

2024 Crop Protection Guide for Tree Fruits in Washington

WASHINGTON STATE UNIVERSITY EXTENSION • EB0419



WASHINGTON STATE UNIVERSITY
EXTENSION

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	206-594-0000
	Central Regional Office	509-575-2490
	Eastern Regional Office	509-329-3400
WSU Extension, Tree Fruits	North Central Washington (Tianna DuPont)	509-293-8758
	Columbia Basin (Karen Lewis)	509-754-2011 ext. 4313
	South Central Washington (Gwen-Alyn Hoheisel)	509-786-5609
	Tree Fruit Research & Extension Center—Wenatchee	509-293-8800
	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.	503-390-2381
Workplace Safety and Health Information	Washington State Department of Labor & Industries	800-423-7233
Horticultural Pest and Disease Boards	Adams County	
	Benton County (shared with Extension office)	509-786-5609
	Franklin County	509-545-3580
	Chelan-Douglas-Okanogan Counties	509-667-6677
	Grant County	509-754-2011 ext. 4313
	Kittitas County	
	Klickitat County	509-773-5817
	Skagit County	360-428-4270
	Walla Walla County (shared with Extension office)	509-524-2685
	Whatcom County	
	Yakima County	509-571-5210
Apiary (Honey Bee) Registration	WSDA Plant Protection Division, Olympia Office	360-902-2070

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STOP

This guide replaces earlier editions.
Do not use after 2024.

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/animal-poison-control/>

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

Pesticide Labels

ATTENTION: 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/departments/pesticides-and-fertilizers>
- WSU Pesticide Resources and Education.
<https://pep.wsu.edu/>
<https://picol.cahnrs.wsu.edu/>

Crop Protection Guide

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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 <https://picol.cahnrs.wsu.edu/>.

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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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, they are 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'.

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 in the bark, and emerges just before and during apple bloom. 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 Pacific Northwest. 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 at <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 generations 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

First generation control sprays should be applied by 1230-1250 degree-days, when only about 10% of the larvae are in their 4th instar. This timing represents the best opportunity to control *Lacanobia 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, dead limbs, and woodpiles from the orchard) is the most effective 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.

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 remains 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 60F and 78F. Wetness plays a marginal role. The fungus then continues with multi-cycle infections through spring and early summer until the production of new leaves and shoots cease. The fungus is slowed down by the rising temperature (above 82F) 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 making leaf removal/incorporation critical to 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-Gray Mold

Gray mold, caused by *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 throughout 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 64F and 78F 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 for fungicide resistance development as the fungus can develop resistance to multiple fungicides 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.

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* has been 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 when it causes 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. 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. **Early bloom.** Apply biologicals (Blossom Protect) during early bloom (2 applications). Reapply biological if lime sulfur was applied (lime sulfur is antimicrobial and reduces biological populations). **Full bloom to petal fall.** Watch the model. Apply materials 12-24 hours BEFORE moisture events. Sprays every 2 days may be necessary to cover opening flowers during extended high or extreme risk periods. Product used must contact the interior of the flowers in sufficient water and approved wetting agent to completely wet the interior. 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 are not effective. **Organic.** Prebloom: Fixed copper sanitation if fire blight was in the orchard last year. Apples Easy to Thin: Blossom Protect/ Buffer Protect early, lime sulfur (+ oil), second Blossom Protect/ Buffer Protect. Followed depending on the model and cultivar russet risk with soluble copper (Previsto 3 qt, Cueva 4 qt, or Cueva 3 qt + Serenade Opti, or Instill). Petal fall + 1-2 weeks Serenade Opti (most fruit safe) or 2% lime sulfur (red apples). Apples Hard to Thin/Long Bloom Period: Lime sulfur (+ oil), then Blossom Protect + Buffer Protect, then a Lime sulfur (+ oil), then a

Second Blossom Protect + Buffer Protect. Depending on the model and cultivar russet risk soluble copper (Previsto 3 qt, Cueva 4 qt, Cueva 3 qt + Serenade Opti, or Instill). Petal fall + 1-2 weeks Serenade Opti or 2% lime sulfur (red apples). Apples Hard to thin varieties/ short bloom period: Lime sulfur (+ oil) 2-3 applications. Depending on the model and cultivar russet risk follow with soluble copper (Previsto 3 qt, Cueva 4 qt, Cueva 3 qt + Serenade Opti, or Instill). Petal fall + 1-2 weeks: Serenade Opti (most fruit safe) or 2% lime sulfur (red apples). Pears Easy to Mark Varieties: 2 applications of Blossom Protect + Buffer Protect during early bloom to petal fall (70-80% bloom if single treatment). Follow with Serenade Opti at petal fall to reduce russet risk from Blossom Protect yeast. Pears Marking Tolerant Varieties: 2 applications of Blossom Protect + Buffer Protect during early bloom to petal fall (70-80% bloom if single treatment). Follow with soluble copper (Cueva 4 qt, Previsto 3 qt, or Cueva 3 qt + Serenade Opti) if the model indicates risk (warm/wet).

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 *Phaciidiopcnis 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 Manchurian crab apple pollinizers which are 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.

Storage Rots (Sphaeropsis, Lambertella, Alternaria)

Several other fungal fruit infections initiated in the orchard can cause storage rots. Alternaria rot: 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 rot: A sporadic emerging disease caused 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 twigs. 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. Yellow-Lambertella rot: 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.
	trifloxystrobin Flint Extra	2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide.
	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 Vanguard. 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	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Place Rally into solution before adding oil. Apply no sooner than half-inch green.

TABLE CONTINUED

Delayed Dormant *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	0 d		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
	flutriafol Topguard	8-12 fl oz	12 h	14 d	3	4	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	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.
	Notes: To limit the potential for development of fungicide resistance, rotate between FRAC groups. Do not make sequential applications of fungicides in the same FRAC group. Do not make more than 2 applications of fungicides in the same FRAC group per season.						
Apple scab	Notes: 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.						
	benzovindiflupyr Aprovia	7 fl oz	12 h	30 d	7	2	
	captan Captan 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.
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.
	trifloxystrobin Flint Extra	2.5-2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	
	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 Vanguard. 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	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.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
	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.

TABLE CONTINUED

Delayed Dormant cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		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
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	
Notes: 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.							
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Aphid eggs, woolly apple aphid	petroleum oil- dormant petroleum oil- dormant	1.5 % v/v	12 h	none listed		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. Organic
	indoxacarb Avaunt	See label	12 h	14 d	22	4	
Cutworms	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	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.
San Jose scale	pyriproxyfen + petroleum oil- dormant Esteem 35WP + petroleum oil- dormant	4-5 oz 1-1.5 % v/v	12 h	45 d	7C	3-4	
	petroleum oil- dormant petroleum oil- dormant	1-1.5 % v/v	12 h	none listed		3-4	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.

Prepink

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	trifloxystrobin Flint Extra	2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide.
	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 Vanguard. 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	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		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
	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	Organic
	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.
	Notes: To limit the potential for development of fungicide resistance, rotate between FRAC groups. Do not make sequential applications of fungicides in the same FRAC group. Do not make more than 2 applications of fungicides in the same FRAC group per season.						
Apple scab	Notes: Apply one Group 3 Fungicide at the same growth stage.						
	Notes: 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.						
	captan Captan 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.
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.

TABLE CONTINUED

Prepink cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	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.
	cyprodinil + difenoconazole Inspire Super	12 fl oz	12 h	14 d	9,3	NR	Inspire Super and Vanguard 75WG are from the same chemical group. Use one or the other of these products. 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.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See Label	48 h	0 d		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
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	
Notes: 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.							
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cutworms	indoxacarb Avaunt	See label	12 h	14 d	22	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 WDG	34.5 oz	12 h	14 d	16	NR	

TABLE CONTINUED

Prepink cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kurstaki DiPel DF	1-2 lb	4 h	0 d	11B2	3	While 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, above 65°F, for 3 or more days. Organic
Lygus and stink bugs	flonicamid Beleaf 50SG	2.8 oz	12 h	21 d	29	NR	Needs further study. 50% control of adults and 65% control of young nymphs in one WA study in alfalfa [Walsh 2018].
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	NR	
	sulfoxaflor Transform	2.25 oz	24 h	7 d	4C	NR	Needs further testing. 68% control of adults and 71% control of young nymphs in one WA study in alfalfa [Walsh 2018].

