tank mix with a fire blight treatment (generally an antibiotic) that is standard in your area. This is generally 2–3 applications between 20% bloom and petal fall depending on the environmental conditions. Do not apply closer than a 7-day interval.

TABLE CONTINUED

Bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight (continued)	copper hydroxide Previsto	3-4 qt	48 h	none listed	M1	3	Pay attention to drying times and do not combine with acidifying products to reduce fruit finish risks. Organic
	kasugamycin Kasumin 2L	64 oz	12 h	90 d	24	4	
	oxytetracycline Mycoshield	See Label	12 h	60 d	41	4	Organic
	oxytetracycline FireLine 17WP	See label	12 h	60 d	41	4	
Notes: Full bloom to petal fall. Watch the model. If an infection event occurs, apply an antibiotic as soon as possible, but within 24 hours of infection (usually wetting of flowers). Repeated antibiotic sprays may be necessary during extended high or extreme risk periods. Best results are obtained when applied within 24-hour window before flower wetting during a high infection risk period. Beneficial only for flower infection prevention. Product used must contact the interior of the flowers in sufficient water and approved wetting agent to completely wet the interior. One pound of any 17% oxytetracycline product per 100 gallons gives a 200 ppm solution. Kasugamycin is another effective antibiotic. Some trials have shown that a full rate of Kasumin and a half rate of oxytetracycline provides excellent control. Applications of less than 100 gal/A can be effective on small trees if flower interiors are well covered, but do not drop the ppm below 200 (oxytetracycline). Application by ground equipment on each row is highly recommended. Application of antibiotics by aircraft is not recommended. Many fire blight bacteria in the Pacific Northwest are resistant to streptomycin, another registered antibiotic. Organic: Depending on the cultivar russet risk and the CougarBlight model risk follow with Bacillus subtilis (Serenade Optimum) (most fruit safe) every 2-5 days during flower/petal fall or copper hydroxide/octanoate (Cueva/Previsto) every 5 to 6 days (This option is less fruit safe for russet but has higher efficacy).							
Summer Rots							
	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	Fontelis has an acceptable efficacy against Alternaria fungus and Sphearoopsis that may infect fruit preharvest. Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Campyloplasma	acetamiprid Assail 70WP	1.7-3.4 oz	12 h	7 d	4A	NR	Use higher rates for high population numbers.
Codling moth	CM pheromone dispensers Isomate-C Plus	See label	none listed	none listed	NR	NR	Install dispensers before first flight (prior to bloom) using the full label rate in the top 2 feet of the canopy. When using aerosol emitters borders should be treated with hand-applied dispensers. Organic
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bts are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern, above 65°F, for 3 or more days. Organic
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Some leafroller populations have developed resistance to Intrepid and in these situations, the level of control can be significantly reduced.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Petal fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	
Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2		Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic
cypromidinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9.3	3		Inspire Super contains cypromidinil, an active ingredient similar to the one in Vangard. Do not rotate this product or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4		Luna Privilege is a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
fluopyram + trifloxystrobin Luna Sensation	5-5.8 fl oz	12 h	14 d	7, 11	4		Luna Sensation contains a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
flutriafol Topguard	8-12 fl oz	12 h	14 d	3	4		Topguard is a FRAC group 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3		Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	4		Sovran is a FRAC 11 fungicide and should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	Do not apply lime sulfur if temperatures will exceed 75°F within 3 days of application. Organic
	myclobutanol Rally 40WSP	5 oz	24 h	14 d	3	4	Rally is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide an should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
	potassium bicarbonate Kalgreen	3 lb	4 h	1 d	NC	2	Under low disease pressure, Kalgreen will provide adequate control. If disease pressure increases, rotation or combination with other materials is recommended. Organic
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	3	Pristine is a FRAC 7 +11 fungicide an should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	2	Do not use at temperature above 75°F and at bloom.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	4	The efficacy level will depend on the absence of resistant populations from the orchard. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides. This limitation is inclusive of all FRAC group 11 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	triflumazole Trionic 4SC	12-16 fl oz	12 h	14 d	3	4	Trionic is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
Apple scab	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	When possible, tank-mix captan with other single-site fungicides to help reduce fungicide resistance development.
	cyprodinil Vangard 75WG	5 oz	12 h	0 d	9	3	Apply in tank mix combination with the recommended rate of a registered protectant fungicide. See label for tank mixture instructions. Vangard and Inspire Super are from the same chemical group (9). Use only one of them at the same growth stage.
	fluopyram + trifloxystrobin Luna Sensation	4-5.8 fl oz	12 h	14 d	7, 11	NR	Luna Sensation, Fontelis, and Aprovia are all from the same chemical group (7). Use one of them ONLY.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves. Use only one Group 3-fungicide at the same growth stage.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Use only one Group 3 fungicide at the same growth stage
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	NR	

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab (continued)	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	triflumazole Trionic 4SC	12-16 fl oz	12 h	14 d	3	NR	Use only one Group-3 fungicide at the same growth stage.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
	ziram	Ziram 76DF	See label	48 h	14 d	M3	NR
Botrytis of Apple and Pear	captan Captan 50WP	8 lb	24 h	0 d	M4	2	Do not apply more than 64 lbs. of Captan 50 Wettable Powder per acre per crop cycle.
	copper octanoate Cueva	8 qt	4 h	0 d	M1	2	Organic
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
							Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	4	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Mertect, used postharvest, therefore careful use is highly recommended.
Bull's eye rot	copper octanoate Cueva	8 qt	4 h	0 d	M1	2	Organic
Fire blight	Bacillus amyloliquefaciens strain D747 Double Nickel 55	See label	4 h	0 d		2	See label and space between rows to select the corresponding rate. Efficacy may vary based on disease pressure. Organic

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight (continued)	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	NR	Organic
	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h	0 d	21	NR	For bloom applications: Apply 1–2 oz/A in a tank mix with a fire blight treatment (generally an antibiotic) that is standard in your area. This is generally 2–3 applications between 20% bloom and petal fall depending on the environmental conditions. Do not apply closer than a 7-day interval.
	copper hydroxide Previsto	3-4 qt	48 h	none listed	M1	3	Pay attention to drying times and do not combine with acidifying products to reduce fruit finish risks. Organic
	kasugamycin Kasumin 2L	64 oz	12 h	90 d	24	4	
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	2-4 % v/v	48 h	none listed			
	oxytetracycline FireLine 17WP	See label	12 h	60 d	41	4	
	oxytetracycline Mycoshield	See Label	12 h	60 d	41	4	Organic
Summer Rot	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	Fontelis has an acceptable efficacy against <i>Alternaria</i> fungus and <i>Spheareosporina</i> that may infect fruit preharvest. Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control <i>Alternaria</i> infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	5 d	28	4	Altacor is highly effective against leafroller larvae and, at this treatment timing, has added value because it is toxic to codling moth eggs laid on product residues (see recommendations under codling moth). Altacor can, therefore, be used as part of a management strategy to delay the first larvicide application against codling moth. Use the leafroller models on the WSU Decision Aid System (https://decisionaid.wsu.edu/) for the optimum timing for this product.

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth (continued)	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	novaluron Rimmon 0.83EC	30-50 fl oz	12 h	14 d	15	3-4	
	petroleum oil, summer petroleum oil, summer	See label	4 h	0 d		NR	Organic
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	3	Should be applied when the last larval stage is present but before pupation has begun. Use the WSU Decision Aid System (https://decisionaid.wsu.edu) for the optimum timing of the product on leafrollers.
	spinetoram Delegate 25WG	7 oz	4 h	7 d	5	4	Delegate is highly effective against leafroller larvae. While Delegate does not directly kill codling moth eggs, it has a strong ovip-larvicidal activity, which means it kills codling moth larvae exiting eggs. Therefore, if Delegate is applied at this timing, it can be used as part of a management strategy to delay the first laricide application against codling moth. Delegate is in the same chemical class, and has the same mode of action, as Success (spinosad) so avoid using these products against two consecutive generations.
Grape mealybug	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	NR	
	imidacloprid Admire Pro 4.6L	2.8 fl oz	12 h	7 d	4A	NR	
	thiacloprid Calypso 4F	8 fl oz	12 h	30 d	4A	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bts are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern, above 65° F, for 3 or more days. Organic
	chlorantraniliprole Altacor 35WG	3-4.5 oz	4 h	5 d	28	4	Altacor is highly effective against leafroller larvae and, at this treatment timing, has added value because it is toxic to codling moth eggs laid on product residues (see recommendations under codling moth). Altacor can, therefore, be used as part of a management strategy to delay the first laricide application against codling moth. Use the leafroller models on the WSU Decision Aid System (https://decisionaid.wsu.edu) for the optimum timing for this product.
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	

TABLE CONTINUED

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READ ALL PRODUCT LABELS

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded) (continued)	emamectin benzoate Proclaim 5SG	3.2-4.8 oz	12 h	14 d	6	4	Belt is in the same chemical class as Altacor and is very effective for control of leafroller larvae. However, Belt does not have ovicidal activity against codling moth eggs laid on its residues and therefore cannot be used as part of a strategy to delay the first larvicide treatment for codling moth. Use the leafroller models on the WSU Decision Aid System (https://decisionaid.wsu.edu) for the optimum timing for this product.
	flubendiamide Belt 4SC	5 fl oz	12 h	14 d	28	4	Some leafroller populations have developed resistance to Intrepid and in these situations, the level of control can be significantly reduced.
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Should be applied when the last larval stage is present but before pupation has begun. Use the WSU Decision Aid System (https://decisionaid.wsu.edu) for the optimum timing of the product on leafrollers.
	novaluron Rimmon 0.83EC	30-50 fl oz	12 h	14 d	15	3-4	Delegate is highly effective against leafroller larvae. While Delegate does not directly kill codling moth eggs it has a strong ovi-larvicidal activity, which means it kills codling moth larvae exiting eggs. Therefore, if Delegate is applied at this timing, it can be used as part of a management strategy to delay the first larvicide application against codling moth. Delegate is in the same chemical class, and has the same mode of action, as Success (spinosad) so avoid using these products against two consecutive generations.
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	4	Some leafroller populations have developed resistance to Success so use of this product in this situation may result in reduced control. Entrust is a spinosad formulation registered for organic apple production. It is effective against codling moth larvae hatching from the egg. It has a residual activity of 7 to 10 days. When Entrust is incorporated into an organic pest control program using pheromones, summer oil, and codling moth virus, good control of this key pest is possible. Best results occur when applications are timed for egg hatch, which may occur during bloom.
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	Spinosad Entrust SC Success 2F
					see note	5	3-4
Rosy apple aphid	spinosad Entrust SC	6-10 fl oz	4 h			NR	Organic
	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	3-4	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Rosy apple aphid (continued)	imidacloprid Provado 1.6F	4-8 fl oz	12 h	7 d	4A	NR	Do not use until pollination is complete and bees have been removed from the area.
Spider mites							
	bifentiazate Acramite 50WS	0.75-1 lb	12 h	7 d	un	4	
	clofentezine Apollo 4SC	6-8 fl oz	12 h	45 d	10A	NR	
	etoxazole Zeal Miticide 172WSP	2-3 oz	12 h	14 d	10B	3-4	
	fenoxyproximate Fujimite 5%EC	1-2 pt	12 h	14 d	21A	3-4	
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	NR	Most effective on the egg stage. When mite populations are high and leaf bronzing has already occurred, a miticide effective on the adult stage may be used in combination.
	pyridaben Nexter 75WSB	4.4-8.8 oz	12 h	7 d	21A	2-3	
	spiroticlofen Envidor 2SC	16-18 fl oz	12 h	7 d	23	3-4	
Western flower thrips							
	spinosad Success 2F	6-8 fl oz	4 h	see note	5	3	
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	
	spinosad Success 2F	6 fl oz	4 h	see note	5	3-4	
Western tentiform leafminer							
	imidacloprid Provado 1.6F	4-8 fl oz	12 h	7 d	4A	4	Do not use until pollination is complete and bees have been removed from the area.
	indoxacarb Avault 30DG	6 oz	12 h	14 d	22A	3-4	
	kaolin clay Surround WP	See label	4 h	0 d	NR	Organic	
	spinosad Success 2F	6-8 fl oz	4 h	see note	5	3	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

14–28 days after full bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	
Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2		Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic
cyprodinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9, 3	3		Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this product or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4		Luna Privilege is a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
flutriafol Topguard	8-12 fl oz	12 h	14 d	3	4		Topguard is a FRAC group 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3		Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	4		Sovran is a FRAC 11 fungicide and should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides labeled for use on pome fruits.
myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4		Rally is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.

TABLE CONTINUED

14–28 days after full bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
	potassium bicarbonate Kalgreen	3 lb	4 h	1 d	NC	2	Under low disease pressure, Kalgreen will provide adequate control. If disease pressure increases, rotation or combination with other materials is recommended. Organic
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	3	Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	4	The efficacy level will depend on the absence of propiconazole-resistant populations from the orchard. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides. This limitation is inclusive of all FRAC group 11 fungicides labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.
Apple scab	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	

TABLE CONTINUED

14–28 days after full bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab (continued)	cyprodinil Vangard 75WG	See label	12 h	0 d	9	3	Apply in tank mix combination with the recommended rate of a registered protectant fungicide. See label for tank mixture instructions. Vangard and Inspire Super are from the same chemical group (9). Use only one of them at the same growth stage.
	cyprodinil + difenconazole Inspire Super	12 fl oz	12 h	14 d	9,3	3	Inspire Super contains cyprodinil, an active ingredient similar to the one in Vangard. Do not rotate this products or use in the same season to avoid fungicide resistance development. Do apply after or before Rally 40WSP or other FRAC group 3 fungicides to minimize fungicide resistance in powdery mildew and other non-target pathogens.
	fluopyram + trifloxystrobin Luna Sensation	4-5.8 fl oz	12 h	14 d	7, 11	NR	Luna Sensation and Fontelis are from the same Chemical group (7). Use only one of them.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Luna Sensation are all from the same chemical group (7). Apply ONLY one of them at the same growth stage.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Rates vary with postinfective schedule; see label. Apply only one Group 3 Fungicide at the same growth stage.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	

TABLE CONTINUED

14–28 days after full bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	4	Pristine is a FRAC 7+11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depend on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
Bull's eye rot	ziram Ziram Granullo 76WDG	6 lb	48 h	14 d	M3	3	Apply 12 to 14 days after calyx stage and repeat as needed through the summer. Do not apply more than 24.2 lbs per acre in a crop cycle. Do not apply within 14 days of harvest. Tank-mixing with other fungicides has been reported to increase efficacy and reduce fungicide resistance development.
Summer Rots	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control <i>Alternaria</i> infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	CM granulosis virus Cyd-X	See Label	4 h	0 d		3	Codling moth granulosis virus is a highly specific control that should always be used as a component of a multi-tactic pest management program. The residual activity lasts at most 7 days. The effect of the virus is most often seen in a suppression of the pest's densities over time. Applying virus one or more times per codling moth generation at the end of the residual period of another insecticide to extend the protection period is a logical use of this technology. <u>Organic</u>
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	If applied to control codling moth, this product will provide control of rosy apple aphid as well at this timing. Use an appropriate surfactant to enhance coverage and penetration.
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	Altacor is effective against codling moth eggs and larvae. At the high rate, it has a residual activity of up to 17 days, at the low rate residual activity is no more than 14 days.
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	

TABLE CONTINUED

14–28 days after full bloom (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth (continued)							
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Intrepid is a stomach poison so complete coverage is important to good control. This product is recommended only as a supplement to mating disruption. Apply the first application of Intrepid at 425 degree days using the new codling moth model and follow with additional applications at 14-day intervals for a total of 3 sprays. Intrepid can also be used in the second generation (if not used in the first generation) timed at egg hatch and using the same re-treatment intervals.
	petroleum oil, summer petroleum oil, summer	See label	4 h	0 d		NR	Organic
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	3	
	spinetoram Delegate 25WG	6-7 oz	4 h	7 d	5	4	Delegate is very effective against codling moth larvae. It has a residual activity of 14 days.
	spinosad Entrust SC	10 fl oz	4 h	7 d	5	NR	Organic
	thiacloprid Calypso 4F	4-8 fl oz	12 h	30 d	4A	4	
Rosy apple aphid							
	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	3-4	If applied to control codling moth, this product will provide control of rosy apple aphid as well at this timing. Use an appropriate surfactant to enhance coverage and penetration.
	imidacloprid Admire Pro 4.6L	1.4-2.8 fl oz	12 h	7 d	4A	NR	
White apple leafhopper	indoxyacarb Avault 30DG	6 oz	12 h	14 d	22A	3-4	
	kaolin clay Surround WP	See label	4 h	0 d		NR	Organic
	potassium salts of fatty acids M-Pede	1 % v/v	12 h	0 d		2-3	The spray timing for soap is when egg hatch is complete, or before adults appear. Best use is for soft programs where initial leafhopper populations are low to moderate. May be phytotoxic. Organic
	thiacloprid Calypso 4F	4 fl oz	12 h	30 d	4A	4	
Woolly apple aphid	spirotetramat Ultor 1.25L	10-14 fl oz	24 h	7 d	23	2-4	Time Ultor applications shortly after petal fall, when the canopy is well developed, but leaves have not hardened off. A second application 14 days after the first may be helpful. This material is systemic and will suppress root and shoot colonies of woolly apple aphid. Ultor suppresses woolly apple aphids later in the season, but overall control is not as good as with the early season timing (see Late Spring and Summer).

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Late spring and summer

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple maggot	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	NR	
Brown marmorated stink bug	fenpropathrin Danitol 2.4EC	20 fl oz	24 h	14 d	3	NR	Lannate has high mammalian toxicity and is known to disrupt biological control for many pests, especially spider mites and aphids.
	methomyl Lannate 90SP	1 lb	4 d peach/ 3 d apple	14 d	1A	NR	
Codling moth							Codling moth granulosis virus is a highly specific control that should always be used as a component of a multi-tactic pest management program. The residual activity lasts at most 7 days. The effect of the virus is most often seen in a suppression of the pests densities over time. Applying virus one or more times per codling moth generation at the end of the residual period of another insecticide to extend the protection period is a logical use of this technology. Organic
	CM granulosis virus Cyd-X	See Label	4 h	0 d	3		
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	Altacor is very effective against leafroller larvae and codling moth eggs and larvae. It has a residual activity of up to 17 days when using the high label rate or not more than 14 days when using the low label rate. Altacor is in the same chemical class as Belt.
	cyantraniliprole Exire	10-17 fl oz	12 h	3 d	28	4	
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	novaluron Rimmon 0.83EC	30-50 fl oz	12 h	14 d	15	3-4	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth (continued)	petroleum oil, summer petroleum oil, summer phosmet Imidan 70W	See label	4 h	0 d		NR	Organic
	spinetoram Delegate 25WG	5 lb	7 d	7 d	1B	3	
		6-7 oz	4 h	7 d	5	4	Delegate is very effective against leafroller and codling moth larvae. It has a residual activity of 14 days. Delegate is in the same chemical class as Success (spinosad) so avoid using these products against two consecutive generations.
	spinosad Entrust SC	10 fl oz	4 h	7 d	5	NR	Organic
	thiacloprid Calypso 4F	4-8 fl oz	12 h	30 d	4A	4	
Cutworms	indoxacarb Avault 30DG	6 oz	12 h	14 d	22A	4	
Grape mealybug	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	NR	
	imidacloprid Admire Pro 4.6L	2.8 fl oz	12 h	7 d	4A	NR	
	phosmet Imidan 70W	4-5 lb	7 d	7 d	1B	2	
	thiacloprid Calypso 4F	8 fl oz	12 h	30 d	4A	NR	
Green apple aphid	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	3-4	
	imidacloprid Provado 1.6F	4-8 fl oz	12 h	7 d	4A	4	
Lacanobia fruitworm	indoxacarb Avault 30DG	3-6 oz	12 h	14 d	22A	4	
	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Organic
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3-4	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Lacanobia fruitworm (continued)							
	spinosad Entrust 80W	3 oz	4 h	see label	5	3-4	Entrust is a spinosad formulation registered for organic apple production. It is effective against codling moth larvae hatching from the egg. It has a residual activity of 7 to 10 days. When Entrust is incorporated into an organic pest control program using pheromones, summer oil, and codling moth virus, good control of this key pest is possible. Some leafroller populations have developed resistance to Success (spinosad) and its use could result in reduced levels of control. Success is in the same chemical class as Delegate (spinetoram) so avoid using these products against two consecutive generations. <u>Organic</u>
	spinosad Success 2F	6-10 fl oz	4 h	see note	5	3-4	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Two or three Bt applications are usually required to achieve acceptable control. Time the first application to coincide with leafroller egg hatch. A repeat application might be required if leafroller populations are high. <u>Organic</u>
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	Altacor is very effective against leafroller larvae and codling moth eggs and larvae. It has a residual activity of up to 17 days when using the high label rate or not more than 14 days when using the low label rate. Altacor is in the same chemical class as Belt.
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	emamectin benzoate Proclaim 5SG	3.2-4.8 oz	12 h	14 d	6	4	
	flubendiamide Belt 4SC	5 fl oz	12 h	14 d	28	4	Belt is in the same chemical class as Altacor and is very effective for control of leafroller larvae.
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	novaluron Rimmon 0.83EC	30-50 fl oz	12 h	14 d	15	3-4	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	Delegate is very effective against leafroller and codling moth larvae. It has a residual activity of 14 days. Delegate is in the same chemical class as Success (spinosad) so avoid using these products against two consecutive generations.
	spinosad Success 2F	6-10 fl oz	4 h	see note	5	3-4	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafroller (Pandemis, Obliquebanded) (continued)	spinosad Entrust 80W	3 oz	4 h	see label	5	3-4	Entrust is a spinosad formulation registered for organic apple production. It is effective against codling moth larvae hatching from the egg. It has a residual activity of 7 to 10 days. When Entrust is incorporated into an organic pest control program using pheromones, summer oil, and codling moth virus, good control of this key pest is possible. Some leafroller populations have developed resistance to Success (spinosad) and its use could result in reduced levels of control. Success is in the same chemical class as Delegate (spinetoram) so avoid using these products against two consecutive generations. <u>Organic</u>
San Jose scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	If the problem is serious, apply 2 sprays, one in early to mid-June, and one 14 days later.
Shothole borer	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	esfenvalerate Asana XL	14.5 fl oz	12 h	21 d	3A	4	
Spider mites	bifenazate Acarmit 50WS	0.75-1 lb	12 h	7 d	un	4	
	etoxazole Zeal Miticide 1 72WSP	2-3 oz	12 h	14 d	10B	3-4	
	fenpyroximate FijiMite 5%EC	1-2 pt	12 h	14 d	21A	3-4	
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	NR	Most effective on the egg stage. When mite populations are high and leaf bronzing has already occurred, a miticide effective on the adult stage may be used in combination.
	pyridaben Nexter 75WSB	4.4-8.8 oz	12 h	7 d	21A	2-3	Use a low to moderate rate for European red mite; a moderate to high rate for twospotted and McDaniel spider mites.
	spiroticlofen Envidor 2SC	16-18 fl oz	12 h	7 d	23	3-4	
Western tentiform leafminer	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	May provide control of mites if used early in the season.
	spinosad Success 2F	6-10 fl oz	4 h	see note	5	3-4	
White apple leafhopper	carbaryl Sevin 4F	1-2 pt	12 h	3 d	1A	4	Carbaryl may disrupt integrated mite control depending on history of use. Use higher rate if leafhopper population is composed primarily of adults.
	imidacloprid Provado 1.6F	4-8 fl oz	12 h	7 d	4A	4	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
White apple leafhopper (continued)	indoxyacarb Avault 30DG kaolin clay Surround WP	4-6 oz See label	12 h 4 h	14 d 0 d	22A	3-4 NR	Organic
Woolly apple aphid	diazinon Diazinon 50W spiracetam Ultor 1.25L	4 lb 10-14 fl oz	4 d 24 h	21 d 7 d	1B 23	4 2-4	If the problem is serious, apply 2 sprays, one in early to mid-June, and one 14 days later. Ultor may only provide suppression if used in mid- and late-season sprays; preliminary evidence suggests that better efficacy may be obtained when it is applied prophylactically shortly after petal fall.
Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2	Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
	potassium bicarbonate Kalgreen	3 lb	4 h	1 d	NC	2	Under low disease pressure, Kalgreen will provide adequate control. If disease pressure increases, rotation or combination with other materials is recommended. Organic
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	3	Pristine is a FRAC 7 + 11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.

TABLE CONTINUED

Late spring and summer (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew (continued)	triflumazole Trionic 4SC	16 fl oz	12 h	14 d	3	4	Trionic is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
Apple scab	captan Captain 50WP	8 lb	24 h	0 d	M4	NR	
	cyprodinil Vangard 75WG	See label	12 h	0 d	9	3	Vangard and Inspire Super are from the same chemical group (9). Use only one of them at the same growth stage.
	fluopyram + trifloxystrobin Luna Sensation	4-5.8 fl oz	12 h	14 d	7, 11	NR	Luna Sensation and Fontelis are from the same Chemical group (7). Use only one of them.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Use only one Group 3 fungicide at the same growth stage.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Mode 11) labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Rates vary with postinfective schedule; see label. Apply only one Group 3 Fungicide at the same growth stage.
Bull's eye rot	ziram Ziram Granulfo 76WDG	6 lb	48 h	14 d	M3	3	Apply 12 to 14 days after calyx stage and repeat as needed through the summer. Do not apply more than 24.2 lbs per acre in a crop cycle. Do not apply within 14 days of harvest. Tank-mixing with other fungicides has been reported to increase efficacy and reduce fungicide resistance development.
Summer Rots	Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2	Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Preharvest

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	When possible, tank-mix captan with other single-site fungicides to help reduce fungicide resistance development.
Botrytis of Apple and Pear	copper octanoate Cueva	8 qt	4 h	0 d	M1	2	Organic
	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	3	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Mertect, used postharvest, therefore careful use is highly recommended.
Bull's eye rot	captan Captain 50WP	6 lb	24 h	0 d	M4	NR	Do not apply more than 64 lbs. of Captain 50 Wettable Powder per acre per crop cycle. Make 1 or 2 applications with late cover sprays and 1 final spray prior to harvest. When possible, tank-mix captan with other single-site fungicides to help reduce fungicide resistance development.
	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	4	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Mertect, used postharvest, therefore careful use is highly recommended.
	ziram Ziram 76DF	See label	48 h	14 d	M3	3	Apply in the first cover spray and in preharvest ideally before rain. Do NOT apply within 14 days of harvest. When applicable, tank-mix with other single-site fungicides to increase efficacy and reduce risk of fungicide resistance development. Do not apply more than 18.4 lbs. a.i. of Ziram 76DF or equivalent per season.

TABLE CONTINUED

Preharvest (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Summer Rots	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control <i>Alternaria</i> infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
	pyraclostrobin + boscalid Pristine	14.5-18.5 oz	12 h	0 d	11, 7	3	Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on the pome fruits. The efficacy level will depends on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	3	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Merit, used postharvest, therefore careful use is highly recommended.
	ziram Ziram Granulito 76WDG	6 lb	48 h	14 d	M3	2	When applicable, tank-mix with other single-site fungicides to reduce risk to fungicide resistance development.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple maggot	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	NR	
Codling moth	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	carbaryl Sevin 4F	2 pt	12 h	3 d	1A	2	
	petroleum oil, summer petroleum oil, summer	See label	4 h	0 d		NR	Organic
	spinetoram Delegate 25WG	6-7 oz	4 h	7 d	5	4	Delegate is effective against codling moth larvae. It has a residual activity of 14 days.

TABLE CONTINUED

Preharvest (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Coddling moth (continued)	spinosad Entrust SC	10 fl oz	4 h	7 d	5	NR	Organic
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bts are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Pear Programs

Major Diseases

Botrytis of Apple and Pear

Botrytis is the second most important apple fruit disease and can be the most important disease affecting pear as shown in recent statewide and regional surveys in the Pacific Northwest. Flowers of both crops are susceptible to Botrytis infections which persist through the growing season until harvest. Botrytis infections remain dormant until storage where the fungus causes Gray Mold with symptoms becoming visible after a few months in storage. Afterward, the fungus can spread to healthy fruit. Temperatures between 64°F and 78°F are optimal for infections. Because infections occur EXCLUSIVELY in the orchard, it is important to start management as early as possible. Delayed management will fail to control infections that started weeks or months before harvest. The fungus is ubiquitous and overwinters on mummified fruit left on trees and fallen leaves. Good sanitation practices will reduce inoculum loads but because of the explosive nature of this disease, fungicide applications are necessary to achieve good control. At bloom time and during spring, fungicides from FRAC groups 7, 9 and 11, used to control apple powdery mildew or scab, will be effective against Botrytis if resistance is absent. Fungicides from FRAC 3 have a limited efficacy against Botrytis infections. As fruit mature, they become more susceptible to Botrytis. Late season management is especially important for cultivars picked after mid-September in WA when wet, disease conducive weather is more likely. Preharvest applications and ROTATIONS of fungicides from the FRAC groups 1, 7, 11 and 19 control Botrytis. Tank-mixture of single-site fungicide with Ziram or captan will increase efficacy and delay the selection for resistant populations. **IMPORTANT:** Botrytis cinerea is the MOST RISKY fungus when it comes to fungicide resistance as the fungus can develop resistance to multiple fungicide simultaneously. Remember this aspect when spraying for other diseases such as powdery mildew, as the same fungicides sprayed early in the season can select for resistant Botrytis populations which will persist throughout the season and to the storage rooms resulting in limited efficacy of eventual postharvest treatment by the grower.

Bull's eye rot

Bull's eye rot is a major disease of apple and pear. The disease can be caused by four different fungal species from the genus *Neofabraea*. The main species causing Bull's eye rot of apple in eastern Washington is *N. perennans*, whereas *N. malicorticis* was reported to be predominant in western Washington. It infects fruit and causes cankers on trees where it overwinters until conditions become favorable in the following spring to start new infections. Fruit are infected exclusively in orchards but bull's eye rot symptoms are only seen after several months in cold storage. Therefore, preharvest management is key to reducing decay rates in the packinghouse. Prune cankered branches to reduce the inoculum load and use fungicide applications prior to harvest to control. Ziram applied within two weeks before harvest is recommended for control of Bull's eye rot in the Pacific Northwest. Topsin-M is ONLY recommended under wet conditions and for cultivars, such as Golden Delicious, Pinata, Fuji and Granny Smith, more susceptible to bull's eye rot. Frequent sprays may increase risks of resistance development to Mertect, a fungicide from the same group as Topsin-M (1) used after harvest. Tank-mixtures of Ziram with other single-site fungicides are recommended to increase efficacy and reduced risks of fungicide resistance development.

Fire blight

There is a risk of fire blight infection any time there are flowers on the tree, the weather is warm, and wetting occurs. Watch for and protect secondary blossoms during the three weeks after petal fall, which is the most common time of fire blight infection. **Early bloom.** Apply biologicals (Blossom Protect) during early bloom. If fire blight was in the orchard last year apply two applications of the biological. Reapply biological a second time if lime sulfur was applied (Lime sulfur is antimicrobial and kills biological). **Full bloom to petal fall.** Watch the model. If an infection event occurs, apply an antibiotic as soon as possible, but within 24 hours of infection (usually wetting of flowers). Repeated antibiotic sprays may be necessary during extended high or extreme risk periods. Best results are obtained when applied within 24-hour window before flower wetting during a high infection risk period. Beneficial only for flower infection prevention. Product used must contact the interior of the flowers in sufficient water and approved wetting agent

to completely wet the interior. One pound of any 17% oxytetracycline product per 100 gallons gives a 200 ppm solution. Kasugamycin is another effective antibiotic. Applications of less than 100 gal/A can be effective on small trees if flower interiors are well covered, but do not drop the ppm below 200 (oxytetracycline). Application by ground equipment on each row is highly recommended. Application of antibiotics by aircraft is not recommended. Many fire blight bacteria in the Pacific Northwest are resistant to streptomycin, another registered antibiotic.

Organic. Prebloom. Fixed copper sanitation if fire blight was in the orchard last year. **Early bloom.** Lime sulfur plus oil. One to two applications of biologicals (Blossom Protect). Reapply biologicals after lime sulfur which is antimicrobial. Depending on the cultivar russet risk and the CougarBlight model risk follow with *Bacillus subtilis* (Serenade Optimum) (most fruit safe) every 2–5 days during flower/petal fall or copper hydroxide/octanoate (Cueva/Previsto) every 5 to 6 days (This option is less fruit safe for russet).

Pear mildew

Apple and pear powdery mildew is caused by the same fungal species *Podosphaera leucotricha* which overwinters in dormant apple buds, whereas its survival in pear is still unknown. When infected buds break in spring, the fungus produces spores that are rain and wind-spread to infect freshly emerged leaves which are highly susceptible powdery mildew. Germination and infections are optimal at temperatures between 60°F and 78°F. Wetness plays a marginal role. The fungus then continues its multi-cycle infections through spring and early summer until the productions of new leaves and shoots cease. The fungus is slowed down by the rising temperature (above 82°F) as summer progresses. Infection resumes in fall where the pathogen overwinters as ascospores (sexual form) or infected buds. Under high disease pressure and mild summer conditions, the fungus can cause russetting on fruits and therefore reduce quality. While no cultivar is immune, cultivars like Granny Smith, Honeycrisp, Idared and Crimson Crisp are highly susceptible, whereas Golden Delicious is susceptible and Fuji, Gala and Red Delicious are the least susceptible. Mildew management should start before bud break and at green tip stage (to reduce spread of new inoculum) with sulfur-based products and continue every 10 to 14 days until the production of new shoots cease. Fungicides from FRAC groups 3, 7, 11 and 19 are effective and SHOULD be ROTATED throughout the season. In growing, regions where scab is a problem, spray programs used to control the latter will control powdery mildew as well. In organic orchards, sulfur, potassium bicarbonate, and some biopesticides usually provide a good level of control.

Pear scab

Scab, caused by the fungus *Venturia pyrina* on pear, is major disease of pear fruit in many growing regions, especially those with high rainfall. Typical scab symptoms include gray-brown to blackish lesions on leaves and fruit. Because of the semi-arid conditions during the growing season in central Washington, scab risk is low. However, some microclimates in the north of the state can be conducive to scab and therefore, management is recommended. Pear scab can cause problems in growing regions north of Washington and in Hood River, Oregon but it is rarely seen in central and south Washington State.

Summer Rots

In addition to the major diseases described separately, other fungal fruit infections starting in the orchard can cause storage rots. **Alternaria Disease.** A dark-brown to black infection caused by *Alternaria alternata* (and other spp.) is ubiquitous in most orchards. Infections, usually sporadic, may become frequent when sanitation is not observed or when wet conditions occur for an extended period. The fungus infects flowers at bloom but can also infect fruit through the calyx end or wounds. Floral infections can result in moldy-core disease later in storage. **Sphaeropsis Disease.** A sporadic emerging disease cause by the fungus *Sphaeropsis pyriputrescens* infects fruits in the orchard and develops stem and calyx end rots in storage. The fungus overwinters on cankers and twig die-back. Prune diseased branches to help reduce inoculum. Pruning symptomatic crab apples is particularly important. Although this disease can be sporadic, it is still quarantined in many export countries and its identification in entry ports will result in fruit lot rejection. **Lambertella disease.** This disease was recently reported in the Pacific Northwest and, therefore, is considered as quarantine pathogen. Infections are caused by the fungus *L. corni-maris*, which has been isolated from mummies of other fruit crops in the past but its disease cycle in apple is still unknown. The disease develops yellow mycelium that cover the fruit, but symptoms are only observed after several months of storage. Recent studies have shown that fungicides from FRAC group 1 are not effective against Lambertella, whereas fungicides from FRAC groups 7 and 11 have only moderate efficacy. Until further research has shown which other preharvest fungicides are effective, it is recommended to apply a fungicide from FRAC group 9 or 12 postharvest, as these were found to be the most effective. The fungus requires a wound on the cuticle to cause an infection, therefore, reducing damages and punctures at harvest will reduce infection risks. The possibility of infections occurring through the calyx- or stem-ends is still unknown.

Major Insects

Codling moth

Codling moth is the key pest of pome fruits in the PNW. In general, apples are more susceptible than pears, and fruits with softer flesh are more susceptible to attack. The increasing frequency of a third generation (two have been the norm historically) means that growers must be vigilant throughout the growing season, and be aware of phenology (See WSU Decision Aid System, <https://decisionaid.systems>). Codling moth has a long history of becoming resistant to insecticides, thus rotation of materials with different modes of action (MOA) is highly recommended. Avoid using the same MOA against consecutive generation to minimize this danger. The MOA for each material is listed in the Tables. Pheromone mating disruption was registered in 1990, and has since been widely adopted in Washington. Use of mating disruption is now considered the foundation of an IPM program. Supplementing mating disruption with insecticides may be necessary depending on pressure, and using pheromone traps for monitoring populations will prevent unnecessary applications. A detailed recommendations on pheromone placement and timing of sprays is available.

Leafrollers (*Pandemis, Obliquebanded*)

Pre-bloom applications of pesticides can be effective and will also conserve natural enemies for leafroller and biological control agents of other pests, such as aphids. If treatments for leafrollers were applied at pink and/or bloom, sampling to determine the density of surviving leafrollers should be completed prior to deciding to apply additional controls at this timing. Most products listed act primarily as stomach poisons versus direct contact to residues, therefore, complete coverage is very important to achieve maximal control. Repeating an application of any product should be based on the leafroller population surviving previous treatments. Use the leafroller models on the WSU Decision Aid System for the optimum timing.

Pear psylla

Pear psylla, *Cacopsylla pyricola*, is a major pest of pears in the PNW. While it is specific to pear, a portion of the population overwinters in alternative host plants such as apple and non-cultivated trees and shrubs. Pear psylla becomes active in orchards in late winter and early spring. Egg lay begins while trees are dormant or at bud swell and generally peaks between popcorn and bloom. The first generation of nymphs emerge between

popcorn and petalfall. Psylla undergo 3–4 generations in a season, the 4th usually occurring during or after harvest depending on the cultivar. While many programs rely heavily on repeated broad spectrum sprays from dormant through harvest, softer programs involving the use of particle films (Surround CF or WP and diatomaceous earth) for adult repellency and soft insecticides (Esteem, Dimilin, Centaur, Neem products, Cinnerate, Rosemary oils) are encouraged for conservation of natural enemies. Predators *Deraeocoris brevis*, *Campylomma verbasci*, earwigs, anthocorids and the parasitoid wasp *Trechnites insidiosus* are highly effective at controlling psylla later in the season when insecticide coverage is compromised by excessive growth. Selective materials may require more frequent applications (10-day intervals), especially from petalfall to July when psylla pressure is high. However, late season sprays will become less necessary after consecutive years in selective or organic production because natural enemies will gradually increase

Pear rust mite

Pear rust mite, *Epitrimerus pyri*, is a common pest of pears. Although similar in appearance and injury, it is not the same as Apple rust mite, *Aculus schlechtendali*. Pear rust mite is a very small mite that requires magnification to see. Pear rust mite becomes active as soon as buds develop. Because natural enemies will not prevent injury, control measures must be taken prior to bloom (lime sulfur before green tissue, micronized sulfur after). If left uncontrolled rust mites will injure the developing fruit, causing scaring around the calyx. Rust mites will continue to feed through the season on both the fruit and leaves, causing a light russetting over their surfaces. If rust mites reemerge in the summer, they are readily controlled by most conventional miticides. Organic products such as Cinnerate and rosemary oils also have shown efficacy against this pest. Postharvest sulfur sprays lower populations for the following season.

San Jose scale

San Jose scale can be a minor pest if adequately controlled, or escalate into a major problem if not. It primarily infests the trunk and limbs, but scale crawlers will settle on the fruit. Damage to this season's crop may become serious, but ultimately the infestation of wood may cause death of limbs or the entire tree. Oil plus an organophosphate in the delayed dormant spray provide control; if the organophosphate is omitted (oil only), monitor the trees carefully and add one of the listed materials if scale become numerous.

Spray Schedule

Dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	esfenvalerate + petroleum oil-dormant Asana XL + petroleum oil-dormant	1 pt 1-1.5 % v/v	12 h	28 d	3A	1-2	Do not use esfenvalerate and permethrin more than 2 times per season. Pyrethroid (MOA 3A) resistance is present in many areas and may severely reduce efficacy.
	kaolin clay + petroleum oil-dormant Surround WP + petroleum oil-dormant	25-50 lb 1-1.5 % v/v	4 h	0 d		4	Apply two to three applications as necessary to cover new growth between dormant/delayed dormant and first bloom. Organic
	lime sulfur/calcium polysulfide + petroleum oil-dormant Rex Lime Sulfur + petroleum oil-dormant	See Label 1-1.5 % v/v	48 h	none listed		4	Organic
	permethrin + petroleum oil-dormant Ambush 25WP + petroleum oil-dormant	12.8-25.6 oz 1-1.5 % v/v	12 h	none listed	3A	4	Do not use esfenvalerate and permethrin more than 2 times per season. Pyrethroid (MOA 3A) resistance is present in many areas and may severely reduce efficacy.
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		4	Organic
	sulfur, dry flowable + petroleum oil-dormant sulfur, dry flowable + petroleum oil-dormant	See label 1-1.5 % v/v	24 h	none listed	M2	4	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Delayed dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cutworms	Lorsban Advanced chlorpyrifos	See label	4 d	none listed	1B	4	Do not make more than one application of chlorpyrifos per year.
European red mite	petroleum oil- dormant petroleum oil- dormant	1.5 % v/v	12 h	none listed		3-4	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals. per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas. Organic
Grape mealybug	chlorpyrifos + petroleum oil- dormant Lorsban Advanced + petroleum oil-dormant	4 pt 1.5 % v/v	4 d	none listed	1B	4	Do not make more than one application of chlorpyrifos per year. Use no more than 5 gals oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals. per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	diazinon + petroleum oil- dormant Diazinon 50W + petroleum oil-dormant	4 lb 1.5 % v/v	4 d	21 d	1B	3	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
Lygus bug, stink bug	dimethoate Dimethoate 2.67EC	3 pt	10/14 d	28 d	1B	NR	
Pear psylla	acetamiprid + petroleum oil- dormant Assail 70WP + petroleum oil-dormant	2.3-3.4 oz 1-1.5 % v/v	12 h	7 d	4A	4	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	diflubenzuron + petroleum oil- dormant Dimilin 2L + petroleum oil-dormant	40-48 fl oz 1-1.5 % v/v	12 h	14 d	15	4	Insect growth regulators Dimilin and Esteem are most effective when applied prior to significant egg deposition. See Label. Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.

TABLE CONTINUED

Delayed dormant (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla (continued)	estenvalerate + petroleum oil-dormant Asana XL + petroleum oil-dormant	1 pt 1-1.5 % v/v	12 h	28 d	3A	1-2	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	kaolin clay + petroleum oil-dormant Surround WP + petroleum oil-dormant	25-50 lb 1-1.5 % v/v	4 h	0 d		4	Apply two to three applications between dormant/delayed dormant and first bloom. Coverage of green tissue is important; apply every 2-3 weeks or as needed to cover new tree growth. Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas. Organic
	lime sulfur/calcium polysulfide + petroleum oil-dormant Sulforix + petroleum oil-dormant	See label	48 h	none listed		4	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		4	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas. Organic
	pyriproxyfen + petroleum oil-dormant Esteem 35WP + petroleum oil-dormant	5 oz 1-1.5 % v/v	12 h	45 d	7C	2-3	Insect growth regulators Dimilin and Esteem are most effective when applied prior to significant egg deposition. See Label. Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	sulfur, dry flowable + petroleum oil-dormant sulfur, dry flowable + petroleum oil-dormant	See label 1-1.5 % v/v	24 h	none listed	M2	4	Do not apply to Anjou pears. Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.

TABLE CONTINUED

Delayed dormant (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear rust mite, pearleaf blister mite	carbaryl + petroleum oil-dormant Sevin 4F + petroleum oil-dormant	4 pt 1-1.5 % v/v	12 h	3 d	1A	NR	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	Organic
	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	NR	Do not apply to Anjou pears.
San Jose scale	chlorpyrifos + petroleum oil-dormant Lorsban Advanced + petroleum oil-dormant	4 pt 1-1.5 % v/v	4 d	none listed	1B	4	Do not make more than one application of chlorpyrifos per year. Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas.
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		4	Use no more than 5 gals. oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gals per acre are applied during the prebloom period. If scale is a problem, use a dilute spray. Use handgun for hard-to-cover problem areas. Organic
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	1	
Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Prepink

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
European red mite	petroleum oil- dormant petroleum oil- dormant	1 % v/v	12 h	none listed		3-4	
Grape mealybug	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	1	
	diazinon	4 lb	4 d	21 d	1B	3	
	phosmet Imidan 70W	5-5.75 lb	7 d	7 d	1B	2	
	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	NR	PHI depends on rate used. Use a diluted spray for full coverage.
Lygus bugs, stink bugs, green fruitworm	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	NR	
	dimethoate Dimethoate 4EC	32 fl oz	10/14 d	28 d	1B	NR	
Pear psylla	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	4	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	2-3	Centaur together with Rimon can mark fruit.
	diflubenzuron Dimilin 2L	40-48 fl oz	12 h	14 d	15	4	
	estenvalerate Asana XL	1 pt	12 h	28 d	3A	1-2	
	novaluron Rimnon 0.83EC	32 fl oz	12 h	14 d	15	3-4	Do not apply novaluron after petal fall. Centaur together with Rimon can mark fruit.
	pyridaben Nexter 75WSB	10 oz	12 h	7 d	21A	3-4	
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	2-3	
	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	4	
Pear rust mite, brown mite	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	NR	
San Jose scale	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	1	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Pink

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew (Anjou)	benzovindiflupyr Aprovia	7 fl oz	12 h	30 d	7	3	Do not follow Aprivia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Group 11) labeled for use on pome fruits.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Aprovia are from the same chemical group (7). Use one of them ONLY at the same growth stage.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	4	The efficacy level will depend on the absence of resistant populations. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide and should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
Pear mildew (other varieties)	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	Flint and Sovran are from the same chemical group (11). To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	Do NOT use lime sulfur or micronized sulfur on Anjou. Organic

TABLE CONTINUED

Pink (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew (other varieties) (continued)	sulfur, dry flowable sulfur, dry flowable	See label	24 h	none listed	M2	NR	Do not use at temperature above 75°F and at bloom. Do NOT use lime sulfur or flowable micronized sulfur on Anjou.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	Flint and Sovran are from the same chemical group (11). To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides labeled for use on pome fruits.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
Pear scab	benzovindiflypr Aprovia	5.5-7 fl oz	12 h	30 d	7	NR	Aprovia and Fontelis are from the same chemical group (7). Use ONLY one of them at the same growth stage.
	cyprodinil Vangard 75WG	See label	12 h	0 d	9	3	Do not apply Vangard alone to pears. Apply in tank mixture with the recommended rate of a protectant or systemic fungicide registered on pome fruits. See label for mixing procedures.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides (Group 11) labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed		NR	Do NOT use lime sulfur or micronized sulfur on Anjou. Organic
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12h	28 d	7	NR	Fontelis and Aprovia are from the same chemical group (7). Use one of them ONLY at the same growth stage.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Rate varies when used in eradicant (postinfective) schedules. See label.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	While too early for Obliquebanded leafrollers, this is the appropriate timing for Pandemis. Bits are stomach poisons, so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern for 3 or more days. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

First bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	Aureobasidium pullulans Blossom Protect kasugamycin Kasumin 2L	1.25 lb 64 fl oz	4 h 12 h	none listed 90 d	4 24	4	Organic
	oxytetracycline FireLine 17WP	1 lb	12 h	60 d	41	4	Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH7 (5.5 optimal).
	oxytetracycline Mycoshield	16 oz	12 h	60 d	41	4	Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH7 (5.5 optimal). Organic
Pear mildew	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	4	Sovran is a FRAC 11 fungicide an should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides labeled for use on pome fruits.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide an should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	4	The efficacy level will depend on the absence of resistant populations from the orchard. To limit the potential for development of fungicide resistance, do not make more than four applications of FRAC group 11 fungicides per season. Do not make more than two sequential applications of FRAC group 11 fungicides. This limitation is inclusive of all FRAC group 11 fungicides labeled for use on pome fruits.
	triflumizole Procure 480 SC	8-16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits. Place Rally into solution before adding oil. Apply no sooner than half-inch green.