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	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.
	trifloxystrobin Flint Extra	2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide.
	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 Vanguard. 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.
	pydiflumetofen Miravis	See Label	12 h	30 d	7	3	
	BLAD Problad Verde	18.1 - 45.7 fl oz	4 h	1 d		2	Apply every 7 days in rotation with other materials. Organic
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	Organic
	lime sulfur/calcium polysulfide Sulforix	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.
	flutriafol Topguard	8-12 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	Notes: To limit the potential for development of fungicide resistance, rotate between FRAC groups. Do not make sequential applications of fungicides in the same FRAC group. Do not make more than 2 applications of fungicides in the same FRAC group per season.						
	Notes: 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

Pink cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	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.
	mancozeb Dithane M45 80W	6 lb	24 h	77 d	M3	NR	Do not apply after bloom. See label for restrictions.
	trifloxystrobin Flint Extra	2.5-2.9 fl oz	12 h	14 d	11	3	
	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.
	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 Vanguard. 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.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Apply only one Group 3 Fungicide at the same growth stage.
	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.
	lime sulfur/calcium polysulfide Sulforix	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.
	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	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.
Notes: 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.							
Fire blight	Aureobasidium pullulans strains DSM 14940 & 14941 Blossom Protect	1.25 lb	4 h	none listed		4	Apply with Buffer Protect. 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.

TABLE CONTINUED

Pink cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	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	spirodiclofen Envidor 2SC	18 fl oz	12 h	7 d	23	NR	
	fenbutatin oxide Vendex 50WP	1-1.5 lb	48 h	14 d	12B	3-4	
Campyloomma	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	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)	chlorantraniliprole Altacor	4.5 oz	4 h	5 d	28	4	
	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
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
Rosy apple aphid	Notes: Target leafroller larvae in the spring at 300-560 DD (Obliquebanded) and 300-460 DD (Pandemis). Target 1st summer generation larvae at 955-1300 DD (Obliquebanded) and 1760-2255 DD (Pandemis). Degree day lower threshold 41°F and upper threshold 85°F.						
	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
Apple mildew	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO5%SC. Use only one of these fungicides in a given season.

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	Notes: To limit the potential for development of fungicide resistance, rotate between FRAC groups. Do not make sequential applications of fungicides in the same FRAC group. Do not make more than 2 applications of fungicides in the same FRAC group per season.						
Botrytis-Gray Mold	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.
	acibenzolar-s-methyl Actigard 50WG	2 fl oz	12 h	60 d	P01	NR	For bloom applications: Apply 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. Also used to reduce re-occurrence of blight after cutting out infected strikes. Apply concentrate to a half meter section of the main leader after cutting see http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/
Fire blight	Aureobasidium pullulans strains DSM 14940 & 14941 Blossom Protect	1.25 lb	4 h	none listed		4	Apply with Buffer Protect. Yeasts need 1-2 days before an infection to colonize the flower before bacteria invade to be effective. Organic
	copper octanoate Cueva	4 qt	4 h	0 d	M1	3	Little russet in semi-arid WA trials. Some russet risk in wetter OR. Tank mix compatible with Bacillus-based biopesticides. Soluble copper efficacy 47% to 73%. From WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus amyloliquefaciens strain D747 DoubleNickel 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. Can be used with copper fungicides to increase control. Relative disease suppression in Washington trials average 30%. Organic
	oxytetracycline FireLine 17WP	See label	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5.5-6.0 optimal. Best activity at 200 ppm: 1.0 lb/100 gal. Label allows up to 1.5 lb/A. Do not go above 150 gal/A to maintain 200 ppm.

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	Copper Sulfate + Pentahydrate (metallic copper 5.4%) Instill	30 fl oz	48 h	0 d	M1	3	Consider drying conditions to minimize marking risk.
	copper sulfate pentahydrate Instill-O	51 fl oz	48 h		M1	3	Consider drying conditions to minimize marking risk. Soluble copper efficacy 47% to 73%. From WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	kasugamycin Kasumin 2L	64 oz	12 h	90 d	24	4	Best control when applied less than 24 hrs before wetness event. Control up to 12 hr after wetness event.
	Copper sulfate pentahydrate Mastercop	40 fl oz	48 h	0 d		3	Organic
	calcium oxytetracycline Mycoshield	See Label	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5 optimal. 200 ppm: 1.0 lb/100 gal.
	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. Soluble copper efficacy 47% to 73%. From WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	2	Efficacy may vary based on disease pressure. Median relative disease suppression 50% in WA trials 2017 to 2021, 60% WA and OR 2012-2015. Organic
Notes: Full bloom to petal fall. Watch the model. Apply materials 12-24 hours BEFORE moisture events. Sprays every 2 days rotating active ingredients may be necessary to cover opening flowers during extended high or extreme risk periods. Product used must contact the interior of the flowers in sufficient water and approved wetting agent to completely wet the interior. 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 effective. Organic: Depending on the cultivar russet risk and the CougarBlight model risk follow biologicals with copper hydroxide/octanoate (Cueva/Previsto/Instill-O) every 2-5 days (this option is less fruit safe for russet but has higher efficacy) or with Bacillus subtilis (Serenade Opti) (most fruit safe, lower efficacy) every 2-5 days during flower/petal fall rotating active ingredients.							
Storage Rots (Sphaeropsis, Lambertella, Alternaria)	Aureobasidium pullulans strain DSM 14940/14941 Botector	7 to 12 oz	4 h	0 d	Biological	3	No more than two applications between early (10%) and late (90%) bloom. Do not apply if Blossom Protect will be applied. Organic
	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	Fontelis has fair efficacy against Alternaria fungus and Sphaeropsis 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.

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rot	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	Organic
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Campyloomma	acetamiprid Assail 70WP	1.7-3.4 oz	12 h	7 d	4A	NR	Use higher rates for high population numbers. May be applied to blooming plant in late evening, do not begin spraying until 6 pm, and stop spraying at midnight.
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
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.
	Notes: Target leafroller larvae in the spring at 300-560 DD (Obliquebanded) and 300-460 DD (Pandemis). Target 1st summer generation larvae at 955-1300 DD (Obliquebanded) and 1760-2255 DD (Pandemis). Degree day lower threshold 41°F and upper threshold 85°F.						

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	trifloxystrobin Flint Extra	2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide.
	flutianil Gatten Fungicide	8 fl oz	12 h	14 d	U13	NR	The mechanism of action of Gatten is yet unknown. Rotate with fungicides from different chemical groups to reduce fungicide resistance.

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	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 Vanguard. 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.
	potassium bicarbonate Kaligreen	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
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide.
	fluopyram + trifloxystrobin Luna Sensation	5-5.8 fl oz	12 h	14 d	7, 11	4	
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide.
	pydiflumetofen Miravis	See Label	12 h	30 d	7	3	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO5%SC. Use only one of these fungicides in a given season.
	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. 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.
	BLAD Problad Verde	18.1 - 45.7 fl oz	4 h	1 d		2	Apply every 7 days in rotation with other materials. Organic
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	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
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	0 d		NR	Do not apply lime sulfur if temperatures will exceed 75°F within 3 days of application. Organic