TABLE CONTINUED

First bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear scab	cypromidinil Vangard 75WG dodine Syllit 3.4FL	See label 3 pt	12 h 48 h	0 d 7 d	9 U12	3 NR	
	kresoxim-methyl Sovran 50WG lime sulfur/calcium polysulfide Rex Lime Sulfur	4-6.4 oz	12 h	30 d	11	NR	
	mancozeb Dithane M45 80W penthiopyrad Fontelis	See label 6 lb 14-20 fl oz	48 h 24 h 12 h	none listed 77 d 28 d	NR M3 7	NR	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
Coddling moth	CM pheromone dispensers Isomate-C Plus	See label	none listed	none listed	NR	NR	Install dispensers before first flight (prior to bloom) using the full label rate in the top 2 feet of the canopy. When using aerosol emitters borders should be treated with hand-applied dispensers. Organic
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	While this is too early for Obliquebanded leafrollers, this timing is appropriate for Pandemis. Bts are stomach poisons, so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern for 3 or more days. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	4	Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. Efficacy dependent on the occurrence of fungicide resistant populations. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
Fire blight	Aureobasidium pullulans Blossom Protect	1.25 lb	4h	none listed	4	4	Organic
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	NR	Organic
	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h	0 d	21	NR	For bloom applications: Apply 1–2 oz/A in a tank mix with a fire blight treatment (generally an antibiotic) that is standard in your area. This is generally 2–3 applications between 20% bloom and petal fall depending on the environmental conditions. Do not apply closer than a 7-day interval.
	copper hydroxide Previsto	3-4 qt	48 h	none listed	M1	3	Organic
	copper octanoate Cueva	4 qt	4 h	0 d	M1	3	Organic
	kasugamycin Kasumin 2L	64 fl oz	12 h	90 d	24	4	
	oxytetracycline Mycoshield	16 oz	12 h	60 d	41	4	Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH7 (5.5 optimal). Organic

TABLE CONTINUED

Bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight (continued)	oxytetracycline FireLine 17WP	1 lb	12 h	60 d	41	4	Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH 7 (5.5 optimal).
Pear scab	acetamiprid + petroleum oil-dormant Assail 30SG + petroleum oil-dormant	8 oz 1 fl oz	12 h	7 d	4A	NR	
Insect							
Pear rust mite	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Petal fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear	copper octanoate Cueva	8 qt	4 h	0 d	M1	2	Organic
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	pyraclostrobin + boscalid Pristine	18.5 oz	12 h	0 d	11, 7	4	Pristine is a FRAC 7 +11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7 + 11 fungicides labeled for use on pome fruits. Efficacy dependant on the occurrence of fungicide resistant populations. For powdery mildew, preferably use other FRAC 7 fungicides in spring.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear (continued)	thiophanate-methyl Topsin M 70WSB	1 lb 2 d	1 d	1	3		Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Meritect, used postharvest, therefore careful use is highly recommended.
Bull's eye rot	ziram Ziram 76DF	See label 48 h	14 d	M3	3		Apply while pear calyx is still upright and then in the first cover spray and in preharvest ideally before rain. Do NOT apply within 14 days of harvest. When applicable, tank-mix with other single-site fungicides to increase efficacy and reduce risk of fungicide resistance development. Do not apply more than 18.4 lbs. a.i. of Ziram 76DF or equivalent per season. Aerial application allowed only at preharvest.
Fire blight	Aureobasidium pullulans Blossom Protect	1.25 lb 20 oz	4 h 0 d	none listed 44	NR NR		Organic
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h 0 d	21	NR		Organic
	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h 0 d				For bloom applications: Apply 1–2 oz/A in a tank mix with a fire blight treatment (generally an antibiotic) that is standard in your area. This is generally 2–3 applications between 20% bloom and petal fall depending on the environmental conditions. Do not apply closer than a 7-day interval.
	copper hydroxide Previsto	3-4 qt	48 h 0 d	none listed M1	3		Organic
	copper octanoate Cueva	4 qt	4 h 0 d	M1	3		Organic
	kasugamycin Kasumin 2L	64 fl oz	12 h 90 d	24	4		
	oxytetracycline FireLine 17WP	1 lb	12 h 60 d	41	4		Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH7 (5.5 optimal).
	oxytetracycline Mycoshield	16 oz	12 h 60 d	41	4		Apply within 24 hours before or after a blight infection event. Use oxytetracycline in ground application as a concentrate spray, 1 pound per 100 gallons per acre, which gives a 200 ppm solution. Acidify alkaline spray water to below pH7 (5.5 optimal). Organic
Pear mildew	Reynoutria sachalinensis Regalia	4 qt	4 h 0 d	P5	2		Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic

TABLE CONTINUED

WSU 2019 Crop Protection Guide for Tree Fruit

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew (continued)	benzovindiflupyr Aprovia	5.5-7 fl oz	12 h	30 d	7	3	Do not follow Aprovia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	4	Sovran is a FRAC 11 fungicide an should not be rotated or used with other FRAC 11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 2 applications of FRAC 11 fungicides per season. Do not make more than two sequential applications of FRAC 11 fungicides.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide an should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
	potassium bicarbonate Kalgreen	3 lb	4 h	1 d	NC	2	Under low disease pressure, Kalgreen will provide adequate control. If disease pressure increases, rotation or combination with other materials is recommended. Organic
	triflumazole Trionic 4SC	16 fl oz	12 h	14 d	3	4	Trionic is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
	triflumizole Procure 480SC	16 fl oz	12 h	14 d	3	4	Procure is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear scab	benzovindiflupyr Aprovia	5.5-7 fl oz	12 h	30 d	7	NR	Aprovia and Fontelis are from the same chemical group (7). Use ONLY one of them for the same growth stage. Do not make more than 4 application per season for fungicides from the same group. Additional restriction may apply, check specific labels.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides labeled for use on pome fruits.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	none listed	NR		Organic
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Aprovia are from the same chemical group (7). Use ONLY one of them for the same growth stage. Do not make more than 4 application per season for fungicides from the same group. Additional restriction may apply, check specific labels.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
Summer Rots							Fontelis has an acceptable efficacy against <i>Alternaria</i> fungus and <i>Nectria</i> that may infect fruit preharvest. Fontelis is a FRAC 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control <i>Alternaria</i> and <i>Nectria</i> infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	CM pheromone dispensers Isomate-C Plus	See label	none listed	none listed		NR	Install dispensers before first flight (prior to bloom) using the full label rate in the top 2 feet of the canopy. When using aerosol emitters borders should be treated with hand applied dispensers. Organic
Grape mealybug	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	NR	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grape mealybug (continued)	diazinon Diazinon 50W imidacloprid Admire Pro 4.6L	4 lb 7 fl oz	4 d 12 h	21 d 7 d	1B 4A	3 NR	
	phosmet Imidan 70W	5.33 lb	7 d	1B	2		
	thiamethoxam Actara 25WDG	4.5-5.5 oz	12 h	14 d/35 d	4A	NR	PHI depends on rate used. See label.
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bt products should be timed to coincide with periods of warm weather when high temperatures are expected to reach 65 degrees for three consecutive days. Multiple applications are typically required to control high populations. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	Altacor is highly effective against leafroller larvae and, at this treatment timing, has the added value of being toxic to codling moth eggs laid on product residues (see recommendations under codling moth). It can, therefore, be used as part of a management strategy to delay the first larvicide application against codling moth. Use the leafroller models at https://decisionaid.systems/ for the optimum timing for this product. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	emamectin benzoate Proclaim 5SG	3.2-4.8 oz	12 h	14 d	6	4	For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	flubendiamide Belt 4SC	5 fl oz	12 h	14 d	28	4	Belt is in the same chemical class as Altacor and is very effective for control of leafroller larvae. However, Belt does not have ovicidal activity against codling moth eggs laid on its residues and therefore cannot be used as part of a strategy to delay the first larvicide treatment for codling moth. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Some leafroller populations have developed resistance to Intrepid and its use could result in reduced levels of control. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	4	Esteem should be applied when last stage larvae are present but before pupation has begun. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafroller (Pandemis, Obliquebanded) (continued)	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	Delegate is effective against leafroller larvae. It has a residual activity of 14 days. Delegate is in the same chemical class (MOA=5) as Success (spinosad). For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	spinosad Success 2F	6-10 fl oz	4 h	see note	5	3-4	Some leafroller populations have developed resistance to spinosad and its use could result in reduced levels of control. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
Lygus bug	dimethoate Dimethoate 4EC	32 fl oz	10/14 d	28 d	1B	NR	
Pear psylla	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	2	
	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	4	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	2-3	
	fenpyroximate Fujimite 5%EC	1-2 pt	12 h	14 d	21A	3-4	
	imidacloprid Admire Pro 4.6L	5.6-7 fl oz	12 h	7 d	4A	NR	
	novaluron Rimon 0.83EC	32 fl oz	12 h	14 d	15	3-4	Do not apply after petal fall.
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	3-4	
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	2-3	
	spinetoram Delegate 25WG	5-7 oz	4 h	7 d	5	NR	
	thiamethoxan Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	4	
Pear rust mite	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	NR	
	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	NR	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear rust mite (continued)	fenbutatin oxide Vendex 50WP	1-1.5 lb	48 h	14 d	12B	NR	
	fenvaproximate Fujimite 5%EC	2 pt	12 h	14 d	21A	NR	
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	NR	
	spirodiclofen Envidor 2SC	16-18 fl oz	12 h	7 d	23	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

14–32 days after full bloom

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	diflubenzuron Dimilin 2L	16 fl oz	12 h	14 d	15	NR	
	imidacloprid Admire Pro 4.6L	7 fl oz	12 h	7 d	4A	NR	
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	3	
	spinetoram Delegate 25WG	6-7 oz	4 h	7 d	5	4	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Late spring and summer

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	diflubenzuron Dimilin 2L	16 fl oz	12 h	14 d	15	NR	
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	phosmet Imidan 70W	3-5.33 lb	7 d	7 d	1B	3	
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	3	
	spinetoram Delegate 25WG	6-7 oz	4 h	7 d	5	4	
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	NR	
Grape mealybug	imidacloprid Admire Pro 4.6L	5.6-7 fl oz	12 h	7 d	4A	NR	
	phosmet Imidan 70W	4.5 lb	7 d	7 d	1B	2	
	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	NR	PHI depends on rate used.
	carbaryl Sevin 4F	2 pt	12 h	3 d	1A	NR	If used in apple/pear interplant blocks, carbaryl may disrupt biological mite control, depending on history of use. Do not apply carbaryl prior to 30 days after full bloom.
	dimethoate Dimethoate 2.67EC	3 pt	10/14 d	28 d	1B	NR	
Grasshoppers and Mormon crickets							
Green apple aphid							

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Green apple aphid (continued)	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. <i>Kurstaki</i> DiPel DF	See label	4 h	0 d	11B2	3	Two or three applications are usually required. Apply when forecasts predict a warm weather pattern for 3 or more days. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control. [organic]
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	5 d	28	4	For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	emamectin benzoate Proclaim 5SG	3.2-4.8 oz	12 h	14 d	6	4	For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Some leafroller populations have developed resistance to methoxyfenozide and its use could result in reduced levels of control. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	spinetoram Delegate 25W/G	4.5-7 oz	4 h	7 d	5	4	For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
	spinosad Success 2F	6-10 fl oz	4 h	see note	5	3-4	Some leafroller populations have developed resistance to spinosad and its use could result in reduced levels of control. For effective leafroller control, this product must be consumed by larvae. Therefore good spray coverage of the foliage is critical to achieving good control.
McDaniel spider mite, two-spotted spider mite, European red mite	abamectin Agri-Mek SC acequinocyl Kanemite 15 SC bifenazate Acramite 50WS	4.25 fl oz 21-31 fl oz 0.75-1 lb	12 h 12 h 12 h	28 d 14 d 7 d	6 20B un	NR NR NR	
	clofentezine Apollo 4SC cyflumetofen Nealta	4-8 fl oz 13.7 fl oz	12 h 12 h	21 d 7 d	10A 25	NR NR	Clofentezine (Apollo) and hexythiazox (Savey) are ovicides. When initial mite populations are high, use in combination with an adulticide.

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
McDaniel spider mite, two spotted spider mite, European red mite (continued)	etoxazole Zeal Miticide 1.72WSP	3 oz	12 h	14 d	10B	NR	
	fenbutatin oxide Vendex 50WP	1.5-2 lb	48 h	14 d	12B	NR	Resistance to fenbutatin oxide exists in many areas.
	fenvaproximate Fujimite 5%EC	1-2 pt	12 h	14 d	21A	NR	
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	NR	Hexythiazox (Savey) and clofentezine (Apollo) are ovicides. When initial mite populations are high, use in combination with an adulticide.
	pyridaben Nexter 75WSB	4.4-10.67 oz	12 h	7 d	21A	NR	Use 4.4 to 5.2 oz/A for ERM; use 6.6 to 10.67 oz/A for two-spotted and McDaniel spider mites.
	spirodiclofen Envidor 2SC	16-18 fl oz	12 h	7 d	23	NR	
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	2	
	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	4	
	azadirachtin Aza-Direct 1.2%L	See label	4 h	0 d	un	2-3	These products have relatively short residues; reapplication may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. Organic
	buprofezin Centaur 70W	34.5 oz	12 h	14 d	16	2-3	
Pear psylla	fenvaproximate Fujimite 5%EC	1-2 pt	12 h	14 d	21A	3-4	
	imidacloprid Admire Pro 4.6L	5.6-7 fl oz	12 h	7 d	4A	NR	
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	3-4	
	spinetoram Delegate 25WG	5-7 oz	4 h	7 d	5	NR	
	spirotetramat Ultor 1.25L	10-14 fl oz	24 h	7 d	23	3-4	
	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	4	PHI depends on rate applied.
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	NR	
	fenbutatin oxide Vendex 50WP	1.5-2 lb	48 h	14 d	12B	NR	Resistance to fenbutatin oxide exists in many areas.
	fenvaproximate Fujimite 5%EC	2 pt	12 h	14 d	21A	NR	
Pear rust mite							

TABLE CONTINUED

WSU 2019 Crop Protection Guide for Tree Fruit

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear rust mite (continued)	pyridaben Nexter 75WSB spirodiclofen Envior 2SC	10.67 oz 16-18 fl oz	12 h 7 d	7 d 23	21A NR	NR	
Pear slug	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	5 d	28	NR	
	fenpyroximate Fujimite 5%EC	2 pt	12 h	14 d	21A	NR	
	spinetoram Delegate 25WG	6 oz	4 h	7 d	5	NR	
	spinosad Success 2F	4 fl oz	4 h	see note	5	NR	
	thiamethoxam Actara 25WDG	5.5 oz	12 h	14 d/35 d	4A	NR	
Notes: Pear Sawfly larvae (pearslug) are fairly susceptible to most pesticides; those listed are the ones tested, but other materials and lower rates may also work. See the cherry section for additional materials.							
Pearleaf blaster mite	abamectin Agri-Mek SC carbaryl Sevin 4F	4.25 fl oz 6 pt	12 h 12 h	28 d 3 d	6 1A	NR	If used in apple/pear interplant blocks, carbaryl may disrupt biological mite control, depending on history of use. Do not apply carbaryl prior to 30 days after full bloom.
San Jose scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	
Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew	Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2	Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic
	fluopyram Luna Privilege	6.84 fl oz	12h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide and should not be rotated or used with fungicides from the same group. Do not apply more than 3 applications of FRAC group 7 fungicides in a season.
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7 fungicides. Do not make more than three FRAC 7 applications in a season.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.

TABLE CONTINUED

Late spring and summer (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew (continued)	potassium bicarbonate Kalogreen	3 lb	4 h	1 d	NC	2	Under low disease pressure, Kaligreen will provide adequate control. If disease pressure increases, rotation or combination with other materials is recommended. Organic
	triflumazole Trionic 4SC	16 fl oz	12 h	14 d	3	4	Trionic is a FRAC 3 fungicide an should not be rotated or used with other FRAC 3 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 3 fungicides per season. Do not make more than two sequential applications of FRAC 3 fungicides labeled for use on pome fruits.
Pear scab	benzovindiflupyr Aprovia	5.5-7 fl oz	12 h	30 d	7	2	Do not follow Aprovia with fungicides from FRAC group 7 such as Fontelis, Luna and Pristine to reduce fungicide resistance development.
	kresoxim-methyl Sovran 50WG	4-6.4 oz	12 h	30 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides labeled for use on pome fruits.
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	Fontelis and Aprovia are from the same chemical group (7). Use only one of them for the same growth stage.
	trifloxystrobin Flint 50W	2-2.5 oz	12 h	14 d	11	NR	To limit the potential for development of fungicide resistance, do not make more than four applications of strobilurin fungicides per season. Do not make more than two sequential applications of strobilurin fungicides. This limitation is inclusive of all strobilurin fungicides labeled for use on pome fruits.
Summer Rots	Reynoutria sachalinensis Regalia	4 qt	4 h	0 d	P5	2	Do not use prior to petal fall. Under low disease pressure, it may help control some summer diseases like Alternaria and Bull's eye rot. Organic
	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	Fontelis has an acceptable efficacy against Alternaria fungus and Nectria that may infect fruit preharvest. Fontelis is a FRAC 7 fungicide an should not be rotated or used with other FRAC 7 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7 fungicides per season. Do not make sequential applications of FRAC 7 fungicides labeled for use on pome fruits.
	polyoxin D zinc salt OSO 5%SSC	13 fl oz	4 h	0 d	19	3	OSO will help control Alternaria and Nectria infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.2 oz. a.i./acre/season.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Preharvest

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis of Apple and Pear	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	3	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Merect, used postharvest, therefore careful use is highly recommended.
Bull's eye rot	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	4	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Merect, used postharvest, therefore careful use is highly recommended.
	ziram	6 lb	48 h	5 d	M3	NR	Because of visible residues, do not use ziram on Asian pears.
Summer Rots	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. Do not make more than three FRAC 7 applications in a season.
	pyraclostrobin + boscalid Pristine	14.5-18.5 oz	12 h	0 d	11, 7	3	Pristine is a FRAC 7+11 fungicide and should not be rotated or used with other FRAC 7+11 fungicides. To limit the potential for development of fungicide resistance, do not make more than 3 applications of FRAC 7+11 fungicides per season. Do not make sequential applications of FRAC 7+11 fungicides labeled for use on pome fruits. The efficacy level will depend on the occurrence of fungicide resistant populations of the pathogen in the orchards. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	thiophanate-methyl Topsin M 70WSB	1 lb	2 d	1 d	1	3	Efficacy level is ensured when resistance is absent from the orchard. Do not apply more than 2.8 lbs. a.i. per acre in a year. Topsin-M is very prone to fungicide resistance development, rotation with other FRAC group is required. Do not make sequential applications of FRAC group 1 fungicides and do not make more than two FRAC 1 fungicides per season. Topsin-M is similar to Merect, used postharvest, therefore careful use is highly recommended.
	ziram	6 lb	48 h	14 d	M3	2	Apply while pear calyx is still upright and then in the first cover spray and in preharvest ideally before rain. Do NOT apply within 14 days of harvest. When applicable, tank-mix with other single-site fungicides to increase efficacy and reduce risk of fungicide resistance development. Do not apply more than 18.4 lbs. a.i. of Ziram 76DF or equivalent per season. Aerial application allowed only at preharvest.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Sweet Cherry Programs

Major Diseases

Bacterial canker or gummosis

Bacterial canker or gummosis (*Pseudomonas syringae*) is a serious disease of cherry in the Pacific Northwest. It is particularly damaging to young trees and can result in replanting issues if un-managed. Spread of the pathogen is favored by cool, moist weather. Optimum timing for control of bacterial gummosis is in late winter before trees break dormancy, spring frost, and wet weather occur. In the Fall, apply most materials before autumn rains or after October 1.

Brown rot

Brown rot is a serious disease of stone fruit when wet conditions occur in the orchard. The disease is caused by the fungus *Monilinia fructicola* although other species (i.e. *M. laxa* and *M. fructigena*) have been reported in other regions. There are both floral and fruit phases of the disease. Brown rot is explosive and highly favored by rain events during bloom (blossom infection) and immediately prior to harvest (fruit infection). Many fungicide materials are effective on both brown rot and powdery mildew. Use the products list on the Bloom table for brown rot, as they are effective, and mildew sprays are not recommended at this stage of tree growth. Neither iprodione nor fenbuconazole are first-rate powdery mildew materials. Always follow fungicide resistance management guidelines.

Cherry Powdery Mildew

Powdery mildew, caused by the fungus *Podosphaera clandestina*, is one of the most serious disease of cherries in the Pacific Northwest. The fungus attacks both foliage and (less commonly) fruit. Most cultivars are susceptible to the disease but it is particularly severe on the cultivar 'Sweetheart'. Management of the foliar phase is important because spores that infect fruit are produced on infected leaves. The fungus survives winter as chasmothecia (the sexual fruiting body); epidemics are initiated in spring when moisture results in ascospore release from the overwintering propagules. Ascospore release requires free moisture at 50°F or greater. Ascospores serve as primary inoculum and give rise to powdery mildew

colonies that continually produce millions of asexual spores (conidia). Conidia serve to spread and intensify the epidemic on both foliage and fruit. The disease is favored by moderate temperatures and high humidity. Management of powdery mildew in sweet cherries involves intensive and expensive fungicide application programs. Synthetic fungicide groups 3, 7, 11, and 13 are generally effective against the disease. Sulfurs, summer oils, polyoxin salts, and potassium bicarbonate are also effective and good companion products for the synthetic compounds. There is a great potential for the development of synthetic fungicide resistance in the Pacific Northwest due to the large acreage of sweet cherry cultivation, severe disease pressure and pathogen reproductive rate, and intensive fungicide application regimes. Resistance management practices should be practiced at ALL times.

Coryneum blight (shothole)

Coryneum blight or shothole, caused by *Wilsonomyces carpophilus*, is a fungal disease of minor importance in the Pacific Northwest. The fungus overwinters in twig cankers. Spores are produced on canker surfaces during early spring rains (or over-the-canopy irrigation) and are splashed to foliage and fruit where they germinate, infect, and cause small lesions. The lesions are small and circular. Necrotic lesion centers may drop giving heavily infected leaves a "shothole" appearance. The disease is managed using fungicide programs early in the growing season.