Petal fall *cont.*

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
	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.
	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.
	Notes: 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.						
	Notes: To limit the potential for development of fungicide resistance, rotate between FRAC groups. Do not make sequential applications of fungicides in the same FRAC group. Do not make more than 2 applications of fungicides in the same FRAC group per season.						
Apple scab	captan Captan 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.
	trifloxystrobin Flint Extra	2.5-2.9 fl oz	12 h	14 d	11	3	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	
	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.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Use only one FRAC group 3 fungicide 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. Use only one Group 3-fungicide at the same growth stage.
	triflumazole Trionic 4SC	12-16 fl oz	12 h	14 d	3	NR	Use only one FRAC group 3 fungicide at the same growth stage.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	Notes: 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.						
Botrytis-Gray Mold	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.
	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.
	thiophanate-methyl Topsin M WSB	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.
Fire blight	acibenzolar-s-methyl Actigard 50WG	2 fl oz	12 h	60 d	P01	NR	For bloom applications: Apply 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. Also used to reduce re-occurrence of blight after cutting out infected strikes. Apply concentrate to a half meter section of the main leader after cutting see http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	cinnamon oil Cinnerate	32 fl oz	none listed	0 d	unknown	2	Essential oil products provided median relative disease suppression (45-49%) in 3 WA trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk.
	copper octanoate Cueva	4 qt	4 h	0 d	M1	3	Little russet in semi-arid WA trials. Some russet risk in wetter OR. Tank mix compatible with Bacillus-based biopesticides. Soluble copper efficacy 47% to 73%. From WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus amyloliquefaciens strain D747 DoubleNickel 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. Can be used with copper fungicides to increase control. Relative disease suppression in Washington trials average 30%. Organic
	oxytetracycline FireLine 17WP	See label	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5.5-6.0 optimal. Best activity at 200 ppm: 1.0 lb/100 gal. Label allows up to 1.5 lb/A. Do not go above 150 gal/A to maintain 200 ppm.
	hydrogen peroxide + peroxyacetic acid Jet-Ag	128 fl oz	4 h	none listed		2	Median relative disease suppression between 48% and 62% in WA trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk.
	kasugamycin Kasumin 2L	64 oz	12 h	90 d	24	4	Best control when applied less than 24 hrs before wetness event. Control up to 12 hr after wetness event.
	calcium oxytetracycline Mycoshield	See Label	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5 optimal. 200 ppm: 1.0 lb/100 gal.
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	2-4 % v/v	48 h	none listed		NR	At petal fall lime sulfur (2 to 4%) to clean up bacteria, yeast, mildew and rot fungi.
	hydrogen peroxide peroxyacetic acid OxiDate 5.0	128 fl oz	See label			2	Provided moderate relative disease suppression (median 48%-62%) in WA over 3 trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk. Organic
	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. Soluble copper efficacy 47% to 73%. From WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	2	Efficacy may vary based on disease pressure. Median relative disease suppression 50% in WA trials 2017 to 2021, 60% WA and OR 2012-2015. Organic

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	thyme oil Thyme Guard	2 qt	4 h			2	Essential oil products provided moderate relative disease suppression (46-49%) in 4 WA trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk. Organic
Storage Rots (Sphaeropsis, Lambertella, Alternaria)	Bacillus subtilis strain IAB/BS03 Aviv	10-30 fl oz	4 h	none listed	44	3	Organic
	penthiopyrad Fontelis	20 fl oz	12 h	28 d	7	3	Fontelis has fair efficacy against Alternaria fungus and Sphaeropsis 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 Alternaria infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO 5%, so use only one of them in a given season.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	chlorantraniliprole Altacor	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 cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	spinetoram Delegate WG	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 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.
	pyriproxifen Esteem 35WP	4-5 oz	12 h	45 d	7C	3	Esteem works as a residual ovicide for codling moth; time applications for about 250 DD. See leafroller section below to determine optimum timing for leafroller.
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	
	novaluron Rimon 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
Notes: WSU recommends a delayed first cover approach. Apply the first oil at 375 DD, then 150 degree days later put on the first cover at 525 DD. Then 15 days later (depending on residue length) put on the second cover. This approach leaves only a small percentage of egg hatch at the end of each generation uncovered. See https://decisionaid.systems							
Grape mealybug	imidacloprid Admire Pro	See Label	12 h	7 d	4A	NR	Rate/PHI for foliar application.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	NR	
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	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 larvicide application against codling moth. Use the leafroller models on the WSU Decision Aid System (https://decisionaid.systems) for the optimum timing for this product.

TABLE CONTINUED

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	spinetoram Delegate WG	4.5-7 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 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.
	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	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 warm weather pattern, above 65°F, for 3 or more days. Organic
	spinosad Entrust SC	10 fl oz	4 h	7 d	5	3-4	Entrust is a spinosad formulation registered for organic apple production. Organic
	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	4	Should be applied when the last larval stage is present but before pupation has begun. Use the WSU Decision Aid System (https://decisionaid-systems) for the optimum timing of the product on leafrollers.
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	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.
	emamectin benzoate Proclaim	3.2-4.8 oz	12 h 48 h for some activities-see label	14 d	6	4	
	novaluron Rimon 0.83EC	30-50 fl oz	12 h	14 d	15	3-4	
	spinosad Success	6-10 fl oz	4 h	7 d	5	3-4	Some leafroller populations have developed resistance to Success so use of this product in this situation may result in reduced control.
	Notes: Target leafroller larvae in the spring at 300-560 DD (Obliquebanded) and 300-460 DD (Pandemis). Target 1st summer generation larvae at 955-1300 DD (Obliquebanded) and 1760-2255 DD (Pandemis). Degree day lower threshold 41°F and upper threshold 85°F.						
Rosy apple aphid	imidacloprid Admire Pro	1.4 - 2.8 fl oz	12 h	7 d	4A	NR	

TABLE CONTINUED

Petal fall cont.

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	
Notes: Use of these materials at this timing will also control other aphid species.							
Spider mites	bifenazate 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	
	spirodiclofen Envior 2SC	16-18 fl oz	12 h	7 d	23	3-4	
	fenpyroximate FujiMite SC	1-2 pt	12 h	14 d	21A	3-4	
	pyridaben Nexter 75WSB	4.4-8.8 oz	12 h	25 d	21A	2-3	
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	2-4	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.
Western flower thrips	etoxazole Zeal Miticide 1 72WSP	2-3 oz	12 h	14 d	10B	3-4	
	spinosad Entrust SC	6-8 fl oz	4 h	7 d	5	3	Organic
	spinosad Success	6-8 fl oz	4 h	7 d	5	3	
Notes: Timing tests for minimizing thrips damage indicate petal fall (5 mm fruit) is better than the traditional bloom timing.							
Western tentiform leafminer	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	
	spinosad Success	6 fl oz	4 h	7 d	5	3-4	
White apple leafhopper	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	4	Do not use until pollination is complete and bees have been removed from the area. Rate indicated is for foliar application.
	indoxacarb Avaunt	6 oz	12 h	14 d	22	3-4	
	spinosad Success	6-8 fl oz	4 h	7 d	5	3	
	kaolin clay Surround WP	40 lb	4 h	0 d		NR	Organic

TABLE CONTINUED

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
White apple leafhopper	Notes: Do not use until pollination is complete and bees have been removed from the area.						

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	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	3	Fontelis is a FRAC 7 fungicide.
	flutianil Gatten Fungicide	8 fl oz	12 h	14 d	U13	NR	The mechanism of action of Gatten is yet unknown. Rotate with fungicides from different chemical groups to reduce fungicide resistance.
	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 Vanguard. 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.
	potassium bicarbonate Kaligreen	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
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide.
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO5%SC. Use only one of these fungicides in a given season.
	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. 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.

TABLE CONTINUED

14-28 days after full bloom *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple mildew	BLAD Problad Verde	18.1 - 45.7 fl oz	4 h	1 d		2	Apply every 7 days in rotation with other materials. Organic
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	4	
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	4	Place Rally into solution before adding oil. Apply no sooner than half-inch green.
	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
	Bacillus pumilus strain QST 2808 Sonata	2-4 qt	4 h	0 d		NR	Organic
	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.
Notes: 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.							
Apple scab	captan Captan 50WP	6 lb	24 h	0 d	M4	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.
	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 Vanguard. 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.
	metiram Polyram 80DF	See label	24 h	77 d	M3	NR	
	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.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	

TABLE CONTINUED

14-28 days after full bloom *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	flutriafol Topguard	13 fl oz	12 h	14 d	3	NR	Topguard may cause a mild phytotoxicity on Braeburn apple leaves.
	ziram Ziram 76DF	See label	48 h	14 d	M3	NR	
	Notes: 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.						
Botrytis-Gray Mold	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.
Bull's eye rot	ziram Ziram Granuflo 76WDG	6 lb	48 h	14 d	M3	3	Apply 12 to 14 days after caylx formation (early fruitset 12-25 mm) and repeat as needed through the summer. Do not apply more than 24.2 lbs per acre in a crop cycle. Tank-mixing with other fungicides has been reported to increase efficacy and reduce fungicide resistance development.
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control Alternaria infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO 5%, so use only one of them in a given season.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	chlorantraniliprole Altacor	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.
	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.

14-28 days after full bloom cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	CM granulosis virus (CpGV) 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. Organic
	spinetoram Delegate WG	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	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. Organic
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	3	
	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 (525 DD when using the delayed first cover with oil at 375 DD) 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.
Rosy apple aphid	petroleum oil, summer petroleum oil, summer	See label	4 h	0 d		NR	Organic
	Notes: For a delayed first cover program, the first larvicide should be applied at 525 degree days. For a standard (no ovicide) program, the timing is 425 degree days (see https://decisionaid.arsystems). If necessary, a second larvicide for the first generation should be applied 14-17 days after the first application.						
	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	NR	

TABLE CONTINUED

14-28 days after full bloom *cont.*

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	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.
White apple leafhopper	indoxacarb Avaunt	6 oz	12 h	14 d	22	3-4	
	kaolin clay Surround WP	40 lb	4 h	0 d		NR	Organic
Woolly apple aphid	sulfoxaflor Transform	See Label	24 h	7 d	4C	3	Use an adjuvant such as Exit at 0.25% vol:vol.
	spirotetramat Ultror	10-14 fl oz	24 h	7 d	23	2-4	Time Ultror 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. Ultror 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	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR	Estimated residual activity: 7-14 days.
	imidacloprid Admire Pro	2.8 fl oz	12 h	7 d	4A	NR	Estimated residual activity: 10-14 days. Rate/PHI for foliar application.
	chlorantraniliprole Altacor	4.5 oz	4 h	5 d	28	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 10-14 days.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	Assail is also used to control codling moth. The estimated residual activity is 10-14 days.
	fenpropathrin Danitol 2.4EC	16-21.3 fl oz	24 h	14 d	3	NR	Also effective against codling moth and leafrollers. Estimated residual activity: 7-10 days.
	spinetoram Delegate WG	6-7 oz	4 h	7 d	5	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 10-14 days.

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple maggot	spinosad Entrust	2-3 oz	4 h	7 d	5	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 5-7 days. Organic
	spinosad GF-120 NF Naturalyte	See Label	4 h	0 d	5	NR	Begin applications as soon as monitoring traps indicate flies are present in the orchard and continue coverage until flights stop. Repeat applications every 7 days, reapplying sooner if rain washes off the deposit. Do not apply more than 10 applications per season. Organic
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	NR	Imidan is also used to control codling moth. The estimated residual activity is 14 days.
	lambda-cyhalothrin Warrior II	1.28-2.56 fl oz	24 h	21 d	3	NR	Also effective against codling moth and leafrollers. Estimated residual activity: 7-10 days.
Codling moth	chlorantraniliprole Altacor	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. (Brunner 2010)
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	CM granulosis virus (CpGV) 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. (Brunner 2010) Organic
	spinetoram Delegate WG	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	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. Organic

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre		REI	PHI	MOA	Eff.	Notes
Codling moth	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4		
	phosmet Imidan 70W	5 lb	7 d	7 d	1B	3		
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3		
	novaluron Rimon 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
	Notes: If a residual ovicide is used against the second generation, it should be applied at 1375 degree days (the delayed first cover timing), and the first larvicide delayed until 1525 degree days. The standard program larvicide is applied at 1425 degree days (when no oil is used at 1375). If necessary, a second larvicide should be applied 14-17 days after the first. Timings for the third generation should add 1,000 degree days to those of the second generation.							
Cutworms	indoxacarb Avaunt	6 oz	12 h	14 d	22	4		
Grape mealybug	imidacloprid Admire Pro	See Label	12 h	7 d	4A	NR		Rate/PHI for foliar application.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1		
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	NR		
	phosmet Imidan 70W	4-5 lb	7 d	7 d	1B	2		
Green apple aphid	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	3-4		
Lacanobia fruitworm	indoxacarb Avaunt	3-6 oz	12 h	14 d	22	4		
	spinosad Entrust	3 oz	4 h	7 d	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. Organic
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3-4		

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Lacanobia fruitworm	spinosad Success	6-10 fl oz	4 h	7 d	5	3-4	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.
	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Organic
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	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.
	spinetoram Delegate WG	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.
	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. Organic
	spinosad Entrust	3 oz	4 h	7 d	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. Organic
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3-4	
	emamectin benzoate Proclaim	3.2-4.8 oz	12 h 48 h for some activities-see label	14 d	6	4	

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	novaluron Rimon 0.83EC	30-50 fl oz	12 h	14 d	15	4	
	spinosad Success	6-10 fl oz	4 h	7 d	5	3-4	
San Jose scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	
Shothole borer	esfenvalerate Asana XL	14.5 fl oz	12 h	21 d	3A	4	Sanitation is the most effective management for shothole borer.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
Spider mites	bifenazate Acramite 50WS	0.75-1 lb	12 h	7 d	un	4	
	spirodiclofen Envior 2SC	16-18 fl oz	12 h	7 d	23	3-4	
	fenpyroximate FujiMite SC	1-2 pt	12 h	14 d	21A	3-4	
	pyridaben Nexter 75WSB	4.4-8.8 oz	12 h	25 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.
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	2-4	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.
	etoxazole Zeal Miticide1 72WSP	2-3 oz	12 h	14 d	10B	3-4	
Western tentiform leafminer	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	
	spinosad Success	6-10 fl oz	4 h	7 d	5	3-4	
White apple leafhopper	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	4	Do not use until pollination is complete and bees have been removed from the area. Rate indicated is for foliar application.
	indoxacarb Avaunt	4-6 oz	12 h	14 d	22	3-4	
	carbaryl carbaryl	2 pt	12 h	3 d	1A	NR	Carbaryl may disrupt integrated mite control depending on history of use. Use higher rate if leafhopper population is comprised primarily of adults.

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
White apple leafhopper	kaolin clay Surround WP	40 lb	4 h	0 d		NR	Organic
Woolly apple aphid	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	4	
	sulfoxafior Transform	See Label	24 h	7 d	4C	3	Use an adjuvant such as Exit at 0.25% vol.vol.
	spirotetramat Ultror	10-14 fl oz	24 h	7 d	23	2-4	Ultror 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	flutianil Gatten Fungicide	8 fl oz	12 h	14 d	U13	NR	The mechanism of action of Gatten is yet unknown. Rotate with fungicides from different chemical groups to reduce fungicide resistance.
	potassium bicarbonate Kaligreen	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
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	7	4	Luna Privilege is a FRAC group 7 fungicide.
	fluxapyroxad + pyraclostrobin Merivon	5.5 fl oz	12 h	0 d	7, 11	3	Merivon is a FRAC group 7 fungicide.
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO5%SC. Use only one of these fungicides in a given season.
	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. 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.
	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
	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.

TABLE CONTINUED

Late spring and summer *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple scab	captan Captan 50WP	8 lb	24 h	0 d	M4	NR	
	trifloxystrobin Flint Extra	2.5-2.9 fl oz	12 h	14 d	11	3	
	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.
	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.
	myclobutanil Rally 40WSP	5 oz	24 h	14 d	3	NR	Use only one Group 3 fungicide 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.
Notes: 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.							
Bull's eye rot	ziram Ziram Granuflo 76WDG	6 lb	48 h	14 d	M3	3	Apply 12 to 14 days after caylx formation (early fruitset 12-25 mm) and repeat as needed through the summer. Do not apply more than 24.2 lbs per acre in a crop cycle. Tank-mixing with other fungicides has been reported to increase efficacy and reduce fungicide resistance development.
Storage Rois (Sphaeropsis, Lambertella, Alternaria)	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 Captan 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-Gray Mold	copper octanoate Cueva	8 qt	4 h	0 d	M1	2	Organic

TABLE CONTINUED

Preharvest cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Botrytis-Gray Mold	thiophanate-methyl Topsin M WSB	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 1 fungicides 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 Captan 50WP	6 lb	24 h	0 d	M4	NR	Do not apply more than 64 lbs. of Captan 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 WSB	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 1 fungicides 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.
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	Aureobasidium pullulans strain DSM 14940/14941 Botector		4 h	0 d	Biological	3	Start applications 5 weeks before harvest up to applications prior to harvest in rotation with other organic materials as needed. Organic
	cinnamon oil Cinnerate	See Label	none listed	0 d	unknown	3	Applications are not recommended temperatures above 85 F.
	hydrogen peroxide + peroxyacetic acid Jet-Ag	126 fl oz	4 h	none listed		3	
	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.