Major Insects

Leafrollers (*Pandemis*, *Obliquebanded*)

Pre-bloom applications of pesticides can be effective and will also conserve natural enemies for leafroller and biological control agents of other pests, such as aphids. If treatments for leafrollers were applied at pink and/or bloom, sampling to determine the density of surviving leafrollers should be completed prior to deciding to apply additional controls at this timing. Most products listed act primarily as stomach poisons versus direct contact to residues, therefore, complete coverage is very important to achieve maximal control. Repeating an application of any product should be based on the leafroller population surviving previous treatments. Use the leafroller models on the WSU Decision Aid System (<https://decisionaid.systems>) for the optimum timing.

Shothole borer

Good sanitation (removing large wood prunings and woodpiles from the orchard) is the best management tactic. Insecticides are only effective against adults. Beetles begin flying in late April and are active through May. The second generation flight begins in late July or early August. Yellow sticky traps placed on orchard borders will detect adult beetle activity. Spraying the border trees (rows) with high water volumes will protect the remainder of the orchard in many situations where external sources are the primary problem.

Spotted-wing drosophila

Spotted-wing drosophila (SWD) is one of the newer invasive species from Asia, first detected in the continental US in 2008, and achieving pest status in eastern Washington in 2010. Among the tree fruits, only cherries are considered to be vulnerable to attack preharvest, although like any drosophilid, SWD will use injured or rotting fruit of any type to complete development. SWD can be controlled by several groups of insecticides, and rotation among MOAs is important for resistance management. Monitoring tools are available, and should be used to gain a general idea of pest pressure in a given year. Experience since 2010 indicates that cold winters, especially those with sudden and extreme cold snaps, will decimate overwintering populations, and result in low pressure the following growing season, with little need for spray coverage. Conversely, mild winters and early springs have preceded extremely high pest pressure, necessitating a full season spray program.

Twospotted spider mite

Twospotted spider mite (TSM) is the most common spider mite pest of pear, although it has a very broad host range and will also feed on other tree fruits. Unlike apple, some

pear cultivars (especially Anjou) have a very low threshold for mite damage, and controls must be applied at lower populations. Like all spider mites, TSM is an induced pest that will be controlled by natural enemies (especially predatory mites) if no disruptive sprays are applied. TSM can also feed on a number of broadleaf weeds, and reservoirs of both pest and predator can build up on the orchard floor. Mowing and herbicide applications beneath the tree may have unintended consequences for population in the tree canopy.

Western cherry fruit fly

Western cherry fruit fly is the key direct pest of cherries, and quarantine regulations create a zero tolerance for this pest. Adult flies lay eggs in the fruit, and the larvae feed and develop inside the fruit until they are ready to pupate. A baited yellow sticky trap can be used for monitoring adult emergence of the single generation per year, and a degree-day model is available. Females have a 7–10 day pre-oviposition period, so sprays (either canopy or bait sprays) can start about a week after first fly detection or when the model predicts emergence. Fly emergence continues after harvest, so post-harvest clean up sprays will help prevent future problems, especially if unharvested fruit remains in the orchard. Many of the materials that kill western cherry fruit fly are also effective on spotted-wing drosophila; the neonicotinyls are a notable exception.

White apple leafhopper

Adults fly from late May until frost. Monitor nymphs on the underside of leaves. Egg parasitoid *Anagrus* spp. attacks overwintering and summer eggs. Only control this indirect pest when necessary. Carbaryl, if used for apple thinning, is also a very effective leafhopper material but the canopy spray technique may not provide adequate coverage for leafhopper control.

Spray Schedule

Dormant

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Bacterial canker or gummosis	copper hydroxide Kocide 3000	See Label	48 h	0 d	M1	NR	
	fixed copper Basic Copper 53	See Label	24 h	0 d	M1	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Delayed dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Black cherry aphid	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		NR	
Cutworms	chlorpyrifos Lorsban Advanced	See label	4 d	none listed	1B	4	
	indoxacarb Avant 30DG	6 oz	12 h	14 d	22A	4	
European red mite	clofentezine Apollo 4SC	4-8 fl oz	12 h	21 d	10A	NR	
	hexythiazox Savvy 50DF	4-6 oz	12 h	28 d	10A	NR	
	petroleum oil-dormant petroleum oil-dormant	1-1.5 % v/v	12 h	none listed		3-4	Organic
San Jose scale & Lecanium scale	chlorpyrifos + petroleum oil-dormant Lorsban Advanced + petroleum oil-dormant	4 pt. 1-1.5 % v/v	4 d	none listed	1B	NR	
	petroleum oil-dormant petroleum oil-dormant	6 gal	12 h	none listed		NR	Organic

TABLE CONTINUED

Delayed dormant (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Two-spotted spider mite	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Prebloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on label. Do not apply more than 2.88 quarts product per acre per season.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	copper hydroxide Kocide 3000	See Label	48 h	0 d	M1	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	tebuconazole + trifloxystrobin Adament 50W/G	4-8 oz	12 h	1 d	3, 11	NR	
	trifloxystrobin Gem 25W	6-8 oz	12 h	1 d	11	NR	
	ziram + copper hydroxide Ziram Granulito 76WDG + Kocide 3000	See Label	48 h	14 d	M3	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Black cherry aphid	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	NR	

TABLE CONTINUED

Prebloom (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cutworms	indoxacarb Avault 30DG	6 oz	12 h	14 d	22A	4	
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	Bts are stomach poisons so complete coverage is very important for control. Two or three applications are usually required. Apply when forecasts predict a warm weather pattern for 3 or more days. This spray timing is too early to control obliquebanded leafroller. Organic
	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil. Make a second application at petal fall if disease-conducive weather occurs.
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	NR	

TABLE CONTINUED

Bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot (continued)	triflumizole Procure 480SC	10-16 fl oz	12 h	1 d	3	NR	Do not apply more than 96 fl oz of Procure 480SC per acre per season.
Cherry Powdery Mildew	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on label. Do not apply more than 2.88 quarts product per acre per season.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	difenoconazole Inspire	7 fl oz	12 h	0 d	3	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	flutriafol Topguard	6-8 fl oz	12 h	7 d	3	NR	
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	metconazole Quash 50WDG	3.5-4 oz	12 h	14 d	3	NR	
	metrafenone Vivando	15.4 fl oz	12 h	7 d	U8	NR	Max 2 applications per year (30.8 fl oz). Do not apply with petroleum oils. Do not exceed 2 sequential applications.
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil. Make a second application at petal fall if disease-conducive weather occurs.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d			Do not apply to oil-sensitive varieties. Do not spray wet foliage. Do not spray when freezing temperatures are anticipated within 48 hours of an oil application, above 90 °F (32 °C) or when plants are under heat or moisture stress. Do not apply between pit hardening and harvest.
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Good Organic Apply every 7-10 days.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	NR	Apply every 7-10 days.
	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	quinoxyfen Quintec 2.08 L	7 fl oz	12 h	7 d	13	NR	

TABLE CONTINUED

WSU 2019 Crop Protection Guide for Tree Fruit

Bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew (continued)							
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	triflioxystrobin Gem 25W	4-8 oz	12 h	1 d	11	NR	
	triflumizole Procure 480SC	8-16 fl oz	12 h	1 d	3	NR	Do not apply more than 96 fl oz of Procure 480SC per acre per season.
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on label. Do not apply more than 2.88 quarts product per acre per season.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Petal fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captan 50WP	4 lb	24 h	0 d	M4	NR	Do not apply Captan if oil will be used at any time for mildew control.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot (continued)	fluopyram + triflioxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	triflumizole Procure 480SC	10-16 fl oz	12 h	1 d	3	NR	Do not apply more than 96 fl. oz. per acre per season.
	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
Cherry Powdery Mildew	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	fluopyram + triflioxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	flutriafol Topguard	6-8 fl oz	12 h	7 d	3	NR	
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	metconazole Quash 50WDG	4 oz	12 h	14 d	3	NR	
	metrafenone Vivando	15.4 fl oz	12 h	7 d	U8	NR	Do not exceed 2 applications per year (30.8 fl oz). Do not apply with petroleum oils. Do not exceed 2 sequential applications.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew (continued)	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d			Do not spray wet foliage. Do not spray when freezing temperatures are anticipated within 48 hours of an oil application, above 90 °F (32 °C) or when plants are under heat or moisture stress. Do not apply between pit hardening and harvest.
polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	NR	Apply every 7–10 days.	
polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7–10 days.	
potassium bicarbonate Kalgreen	See Label	4 h	1 d	NC	NR		Organic
pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR		
quinoxyfen Quintec 2.08L	7 fl oz	12 h	7 d	13	NR		
tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR		
triflumizole Procure 480SC	8-16 fl oz	12 h	1 d	3	NR	Do not apply more than 96 fl. oz. per acre per season.	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fruittree leafroller	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	10 d	28	NR	
	flubendiamide Belt 4SC	4 fl oz	12 h	7 d	28	NR	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. <i>kurstaki</i> DiPel DF	See Label	4 h	0 d	11B2	3	Apply when warm weather is predicted for 3 or more days. Two or three applications per pest generation may be required to achieve adequate control. Organic
	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	10 d	28	4	
	flubendiamide Belt 4SC	4 fl oz	12 h	7 d	28	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	3	Some leafroller populations have developed resistance to Intrepid and its use could result in reduced levels of control.
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded) (continued)	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	Organic
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	3-4	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Shuck fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention Information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	4 lb	24 h	0 d	M4	NR	Do not use Captain if using oil for mildew control.
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	Do not apply within 14 days of an oil application.

TABLE CONTINUED

Shuck fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot (continued)	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adamant 50WDG	4-8 oz	12 h	1 d	3, 11	NR	
	triflumizole Procure 480SC	10-16 fl oz	12 h	1 d	3	NR	Do not apply more than 96 fl. oz. of PROCURE 480SC per acre per season.
Cherry Powdery Mildew	azoxystrobin Abound 2.08F	11-15.5 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	difenoconazole Inspire	7 fl oz	12 h	0 d	3	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	3.5-4 oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil.
	pentriopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d			Good Organic Do not apply between pit hardening and harvest.
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Do not spray wet foliage. Do not spray when freezing temperatures are anticipated within 48 hours of an oil application, above 90°F (32°C) or when plants are under heat or moisture stress. Do not apply between pit hardening and harvest.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	NR	Apply every 7-10 days.
	potassium bicarbonate	See Label	4 h	1 d	NC	NR	Organic
	pyraclostrobin Kalogreen						
	pyraclostrobin + boscalid Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	quinoxyfen Quintec 2.08L	7 fl oz	12 h	7 d	13	NR	

TABLE CONTINUED

Shuck fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew (continued)	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	Do not apply within 14 days of an oil application.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	4 lb	24 h	0 d	M4	NR	Do not use Captain if using oil for mildew control.
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Black cherry aphid	acetamiprid Assail 70WP	2.3 oz	12 h	7 d	4A	NR	
	imidacloprid Admire Pro 4.6L	1.4-2.8 fl oz	12 h	7 d	4A	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	3	Two or three applications are usually required. Apply when forecasts predict a warm weather pattern for 3 or more days. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	3	
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	14 d	7C	4	Time pyriproxyfen to coincide with the presence of the last larval stage but before pupae are present.
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	

TABLE CONTINUED

Shuck fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded) (continued)	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	Organic
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	3-4	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
White apple leafhopper	carbaryl Sevin 4F	1-2 pt	12 h	3 d	1A	4	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Late spring and summer

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	4 lb	24 h	0 d	M4	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	NR	

TABLE CONTINUED

Late spring and summer (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	metconazole Quash 50WDG	3.5-4 oz	12 h	14 d	3	NR	
	metrafenone Vivando	15.4 fl oz	12 h	7 d	U8	NR	Max 2 applications per year (30.8 fl oz.). Do not apply with petroleum oils. Do not exceed 2 sequential applications.
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d			Do not apply to oil-sensitive varieties. Do not spray wet foliage. Do not spray when freezing temperatures are anticipated within 48 hours of an oil application, above 90°F (32°C) or when plants are under heat or moisture stress. Do not apply between pit hardening and harvest.
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Good Organic Apply every 7-10 days.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	NR	Apply every 7-10 days.
	potassium bicarbonate Kalgreen	See Label	4 h	1 d	NC	NR	Organic
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	quinoxyfen Quintec 2.08L	7 fl oz	12 h	7 d	13	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury

TABLE CONTINUED

Late spring and summer (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew (continued)	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry rust mite	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	3	Two or three applications are usually required to achieve acceptable control of high populations. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	4	
	flu bendiamide Belt 4SC	4 fl oz	12 h	7 d	28	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	3	Some leafroller populations have developed resistance to Intrepid and its use could result in reduced levels of control.
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	14 d	7C	4	Time pyriproxyfen to coincide with the presence of the last larvae stage but before pupae appear. Timing for leafrollers should also provide control of scale.
	spinetoram Delegate 25WG	4.5-7 oz	4 h	7 d	5	4	
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	3-4	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	There is a Washington 24(c) label for Entrust that allows a shorter preharvest interval, but has more restrictions on rates and timing. See label. Organic
Peachtree Borer	Peach Tree Borer pheromone Isomate-P	See Label	none listed	none listed	NR		
Pear slug	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	10 d	28	NR	
	lambda-cyhalothrin Warrior II	1.5 fl oz	24 h	14 d	3	NR	Pyrethroids are broadly toxic to predatory mites, and repeated use of such products may cause mite flare-ups.
	spinetoram Delegate 25WG	4.6 oz	4 h	7 d	5	NR	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear slug (continued)	spinosad Success 2F	4 fl oz	4 h	see note	5	NR	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
San Jose scale & Leanium scale	pyriproxyfen Esteem 35WP	4-5 oz	12 h	14 d	7C	NR	Time pyriproxyfen to coincide with the presence of the last larvae stage but before pupae appear. Timing for leafrollers should also provide control of scale.
Shothole borer	acetamiprid Assail 30SG esfenvalerate Asana XL	8 oz	12 h	7 d	4A	NR	
Spider mites	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	NR	Apply sprays in early May.
Spotted-wing drosophila	lambda-cyhalothrin Warrior II	2.56 fl oz	24 h	14 d	3	NR	Pyrethroids are broadly toxic to predatory mites, and repeated use of such products may cause mite flare-ups.
	malathion Malathion ULV	16 fl oz	12 h	1 d	1B	NR	Apply malathion ULV by air only (ULV is NOT mixed with any water) (see text—Aerial Application). Malathion Aquamul 8 applied by ground may cause leaf injury. Activity against spotted-wing drosophila is only a few days.
	spinetoram Delegate 25WG	7 oz	4 h	7 d	5	NR	
	spinosad Entrust SC	8 fl oz	4 h	7 d	5	NR	There is a Washington 24(c) label for Entrust that allows a shorter preharvest interval, but has more restrictions on rates and timing. See label. Organic
	spinosad Success 2F	8 fl oz	4 h	see note	5	NR	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
Western cherry fruit fly	acetamiprid Assail 70WP carbaryl Sevin XLR Plus imidacloprid Admire Pro 4.6L	2.3-3.4 fl oz	12 h	7 d	4A	NR	WARNING: multiple applications of carbaryl may cause mite problems.
	malathion Malathion ULV	16 fl oz	12 h	1 d	1B	NR	Apply malathion ULV by air only (ULV is NOT mixed with any water) (see text—Aerial Application). Malathion Aquamul 8 applied by ground may cause leaf injury. Activity against spotted-wing drosophila is only a few days.
	spinetoram Delegate 25WG	4-4.5 oz	4 h	7 d	5	NR	

TABLE CONTINUED

Late spring and summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Western cherry fruit fly (continued)	spinosad GF-120 0.02% Bait	20 fl oz	4 h	0 d	5	NR	This is a spinosad formulation registered specifically for management of Tephritis fruit flies. This product has not proven sufficiently effective for the control of spotted wing drosophila. Monitor carefully for SWD if you use this bait. Apply to alternate rows with special auxiliary applicator; dilute with no more than 3 quarts of water per acre. Reapply after rain. For application method, see label. Organic
	spinosad Entrust SC	4.8-6 fl oz	4 h	7 d	5	NR	There is a Washington 24(c) label for Entrust that allows a shorter preharvest interval but has more restrictions on rates and timing. See label. Organic
	spinosad Success 2F	4-6 fl oz	4 h	see note	5	NR	Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Preharvest and harvest

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	

TABLE CONTINUED

Preharvest and harvest (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot (continued)	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	NR	
Cherry Powdery Mildew	azoxystrobin Abound 2.08FL	11-15 fl oz	4 h	0 d	11	NR	Azoxystrobin is extremely toxic to certain apple varieties. See label for further information.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	metconazole Quash 50WDG	3.5-4 oz	12 h	14 d	3	NR	
	metrafenone Vivando	15.4 fl oz	12 h	7 d	U8	NR	Max 2 applications per year (30.8 fl oz.). Do not apply with petroleum oils. Do not exceed 2 sequential applications.
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil. See remarks in shuck fall section.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7-10 days.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	NR	Apply every 7-10 days.
	potassium bicarbonate Kalgreen	See Label	4 h	1 d	NC	NR	Organic
	pyraclostrobin Cabrio 20EG	9.5 oz	12 h	0 d	11	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	NR	
	quinoxyfen Quintec 2.08L	7 fl oz	12 h	7 d	13	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury

TABLE CONTINUED

Preharvest and harvest (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew (continued)	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	NR	
	tebuconazole + triflioxystrobin Adamant 50WG	8 oz	12 h	1 d	3, 11	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Spotted-wing drosophila	lambda-cyhalothrin Warrior II	2.56 fl oz	24 h	14 d	3	NR	Pyrethroids are broadly toxic to predatory mites, and repeated use of such products may cause mite flare-ups.
	malathion Malathion ULV	16 fl oz	12 h	1 d	1B	NR	Apply malathion by air only, ULV, not mixed with water. See text—Aerial Application. Activity against spotted-wing drosophila is only a few days.
	spinetoram Delegate 25WG	7 oz	4 h	7 d	5	NR	
	spinosad Entrust SC	8 fl oz	4 h	7 d	5	NR	There is a Washington 24(c) label for Entrust that allows a shorter preharvest interval but has more restrictions on rate and timing. See label. Organic
	spinosad Success 2F	8 fl oz	4 h	see note	5	NR	
Western cherry fruit fly	carbaryl Sevin 4F	4 pt	12 h	3 d	1A	NR	Carbaryl may cause mite flare-ups, especially with multiple applications.
	imidacloprid Admire Pro 4.6L	1.4-2.8 fl oz	12 h	7 d	4A	NR	
	malathion Malathion ULV	16 fl oz	12 h	1 d	1B	NR	Apply malathion by air only, ULV, not mixed with water. See text—Aerial Application.
	spinetoram Delegate 25WG	4-4.5 oz	4 h	7 d	5	NR	
	spinosad GF-120 0.02% Bait	20 fl oz	4 h	0 d	5	NR	This is a spinosad formulation registered specifically for management of Tephritis fruit flies. This product has not proven sufficiently effective for the control of spotted wing drosophila. Monitor carefully for SWD if you use this bait. Apply to alternate rows with special auxiliary applicator; dilute with no more than 3 quarts of water per acre. Re-apply after rain. Organic
	spinosad Success 2F	4-6 fl oz	4 h	see note	5	NR	
	spinosad Entrust SC	4-6 fl oz	4 h	7 d	5	NR	There is a Washington 24(c) label for Entrust that allows a shorter preharvest interval but has more restrictions on rate and timing. See label. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Bacterial canker or gummosis	copper hydroxide Kocide 3000	See Label	48 h	0 d	M1	NR	
	fixed copper Basic Copper 53	See Label	24 h	0 d	M1	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Stone Fruit Programs

Major Diseases

Bacterial canker or gummosis

Bacterial canker or gummosis (*Pseudomonas syringae*) is a serious disease of cherry in the Pacific Northwest. It is particularly damaging to young trees and can result in replanting issues if unmanaged. Spread of the pathogen is favored by cool, moist weather. Optimum timing for control of bacterial gummosis is in late winter before trees break dormancy, spring frost, and wet weather occur. In the Fall, apply most materials before autumn rains or after October 1.

Brown rot

Brown rot is a serious disease of stone fruit when wet conditions occur in the orchard. The disease is caused by the fungus *Monilinia fructicola* although other species (i.e. *M. laxa* and *M. fructigena*) have been reported in other regions. There are both floral and fruit phases of the disease. Brown rot is explosive and highly favored by rain events during bloom (blossom infection) and immediately prior to harvest (fruit infection). Many fungicide materials are effective on both brown rot and powdery mildew. Use the products list on the Bloom table for brown rot, as they are effective, and mildew sprays are not recommended at this stage of tree growth. Neither iprodione nor fenbuconazole are first-rate powdery mildew materials. Always follow fungicide resistance management guidelines.

Coryneum blight (shothole)

Coryneum blight or shothole, caused by *Wilsonomyces carpophilus*, is a fungal disease of minor importance in the Pacific Northwest. The fungus overwinters in twig cankers. Spores are produced on canker surfaces during early spring rains (or over-the-canopy irrigation) and are splashed to foliage and fruit where they germinate, infect, and cause small lesions. The lesions are small and circular. Necrotic lesion centers may drop giving heavily infected leaves a "shothole" appearance. The disease is managed using fungicide programs early in the growing season.

Peach leaf curl

Peach leaf curl, which is caused by the fungus *Taphrina deformans*, is a relatively common disease of minor economic importance. The disease first appears as reddish areas on the leaf surface; these areas eventually pucker, blister, and become severely deformed.

Defoliation may occur. Symptoms typically appear about 2 weeks after bud break. Wet and cool weather during and immediately after bud break favors the disease.

Powdery Mildew (Stone Fruit)

Powdery mildew of soft fruit is caused by a fungus (*Podosphaera pannosa*) different from the powdery mildew of cherry. If unmanaged losses due to powdery mildew can become quite severe. The fungus attacks both fruit and foliage and survives winter on bud scales. Conidia produced on bud scales serve as primary inoculum. Fruit are most susceptible to infection prior to pit hardening. The disease is managed with fungicide spray programs.

Major Insects

Leafrollers (*Pandemis, Obliquebanded*)

Pre-bloom applications of pesticides can be effective and will also conserve natural enemies for leafroller and biological control agents of other pests, such as aphids. If treatments for leafrollers were applied at pink and/or bloom, sampling to determine the density of surviving leafrollers should be completed prior to deciding to apply additional controls at this timing. Most products listed act primarily as stomach poisons versus direct contact to residues, therefore, complete coverage is very important to achieve maximal control. Repeating an application of any product should be based on the leafroller population surviving previous treatments. Use the leafroller models on the WSU Decision Aid System (<https://decisionaid.systems>) for the optimum timing.

Peach twig borer

Use the phenology model on the the WSU Decision Aid System (<https://decisionaid.systems>) to time insecticides.

Plum aphids

Several different aphid species can attack stone fruit. They are generally not a problem when a regular spray program is used to control other insects. The most effective of these programs would be a delayed-dormant spray of oil with an appropriate pesticide. After the aphids become active and leaves begin to curl they are more protected and harder

to control. Attempts at late season control can disrupt predators. Low populations in the orchard early in the season may be beneficial in attracting predators. Later in the season, predators and migration to summer hosts should keep populations at acceptable levels. Aphids returning from summer hosts in the fall lay overwintering eggs on stone fruit. Fall-applied aphicides may prevent egg-laying, and thus next year's spring population.