TABLE CONTINUED

Preharvest cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rots (Sphaeropsis, Lambertella, Alternaria)	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	0 d	19	3	OSO will help control Alternaria infections preharvest. OSO is FRAC 19 fungicide recommended to rotate with other FRAC groups labeled for pome fruit. Do not apply more than 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Ph-D is similar to OSO 5%, so use only one of them in a given season.
	pyraclostrobin + boscalid Pristine	14.5-18.5 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.
	BLAD Problad Verde		4 h	1 d		2-3	Apply as a preharvest spray within 1 to 10 days before harvest. Organic
	thiophanate-methyl Topsin M WSB	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.
	ziram Ziram Granuflo 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	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR	Estimated residual activity: 7-14 days.
	chlorantraniliprole Altacor	4.5 oz	4 h	5 d	28	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 10-14 days.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	Assail is also used to control codling moth. The estimated residual activity is 10-14 days.
	fenpropathrin Danitol 2.4EC	16-21.3 fl oz	24 h	14 d	3	NR	Also effective against codling moth and leafrollers. Estimated residual activity: 7-10 days.

TABLE CONTINUED

Preharvest cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Apple maggot	spinetoram Delegate WG	6-7 oz	4 h	7 d	5	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 10-14 days.
	spinosad Entrust	2-3 oz	4 h	7 d	5	NR	Provides suppression only. Also effective against codling moth and leafrollers. Estimated residual activity: 5-7 days. Organic
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	NR	Imidan is also used to control codling moth. The estimated residual activity is 14 days.
	lambda-cyhalothrin Warrior II	1.28-2.56 fl oz	24 h	21 d	3	NR	Also effective against codling moth and leafrollers. Estimated residual activity: 7-10 days.
Codling moth	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	spinetoram Delegate WG	6-7 oz	4 h	7 d	5	4	Delegate is 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	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. Organic
	carbaryl Sevin XLR Plus	1-3 qt	12 h	3 d	1A	2	
Leafrollers (Pandemis, Obliquebanded)	petroleum oil, summer petroleum oil, summer	See label	4 h	0 d		NR	Organic
	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-Gray Mold

Gray mold, caused by *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 throughout 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 64F and 78F 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 for fungicide resistance development as the fungus can develop resistance to multiple fungicides 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.

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 remains 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 60F and 78F. 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 82F) 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 a 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 Northcentral Washington can be conducive to scab and therefore, management is recommended. In western Washington scab is common. Pear scab can cause problems in northern Washington growing regions and in Hood River, Oregon but it is rarely seen in central and south Washington State.

Storage Rots (Sphaeropsis, Lambertella, Alternaria)

Several other fungal fruit infections initiated in the orchard can cause storage rots. Alternaria rot: 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 rot: A sporadic emerging disease caused 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 twigs. 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. Yellow-Lambertella rot: 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 Pacific Northwest. 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 at <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 generations 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.

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.

Pear psylla

Pear psylla, *Cacopsylla pyricola*, is a major pest of pears in the Pacific Northwest. 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 on wood while trees are dormant or at bud swell and generally peaks between popcorn and bloom on green tissues. The first generation of nymphs emerge between popcorn and petalfall. Pear

psylla undergo 3–4 generations in a season, with the 3rd and 4th usually occurring during or after harvest depending on the cultivar and season. While many programs rely heavily on repeated broad-spectrum sprays from dormant through harvest, softer programs use particle films (Surround CF or WP and diatomaceous earth for adult repellency and selective insecticides (Esteem, Dimilin, Centaur, Neem products, Cinnerate) are encouraged for conservation of natural enemies. Therefore, when possible, materials are noted as broad-spectrum when expected to disrupt some combination of predators *Deraeocoris brevis*, *Campylomma verbasci*, earwigs, anthrocorids and the parasitoid wasp *Trechmites insidiosus*. Selective materials are expected to conserve these natural enemies, which are highly effective at controlling psylla later in the season.

Pear rust mite

Pear rust mite, *Epirimerus 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 scarring around the calyx. Rust mites will continue to feed through the season on both the fruit and leaves, causing a light russeting over their surfaces. If rust mites reemerge in the summer, they are readily controlled by most conventional miticides. Organic products such as cinnamon 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	diatomaceous earth Celite 610	40-70 lb	none listed	none listed	particle film	3-4	Adding a spreader sticker will improve residue stability. Organic
	petroleum oil- dormant petroleum oil- dormant	1-1.5 % v/v	12 h	none listed		4	Organic
	lime sulfur/calcium polysulfide + petroleum oil- dormant Rex Lime Sulfur + petroleum oil- dormant	See Label 1-1.5 % v/v	48 h	0 d		4	Organic
	kaolin Surround CF	50-100 lb	4 h	see label		4	This formulation is designed for mixing with cold water, preferred for pre-bloom sprays. Organic
	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
	lambda-cyhalothrin Warrior II	2.56 fl oz	24 h	21 d	3	1-2	Can be mixed with Piperonyl butoxide (PBO) to increase efficacy. Pyrethroid (MOA 3A) resistance is present in many areas and may severely reduce efficacy.

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
European red mite	petroleum oil- dormant petroleum oil- dormant	1.5 % v/v	12 h	none listed		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. Organic
Grape mealybug	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. Diazinon is labeled for a maximum of one dormant and one in-season application in pear.
	petroleum oil- dormant petroleum oil- dormant	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
Pear psylla	diatomaceous earth Celite 610	40-70 lb	none listed	none listed	particle film	3-4	Adding a spreader sticker will improve residue stability. Organic
	diflubenzuron + petroleum oil- dormant Dimilin 2L + petroleum oil- dormant	40-48 fl oz 1-1.5 % v/v	12 h	14 d	15	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.
	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
	lime sulfur/calcium polysulfide + petroleum oil- dormant lime sulfur/calcium polysulfide + petroleum oil- dormant	See label gal See label See Label	48 h	0 d		4	Use no more than 5 gal oil per acre in concentrate sprays. In areas where pears are susceptible to oil injury, reduce dosage so that no more than 5 gal 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

TABLE CONTINUED

Delayed dormant cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	kaolin Surround CF	50-100 lb	4 h	see label		4	This formulation is designed for mixing with cold water, preferred for pre-bloom sprays. Organic
	kaolin clay + petroleum oil- dormant Surround WP + petroleum oil- dormant	50-100 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
	petroleum oil, summer + cinnamon oil petroleum oil, summer + Cinnerate	1-2 gal 48-64 fl oz	4 h	0 d		1-3	Marking has been seen only when applied after June turn down. 200 GPA sprays can increase likelihood of marking. Contact only, requires repeat sprays.
	lambda-cyhalothrin Warrior II	2.56 fl oz	24 h	21 d	3	1-2	Can be mixed with Piperonyl butoxide (PBO) to increase efficacy. Pyrethroid (MOA 3A) resistance is present in many areas and may severely reduce efficacy.
Pear rust mite, pearleaf blister mite	petroleum oil- dormant petroleum oil- dormant	1-1.5 % v/v	12 h	none listed		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. Organic
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		3-4	Organic
San Jose scale	pyriproxyfen Esteem 35WP	4-5 oz	12 h	45 d	7C	1	
	petroleum oil- dormant petroleum oil- dormant	1-1.5 % v/v	12 h	none listed		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. 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.