San Jose scale

San Jose scale can be a minor pest if adequately controlled, or escalate into a major problem if not. It primarily infests the trunk and limbs, but scale crawlers will settle on the fruit. Damage to this season's crop may become serious, but ultimately the infestation of wood may cause death of limbs or the entire tree. Oil plus an organophosphate in the delayed dormant spray provide control; if the organophosphate is omitted (oil only), monitor the trees carefully and add one of the listed materials if scale become numerous.

Shothole borer

Good sanitation (removing large wood prunings and woodpiles from the orchard) is the best management tactic. Insecticides are only effective against adults. Beetles begin flying in late April and are active through May. The second generation flight begins in late July or early August. Yellow sticky traps placed on orchard borders will detect adult beetle activity. Spraying the border trees (rows) with high water volumes will protect the remainder of the orchard in many situations where external sources are the primary problem.

White apple leafhopper

Adults fly from late May until frost. Monitor nymphs on the underside of leaves. Egg parasitoid *Anagrus* spp. attacks overwintering and summer eggs. Only control this indirect pest when necessary. Carbaryl, if used for apple thinning, is also a very effective leafhopper material but the canopy spray technique may not provide adequate coverage for leafhopper control.

Spray Schedule

Dormant

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shothole)	chlorothalonil Bravo Ultrex 82.5WDG	See Label	12 h	none listed	M5	apricot, peach, nectarine, plum	NR	
copper hydroxide	Kocide 3000	See Label	48 h	0 d	M1	apricot, peach, nectarine, plum	NR	
fixed copper	Basic Copper 53	See Label	24 h	0 d	M1	apricot, peach, nectarine, plum	NR	
ziram	Ziram Granulio 76WDG	6-8 lb	48 h	30 d	M3	apricot, peach, nectarine	NR	
Peach leaf curl	chlorothalonil Bravo Ultrex 82.5WDG	See Label	12 h	none listed	M5	apricot, peach, nectarine	NR	
	fixed copper Basic Copper 53	20 lb	24 h	0 d	M1	apricot, peach, nectarine	NR	
	ziram	Ziram 76DF	See Label	48 h	30 d	M3	apricot, peach, nectarine	NR
	thiram	Thiram Granulio 75WDG	3.5 lb	24 h	7 d	M3	peach	NR

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Delayed dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Cutworms	chlorpyrifos Lorsban Advanced - trunk spray	See Label	4 d	14 d	1B	peach, nectarine, plum	NR	Trunk spray; apply only as a dormant or delayed dormant spray. Make only one application of chlorpyrifos per year.
European red mite	petroleum oil- dormant petroleum oil- dormant	1-1.25 % v/v	12 h	none listed		peach, nectarine, apricot, plum	3-4	Targeting overwintering eggs at this timing. Oil is indispensable for an integrated mite control program. Avoid spraying oil during cool (lower than 45°F), damp, or windy weather. Adequate agitation is required. Do not use over 5 gallons of oil per acre on mature trees. Organic
Green peach aphid	esfenvalerate + petroleum oil- dormant Asana XL + petroleum oil-dormant	6-8 fl oz 1-1.25 % v/v	12 h	14 d	3A	peach, nectarine	NR	May cause increased mite problems, especially when used after delayed dormant.
	petroleum oil- dormant petroleum oil-dormant	1-1.25 % v/v	12 h	none listed		peach, nectarine, apricot, plum	NR	Organic
San Jose scale & Lecanium scale	chlorpyrifos + petroleum oil- dormant Lorsban Advanced + petroleum oil-dormant	4 pt 1-1.25 % v/v	4 d	none listed	1B	peach, nectarine, plum	NR	
	methidathion + petroleum oil- dormant Supracide 2E + petroleum oil-dormant	8 pt 1-1.25 % v/v	3 d	none listed	1B	peach, nectarine, apricot, plum	NR	
	petroleum oil- dormant petroleum oil-dormant	6 gal	12 h	none listed		peach, nectarine, apricot, plum	NR	Organic
	pyriproxyfen + petroleum oil- dormant Esteem 35WP + petroleum oil-dormant	4-5 oz 1-1.25 % v/v	12 h	14 d	7C	peach, nectarine, apricot, plum	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Prebloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	metconazole Quash 50WDG	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot	NR	
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captan 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Prebloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shothole) (continued)	chlorothalonil Bravo Ultrex 82.5WDG	See Label	12 h	none listed	M5	peach, nectarine, apricot	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	nectarine, apricot	NR	
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	nectarine, apricot, plum	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Grape mealybug, mealy plum aphid, leaf curl plum aphid	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	peach, nectarine, apricot, plum	NR	
	fosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki Dipel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot	3	This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	4	PHI for apricot is 14 d; 1 d for peach, nectarine, and plum. This is a stomach poison so complete coverage is very important for efficacy. Repeat applications of product should be based on pest pressure and the efficacy of the initial treatments based on sampling.

TABLE CONTINUED

Prebloom (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (<i>Pandemis</i> , <i>Oblliquebanded</i>) (continued)	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	3-4	PHI for apricot is 14 d; 1 d for peach and nectarine; so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. Entrust is a spinosad formulation registered for organic production. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control. Organic
Lecanium scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	peach, nectarine, apricot, plum	NR	
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	14 d	7C	peach, nectarine, apricot, plum	NR	
Oriental fruit moth	OFM pheromone dispensers CheckMate OFM	See Label	none listed	none listed		peach, nectarine, apricot, plum	NR	Organic
Peach twig borer	Bacillus thuringiensis subsp. kurstaki Dipel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	NR	This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	Altacor and Belt are in the same chemical class and are very effective on peach twig borer larvae.
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	Belt and Altacor are in the same chemical class and are very effective on peach twig borer larvae.

TABLE CONTINUED

Prebloom (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Peach twig borer (continued)	spinetoram Delegate 25WG	3-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI for apricot is 14 d; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot, 1 d for peach and nectarine, and on plum. Entrust is a spinosad formulation registered for organic production. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control. Organic
Peach silver mite	proargite Omite 30WS	5 lb		2 d sweet cherry, 5 d nectarine	14 d 12C	nectarine	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	See Application Directions, Resistance Management, and Attention Information on label. Abound is extremely phytotoxic to certain apple varieties.

TABLE CONTINUED

Bloom (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot (continued)	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR		
iprodione Rovral 4F	1-2 pt	24 h	none listed	2	peach, nectarine, apricot, plum	NR	Apply at 5% bloom. Apply again at full bloom or petal fall if disease-conducive weather occurs.	
penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR		
pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR		
sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.	
tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.	
tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR		
thiram Thiram Granulito 75WDG	3.5 lb	24 h	7 d	M3	peach	NR	Apply at 3-4 day interval during bloom. See label for fruit rot management recommendations. Not for use on nectarines.	
metconazole Quash 50WDG	4 oz	12 h	14 d	3	apricot	NR		
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Cutworms	chlorpyrifos Lorsban 75WG - trunk spray	16 lb	4 d	14 d	1B	peach	NR	Trunk spray; apply only as a dormant or delayed dormant spray. Make only one application of chlorpyrifos per year.

TABLE CONTINUED

Bloom (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	3	Use when predicted high temperatures are >65 degrees for 3+ days. Bt has a short residual activity, and may require 2–3 applications per generation. Organic

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Petal fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR	
	metconazole Quash 50WDG	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	See label for specific use recommendations. Place into solution before adding oil.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot (continued)	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
	iprodione Roval 4F	1-2 pt	24 h	none listed	2	apricot	NR	
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	chlorothalonil Bravo Ultrex 82.5WDG	See Label	12 h	none listed	M5	peach, nectarine, apricot, plum	NR	Apply no later than shuck split.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
Powdery Mildew (Stone Fruit)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.

TABLE CONTINUED

Petal fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit) (continued)	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	See label for specific use recommendations. Place into solution before adding oil.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Grape mealybug, mealy plum aphid, leaf curl plum aphid	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	peach, nectarine, apricot, plum	NR	
	imidacloprid Provado 1.6F	8 fl oz	12 h	see note	4A	peach, nectarine, apricot, plum	NR	PHI for plum is 7 d; PHI for apricot, nectarine, and peach is 0 d.
	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Green peach aphid	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	peach, nectarine, apricot, plum	NR	
	imidacloprid Provado 1.6F	4-8 fl oz	12 h	see note	4A	peach, nectarine, apricot, plum	NR	PHI for plum is 7 d; PHI for apricot, nectarine, and peach is 0 d.
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	3	Use when predicted high temperatures are >65 degrees for 3+ days. Bt has a short residual activity and may require 2-3 applications per generation. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	3	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, plum	4	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	3-4	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.

TABLE CONTINUED

WSU 2019 Crop Protection Guide for Tree Fruit

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	peach, nectarine, apricot, plum	NR	
	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	
	fosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. [Organic]
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling.
Peach twig borer	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	NR	Use when predicted high temperatures are >65 degrees for 3+ days. Bt has a short residual activity and may require 2-3 applications per generation. [Organic]
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot	NR	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Petal fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Peach twig borer (continued)	phosmet Imidan 70W	4.25 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate 25WG	7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. [Organic]
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling.
Western flower thrips	spinetoram Delegate 25WG	7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	2.5 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. [Organic]
	spinosad Success 2F	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	3	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Shuck fall

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR	
	metconazole Quash 50WDG	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11.7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Shuck fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shothole)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR		
penthiopyrad Fontelis		14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR		
tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR		
ziram Ziram Granulfo 76WDG	6 lb	48 h	30 d	M3	peach, nectarine, apricot	NR		
Powdery Mildew (Stone Fruit)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	lime sulfur/calcium poly sulfide lime sulfur/calcium polysulfide	See Label	48 h	2 d		peach, nectarine, plum	NR	Do not apply to apricots. Organic
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Shuck fall (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit) (continued)	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	See label for specific use recommendations. Place into solution before adding oil.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	14.5 oz	12 h	0 d	11, 7	apricot	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	3	Use when predicted high temperatures are >65 degrees for 3+ days. Bt has a short residual activity and may require 2-3 applications per generation. This product is a stomach poison so complete coverage is very important for efficacy. <u>Organic</u>
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	3	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	4	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. The product is a stomach poison so complete coverage is very important for efficacy.

TABLE CONTINUED

Shuck fall (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (<i>Pandemis</i> , Obliquebanded) (continued)	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	3-4	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. The product is a stomach poison so complete coverage is very important for efficacy. Organic

Notes: Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Summer

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR		
metconazole Quash 50WDG	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR		
penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR		
pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR		
sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Apply 2-3 weeks after shuck fall. Do not apply to apricots.	
tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.	
tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR		
thiram Thiram Granulio 75WDG	3.5 lb	24 h	7 d	M3	peach	NR		
azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR		
Powdery Mildew (Stone Fruit)								

TABLE CONTINUED

Summer (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit) (continued)	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	lime sulfur/calcium poly sulfide lime sulfur/calcium polysulfide	See Label	48 h	2 d		peach, nectarine, plum	NR	Do not apply at temperatures above 84 °F. Allow 30 days to elapse between lime-sulfur and oil sprays. Do not apply to apricots. <u>Organic</u>
	metconazole Quash 50WDG	2.5-3.5 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Apply 2-3 weeks after shuck fall. Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adamant 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Earwigs	carbaryl Sevin 4F	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	Apply to trunk and base of tree. Do not apply on blooming cover crops because of hazard to bees.
Grape mealybug	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Grape mealybug (continued)	imidacloprid Provado 1.6F	4-8 fl oz	12 h	see note	4A	peach, nectarine, apricot, plum	NR	PHI for plum is 7 d; PHI for apricot, nectarine, and peach is 0 d.
Grasshoppers and Mormon crickets	carbaryl Svin 4F	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	Do not apply on blooming cover crops because of hazard to bees.
Leafrollers (Pandemis, Obliquebanded)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	3	Apply when warm weather is predicted for 3 or more days. This product is a stomach poison so complete coverage is very important for efficacy. Two or three applications per pest generation may be required to achieve adequate control. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	4	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	3	
	spinetoram Delegate 25WG	7 oz	4 h	see note	5	peach, nectarine, apricot, plum	4	Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	3-4	PHI for apricot is 14 d; 1 d for peach and nectarine; and 7 d for plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications should be based on pest pressure and the efficacy of the initial treatments based on sampling. Some leafroller populations have developed resistance to spinosad products and repeated use of these products during the growing season could result in reduced levels of control.
								Notes: Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.

TABLE CONTINUED

Summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
McDaniel spider mite, two-spotted spider mite, European red mite	bifentiazate Acramite 50WS	0.75-1 lb	12 h	3 d	un	peach, nectarine, apricot, plum	NR	
	clofentezine Apollo 4SC	4-8 fl oz	12 h	21 d	10A	peach, nectarine, apricot	NR	This product is most effective on the egg stage; does not control adult spider mites.
	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	peach, nectarine, plum	NR	
	hexythiazox Savey 50DF	3-6 oz	12 h	28 d	10A	peach, nectarine, apricot, plum	NR	
	spirodiclofen Envidor 2SC	18 fl oz	12 h	7 d	23	peach, nectarine, apricot, plum	NR	
	propargite Ornith 30WS	5-6 lb	2 d sweet cherry, 5 d nectarine	14 d	12C	nectarine	NR	User higher rate for European red mite.
Oriental fruit moth	chlorantraniliprole Altacor 35WDG	4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	
	methoxyfenozide Intrepid 2F	10-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	NR	
	phosmet Imidan 70W	3-4.25 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth (continued)	spinetoram Delegate 25WG	7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot, 1 d for peach and nectarine, and 7 d on plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. Organic
Peach silver mite	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Apply 2-3 weeks after shuck fall. Do not apply to apricots.
	propargite Omite 30WS	5 lb		2 d sweet cherry, 5 d nectarine	14 d	12C	nectarine	NR
Peach twig borer	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	flubendiamide Belt 4SC	4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	NR	
	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Summer (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Peach twig borer (continued)	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot	NR	PHI is 14 d on apricot, 1 d for peach and nectarine, and 7 d on plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
Peachtree Borer	Peach Tree Borer pheromone Isomate-P	See Label	none listed	none listed	peach, nectarine, apricot, plum	NR	Apply dispensers in late June or when the first moths are caught in pheromone traps. Place dispensers in upper half of canopy.	
	chlorpyrifos Lorsban Advanced	See Label	4 d	none listed	1B	peach, nectarine, plum	NR	Apply as a trunk spray, using a handgun directed at the trunk and soil at the base of the trees.
Plum rust mite	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Apply 2-3 weeks after shuck fall. Do not apply to apricots.
San Jose scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	peach, nectarine, apricot, plum	3	
Shothole borer	acetamiprid Assail 30SG	8 oz	12 h	7 d	4A	peach, nectarine, apricot, plum	NR	
	esfenvalerate Asana XL	14.5 fl oz	12 h	14 d	3A	peach, nectarine, apricot, plum	4	
White apple leafhopper	cabaryl Sevin XLR Plus	2-3 pt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Preharvest and harvest

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound 2.08F	12-15.5 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	captan Captain 50WP	See Label	24 h	0 d	M4	peach, nectarine, apricot, plum	NR	
	metconazole Quash 50WDG	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	sulfur, dry flowable sulfur, dry flowable	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + sulfur Unicorn DF	2-3 lb	5 d	0 d	3, M2	peach, nectarine, plum	NR	Do not apply to apricots.
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
	thiram Thiram Granulfl 75WDG	3.5 lb	24 h	7 d	M3	peach	NR	

TABLE CONTINUED

Preharvest and harvest (continued)

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit)	azoxystrobin Abound 2.08F	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	Abound is extremely phytotoxic to certain apple varieties. See Application Directions, Resistance Management, and Attention information on the label.
	azoxystrobin + difenoconazole Quadris Top	12-14 fl oz	12 h	0 d	11, 3	peach, nectarine, apricot, plum	NR	The azoxystrobin component of Quadris Top is extremely toxic to certain apple varieties. See label for further information.
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	2 d		peach, nectarine, plum	NR	Do not apply to apricots. <u>Organic</u>
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	tebuconazole + trifloxystrobin Adament 50WG	4-8 oz	12 h	1 d	3, 11	peach, nectarine, apricot, plum	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth	carbaryl Sevin 4F	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.

TABLE CONTINUED

Preharvest and harvest (continued)

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth (continued)	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. <small>Organic</small>
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot, 1 d for peach and nectarine, and 7 d on plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
Peach twig borer	carbaryl Sevin 4F	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	
	chlorantraniliprole Altacor 35WDG	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	flubendiamide Belt 4SC	3-4 fl oz	12 h	7 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate 25WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.
	spinosad Entrust SC	8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot; 1 d for peach, nectarine, and plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling. <small>Organic</small>
	spinosad Success 2F	4-8 fl oz	4 h	see note	5	peach, nectarine, apricot, plum	NR	PHI is 14 d on apricot, 1 d for peach and nectarine, and 7 d on plum. This product is a stomach poison so complete coverage is very important for efficacy. Repeat applications of any product should be based on pest pressure and the efficacy of the initial treatments based on sampling.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Apple Sunburn

Sunburn damage costs apple growers tens of millions of dollars annually and is often the number one cause of fruit cullage for apples grown in the Pacific Northwest. Growers often lose more than 10% of their apples to sunburn unless they have used some means of protecting their fruit from sunburn damage. There are three types of apple sunburn: (i) Sunburn Necrosis, (ii) Sunburn Browning, and (iii) Photo-Oxidative Sunburn. Apple fruit are susceptible to sunburn because they have a much higher thermal mass (the ability of a material to absorb and store heat energy) than leaves and are not able to dissipate this heat as well as leaves. It is important to remember that fruit temperature can be considerably higher (20–30°F) than the air temperature, for example, 125°F fruit surface temperature and 95°F air temperature in the afternoon.

Sunburn Browning is caused by a combination of UV-B radiation and high fruit surface temperature (115–120°F, depending on variety). Risk parameters for sunburn browning are maximum daily air temperature and mean maximum hourly temperature between 11 am and 5 pm. WSU DAS has a model for sunburn browning available. Sunburn browning is the major type of sunburn in Washington. A yellow, bronze or brown spot develops on the sun-exposed side of the peel, but may not appear for a few days.

Sunburn Necrosis occurs when the fruit surface temperature is greater than 125°F for as little as 10 minutes and results in cell death. Development is exacerbated by low relative humidity.

Photo-Oxidative Sunburn is caused when the fruit experiences a shock exposure to visible light and the light bleaches the peel. This is temperature independent and can even occur when the air temperature is less than 64°F. Risk factors are hand thinning, selective picking, branch movement, summer pruning, harvest and transit.

While sunburn obviously affects the apple's external appearance, recent research has revealed that internal fruit quality is also affected in apples with even slight sunburn. Increased flesh firmness and sugar content

have been noted in apples with sunburn browning at harvest and during storage, but titratable acidity (TA) decreased as severity of sunburn browning increased, especially throughout the storage season. Since TA is not only directly related to tartness in the taste of apples, but also provides the metabolic fuel for the development of most flavor components, fruit with diminished acid levels are often considered to be bland and undesirable by consumers.

Effective strategies to mitigate sunburn damage and improve fruit quality are to reduce FST and/or UV-B light exposure to fruit. Growers in Washington have three basic options to achieve this goal: (i) Evaporative cooling (EC), (ii) Protective netting, and (iii) Sprayable sunburn protectants. While these strategies have been proven to reduce apple sunburn incidence, none are 100% effective under extreme heat and light conditions. For maximum protection during severe weather periods, growers should consider a combination of strategies.

Evaporative cooling is very effective for lowering FST of apples, but EC alone does not adequately reduce damaging UV rays; thus, sunburn can occur even with EC.

Protective netting may be deployed above the orchard canopy or draped directly over apple trees and has proven to be effective at reducing sunburn incidence, as well as conferring other benefits such as protecting against hail damage, reducing wind stress, and potentially excluding some invasive insect pests and birds.

Growers seeking immediate, temporary relief from sunburn pressure at lower up-front costs than installing an EC system or protective nets should consider the application of **sprayable sunburn protectants**. These products generally fall into one of five categories: (1) Kaolin clay-based particle films (e.g. Surround WP), (2) Calcium carbonate-based particle films (e.g. Eclipse, Diffusion, MicroCal), (3) Talc-based particle films (e.g. Invelop), (4) Calcium oxide (e.g. DeccoShield), and (5) UV-blocking wax matrices (e.g. Raynox). When properly applied, most sprayable sunburn protectants can reduce sunburn symptoms by up to 50% in apple fruit. Wax-based products like Raynox may be used in combination with EC to achieve even greater protection from sunburn than either strategy alone. Since sunburn incidence is highest in unshaded fruit that are exposed

to direct sun (typically in the tops of trees), good spray coverage to the upper portion of tree canopies is critical. In some cases, helicopter applications may be superior to tractor-pulled sprayers.

Some particle films, particularly those comprised of kaolin clay, can be challenging to wash off the fruit surface during packing and growers should consult with their warehouse before using these products aggressively near harvest.

Sunburn on apples: DO NOT mix RAYNOX and Surround in the same tank; they are physically incompatible. Do not apply RAYNOX and Surround in the same season on the same trees.

See General Recommendations for guidelines on table use. Read all product labels carefully.

Sunburn on apples

Product	Except where noted, rates are amount per acre (amount per 100 gallons in dilute sprays)
Diffusion	2-4 gal (2-4 gal)
Diffusion O	2-4 gal (2-4 gal)
Eclipse	2.5-3 gal (2.5-3 gal)
Microcal	2.5-3 gal (2.5-3 gal)
Raynox	2.5 gal (2.5 gal)
Surround WP Kaolin clay	25-50 lb (25-50 lb)

Diffusion: Apply prior to heat event and repeat every 2-3 weeks as needed. Residue removal on the packing line may be improved by acidifying rinse water to pH 5.5 or below.

Diffusion O: Apply prior to heat event and repeat every 2-3 weeks as needed. Residue removal on the packing line may be improved by acidifying rinse water to pH 5.5 or below.

Eclipse: Re-apply as needed to maintain adequate coverage as fruit grows.

Microcal: Re-apply as needed to maintain adequate coverage as fruit grows.

Raynox: Follow manufacturer's label, and apply 2.5 gal. RAYNOX in either 50 or 100 gal. water conditioned with RAYNOX water softener (according to label). To maintain good coverage of fruits as they expand, four applications should be made: first about 7 weeks after full bloom; 2nd 10 days later; third 3 weeks later; and fourth 4 weeks later. Do not apply when air temperature exceeds 85°F.

For RAYNOX AIR, mix 2.5 gal RAYNOX AIR in 15 gal. of conditioned water. Apply no less than 17.5 gallons of spray volume per acre. Four applications should be made as described above for RAYNOX.

For RAYNOX ORGANIC, mix 3.0 gal RAYNOX ORGANIC in 47 or 97 gallons of water (no RAYNOX water softener is needed). Four applications should be made as described above for RAYNOX.

Surround WP: Follow manufacturer's label. At least three applications are recommended. Do not apply any substance with or on top of particle film sprays that will increase the difficulty of removal.

Cherry Rain Cracking

Rain-Induced Cherry Cracking of sweet cherries induced by rain is often the greatest single cause of fruit cullage. Even in the arid regions east of the Cascade Mountains in the Pacific Northwest, cherry growers know how devastating a rain event can be if it occurs when cherries are nearing maturity. Cherry cracking has been studied for several decades, but the causes of cracking are still not fully understood.

Evidence exists for two causes of cherry cracking. The first relates to excessive water being supplied to the fruit through the tree's vascular system and is termed "plant internal water-induced cracking". This builds up tensile forces acting on the skin from inside the fruit. This cracking can occur in orchards that have been over-irrigated and can be exacerbated when rain follows shortly after irrigation or with large fluctuations in soil water content. There are no well-established remedies for this type of cracking.