Tight cluster

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		2	Organic
Grape mealybug	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR	PHI depends on rate used. Use a diluted spray for full coverage.
	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	3-4	
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	Diazinon is labeled for a maximum of one dormant and one in-season application in pear.
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	2	Broad-spectrum on pear psylla natural enemies.
Lygus bugs, stink bugs, green fruitworm	flonicamid Beleaf 50SG	2-2.8 oz	12 h	21 d	29	NR	Needs further study. 50% control of adults and 65% control of young nymphs in one WA study in alfalfa [Walsh 2018].
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	NR	Do not mix diazinon with oil. Diazinon is labeled for a maximum of one dormant and one in-season application in pear.
	sulfoxaflor Transform	1.5-2.75 oz	24 h	7 d	4C	NR	Needs further testing. 68% control of adults and 71% control of young nymphs in one WA study in alfalfa [Walsh 2018].
	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	3	Broad-spectrum on pear psylla natural enemies.
Pear psylla	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	2	Resistance to abamectin has been documented in certain areas, so efficacy may vary. Broad-spectrum on mite and pear psylla predators.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	Adult, egg and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	azadirachtin Aza-Direct	See label	4 h	0 d	un	2-3	Selective; compatible with pear psylla natural enemies. Short residues; 7-10 day reapplication intervals may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. Organic
	tolfenpyrad Bexar	27 fl oz	12 h	14 d	21A	4	Do not make more than two applications of Bexar in a season. Mortality of adults, eggs, and nymphs.
	diatomaceous earth Celite 610	40-70 lb	none listed	none listed	particle film	3-4	Adding a spreader sticker will improve residue stability. Organic

TABLE CONTINUED

Tight cluster cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	2-3	
	spinetoram Delegate WG	7 oz	4 h	7 d	5	3-4	Psylla adult and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	2-4	Pyriproxyfen needs to be timed with adults just before they lay eggs. It will not kill adults or prevent egg lay, but will cause adults to lay infertile eggs. Selective; compatible with pear psylla natural enemies.
	kaolin Surround CF	50-100 lb	4 h	see label		4	This formulation is designed for mixing with cold water, preferred for pre-bloom sprays. Organic
	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Kaolin clay residues used after June may be difficult to remove from fruit when packing, especially red or soft skin varieties. Organic
San Jose scale	petroleum oil, summer + cinnamon oil petroleum oil, summer + Cinnerate	1-2 gal 48-64 fl oz	4 h	0 d		1-3	Marking has been seen only when applied after June turn down. 200 GPA sprays can increase likelihood of marking. Contact only, requires repeat sprays.
	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.

Popcorn

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear 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.
	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.
	pydiflumetofen Miravis	3.4 fl oz	12 h	30 d	7	3	Rotate with other FRAC groups other than FRAC 7.
TABLE CONTINUED							

Popcorn cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew	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.
	lime sulfur/calcium polysulfide Rex Lime Sulfur	12 % v/v	48 h	0 d		NR	Do NOT use lime sulfur or micronized sulfur on Anjou. Organic
	mancozeb mancozeb	6 lb	24 h	77 d	M3	NR	
Pear scab	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.
	pydiflumetofen + benzovindiflupyr Miravis + Aprovia	3.4 fl oz 5.5-7 fl oz	12 h	30 d	7	NR	Aprovia, Fontelis, and Miravis are from the same chemical group (7). Use ONLY one of them at the same growth stage.
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	Rate varies when used in eradicator (postinfective) schedules. See label.
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		NR	Do NOT use lime sulfur or micronized sulfur on Anjou. Organic
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. 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
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	Adult, egg and nymph mortality. Broad-spectrum on pear psylla natural enemies.
Pear psylla	azadirachtin Aza-Direct	See label	4 h	0 d	un	2-3	Selective; compatible with pear psylla natural enemies. Short residues; 7-10 day reapplication intervals may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. Organic
	tolfenpyrad Bexar	27 fl oz	12 h	14 d	21A	4	Do not make more than two applications of Bexar in a season. Mortality of adults, eggs, and nymphs.
	spinetoram Delegate WG	7 oz	4 h	7 d	5	3-4	Psylla adult and nymph mortality. Broad-spectrum on pear psylla natural enemies.

TABLE CONTINUED

Popcorn cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	diflubenzuron Dimilin 2L	40-48 fl oz	12 h	14 d	15	2-3	
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	2-4	Pyriproxyfen needs to be timed with adults just before they lay eggs. It will not kill adults or prevent egg lay, but will cause adults to lay infertile eggs. Selective; compatible with pear psylla natural enemies.
	novaluron Rimon 0.83EC	32 fl oz	12 h	14 d	15	3	Do not apply after initiation of pear turn-down. Broad-spectrum on pear psylla natural enemies.
	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Kaolin clay residues used after June may be difficult to remove from fruit when packing, especially red or soft skin varieties. Organic
	petroleum oil, summer + cinnamon oil petroleum oil, summer + Cinnerate	1-2 gal 48-64 fl oz	4 h	0 d		1-3	Marking has been seen only when applied after June turn down. 200 GPA sprays can increase likelihood of marking. Contact only, requires repeat sprays.

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	pydiflumetofen Miravis	3.4 fl oz	12 h	30 d	7	3	Rotate with other FRAC groups other than FRAC 7.

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 strains DSM 14940 & 14941 Blossom Protect	1.25 lb	4 h	none listed		4	Apply with Buffer Protect. Two or more applications best. Yeasts need 1-2 days before an infection to colonize the flower before bacteria invade to be effective. Russet potential on sensitive varieties in humid conditions. Organic
	oxytetracycline FireLine 17WP	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5.5-6.0 optimal. Best activity at 200 ppm: 1.0 lb/100 gal.
	kasugamycin Kasumin 2L	64 fl oz	12 h	90 d	24	4	Best control when applied less than 24 h before wetness event. Potentially some control up to 12 h after wetting.
	calcium oxytetracycline Mycoshield	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5 optimal. 200 ppm: 1.0 lb/100 gal.
Pear mildew	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.
	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. Apply no sooner than half-inch green.
	Notes: 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.						
Pear scab	mancozeb mancozeb	6 lb	24 h	77 d	M3	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	28 d	7	NR	
	triflumizole Procure 480SC	8-16 fl oz	12 h	14 d	3	NR	
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		NR	Organic
	dodine Sylit FL	3 pt	48 h	7 d	U12	NR	

TABLE CONTINUED

First bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	Aureobasidium pullulans strain DSM 14940/14941 Botector	10 oz	4 h	0 d	Biological	NR	Apply no more than 2 times between 10 and 90% bloom. Do not apply if Blossom Protect will be applied. Organic
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
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-Gray Mold	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 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. Efficacy dependent on the occurrence of fungicide resistant populations. For powdery mildew, preferably use other FRAC 7 fungicides in spring.

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h	60 d	P01	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. Also used to reduce re-occurrence of blight after cutting out infected strikes. Apply concentrate to a one meter section of the main leader after cutting see http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/
	Aureobasidium pullulans strains DSM 14940 & 14941 Blossom Protect	1.25 lb	4 h	none listed		4	Apply with Buffer Protect. Two or more applications best. Yeasts need 1-2 days before an infection to colonize the flower before bacteria invade to be effective. Russet potential on sensitive varieties in humid conditions. Organic
	copper octanoate Cueva	4 qt	4 h	0 d	M1	3	Little russet in semi-arid WA trials. Some russet risk in wetter OR. Tank mix compatible with Bacillus-based biopesticides. Soluble copper efficacy 47% to 73% in WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus amyloliquefaciens strain D747 DoubleNickel 55	3 lb	4 h	0 d		2	See label and space between rows to select the corresponding rate. Efficacy may vary based on disease pressure. Can be used with copper fungicides to increase control. Relative disease suppression in Washington trials average 30%. Organic
	oxytetracycline FireLine 17WP	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5.5-6.0 optimal. Best activity at 200 ppm: 1.0 lb/100 gal.
	kasugamycin Kasumin 2L	64 fl oz	12 h	90 d	24	4	Best control when applied less than 24 h before wetness event. Potentially some control up to 12 h after wetting.
	Copper sulfate pentahydrate Mastercop	40 fl oz	48 h	0 d		3	Pay attention to drying times. Soluble copper efficacy 47% to 73% in WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	calcium oxytetracycline Mycoshield	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5 optimal. 200 ppm: 1.0 lb/100 gal.
	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
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	2	Efficacy may vary based on disease pressure. Median relative disease suppression 50% in WA trials 2017 to 2021, 60% WA and OR 2012-2015. Organic

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rots (Sphaeropsis, Lambertella, Alternaria)	Aureobasidium pullulans strain DSM 14940/14941 Botector	10 oz	4 h	0 d	Biological	NR	Apply no more than 2 times between 10 and 90% bloom. Do not apply if Blossom Protect will be applied. 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	Eff.	Notes
Botrytis-Gray Mold	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 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. Efficacy dependent on the occurrence of fungicide resistant populations. For powdery mildew, preferably use other FRAC 7 fungicides in spring.
	thiophanate-methyl Topsin M WSB	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.