The more common type of cracking occurs as a result of direct osmotic water absorption through the fruit cuticle and skin and is termed "rain-induced cracking". Consequently, factors affecting the permeability of the cuticle and skin are of major importance in determining fruit resistance to water absorption. Penetration of the cuticle occurs by diffusion or by mass flow through cuticular cracks and other surface structures. As water penetration through the cuticle increases, the cuticle can separate from the epidermal cell wall. As more water is absorbed, the inner epidermal cell wall swells and detaches from sub-epidermal cells. Cellular contents are lost from epidermal cells near the fracture. Swelling of the epidermal cell wall region results in cuticular fracturing that generally precedes fruit cracking. This is the putative mechanism for postharvest cracking which can manifest in the packinghouse or during shipping.

Physical Water Removal

Fruit losses from rain-induced cracking can be reduced by drying cherries with airblast sprayer fans or helicopter rotor wash shortly after a rain event.

Osmoticum Sprays

Salts (usually calcium chloride) can be used to reduce

and slow the osmotic infiltration of water into the fruit by decreasing the osmotic potential of the water on the fruit surface. To be effective, the salt must be on the fruit surface while there is water on the surface. As these salts are water-soluble, they will need to be re-applied after a rain event.

An application rate of 0.5–1.0 % CaCl₂ has proven effective if the system and automated program are effective in supplying an adequate concentration of CaCl₂ at the appropriate time. A non-ionic wetter/spreader should improve effectiveness. Note that the salt can leave a residue on the fruit that will require postharvest washing.

Fruit Coatings

Parka and RainGard contain natural compounds that supplement the natural fruit cuticle and seal micro-fractures, limiting the movement of water on the fruit surface into the fruit; coatings do not reduce internal-water cracking. Coatings require good fruit coverage to be effective.

These products have the greatest efficacy when they have fully dried on the fruit surface before the onset of rain. As cherry fruit grow, the protective coating from these products breaks apart, so 2–3 repeat applications at 7–10-day intervals are advised to maintain adequate coverage throughout the period of cracking susceptibility.

There are cultivar differences in cracking susceptibility, and cherries generally become more susceptible to rain-induced cracking as they mature, but recent research has demonstrated that there is considerable variability in cracking susceptibility from site to site within the same year, as well as year-to-year at the same site. It can, therefore, be difficult for growers to anticipate how vulnerable their fruit is to rain damage at any given time. A simple benchtop test is available to help cherry growers make informed decisions about when to protect their fruit vs. saving money on sprays or helicopters. More information on this test is available from the WTFRC at tinyurl.com/cracking-test.

See General Recommendations for guidelines on table use. Read all product labels carefully.

Cracking from rain

Product	Except where noted, rates are amount per acre (amount per 100 gallons in dilute sprays)
Parka	1-2 gal (0.5-1 gal)
RainGard	102 fl oz (102 fl oz)

Parka: Do not exceed 1% V/V Parka in spray solution. Do not apply with surfactants, stickers, or pinolene-based materials. Consult product label for more details. Parka has been reported to cause phytotoxicity in some sensitive cherry varieties; growers are advised to consult with warehouse field staff or Extension personnel for more information. RainGard: Follow manufacturer's label, and apply 102 ounces RainGard in 100 gal. water. Best efficacy is obtained with 0.8% (v/v) dilution and must be maintained with larger spray volumes to improve coverage. In addition, to maintain good coverage of fruits as they expand, three applications should be made. First application is made about 4 weeks before harvest with additional applications at 7-10 day intervals thereafter.

RainGard is usually compatible with commonly used agricultural products to be tank mixed.

Apple Chemical Thinning

Apple chemical bloom and postbloom thinning programs are intended to reduce the current season's crop load in pursuit of three fundamental goals: 1) inhibit fruit set to minimize green fruitlet hand thinning; 2) improve size and quality of surviving fruit; and 3) promote return bloom to encourage annual cropping. Successful chemical thinning usually requires comprehensive programs employing multiple chemistries during the bloom and postbloom period. Bloom thinners (applied when flowers are open and viable) reduce fruit set by damaging flower parts and/or inducing plant stress. Most postbloom thinners (applied after petal fall) typically mimic the effect of plant hormones to elicit a specific physiological response (e.g. increased ethylene evolution, which triggers fruitlet abortion) to achieve reductions in crop load.

Fertilized flowers become more difficult to thin with each passing day, making early, aggressive thinning strategies more successful than those which rely primarily on chemical applications after 10 mm fruitlet size. Research indicates that early thinning results not only in more significant reductions in fruit set, but greater improvements fruit size, fruit quality, and return bloom. Even with more aggressive chemical rates, applications of postbloom chemical thinners after 15 mm fruitlet size are usually of marginal benefit in typical Washington conditions. Timings based on weather and crop developmental stage (i.e. mean fruitlet diameter) are generally more reliable and accurate than those based on the calendar (i.e. days after full bloom). Application timing for chemical bloom thinners may be improved with the guidance of pollen tube growth models available on WSU's AgWeatherNet system (weather.wsu.edu); these models can be used to predict when apple flowers are effectively fertilized, which can be helpful information when making chemical thinning decisions.

Chemical thinning efficacy is a function of many factors, including apple cultivar and strain, rootstock, tree condition, pollen strength and density, bee activity, weather, product chemistry, rate, application method, timing, and coverage. Therefore, thinning programs should be customized to individual blocks. Select materials, timings, and rates accordingly and observe

label recommendations and restrictions. Spring frosts can induce significant fruitlet abortion in lower parts of the tree, but upper parts of the canopy may still be overcropped; in these cases, thinning sprays targeted to tree tops are often advisable to keep the trees in balance and discourage alternate bearing.

Response to chemical thinners can vary relative to weather conditions before, during, and after application, especially in the case of postbloom materials. Caution should be exercised when applying thinning materials in temperatures above 80°F, especially during dark, cloudy conditions, as fruitlet abortion and/or phytotoxicity may become excessive in some cases. Thinner efficacy may be diminished below 60°F, but low temperatures can also temporarily mask the symptoms of a significant thinning response; growers dissatisfied with the performance of thinning sprays during cool conditions may be well advised to wait for a few days of warm temperatures to reassess fruit set before applying additional thinners. See individual product labels for additional guidance.

Effective chemical thinning is more difficult in some apple cultivars; Fuji, Golden Delicious, and Cameo generally require more aggressive tactics (i.e. more applications and/or higher rates) than do Red Delicious, Gala, Cripps Pink (Pink Lady®), Granny Smith, Honeycrisp, Jonagold, or Braeburn to achieve comparable results. Spur-type Red Delicious are often more difficult to thin than non-spur Red Delicious. Ineffective thinning can result in over-cropping and induce alternate (biennial) bearing in many apple cultivars, especially Fuji, Golden Delicious, Cameo, and Honeycrisp. Unfortunately, alternate bearing cycles are easy to establish and difficult to break and can dramatically hurt orchard profitability over time. Early, aggressive chemical thinning programs should be the first defense against over-cropping, but consistent annual bearing may also be promoted with effective use of bioregulators; please refer to the section "Apple Plant Growth Regulators" for more information.

Research has shown that materials which damage sensitive flower parts (stigmas, styles, pollen) and/or induce whole-tree stress can reduce fruit set. Programs which have shown promise in experimental settings

include caustic salts, weak acids, lime sulfur, and combinations of spray oils and lime sulfur. Lime sulfur programs not only damage floral anatomy but can kill growing pollen tubes in pollinated flowers, as well as temporarily depress plant photosynthesis, inducing apple trees to abort some fruitlets which may have already been fertilized. Because their success is not solely reliant on damaging recently exposed organs in unpollinated flowers, lime sulfur-based thinning programs have shown more of a “kickback” effect than caustic salts in research studies. Sequential applications of lime sulfur

or oil + lime sulfur can have a cumulative effect on plant stress and typically increase levels of thinning. Growers might improve their chances of hitting chemical thinning objectives with the use of pollen tube growth models to time their bloom thinning applications; these models may be accessed on WSU's AgWeatherNet system (<http://weather.wsu.edu/>).

See General Recommendations for guidelines on table use. Read all product labels carefully.

Bloom thinning on apples

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
Difficult to thin varieties including Golden Delicious, Fuji, Cameo, Pacific Rose	lime sulfur/calcium polysulfide + fish oil lime sulfur/calcium polysulfide + Crocker's Fish Oil	1-3 % v/v 2 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide + petroleum oil, summer lime sulfur/calcium polysulfide + petroleum oil, summer	1-3 % v/v 1-1.5 % v/v	48 h	0d	Organic
	lime sulfur/calcium polysulfide + petroleum oil-dormant lime sulfur/calcium polysulfide + petroleum oil-dormant	1-3 % v/v 0.5-1 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	6-12 % v/v	48 h	none listed	Organic
Easy to thin varieties including Red Delicious, Gala, Braeburn, Cripps Pink, Jonagold, Granny Smith, Honeycrisp	lime sulfur/calcium polysulfide + fish oil lime sulfur/calcium polysulfide + Crocker's Fish Oil	1-2 % v/v 2 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide + petroleum oil, summer lime sulfur/calcium polysulfide + petroleum oil, summer	1-2 % v/v 1-1.5 % v/v	48 h	0d	Organic
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	4-10 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide + petroleum oil-dormant lime sulfur/calcium polysulfide + petroleum oil-dormant	1-2 % v/v 0.5-1 % v/v	48 h	none listed	Organic
	Notes: Lime sulfur is registered for use as a bloom thinner either alone or in combination with horticultural oil products on Red Delicious, Golden Delicious, Gala, Fuji, Honeycrisp, Braeburn, Cameo, Cripps Pink (Pink Lady®), Granny Smith, Jonagold, or Pacific Rose. Oils tend to increase the penetration and efficacy of lime sulfur, requiring lower concentrations of lime sulfur when combined with oils to achieve desirable results. If using oil with lime sulfur, consult the oil label for specific use guidelines. A maximum of three applications can be made during bloom according to the needs of the individual block.				

Postbloom thinning on apples

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
Postbloom thinning all varieties	6-BA Exilis Plus 6-BA MaxCel	46-122 fl oz 48-128 fl oz	12 h 12 h	86 d 86 d	See notes for Exilis 9.5SC. See notes for Exilis 9.5SC.
	6-BA Exilis 9.5 SC	9.6-25.6 fl oz	12 h	86 d	6-benzyladenine (BA) is a cytokinin analog which has the ability to thin fruitlets as well as enhancing cell division in developing fruit, ultimately resulting in larger fruit size. For thinning, use one to two applications of BA when king-bloom fruit are 5-10 mm fruit diameter according to specific recommendations of the product label. Best results are obtained when BA is combined with carbaryl or NAA and temperatures greater than 65 °F occur during and for a period of several days following application. If increased fruit size is desired without reducing fruit set, BA may be used by itself at lower concentrations than the maximum allowed by the label (see section on promotion of fruit size). Use a well-calibrated sprayer for BA applications to ensure uniform and complete coverage. Spray volumes of 100 to 200 gallons per acre should be adequate for most orchard spacings and tree row volumes.
	NAA Fruitone N	1.2-8 oz	48 h	2 d	NAA (K-Salt Fruit Fix 200, K-Salt Fruit Fix 800, Fruitone, PoMaxa, Refine). Naphthaleneacetic acid (NAA) is an auxin analog which can be applied from petal fall to 30 days past full bloom, with best results occurring from applications between 5-15 mm. The thinning effects of NAA increase dramatically when apple trees are under photosynthetic stress, so exercise caution if applying shortly before or during hot and/or cloudy conditions. Use higher concentrations of NAA if applying without a surfactant; see product label for more guidance. To increase thinning, tank mix NAA with other thinning agents such as carbaryl or 6-BA.
	NAA PoMaxa	0.5-4 fl oz	48 h	2 d	See NAA comments for Fruitone N.
	K-Salt Fruit Fix 200	0.48-4.8 fl oz	48 h	2 d	See NAA comments for Fruitone N.
	NAD Amid-Thin W	2.4-8 oz	48 h	none listed	Naphthaleneacetamide (NAD) is chemically similar to NAA and can be used on varieties other than Red Delicious, where it may cause abnormally small (pygmy) fruit. Apply from petal fall to 14 days past full bloom. When the weather is cool after bloom, delay applications until the largest fruit are 2-3 mm in diameter and forecasted temperatures after spraying are above 50 °F, and preferably above 65 °F. Use higher concentrations of NAD if applied without a surfactant; see product label for more guidance. To increase thinning, tank mix NAD with carbaryl (see section on carbaryl).

TABLE CONTINUED

Postbloom thinning on apples (continued)

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
Postbloom thinning all varieties (continued)	carbaryl Sevin 4F-chemical thinning	1-3 qt	12 h	3 d	Carbaryl is a carbamate-class insecticide that also mimics the action of auxins and can be applied to apple as a chemical thinner any time from 80% petal fall to 16 mm fruit size. Results from carbaryl depend on temperature, chemical rates, variety, and pollination. Other factors to consider include potential toxicity to bees in or near the orchard and possible impacts on mite management. Please check the product label for additional guidance. Carbaryl may be applied with NAA or NAD; their use in combination is more effective than when used separately. For optimal response, apply the combination of carbaryl + NAD or NAA at 3–10 mm fruit diameter. Excessive thinning may occur if daytime temperatures are above 80 F. Caution: Many formulations of carbaryl are highly toxic to bees; use 4F or 4L formulations, which are less hazardous. If open bloom is present, apply when bees are not foraging. Before using any carbaryl formulation, it is advisable to eliminate flowers in the cover crop (i.e., by mowing) to minimize bee kill. Carbaryl can also be highly toxic to predatory mites and the rust mites on which they feed. The hazard is greatest in orchards where carbaryl has not been used extensively and little resistance has developed. Reduce the hazard of injury to mites by directing sprays towards tree tops, applying early in the season, and limiting the total number of applications.
	ethephon Motivate	1.5-6 pt	48/72 h	7 d	Ethepron is a synthetic precursor of ethylene and may be applied with carbaryl, NAA, and/or NAD to increase fruit thinning and promote return bloom. Applications for thinning are most effective 10–20 days after full bloom. Caution: high rates of ethepron may reduce fruit size; Red Delicious fruit shape may also be affected by inhibiting calyx-end development when applied earlier than 3 weeks after bloom. Please refer to the product label for more guidance and section "Apple Plant Growth Regulators" for more information on other uses of ethepron.

Pear Chemical Thinning

Like apple, chemical thinning in pear is intended to reduce the current season's crop load in pursuit of three fundamental goals: 1) inhibit fruit set to minimize green fruitlet hand thinning; 2) improve size and quality of surviving fruit; and 3) promote return bloom to encourage annual cropping. While many pear varieties largely self-regulate their crops without chemical intervention, well-managed chemical and hand thinning programs can increase the long term profitability of some varieties including Bartlett. Some pear blocks can struggle to set commercially adequate levels of fruit and it may be advisable to clearly assess pear set before applying chemical thinners, especially when conditions have been cool and/or wet during bloom

Postbloom thinning on pears

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
All varieties	6-BA Exilis Plus 6-BA + 6-BA Exilis 9.5 SC + Exilis 9.5 SC	46-122 fl oz 1 lb 9.6-25.6 fl oz	12 h 12 h	86 d 86 d	
Bartlett, Bosc	6-BA MaxCel	48-128 fl oz	12 h	86 d	BA may be applied when pears are 5–15 mm in diameter to reduce fruit set; increase fruit size, and promote return bloom.
Bartlett, Bosc, Comice	NAA PoMaxa NAD Amid-Thin W	4 fl oz 1.6-8 oz	48 h 48 h	2 d none listed	Can be used to thin pears 15–28 days after full bloom. For best results, apply NAA products with a surfactant (wetting agent) when temperatures are between 70° and 75°F.
	NAA Fruitone N NAA K-Salt Fruit Fix 200 NAA Refine 6.25L	12-20 oz 8-12 fl oz 8-12 fl oz	48 h 48 h 48 h	2 d 2 d 2 d	

Apple Plant Growth Regulator Programs

Apples - bearing

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To advance maturity and promote red color	ethephon Motivate	1-4 pt h	48/72 h	7 d	<p>Notes: To promote more color by advancing fruit maturity, ethephon (Motivate) can be applied 7 to 21 days before expected harvest, depending on cultivar and season of fruit maturity. Follow label instructions carefully. Applications to advance maturity 3 to 5 days can result in smaller fruit size and shorten the storage life of fruit not harvested at proper maturity. Ethepron may not promote color when warm weather persists late in the season. Ethepron may not improve color on poor-coloring varieties and standard strains; it is less effective on interior, shaded fruit. Caution: Ethepron promotes abscission and fruit drop. Use in combination with a preharvest stop-drop spray. Ethephon is not effective for color change on Golden Delicious or advancing maturity of Granny Smith.</p>
To decrease preharvest fruit drop, delay watercore and improve harvest maturity management	AVG ReTain	0.73 lb 12 h		7 d	<p>Notes: ReTain. ReTain (aminoethoxyvinylglycine, AVG) is an inhibitor of ethylene biosynthesis in fruit tissues and can be used to adjust harvest timing and control fruit drop registered for use on both apples and pears. Inhibition of ethylene biosynthesis in apples delays maturation and permits fruit to remain on the trees longer for better color and greater size without adverse effects on storage life. For pear growers, ReTain may help maintain fruit firmness for 7–10 days. The manufacturer recommends that ReTain be applied once 4 weeks before the anticipated beginning of normal harvest for that season based on appropriate maturity indices of untreated fruit. If fruit will be harvested using a multiple-pick schedule, ReTain should be applied once at 1–2 weeks before the start of normal harvest of untreated fruit. The recommended application rate for ReTain is 50 grams active ingredient per acre (one 0.73-lb. pouch per acre). Variety-specific rates have not been determined. If weather conditions are not favorable for ReTain application, apply slightly earlier to avoid problems with PHI. Tank-mixes with NAA or ethephon are discouraged because these products may counteract the ethylene inhibition produced by Re Tain. Tank mixes with Biobit, DiPel, or XenTari biological insecticides are permitted. For optimum response, apply ReTain during periods of slow drying conditions to enhance uptake. ReTain should be applied in a sufficient amount of water to ensure thorough wetting of the fruit, but not to runoff. Use tree row volume. Do not use overhead irrigation or cooling systems for at least 8 hours following a Re Tain application. To minimize foaming of spray mixture, fill spray tank with half the amount of water needed for the final spray volume, add Re Tain (in its soluble packaging) and continue to fill tank. Add the surfactant just prior to filling the tank. Minimize agitation of the mixture. Use approved surfactants at a concentration of between 0.05% and 0.1% v/v (0.4–0.8 pint/100 gallons maximum). Compatibility and performance data with anti-foaming agents are not available; such products are not recommended for use with ReTain.</p>

TABLE CONTINUED

Apples - bearing (continued)

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To increase fruit size	6-BA Exilis Plus	6-30 fl oz	12 h	86 d	Make 2–4 applications starting at petal-fall and repeating at 3- to 10-day intervals. Apply when temperatures will exceed 65°F for a few days following application. Do not apply within 86 days of harvest. Follow all label instructions.
	6-BA MaxCel	6-32 fl oz	12 h	86 d	Make 2–4 applications starting at petal-fall and repeating at 3- to 10-day intervals. Apply when temperatures will exceed 65°F for a few days following application. Do not apply within 86 days of harvest.
	6-BA Exilis 9.5 SC	1.3-6.4 fl oz	12 h	86 d	Make 2–4 applications starting at petal-fall and repeating at 3- to 10-day intervals. Apply when temperatures will exceed 65°F for a few days following application. Do not apply within 86 days of harvest. Follow all label instructions.
To prevent preharvest fruit drop (apples)	NAA K-Salt Fruit Fix 200	16-32 fl oz	48 h	2 d	
	NAA Fruitone N	4-8 oz	48 h	2 d	
	NAA K-Salt Fruit Fix 800	4-8 fl oz	48 h	2 d	
	NAA Refine 6.25L	16-32 fl oz	48 h	2 d	
	NAA PoMaxa	See Label	48 h	2 d	
	NAA Refine 24.2L	4-8 fl oz	48h	2 d	
	Notes: NAA (K-Salt Fruit Fix 200, K-Salt Fruit Fix 800, Fruitone, PoMaxa, Refine) may be used to control preharvest drop of apples. NAA does not actually re-tighten the pedicel (fruit stem) after application, but retards the development of the abscission layer between the pedicel and the spur. Experimental evidence shows that NAA sprays are best applied alone and are more effective at dilute concentrations. Application timing of NAA products to control preharvest drop of apples is critical. Generally, NAA should be applied 7 to 14 days prior to planned harvest, but no closer than 2 to 5 days before harvest. NAA becomes effective for reducing fruit drop 3 to 4 days following application and has an effective period of 2 weeks. NAA has been applied as a stop-drop for apples by aircraft in those cases where it is not possible or desirable to make ground-based applications. By aircraft, the rate used is 0.25 to 0.5 pint of NAA 800 per acre. See manufacturer's label for specific recommendations as products may differ. NAA does not completely suppress fruit ethylene production; NAA-treated fruit may show evidence of changes in skin color and/or flesh softening during the interval between application and harvest, even though the typical climacteric ripening response may not be observed and fruit drop is reduced. Growers should frequently monitor both fruit maturation and fruit loosening following NAA application. Careful attention to these possible changes can help growers take advantage of reduced fruit drop while minimizing the risk of losses at harvest and/or of problems after storage.				
To promote return bloom	NAA PoMaxa	2-8 fl oz	48 h	2 d	
	NAA Fruitone N	1.2-2.1 oz	48 h	2 d	
	ethephon Motivate	0.5-3 pt	48/72 h	7 d	

TABLE CONTINUED

Apples - bearing (continued)

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To promote return bloom (continued)	Notes: Young trees that are slow to bear or mature trees that produce only a limited number of flowers in off years may be helped by applications of ethephon (Motivate). Delay ethephon application until at least 5–6 weeks after bloom (after the beginning of June drop) to avoid excessive fruit thinning. NAA products (K-Salt Fruit Fix 200, K-Salt Fruit Fix 800, Fruition, PoMaxa, Refine) may similarly be applied as a single application at 3–5 ppm five to six weeks after bloom to induce flowering the following year. If results are unsatisfactory after the first year, 1–2 applications may be required the next year at 7–10 day intervals to stimulate flowering. Biennial or alternate bearing can be problematic in a number of apple cultivars, particularly Golden Delicious, Honeycrisp, Cameo, and Fuji. In an "on" year, trees in biennial cycles set heavy crops which generally produce high numbers of small fruit, often with poor color and eating quality, in the "off" year, flowering and fruit set are typically very low, resulting in small yields of large fruit that can be prone to physiological disorders such as bitter pit. Effective pruning and chemical thinning are crucial to mitigating biennial bearing patterns, but strategic use of plant growth regulators may also help promote consistent annual cropping. Ethephon may be applied 5–6 weeks after bloom in the heavy crop year to improve flowering the next season. NAA may also be applied in single or multiple applications at 3–5 ppm starting five to six weeks after bloom to induce flowering the following year. Even though these spray programs may be popular in some sectors of the apple industry, growers should be advised that ethephon and NAA have rarely increased return bloom in several years of WA research trials. Caution: Applications of ethephon may reduce fruit size. Early-season applications of ethephon before the start of June drop may cause excessive thinning. Use of ethephon on weak trees can produce excessive thinning, excessive flowering the following season, and stunting of growth.				
To suppress fruit russet	GA4 + 7 ProVide 10SG	2.1-3.5 oz	4 h	none listed	Organic
	GA4 + 7 NovaGib 10L	20-33 fl oz	4 h	none listed	
Vegetative growth control in apple	prohexadione calcium Apogee PGR	6-24 oz	12 h	45 d	
	prohexadione calcium Kudos 27.5 WDG	6-20 oz	12 h	45 d	

TABLE CONTINUED

Apples - bearing (continued)

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
Vegetative growth control in apple (continued)	Notes: Prohexadione calcium (Apogee, Kudos 27.5WDG) is a potent inhibitor of gibberellin biosynthesis. Gibberellins are associated with normal shoot elongation during the growing season. Inhibition of these naturally occurring gibberellins can produce a decrease in shoot growth and overall tree vigor. The control of vegetative growth allows a balance between canopy development and fruit growth and may favorably affect fruit quality. Prohexadione calcium applications to vigorous apple trees in Washington research trials, however, have not resulted in improved flowering the following year. Similarly, research trials with prohexadione calcium in Washington have not produced beneficial changes in fruit postharvest or storage behavior. Manufacturers' labels indicate prohexadione calcium can be used on trees with various levels of vigor, from high to low. However, under Washington growing conditions, prohexadione calcium is recommended ONLY on medium to high vigor trees. Prohexadione calcium has not shown beneficial effects on low vigor trees under Washington conditions. Evidence from other growing regions indicates prohexadione calcium may reduce the incidence of shoot blight infections from the fireblight (<i>Erwinia amylovora</i>) bacterium. Successful control of fire blight using prohexadione calcium in Washington has not been demonstrated. Treatment of vigorous shoots with prohexadione calcium does not necessarily result in the stimulation of terminal bud formation. If shoots do not form terminal buds, they have the potential to resume growth later in the season. Research with prohexadione calcium in Washington has shown that two or more applications in the spring can still result in a second growth flush in midsummer, although the vigor of this flush is reduced with a greater number of applications. Once a prohexadione calcium program is started, be sure to maintain an application sequence of every 2–3 weeks per application to sustain the active control over GA biosynthesis in the new shoots. Once a second growth flush has started, this second, midsummer flush is difficult to control with additional applications, especially if there was an interruption in the application sequence earlier in the growing season. Growth control from a single application of prohexadione calcium lasts only a short time (4 to 6 weeks maximum under most conditions). A minimum of two applications per season is advised under Washington conditions, but more may be needed to maintain season-long control over shoot growth. For best results, the first application should be made early, when newly-forming terminal shoots are no more than about 1 inch in length. The second and any subsequent applications should be made at intervals of 2–3 weeks. Good results have been obtained in Washington using a rate of 6–12 ounces per 100 gallons spray volume of water. Spraying dilute (i.e. 200 gallons per acre) tends to increase product efficacy. Growers should carefully follow the growth response to prohexadione calcium in their orchards and make adjustments in both rate and timing as necessary to improve the response. In Washington research trials, properly applied low volume sprays have proven as effective as dilute spray volumes. Three to five applications may be necessary for high vigor trees having a light crop load. Follow label directions for adjuvants and recommendations for mixing and applying prohexadione calcium. Note: Applications of 12 ounces/100 gallons at pink and repeated within 14 days provide the greatest effect. Being late with the application(s) will reduce the result. The effectiveness of prohexadione calcium can be reduced if it is applied in water containing high concentrations of calcium salts such as calcium carbonate, typical of "hard" water. It is better to use water free of calcium salts. If using "hard" water, add one pound of high-quality, spray-grade ammonium sulfate for each pound of Apogee or Kudos 27.5WDG used, check spray water pH and adjust to a pH value lower than 7 if spray water is alkaline in pH. CAUTION: This approach may not produce satisfactory growth control if prohexadione calcium is applied in high-calcium water. Do not mix prohexadione calcium with any spray products containing calcium; the efficacy of the prohexadione calcium will likely be reduced.				

Apples non bearing

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To promote lateral branching (1-3 in terminal growth)	GA4 + 7 + BA GA4+7+BA	125-500 ppm	4 h	none listed	0.25-1 pt per 5 gal. Use with surfactant. Notes: Apply at 1 to 3 inches of new terminal growth. Approximately 5 to 10 gal of spray mixture applied with a pressurized hand sprayer will treat 200–300 nonbearing orchard trees 1 to 4 years old. Rate depends on tree vigor. Do not use on weak trees or stunted trees on M9 rootstocks. Do not apply after buds break. Applications after buds have broken may cause some injury to tender shoot tips and fail to promote shoot growth from that point.
To promote lateral branching (bud swell)	GA4 + 7 + BA GA4+7+BA	5000-7500 ppm	4 h	none listed	 Notes: Apply in spring when terminal buds begin to swell but before green tissues emerge. Mix with latex paint. 0.2-0.33 pt per pt of paint. Apply the GA4+7+BA-latex mixture with a brush or sponge to thoroughly cover the bark surface where growth is desired. Apply only to 1-year old wood.

Pear Plant Growth Regulator Programs

Pears - bearing

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To prevent preharvest fruit drop (Anjou, Bartlett, Bosc)	AVG ReTrain	0.73 lb	12 h	7 d	Apply ReTrain 1-2 weeks before start of normal harvest. Follow label instructions.
	NAA K-Salt Fruit Fix 200	2-4 fl oz	48 h	2 d	
	NAA Refine 6.25L	See Label	48 h	2 d	
	NAA PoMaxa	See Label	48 h	2 d	
	NAA Fruitone N	0.88-1.75 lb	48 h	2 d	
	NAA K-Salt Fruit Fix 800	0.5-1 fl oz	48 h	2 d	
	NAA Refine 24.2L	See Label	48 h	2 d	NAA becomes effective as a stop drop 3-4 days after application and typically reduces drop for 2 weeks.

Notes: AVG or aminoethoxyvinylglycine (ReTrain) is an inhibitor of ethylene biosynthesis in fruit tissues and can be used to adjust harvest timing and control fruit drop. It is registered for use on both apples and pears. Inhibition of ethylene biosynthesis delays maturation and permits fruit to remain on the trees longer for greater size without adverse effects on storage life. The preharvest interval (PHI) for ReTrain has been set at 7 days before harvest. ReTrain should be applied to pears once at 7–16 days before the start of normal harvest of untreated fruit. The recommended application rate for ReTrain is 50 grams active ingredient per acre (one 0.73-lb. pouch per acre). If weather conditions are not favorable for ReTrain application, it is suggested that the product be applied slightly earlier to avoid problems with PHI. Apply together with a registered organosilicone surfactant. Tank-mixes of ReTrain with NAA or ethephon are discouraged because these products may counteract the ethylene inhibition produced by ReTrain. For optimum response, apply ReTrain during periods of slow drying conditions to enhance uptake. ReTrain should be applied in a sufficient amount of water to ensure thorough wetting of the fruit, but not to runoff. Pear orchards with denser canopies may require at least 200 gal/acre of water to ensure adequate coverage. Adjust water volumes based on tree size, spacing and canopy density. Do not use overhead irrigation or cooling systems for at least 8 hours following a ReTrain application. To minimize foaming of spray mixture, fill spray tank with half the amount of water needed for the final spray volume, add ReTrain (in its soluble packaging) and continue to fill tank. Add the surfactant just prior to filling the tank. Minimize agitation of the mixture. Use approved surfactants at a concentration of between 0.05% and 0.1% v/v (0.4-0.8 pint/100 gallons maximum). Compatibility and performance data with anti-foaming agents are not available; such products are not recommended for use with ReTrain.

TABLE CONTINUED

Pears - bearing (continued)

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To prevent preharvest fruit drop (Anjou, Bartlett, Bosc) (continued)	Notes: NAA (K-Salt Fruit Fix 200, K-Salt Fruit Fix 800, Fruitone, PoMaxa, Refine) is effective in preventing preharvest drop of pears. NAA does not actually re-tighten the pedicel (fruit stem) after application, but retards the development of the abscission layer between the pedicel and the spur. Application timing of NAA products to prevent preharvest drop of pears is critical. Generally, NAA should be applied 6 to 7 days prior to harvest, but no closer than 2 days before harvest. NAA becomes effective 3 to 4 days following application, and has an effective period of about 2 weeks. Short-stemmed varieties may respond erratically.				

Stone Fruit Plant Growth Regulator Programs

To Delay Fruit Maturity—Sweet Cherries

The normal harvest period for sweet cherries can be extended by use of **GA3 (ProGibb, Falgro, GibGro, N-Large)**. The Falgro, Gibgro or N-Large products should be applied only as a single spray of 16–48 grams active ingredient per acre when fruit is light green to straw colored. ProGibb formulations may be applied once or twice prior to harvest. If applying twice, make the first application when the fruit are translucent green and

the second 3 to 7 days later when the fruit reach straw color. Apply approximately 1/3 to 1/2 of the total allowed amount of 16–48 grams active ingredient in the first application and the remainder in the second application. The application of GA3 delays fruit maturity from three to seven days and gives larger and much firmer fruit, bright green stems, and much longer storage life. Rates of GA3 can be reduced on lightly cropped trees. Complete coverage of the tree is important for uniform fruit maturity.

GA3 can reduce soluble solids and slightly reduce fruit bud set the following year. If reduction in return bloom is observed and not wanted, reduce the amount of GA3 applied per acre in subsequent years.

Sweet Cherry - bearing

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To delay fruit maturity	GA3 Falgro 20SP	0.7-2 oz	4 h	0 d	Organic
	GA3 Falgro 4L	0.2-0.75 pt	4 h	0 d	Organic
	GA3 ProGibb 4%	0.25-0.75 pt	4 h	0 d	Organic
	GA3 ProGibb 40%WSG	0.35-1 oz	4 h	0 d	Organic

Weed Control Pome Fruit

Seasonal Weed Control

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	dichlobenil Casoron 4G	11-150 lb 12 h	none listed	20	NR		WSSA Group 20: inhibits cellulose biosynthesis, disrupts cellulose formation in the cell wall. A soil-active herbicide for long-term or seasonal control of most weeds. Dichlobenil can suppress the growth of some perennials (Canada thistle, quackgrass, field bindweed and bermudagrass), although higher use rates are recommended. Dichlobenil can be applied where weeds are present. Can be used in non-bearing orchards, as long as trees have been established for at least four weeks. More effective when applied in the fall when the soil is cool and still not frozen. Application before a rain will reduce volatility and improve weed suppression. Follow label directions closely for springtime applications.
	indaaziflam Alion 1.67	3.5-6.5 fl oz 12 h	14 d	29	NR		WSSA Group 29: inhibits cellulose biosynthesis, disrupts cellulose formation in the cell wall. Alion is a pre-emergent annual grasses and broadleaf weed herbicide. Rate, timing and tank mixes will effect control. It will not control established perennials or emerged annuals. Excessive crop residue or leaf litter may also reduce efficacy. Apply to trees established for at least three years. Apply as a uniform broadcast or banded application to dry soil surface that does not have cracks or depressions. Do not use on sand or soils containing >20% gravel. Do not apply to frozen/snow covered soils or saturated soils. Light irrigation or rain within three weeks is necessary for incorporation. Spring applications are more effective if glyphosate was used in the previous fall or late summer to control perennial weeds. Avoid direct contact with foliage, green bark, or roots.

TABLE CONTINUED

Seasonal Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)	norflurazon Solicam 78.6DF	2-5 lb	12 h	60 d	12	NR	WSSA Group 12: inhibits carotenoid biosynthesis. Norflurazon is effective against annual grasses and some broadleaf weeds, but is not commonly used except as a partner with another product that can broaden the weed control spectrum. Commonly paired with simazine or diuron. May suppress, but not control, Equisetum (field horsetail, scouring rush). Solicam does not have any post-emergence weed control activity. Solicam can be applied from fall to early spring to non-frozen soil before the weeds emerge. The soil should be settled and firm at the time of application and the surface must be free of soil clods, depressions, weeds and other plant residue. Requires moisture within 4 weeks of application to activate. Due to the long residual nature of this product, make only one application per year, and reduce rates in subsequent seasons to avoid the potential for crop injury. Can be applied to apple at any time, but pears must be established at least 18 months. Grazing of livestock is prohibited.
	oryzalin Surflan AS	2-4 qt	24 h	none listed	3	NR	WSSA Group 3: microtubule assembly inhibitor. Surflan is a pre-emergence herbicide that is particularly effective against annual grasses and some broadleaved weed species. Oryzalin should be applied to weed-free soil or with an approved post-emergence herbicide when established weeds are present. Approved tank-mix partners can increase the spectrum of weed control. Delay application to newly planted trees until ground is settled. Requires rain or irrigation to activate herbicide. Shallow cultivation can control newly germinated weeds without reducing herbicide activity. Lower rate is for 4 month's control; higher rate for 8-12 months. Alternate trade name: Oryzalin 4AS. Grazing of livestock is prohibited.
	oxyfluorfen Goal 2XL	2-6 pt	24 h	none listed	14	NR	WSSA Group 14: protoporphyrinogen oxidase (PPO) inhibitor. Provides both pre-emergent and early post-emergent control of broadleaf weeds in dormant orchards. May require a tank mix partner to control grasses. It is most effective as a post-emergence weed control can be improved by tank-mixing with appropriate partners and adjuvants. Apply as a banded application to bare soil under healthy trees. Do not apply after tree buds start to swell or when foliage or fruits are present. Avoid direct plant contact. Soil moisture within 3 to 4 weeks will enhance pre-emergence herbicide activity.
	oxyfluorfen GoalTender	1-3 pt	24 h	none listed	14	NR	See comments for Goal 2XL.

TABLE CONTINUED

Seasonal Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)	pendimethalin Prowl H2O	2-4 qt	24 h	60 d	3	NR	WSSA Group 3: microtubule assembly inhibitor. Pendimethalin is a pre-emergence herbicide that is particularly effective against grasses. Often used in combination with other residuals, such as simazine or rimsulfuron, to broaden the spectrum of weed control. Pendimethalin should be applied to weed-free soil. Delay application to newly planted trees until ground has settled and no cracks are present. May be surface applied pre-emergence or surface incorporated. If applying before transplanting, do not allow treated soil to come into contact with roots. Contact with leaves, shoots, buds, or fruit may cause injury. The use rate is determined by the weeds requiring control and the length of control needed. Use lower rate for 4 month control and higher rate or 6-8 months control.
	pronamide Kerb 50W	2-6 lb	24 h	none listed	3	NR	WSSA Group 3: microtubule assembly inhibitor. Pronamide is a soil-applied product that is used for the control of grasses (annuals and some perennials) and some broadleaved species. It is most effective on cool season grasses. Pronamide can control some small weeds that have emerged. Pronamide should be applied in the fall after harvest, but before leaf drop and soil freeze up to trash-free soil. Use the lower rates for annual grasses and susceptible broadleaf weeds; use the higher rates for controlling quackgrass. Use rate will also be affected by soil texture; use lower rates on coarse soils. Rainfall or overhead irrigation is required following application. Soil temperatures above 55°F may result in reduced weed control. Do not apply around seedling trees less than 1 year old or fall-transplanted trees established less than 1 year or spring transplanted trees established less than 6 months. Grazing of livestock is prohibited.
	rimsulfuron Matrix FNV	4 oz	4 h	7 d	2	NR	WSSA Group 2: acetolactate synthase (ALS) inhibitor. Matrix has both pre-emergence and very early post-emergence activity. To broaden the weed control spectrum and/or extend the residual effectiveness rimsulfuron may be tank-mixed with other registered herbicides having a different mode of action. Tank mixes well with Alion. For maximum pre-emergence activity, the herbicide should be applied to a soil surface that is smooth and relatively free of crop and weed trash. Rainfall or irrigation is required within 2 weeks of application for pre-emergence incorporation. Susceptible weeds are controlled for 60 to 90 days after application. For best results, maintain spray tank solution at pH 5 to 7. Avoid contact with green bark, foliage, or fruit.

TABLE CONTINUED

Seasonal Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)	simazine Princep 4L	1.6-3.2 qt	12 h	150 d	5	NR	WSSA Group 5, photosystem II inhibitor. Princep is a soil applied herbicide with efficacy against some grasses and broadleaf weeds. Tank mixing with appropriate partners can increase the spectrum of weed control. Do not apply on light sandy or rocky soils with little organic matter. Do not apply to newly established orchards within 150 days of harvest. Moisture is required for activation. PHI for apple is 150 d, no PHI listed for pear.
	simazine Princep Caliber 90	2-3.6 lb	12 h	150 d	5	NR	see comments for Princep 4L.
	terbacil Sinbar 80WDG	2 lb	12 h	60 d	5	NR	WSSA Group 5, Photosystem II inhibitor. Terbacil is labeled for the pre-emergence control of annual weeds in apples; do not use terbacil in pears. Terbacil can be applied to weed-free soil or with an approved post-emergence herbicide if established weeds are present. Do not apply alone to trees established less than three years. A tank mix with diuron can be used on apples at lower rates to reduce the potential for injury. Trees must be established at least two years. More effective when applied in the fall, after November 1, but before ground is frozen. Avoid contact with bark and foliage. If leached into the root system of the tree, terbacil can cause serious tree injury. Do not apply to sandy or gravelly soils or to soils with less than 1% organic matter, particularly if sprinkler irrigation is used. Avoid use for 2 years if replanting is anticipated. Note label recommendations regarding applications under different irrigation systems and follow directions closely. Do not make more than one application per year in the Columbia Basin. Grazing of livestock is prohibited.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Temporary Weed Control

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Broadleaf weeds	2,4-D Saber	3 pt 3 pt	48 h 48 h	14 d 4	NR NR		WSSA Group 4: synthetic auxin. Alternate trade names: Saber, Orchard Master, Weedar 64, Opti-Amine, Amine 4, 2,4-D. Kills most annual and many perennial broadleaf weeds. Apply as directed spray on weeds to point of runoff. Avoid contact with tree foliage, limbs, and trunk. Do not apply during windy periods. Do not apply to shallow or sandy soils. Best results are obtained when applied within 2 days following an irrigation and the weeds are growing actively. In sprinkler-irrigated orchards, apply only after irrigation and never to dry or bare ground. Can be absorbed by tree roots and cause serious injury if carried into the root zone by irrigation. The Gala, Fuji and Golden Delicious apple varieties appear to be more sensitive to root uptake of 2,4-D than other varieties. Reduce possible root uptake by applying 2,4-D at a time of season when frequent irrigation is not necessary. Do not apply to trees established in orchard less than 1 year. Do not apply during bloom. Do not make more than two applications per season. Do not harvest within 14 days of application.
	pyraflufen-ethyl Venue						Group 14: protoporphyrinogen oxidase (PPO) inhibitor. A contact herbicide that is active on annual broadleaf weeds. Use as a directed spray when the weeds are less than 4 inches tall or 3 inches across. Thorough coverage is required for control. Apply during the dormant season and prior to bloom. Addition of a crop oil concentrate or non-ionic surfactant will enhance control. Keep off green stems and foliage, will burn off young green crown and root suckers. Use lower rates for small weeds and higher rate for larger weeds. Tank mixing can increase the weed spectrum that is controlled.
Grass and/or broadleaf weeds	glufosinate-ammonium Rely 280	1.28-2.56 qt	12 h	0 d	14	NR	WSSA Group 10: glutamine synthase inhibitor. Foliage applied, contact herbicide used to control annual broadleaf and grass weeds and to suppress perennial weeds. Apply when weeds are small and actively growing. Stressed weeds may be more difficult to control. Use rate is dependent on weed size and growth stage. Use as a directed spray. Avoid contact of spray or mist on new foliage or green shoots; only apply to trees with calloused, mature, brown bark. Thorough coverage of target weeds is essential for control. No additional surfactant is needed.

TABLE CONTINUED

Temporary Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)							WSSA Group 9: EPSPS inhibitor. Glyphosate is a broad-spectrum, systemic herbicide. It is one of the most commonly applied herbicides and is sold under many trade names. Some of the products containing glyphosate are identical to the original product, others vary in their additives (such as wetting agents) and amount of active ingredient. The parent acid, the "active ingredient," is formulated with ammonium, potassium, or isopropylamine and varies in content per gallon from one product to another. The active ingredient is called "acid equivalent" in glyphosate products, and can range from 3 to 5 pounds per gallon, depending on the product. If you switch products, compare the acid equivalent of the two, and make rate adjustments, if necessary. Repeated use of glyphosate has led to the development of glyphosate resistance in many species common to perennial systems in the West Coast; rotate with other foliar-applied herbicides. Water quality and quantity can affect glyphosate performance; high pH, presence of cations, or dirty water can reduce efficacy. See label regarding adjuvant use.
	glyphosate glyphosate	1-3 qt	4 h	1 d	9	NR	WSSA Group 22: photosystem I electron diverter. PHI for apple is 150 days. For pears none listed. See entry for Bonodry.
	paraquat paraquat	1.7-2.7 pt	24 h	see note	22	NR	WSSA Group 22: photosystem I electron diverter. Foliage applied, contact herbicide used to control annual broadleaf and grass weeds and to suppress perennial weeds. Apply as a directed spray. May be used at any time, but most effective when weeds are no more than 4-6 inches tall and growing actively. Thorough spray coverage is required to ensure control. Keep off tree foliage, fruit, and green bark. Often tank-mixed with soil residual herbicides to control established weeds. Paraquat is corrosive to aluminum. This is a restricted-use herbicide. Use this product only if you carefully read and follow PPE directions on the label. Use a full face shield, gloves and apron when filling and mixing. Do not ingest or inhale spray mist when spraying. PHI for apples and pears is not listed.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Weed Control Stone Fruit

Seasonal Weed Control

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	dichlobenil Casoron 4G	11-150 lb 12 h	none listed	20	NR		WSSA Group 20: inhibits cellulose biosynthesis, disrupts cellulose formation in the cell wall. A soil-active herbicide for long-term or seasonal control of most weeds. Dichlobenil can suppress the growth of some perennials (Canada thistle, quackgrass, field bindweed and bermudagrass), although higher use rates are recommended. Dichlobenil can be applied where weeds are present. Can be used in non-bearing orchards, as long as trees have been established for at least four weeks. More effective when applied in the fall when the soil is cool and still not frozen. Application before a rain will reduce volatility and improve weed suppression. For use in cherries, only.
	indaaziflam Alion 1.67	3.5-6.5 fl oz 12 h	14 d	29	NR		WSSA Group 29: inhibits cellulose biosynthesis, disrupts cellulose formation in the cell wall. Alion is a pre-emergent annual grasses and broadleaf weed herbicide. Rate, timing and tank mixes will effect control. It will not control established perennials or emerged annuals. Excessive crop residue or leaf litter may also reduce efficacy. Apply to trees established for at least three years. Apply as a uniform broadcast or banded application to dry soil surface that does not have cracks or depressions. Do not use on sand or soils containing >20% gravel. Do not apply to frozen/snow covered soils or saturated soils. Light irrigation or rain within three weeks is necessary for incorporation. Spring applications are more effective if glyphosate was used in the previous fall or late summer to control perennial weeds. Avoid direct contact with foliage, green bark, or roots.

TABLE CONTINUED

Seasonal Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)							WSSA Group 12: inhibits carotenoid biosynthesis. Norflurazon is effective against annual grasses and some broadleaf weeds, but is not commonly used except as a partner with another product that can broaden the weed control spectrum. May suppress, but not control, <i>Equisetum</i> (field horsetail, scouring rush). Solicam does not have any post-emergence weed control activity. Solicam can be applied from fall to early spring to non-frozen soil before the weeds emerge. The soil should be settled and firm at the time of application and the surface must be free of soil clods, depressions, weeds and other plant residue. Requires moisture within 4 weeks of application to activate. Trees must be established in orchard at least 18 months. Make only one application per year. Repeated applications over a period of years may result in tree injury if rates are not reduced after the first season. Not labeled for cherries on gravelly, sand or loamy sand soils because of potential for tree injury; death of young cherry trees has occurred under these conditions.
	norflurazon Solicam 78.6DF	2.5-5 lb	12 h	60 d	12	NR	
	oryzalin Surflan AS	2-6 qt	24 h	none listed	3	NR	
	oxyfluorfen Goal 2XL	2-6 pt	24 h	none listed	14	NR	
	oxyfluorfen GoalTender	1-3 pt	24 h	none listed	14	NR	See comments for Goal 2XL.