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
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	acibenzolar-s-methyl Actigard 50WG	1-2 fl oz	12 h	60 d	P01	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. Also used to reduce re-occurrence of blight after cutting out infected strikes. Apply concentrate to a one meter section of the main leader after cutting see http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/
	cinnamon oil Cinnerate	32 fl oz	none listed	0 d	unknown	2	Essential oil products provided median relative disease suppression (45-49%) in 3 WA trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk.
	copper octanoate Cueva	4 qt	4 h	0 d	M1	3	Little russet in semi-arid WA trials. Some russet risk in wetter OR. Tank mix compatible with Bacillus-based biopesticides. Soluble copper efficacy 47% to 73% in WSU trials 2013 to 2022 (DuPont et al. 2023). Organic
	Bacillus amyloliquefaciens strain D747 DoubleNickel 55	3 lb	4 h	0 d		2	See label and space between rows to select the corresponding rate. Efficacy may vary based on disease pressure. Can be used with copper fungicides to increase control. Relative disease suppression in Washington trials average 30%. Organic
	oxytetracycline FireLine 17WP	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5.5-6.0 optimal. Best activity at 200 ppm: 1.0 lb/100 gal.
	hydrogen peroxide + peroxyacetic acid Jet-Ag	128 fl oz	4 h	none listed		2	Provided moderate relative disease suppression (median 48%-62%) in WA over 3 trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk.
	kasugamycin Kasumin 2L	64 fl oz	12 h	90 d	24	4	Best control when applied less than 24 h before wetness event. Potentially some control up to 12 h after wetting.

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fire blight	calcium oxytetracycline Mycoshield	16 oz	12 h	60 d	41	4	Best activity within 24 h before wetness event. Check spray tank pH, 5 optimal. 200 ppm: 1.0 lb/100 gal.
	hydrogen peroxide peroxyacetic acid OxiDate 5.0	128 fl oz	See label			2	Provided moderate relative disease suppression (median 48%-62%) in WA over 3 trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk. Organic
	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
	Bacillus subtilis strain QST 713 Serenade Opti	20 oz	4 h	0 d	44	2	Efficacy may vary based on disease pressure. Median relative disease suppression 50% in WA trials 2017 to 2021, 60% WA and OR 2012-2015. Organic
	thyme oil Thyme Guard	2 qt	4 h			2	Essential oil products provided moderate relative disease suppression (46-49%) in 4 WA trials with repeat applications. Use as part of an integrated program. Consider drying times to minimize marking risk. Organic
Pear mildew	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.
	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.
	potassium bicarbonate Kaligreen	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
	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.
	pydiflumetofen Miravis	3.4 fl oz	12 h	30 d	7	3	Rotate with other FRAC groups other than FRAC 7.

TABLE CONTINUED

Petal fall *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew	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 4.3 oz. a.i./acre/season. Organic
	triflumizole Procure 480SC	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.
	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
	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.
Pear scab	mancozeb mancozeb	6 lb	24 h	77 d	M3	NR	
	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.
	pydiflumetofen + benzovindiflupyr Miravis + Aprovia	3.4 fl oz 5.5-7 fl oz	12 h	30 d	7	NR	Aprovia, Fontelis, and Miravis 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	
	lime sulfur/calcium polysulfide Rex Lime Sulfur	See label	48 h	0 d		NR	Organic

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	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 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 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 4.3 oz. a.i./acre/season. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	3	
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
	petroleum oil, summer petroleum oil, summer	See Label	4 h	0 d		NR	Organic
Grape mealybug	thiamethoxam Actara	4.5-5.5 oz	12 h	14 d/35 d	4A	NR	PHI depends on rate used. See label.
	imidacloprid Admire Pro	5.6-7 fl oz	12 h	7 d	4A	NR	Rate/PHI for foliar application.
	acetamiprid Assail 70WP	2.3-3.4 oz	12 h	7 d	4A	1	
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	NR	
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	Diazinon is labeled for a maximum of one dormant and one in-season application in pear.
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	2	Broad-spectrum on pear psylla natural enemies.

TABLE CONTINUED

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	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.ars.usda.gov/ 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.
	spinetoram Delegate WG	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.
	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
	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.
	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.
	emamectin benzoate Proclaim	3.2-4.8 oz	12 h 48 h for some activities-see label	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.

TABLE CONTINUED

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	spinosad Success	6-10 fl oz	4 h	7 d	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, twospotted spider mite, European red mite	cyflumetofen Nealta	13.7 fl oz	12 h	7 d	25	3-4	Low impacts on natural enemies.
Pear psylla	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	3	Broad-spectrum on pear psylla natural enemies.
	imidacloprid Admire Pro	5.6-7 fl oz	12 h	7 d	4A	2-3	
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	2	Resistance to abamectin has been documented in certain areas, so efficacy may vary. Broad-spectrum on mite and pear psylla predators.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	Adult, egg and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	azadirachtin Aza-Direct	See label	4 h	0 d	un	2-3	Selective; compatible with pear psylla natural enemies. Short residues; 7-10 day reapplication intervals may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. Organic
	tolfenpyrad Bexar	27 fl oz	12 h	14 d	21A	4	Do not make more than two applications of Bexar in a season. Mortality of adults, eggs, and nymphs.
	diatomaceous earth Celite 610	40-70 lb	none listed	none listed	particle film	3-4	Adding a spreader sticker will improve residue stability. Organic
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	2-3	
	spinetoram Delegate WG	7 oz	4 h	7 d	5	3-4	Psylla adult and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	2-4	Pyriproxyfen needs to be timed with adults just before they lay eggs. It will not kill adults or prevent egg lay, but will cause adults to lay infertile eggs. Selective; compatible with pear psylla natural enemies.
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	3-4	
	novaluron Rimon 0.83EC	32 fl oz	12 h	14 d	15	3	Do not apply after initiation of pear turnaround. Broad-spectrum on pear psylla natural enemies.

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Kaolin clay residues used after June may be difficult to remove from fruit when packing, especially red or soft skin varieties. Organic
	petroleum oil, summer + cinnamon oil petroleum oil, summer + Cinnerate	1-2 gal 48-64 fl oz	4 h	0 d		1-3	Marking has been seen only when applied after June turn down. 200 GPA sprays can increase likelihood of marking. Contact only, requires repeat sprays.
	spirotetramat Ultror	10-14 fl oz	24 h	7 d	23	2-4	Time Ultror applications 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. It kills feeding nymphs and must be applied before eggs hatch. Selective on pear psylla; compatible with natural enemies.
Pear rust mite	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	Broad-spectrum on mite and pear psylla predators.
	spirodiclofen Envior 2SC	16-18 fl oz	12 h	7 d	23	4	
	fenpyroximate FujiiMite SC	2 pt	12 h	14 d	21A	NR	
	cyflumetofen Nealta	13.7 fl oz	12 h	7 d	25	3-4	Effective against mites and has low impacts on natural enemies.
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	3	
	fenbutatin oxide Vendex 50WP	1-1.5 lb	48 h	14 d	12B	2-4	
Pearleaf blister mite	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	NR	Broad-spectrum on mite and pear psylla predators.