TABLE CONTINUED

Seasonal Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds (continued)	pronamide Kerb 50W	2-6 lb 24 h none listed	3	NR			WSSA Group 3: microtubule assembly inhibitor. Pronamide is a soil-applied product that is used for the control of grasses (annuals and some perennials) and some broadleaved species. It is most effective on cool season grasses. Pronamide can control some small weeds that have emerged. Pronamide should be applied in the fall after harvest, but before leaf drop and soil freeze up to trash-free soil. Use the lower rates for annual grasses and susceptible broadleaf weeds; use the higher rates for controlling quackgrass. Use rate will also be affected by soil texture; use lower rates on coarse soils. Rainfall or overhead irrigation is required following application. Soil temperatures above 55°F may result in reduced weed control. Do not apply around seedling trees less than 1 year old or fall-transplanted trees established less than 1 year or spring transplanted trees established less than 6 months.
	rimsulfuron Matrix FNV	4 oz 4 h	14 d 2	NR			WSSA Group 2: acetolactate synthase (ALS) inhibitor. Matrix has both pre-emergence and very early post-emergence activity. To broaden the weed control spectrum and/or extend the residual effectiveness rimsulfuron may be tank-mixed with other registered herbicides having a different mode of action. Tank mixes well with Alion. For maximum pre-emergence activity, the herbicide should be applied to a soil surface that is smooth and relatively free of crop and weed trash. Rainfall or irrigation is required within 2 weeks of application for pre-emergence incorporation. Susceptible weeds are controlled from 60 to 90 days after application. For best results, maintain spray tank solution at pH 5 to 7. Avoid contact with green bark, foliage, or fruit.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Temporary Weed Control

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Broadleaf weeds							WSSA Group 4: synthetic auxin. Multiple trade names: Saber, Orchard Master (not on apricots and nectarines), Weedar 64, Amine 4 and 2,4-D. Kills most annual and many perennial broadleaf weeds. Apply as directed spray to weeds. Avoid contact with foliage, limbs and trunk. Do not apply during windy periods. May be used at any time except during bloom but most effective when weeds are small and growing actively. Can be absorbed by tree roots and cause serious injury. Best results are obtained when applied within 2 days following an irrigation and the weeds are growing actively. In sprinkler-irrigated orchards, apply only after irrigation and never to dry or bare ground. Do not apply to trees established in orchard for less than 1 year. Do not make more than 2 applications per year. Do not harvest within 40 days of application.
2,4-D Saber	3 pt	48 h	40 d	4	NR		WSSA Group 4: synthetic auxin. Controls many difficult to control weeds in the sunflower, buckwheat (or knotweed), nightshade and legume families. Apply to actively growing weeds in a minimum of 10 gallons of water per acre. Apply to Canada thistle after a majority of basal leaves have emerged, but prior to bud stage. Up to two applications may be made during the crop year, but do not exceed a total of 2/3 pint of product per sprayed acre per year. Do not apply within 30 days of harvest.
clopyralid Stinger	0.33-0.67 pt	12 h	30 d	4	NR		Group 14: protoporphyrinogen oxidase (PPO) inhibitor. A contact herbicide that is active on annual broadleaf weeds. Use as a directed spray when the weeds are less than 4 inches tall or 3 inches across. Thorough coverage is required for control. Apply during the dormant season and prior to bloom. Addition of a crop oil concentrate or non-ionic surfactant will enhance control. Keep off green stems and foliage; will burn off young green crown and root suckers. Use lower rates for small weeds and higher rate for larger weeds. Tank mixing can increase the weed spectrum that is controlled.
pyraflufen-ethyl Venue	1-4 fl oz	12 h	0 d	14	NR		

TABLE CONTINUED

Temporary Weed Control (continued)

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	glyphosate glyphosate	1-3 qt	4 h	17 d	9	NR	WSSA Group 9: EPSPS inhibitor. Glyphosate is a broad-spectrum, systemic herbicide. It is one of the most commonly applied herbicides and is sold under many trade names. Some of the products containing glyphosate are identical to the original product, others vary in their additives (such as wetting agents) and amount of active ingredient. The parent acid, the "active ingredient" is formulated with ammonium, potassium, or isopropylamine and varies in content per gallon from one product to another. The active ingredient is called "acid equivalent" in glyphosate products, and can range from 3 to 5 pounds per gallon, depending on the product. If you switch products, compare the acid equivalent of the two, and make rate adjustments, if necessary. Repeated use of glyphosate has led to the development of glyphosate resistance in many species common to perennial systems in the West Coast; rotate with other foliar-applied herbicides. Water quality and quantity can affect glyphosate performance, high pH, presence of cations, or dirty water can reduce efficacy. See label regarding adjuvant use.
	paraquat paraquat	1.7-2.7 pt	24 h	see note	22	NR	WSSA Group 22: photosystem I electron diverter. See entry for Bonidey. 28 day PHI applies to all stone fruit but peach; PHI for peach is 14 days.
	paraquat dichloride Bonidey	1.7-2.7 pt	24 h	see note	22	NR	WSSA Group 22: photosystem I electron diverter. Foliage applied, contact herbicide used to control annual broadleaf and grass weeds and to suppress perennial weeds. Apply as a directed spray. May be used at any time, but most effective when weeds are no more than 4-6 inches tall and growing actively. Thorough spray coverage is required to ensure control. Keep off tree foliage, fruit and green bark. Often tank-mixed with soil residual herbicides to control established weeds. Paraquat is corrosive to aluminum. This is a restricted-use herbicide. Use this product only if you carefully read and follow PPE directions on the label. Use a full face shield, gloves and apron when filling and mixing. Do not ingest or inhale spray mist when spraying. 28 day PHI applies to all stone fruit but peach; PHI for peach is 14 days.

Efficacy numbers denote the relative efficacy of a pesticide against a given pest on a 1 to 4 scale with 1 being low and 4 high efficacy. This information is based primarily on research conducted with WSU researchers in Washington.

Pesticide Timing Recommendations for Pollinator Protection

See PNW 591, *How to Reduce Bee Poisoning from Pesticides*, for further information.

Website—<https://pubs.wsu.edu/ListsItems.aspx?Keyword=pnw591>

Revisions to toxicity table

I—Do not apply to blooming plants (including fruit trees and broadleaf weeds)

Actara 25WDG (thiamethoxam)	Envitor 2SC (spiroticlofen)	Seven RP4 - chemical thinning (carbaryl)
Admire 2F (imidacloprid)	Exirel (cyantraniliprole)	Sevin 4F (carbaryl)
Admire Pro 4.6L (imidacloprid)	Imidan 70W (phosmet)	Sevin 4F- chemical thinning (carbaryl)
Ambush 25WP (permethrin)	Lorsban 75WG (chlorpyrifos)	Sevin 4F-chemical thinning (carbaryl)
Asana XL (esfenvalerate)	Lorsban 75WG - trunk spray (chlorpyrifos)	Sevin 80 WSP (carbaryl)
Belay 50WDG (clothianidin)	Lorsban Advanced (chlorpyrifos)	Sevin XLR Plus (carbaryl)
Belt 4SC (flubendiamide)	Lorsban Advanced - trunk spray (chlorpyrifos)	Sevin XLR Plus - chemical thinning (carbaryl)
Blush (prohydrogastron)	Malathion ULV (malathion)	Supracide 25W (methidathion)
Captan 50WP (captan)	Movento 2L (spirotetramat)	Supracide 2E (methidathion)
Closer SC (sulfoxaflor)	Pounce 3.2EC (permethrin)	Ultor 1.25L (spirotetramat)
Clutch 50WDG (clothianidin)	Proaxis 0.5L (gamma-cyhalothrin)	Warrior 1CS (lambda-cyhalothrin)
Danitol 2.4EC (fenpropothrin)	Proclaim 5SG (emamectin benzoate)	Warrior II (lambda-cyhalothrin)
Diazinon 50W (diazinon)	Provado 1.6F (imidacloprid)	Ziram 76DF (ziram)
Diazinon AG500 (diazinon)	Rimon 0.83EC (novaluron)	Ziram Granuflo 76WDG (ziram)
Dimethoate 2.67EC (dimethoate)	Rovral 4F (iprodione)	
Dimethoate 4EC (dimethoate)	Rovral 50W (iprodione)	

II—May be applied to blooming plants in late evening (do not begin spraying until 6 p.m., and stop spraying at midnight)^{1,2}

Agri-Mek SC (abamectin)	Confirm 2F (tebufenozide)	TriStar 8.5 SL (acetamiprid)
Assail 30SG (acetamiprid)	Epi-Mek 0.15EC (abamectin)	Vydate 2L (oxamyl)
Assail 70WP (acetamiprid)	Malathion Aquamul 8 (malathion)	
Carzol 92SP (formetanate hydrochloride)	TriStar 30SG (acetamiprid)	

III—May be applied to blooming plants in late evening or early morning (do not begin spraying until 6 p.m., and stop spraying at 7 a.m.)^{1,2}

Acramite 50WS (bifenazate)	Entrust SC (spinosad)	petroleum oil-summer
Avaunt 30DG (indoxacarb)	GF-120 0.02% Bait (spinosad)	PyGanic 1.4EC (pyrethrins)
Aza-Direct 1.2%L (azadirachtin)	Lannate 90SP (methomyl)	PyGanic 5EC (pyrethrins)
Battalion 0.2EC (deltamethrin)	Lannate LV 2.4L (methomyl)	Success 2F (spinosad)
Calypso 4F (thiacloprid)	Neemix 4.5%L (azadirachtin)	TriTek (petroleum oil, summer)
Delegate 25WG (spinetoram)	Nexter 75WSB (pyridaben)	
Entrust 80W (spinosad)	petroleum oil- dormant	

IV—May be applied to blooming plants at any time

Academy (difenoconazole+fludioxonil)	K-Salt Fruit Fix 200 (NAA)	Proganic Micronized Sulfur 92%
Actigard 50WG (acibenzolar-s-methyl)	Kanemite 15SC (acequinocyl)	(sulfur, wettable)
Altacor 35WDG (chlorantraniliprole)	Kasumin 2L (kasugamycin)	Rally 40WSP (myclobutanil)
Apollo 4SC (clofentezine)	Kudos 27.5 WDG (prohexadione calcium)	Refine 6.25L (NAA)
Bacillus thuringiensis subsp. <i>kurstaki</i>	Kumulus 80DF (sulfur, dry flowable)	Rex Lime Sulfur (lime sulfur/calcium polysulfide)
Beleaf 50SG (flonicamid)	Luna Privilege (fluopyram)	Rex Lime Sulfur - blossom thinner (lime sulfur/ calcium polysulfide)
Cabrio 20EG (pyraclostrobin)	Luna Sensation (fluopyram+trifloxystrobin)	Savay 50DF (hexythiazox)
Casoron CS (dichlobenil)	M-Pede (potassium salts of fatty acids)	Serenade Max (<i>Bacillus subtilis</i> strain QST 713)
Centaur 70W (buprofezin)	Motivate (ethephon)	Serenade Opti (<i>Bacillus subtilis</i> strain QST 713)
Cueva (copper octanoate)	Nealta (cyflumetofen)	Sulforix (lime sulfur/calcium polysulfide)
Cyd-X (CM granulosis virus)	NovaSource Lime Sulfur - blossom thinner (lime sulfur/calcium polysulfide)	Surround WP (kaolin clay)
Dicofol 4E (dicofol)	Omite 30WS (propargite)	ThinRite (endothall)
Dimilin 2L (diflubenzuron)	Onager 1EC (hexythiazox)	Topguard (flutriafol)
DoubleNickel 55 (<i>Bacillus amyloliquefaciens</i> strain D747)	OSO 5%SC (polyoxin D zinc salt)	Trionic 4SC (triflumazole)
Esteem 35WP (pyriproxyfen)	Ph-D (polyoxin D zinc salt)	Unicorn DF (tebuconazole+sulfur)
Ethrel (ethephon)	PoMaxa (NAA)	Vanguard 75WG (cypromidol)
Fontelis (penthiopyrad)	Previsto (copper hydroxide)	Vendex 50WP (fenbutatin oxide)
Fruitone N (NAA)	Pristine (pyraclostrobin+bosalid)	Vivando (metrafenone)
FujiMite 5%EC (fenpyroximate)	Procure 480SC (triflumizole)	Zeal 72WDG (etoxazole)
Golden Micronized Sulfur 92% (sulfur)	Procure 50WS (triflumizole)	
Intrepid 2F (methoxyfenozide)		

¹If temperature is below 50°F all day, then it is safe to spray at any time of day.

²If temperature is above 70°F in the evening, then bees clustering on the outside of

Natural Enemy Relative Impact Guide

This table is intended as a guide to the relative impact of commonly applied pesticides to 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 give recommended rates and timing of sprays. The impact of some insecticides may vary considerably with the history of use in a given orchard. This is especially true relative to their effect on the western predatory mite (WPM) and the apple rust mite (ARM). Footnotes follow the second half of the table at the bottom of the page.

Trade Name	Compound	WPM ²	Mite predators	ARM ³	Colpocephalus floridus ⁴	Pnigallo flavipes ⁴	Lepidopteran parasitoids*	Aphelinus mali	Aphid parasitoids and predators*	Coccinellids	Lacewings* ⁵	Predatory true bugs	Relative impact rating ¹		Scale insect enemies
													A	B	
Acrimate 50WS	bifentiazate	L	L	M	L ⁸	M	M	H	L	M	H	H	H	H	H
Actara 25WDG	thiamethoxam	L ⁸	M	L ⁸	H ⁶	M ⁶	L	H	H	M ⁶	L	H	H	H	L
Agri-Mek 0.15EC/ Epi-Mek 0.15EC	abamectin	H ⁶	H	H ⁶	L	M	L	L	L ^{14,15}	L	H ¹⁵	H ¹⁵	L	H	H
Altacor 35WDG	chlorantraniliprole	L ¹⁵	L	L	H	H	M	H	H	H	H	H	H	H	H
Ambush 25WP/ Pounce 3.2EC	permethrin	H	H	L	M	H	H	H	H	H	H	H	H	H	H
Apollo 4SC	clofentezine	L	L	L	L	M	M-H	L	L	L	L	L	L	L	L
Asana XL	esfenvalerate	H	H	L	M	M	H	H	H	H	H	H	H	H	H
Assail	acetamiprid	M-H ¹⁰	M	L	H	H	M-H ¹⁴	H	M-H ¹⁴	H	M	H	H	H	H
Avaunt 30DG	indoxacarb	L ⁹	L	L ⁹	M	M	M	M	L	M	L	M	L	M	H
Aza-Direct 1.2%/ Neemix 4.5% ¹¹ L	azadirachtin	L	L	L	L	M	M	M	L	L	L	L	L	L	L
Bacillus thuringiensis subsp. <i>kurstaki</i>		L	L	L	L	L	L	L	L	L	L	L	L	L	L
Belt 4SC	flubendiamide	L	L	L	L	L	L	L	L	M-H ¹⁴	M	H	L	L	L
Calypso 4F	thiacloprid	M-H	M	M-H	H	H	H	M-H ¹⁴	M	H	H	H	H	H	H
Carzol 92SP	formetanate hydrochloride	L	L	L	L	L	L	L	L	L	M	L	M	H	H
Centaur 70W	buprofezin	L	L	L	L	L	L	L	L	L	L	L	L	L	M
Clutch 50WDG	clothianidin	L	L	L	L	L	L	L	L	L	L	L	L	L	L
CM granulosis virus		L	L	L	L	L	L	L	L	L	L	L	L	L	L
Confirm 2F	tebufenozide	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Danitol 2.4EC	fenpropathrin	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Delegate 25WG	spinetoram	M-H ^{13,15}	M	M	L	H	H	H	H ¹⁵	H ¹⁵	L	H ¹⁵	H ¹⁵	H	H
Diazinon	diazinon	L	M	L	H	H	H	H	H	H	H	H	H	M	M
Dimethoate	dimethoate	L-M	H	L	H	H	M	H	H	H	H	H	H	H	H
Dimilin 2L	diflubenzuron	L	H	H	H	H	L	L	L	L	L	H	L	M	M
Entrust 80W	spinosad	M	L	M-H	H	H	M	M	M	L	L	L	L	L	L
Envidor 25C	spiroticlofen	M	L	L	L	M	L	L	M	L	M	L	M	M	M
Esteem 35WP	pyriproxyfen	L	M	M	L	L	L	L	L	L	L	L	L	L	H
FijiMite 5%EC	fennproximate	H	M	H	H	H	H	H	H	H	M	M	L	L	L
Guthion	azinphos methyl	L	M	L	H	L	H	H	H ¹⁴	H	H	H	M	M	H
Imidan 70W	phosmet	L	L	L	H	L	H	H	H	H	H	L	L	L	H
Intrepid 2F	methoxyfenozide	L	L	L	L	L	L	M	M	L	L	L	L	L	L
Lannate	methomyl	H	L	M-H	H	H	H	H	H	H	H	H	H	H	H
lime sulfur/calcium polysulfide		M-H		M		L		H		H ¹⁴		H		H	
Lorsban	chlorpyrifos	L-M	M	M	H	H	H	H	H	H	H	H	H	H	H
Malathion	malathion	M	M	M	L ¹⁴	M	L ¹⁵	M	M ¹⁵	M ¹⁵	M ¹⁵	M ¹⁵	M ¹⁵	M ¹⁵	L
Manzate	mancozeb	H ¹⁵	M	M	M	M	M	M	M	M	M	M	M	M	L

Natural Enemy Relative Impact Guide (continued)

Sources: Koppert Biological Systems, WSU Crop Protection Guide, USDA-NIFRA SCRI Project "Enhancing Biological Control in Western Orchards", USDA-IFAFS & USDA-RAMP Projects "Areawide Codling Moth Control Program II", International Organisation for Biological Control (IOBC), Cornell University, Ohio State University, Pennsylvania State University, University of California Extension

Trade Name	Compound	WP ¹	Mite predators	ARM ³	Colpocephalus florae ⁴	Pnigallo flavipes ⁵	Lepidopteran parasitoids*	Aphelinus mali	Aphid parasitoids and predators*	Coccinellids	Lacewings ⁶	Predatory true bugs	Relative impact rating ¹	
													Aphid parasitoids	Scale insect enemies
Movanto 2L	spirotetramat	H ¹⁵	L										L ¹⁴	
Nexter 75WSB	pyridaben	M	M	H	M-H		H						M	H
petroleum oil-summer		M ^{6,7}	M	L ⁶	L				L				L	L
potassium salts of fatty acids		M ⁶	H	M ⁶		H		H		H	L	H	H	H
Proclaim 5SG	emamectin benzoate		L					L					L	L
Provado/Admire Pro 4.6L	imidacloprid	L ⁸	M	L ⁸	M-H ⁶		H		H		M	M-H	H	M
Rimon 0.83EC	novaluron	M-H	L					M	M ¹⁴				H ¹⁵	H ¹⁵
Savey 50DF/ Onager 1EC	hexythiazox	L	L	L				L		L	L	L	L	L
Sevin	carbaryl	M-H ¹⁰	M	L-M	H	L	H	H ¹⁴	H	H	H	H	H	H
Success 2F	spinosad	M	L	M-H	H	H	H		M	L ¹⁴	L ¹⁵	M ¹⁵	M ¹⁵	M
sulfur, dry flowable		H ¹⁵	M							L ¹⁴				
sulfur, wettable		M												
Supracide	methidathion	H					H							
Surround WP	kaolin clay	M-H	M			M				L		M-H ⁵		
Thionex	endosulfan	L	H	M-H	M	M	H		M	M-H		L	H	H
Ultor 1.25L	spirotetramat	H ¹⁵	L	H	L			L ¹⁴						
Vendex 50WP	fenbutatin oxide	M	L	H	L									
Vydate 2L	oxamyl	H				H								
Warrior	lambda-cyhalothrin	H ¹⁵	H				H	H ¹⁴	H ¹⁵	H	H ¹⁵	H ¹⁵	H	H
Zeal 72WDG	etoxazole	M				M				L	M	M	M	M

*These ratings are based on acute toxicity of pesticides on natural enemies represented in the groupings shown.

¹Rating system: L = low impact, M = moderate impact, H = high impact, – no data available.

²WPM = western predatory mite, *Typhlodromus occidentalis*.

³ARM = apple rust mite, *Aculus schlechtendali*. Although ARM is a plant feeding species, its presence is very useful in maintaining populations of *Typhlodromus occidentalis*.

⁴C. florae is a wasp parasitoid of leafrollers; *P. flavipes* is a wasp parasitoid of western tentiform leafminer. See Orchard Pest Management for more information.

⁵Coccinellid data based on bioassays of late instar larvae of *Harmonia axyridis*, *Hippodamia convergens*, and *Coccinella transversoguttata*. Karolin data based on bioassays using *Stethorus punctum*.

⁶Overall negative impact is reduced due to short residual activity.

⁷Spray volume may be important in determining toxicity.

⁸Preliminary data; based on field trials of 4 cover sprays.

⁹Preliminary data; based on field trials with a single application.

¹⁰The use of this material has been associated with mite problems, although the effect is inconsistent; there appears to be moderate acute toxicity, but more severe reproductive effects on WPM.

¹¹100% mortality/sterility was caused by exposure to novaluron

¹²Novaluron 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.

¹³While this material is toxic to WPM, it is also somewhat miticidal, and thus may not causeflare-ups of mites.

¹⁴Preliminary data, based on laboratory acute toxicity tests.

¹⁵Acute mortality is low, however, new information shows that exposure to this product suppresses the natural enemies population growth

Critical Temperatures / Bud Death Table

	Bud Stage						
	1	2	3	4	5	6	7
	Degrees Fahrenheit						
APPLE							
	silver tip	green tip	1/2 inch green	tight cluster	first pink	full pink	first bloom
10% kill	15	18	23	27	28	28	28
90% kill	2	10	15	21	24	25	25
PEAR							
	buds opening	buds exposed	tight cluster	first white	full white	first bloom	full bloom
10% kill	15	20	24	25	26	27	28
90% kill	0	6	15	19	22	23	24
PEACH							
	first swelling	calyx green	calyx red	first pink	first bloom	full bloom	postbloom
10% kill	18	21	23	25	26	27	28
90% kill	1	5	9	15	21	24	25
APRICOT							
	first swelling	tip separates	calyx red	first white	first bloom	full bloom	in the shuck
10% kill	15	20	22	24	25	27	27
90% kill	—	0	9	14	19	22	24
PLUM (PRUNE)							
	first swelling	side white	tip green	tight cluster	first white	first bloom	full bloom
10% kill	17	20	24	25	26	27	28
90% kill	3	7	16	20	22	23	23
CHERRY							
	first swelling	side green	tip green	tight cluster	open cluster	first white	first bloom
10% kill	17	22	25	26	27	27	28
90% kill	5	9	14	17	21	24	25

Remember to order your 2020 Crop Protection Guide for Tree Fruit in Washington in February 2020.

The next printed edition will be due out about late February.

Please contact the Extension Publishing office or your county office for order information. Most county offices in tree fruit growing areas carry this publication.

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P.O. Box 645912
Pullman, WA 99164-5912

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EB0419