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	imidacloprid Admire Pro	7 fl oz	12 h	7 d	4A	NR	
	chlorantraniliprole Altacor	3-4.5 oz	4 h	5 d	28	4	Selective; compatible with pear psylla natural enemies.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	Broad-spectrum on pear psylla natural enemies.
	spinetoram Delegate WG	6-7 oz	4 h	7 d	5	4	Broad-spectrum on pear psylla natural enemies.
	diflubenzuron Dimilin 2L	16 fl oz	12 h	14 d	15	4	Selective, compatible with pear psylla natural enemies. In trials percent control compared to the untreated check (based on fruit infected or with stings) has ranged from 76-90 percent (Dunley et al. 2002), 87 percent for Dimilin+oil (Van Steenwyk et al. 2004), 89 percent (Van Steenwyk and Nomoto 2002), 98 percent (Van Steenwyk et al. 2003).
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	3	Broad-spectrum on pear psylla natural enemies.
Pear psylla	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3	Selective; compatible with pear psylla natural enemies. Should be applied before egg hatch. In efficacy studies it has provided 89 percent control (Van Steenwyk and Nomoto 2002) and 95 percent control (Van Steenwyk and Weiss 2015).
	Notes: WSU recommends a delayed first cover management program: Apply the first oil at 375 DD, then 150 degree days later put on the first cover at 525 DD. Then 15 days later (depending on residue length) put on the second cover. This approach leaves only a small percentage of egg hatch at the end of each generation uncovered. An oil-only program requires re-application intervals of 200 DD under low pest pressure and 150 DD under high pest pressure. CM granulovirus is effective when applied at 525 DD and repeated every 5-7 days until about 950 DD (4-5 applications). In any program, mating disruption increases control considerably. In high pressure situations, use CM granulovirus with oil for better control. For summer generations add 1000 degree days for second and third cover.						
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	Adult, egg and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	diflubenzuron Dimilin 2L	48 fl oz	12 h	14 d	15	2-3	
	pyriproxifen Esteem 35WP	5 oz	12 h	45 d	7C	2-4	Pyriproxifen needs to be timed with adults just before they lay eggs. It will not kill adults or prevent egg lay, but will cause adults to lay infertile eggs. Selective; compatible with pear psylla natural enemies.

TABLE CONTINUED

14-32 days after full bloom *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Kaolin clay residues used after June may be difficult to remove from fruit when packing, especially red or soft skin varieties. Organic
Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear mildew	pydiflumetofen Miravis	3.4 fl oz	12 h	30 d	7	3	Rotate with other FRAC groups other than FRAC 7.

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	chlorantraniliprole Altacor	3-4.5 oz	4 h	5 d	28	4	Selective; compatible with pear psylla natural enemies.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	Broad-spectrum on pear psylla natural enemies.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	
	spinetoram Delegate WG	6-7 oz	4 h	7 d	5	4	Broad-spectrum on pear psylla natural enemies.
	diflubenzuron Dimilin 2L	16 fl oz	12 h	14 d	15	4	Selective, compatible with pear psylla natural enemies. In trials percent control compared to the untreated check (based on fruit infected or with stings) has ranged from 76-90 percent (Dunley et al. 2002), 87 percent for Dimilin+oil (Van Steenwyk et al. 2004), 89 percent (Van Steenwyk and Nomoto 2002), 98 percent (Van Steenwyk et al. 2003).
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C	3	
	cyantraniliprole Exirel	10-17 fl oz	12 h	3 d	28	4	
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	3	Broad-spectrum on pear psylla natural enemies.
TABLE CONTINUED							

Late spring and summer cont.

Insect	Chemical	Rate per Acre		REI	PHI	MOA	Eff.	Notes
Codling moth	methoxyfenozide Intrepid 2F	16 fl oz	4 h	14 d	18A	3		Selective; compatible with pear psylla natural enemies. Should be applied before egg hatch. In efficacy studies it has provided 89 percent control (Van Steenwyk and Nomoto 2002) and 95 percent control (Van Steenwyk and Weiss 2015).
	petroleum oil, summer petroleum oil, summer	See Label	4 h	0 d		NR		Organic
	Notes: WSU recommends a delayed first cover management program: Apply the first oil at 375 DD, then 150 degree days later put on the first cover at 525 DD. Then 15 days later (depending on residue length) put on the second cover. This approach leaves only a small percentage of egg hatch at the end of each generation uncovered. An oil-only program requires re-application intervals of 200 DD under low pest pressure and 150 DD under high pest pressure. CM granulovirus is effective when applied at 525 DD and repeated every 5-7 days until about 950 DD (4-5 applications). In any program, mating disruption increases control considerably. In high pressure situations, use CM granulovirus with oil for better control. For summer generations add 1000 degree days for second and third cover.							
Grape mealybug	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR		PHI depends on rate used.
	imidacloprid Admire Pro	5.6-7 fl oz	12 h	7 d	4A	NR		Rate/PHI for foliar application.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	1		
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	NR		
	phosmet Imidan 70W	5.33 lb	7 d	7 d	1B	2		Broad-spectrum on pear psylla natural enemies.
Grasshoppers and Mormon crickets	carbaryl carbaryl	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.
Green apple aphid	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR		
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	4		
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	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.
	spinetoram Delegate WG	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.

TABLE CONTINUED

Late spring and summer cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
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. 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
	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.
	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.
	emamectin benzoate Proclaim	3.2-4.8 oz	12 h 48 h for some activities-see label	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.
	spinosad Success	6-10 fl oz	4 h	7 d	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, twospotted spider mite, European red mite	bifenazate Acramite 50WS	0.75-1 lb	12 h	7 d	un	2-4	
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	1-3	Broad-spectrum on mite and pear psylla predators.
	clofentezine Apollo 4SC	4-8 fl oz	12 h	21 d	10A	2-4	Clofentezine (Apollo) and hexythiazox (Savey) are ovicides. When initial mite populations are high, use in combination with an adulticide.
	spirodiclofen Envidor 2SC	16-18 fl oz	12 h	7 d	23	3-4	
	fenpyroximate FujiiMite SC	1-2 pt	12 h	14 d	21A	3-4	Broad-spectrum on predator mites.
	acequinocyl Kanemite 15 SC	21-31 fl oz	12 h	14 d	20B	NR	

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
McDaniel spider mite, twospotted spider mite, European red mite	cyflumetofen Nealta	13.7 fl oz	12 h	7 d	25	3-4	Low impacts on natural enemies.
	pyridaben Nexter 75WSB	4.4-10.67 oz	12 h	7 d	21A	2-4	Use 4.4 to 5.2 oz/A for ERM; use 6.6 to 10.67 oz/A for twospotted and McDaniel spider mites.
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	2-4	Hexythiazox (Savey) and clofentezine (Apollo) are oviocides. When initial mite populations are high, use in combination with an adulticide.
	fenbutatin oxide Vendex 50WP	1.5-2 lb	48 h	14 d	12B	2-4	Resistance to fenbutatin oxide exists in many areas. Somewhat selective to spider mites; medium effects on predator mites.
	etoxazole Zeal Miticide1 72WSP	3 oz	12 h	14 d	10B	1-3	
Pear psylla	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	3	Broad-spectrum on pear psylla natural enemies.
	imidacloprid Admire Pro	5.6-7 fl oz	12 h	7 d	4A	NR	
	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	2	Resistance to abamectin has been documented in certain areas, so efficacy may vary. Broad-spectrum on mite and pear psylla predators.
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	Adult, egg and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	azadirachtin Aza-Direct	See label	4 h	0 d	un	2-3	Selective; compatible with pear psylla natural enemies. Short residues; 7-10 day reapplication intervals may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. Organic
	toltenpyrad Bexar	27 fl oz	12 h	14 d	21A	3-4	This is a contact insecticide so coverage will greatly effect efficacy. Check with packing house acceptability of applications later than June.
	diatomaceous earth Celite 610	40-70 lb	none listed	none listed	particle film	3-4	Adding a spreader sticker will improve residue stability. Organic
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	2-3	
	spinetoram Delegate WG	7 oz	4 h	7 d	5	3-4	Psylla adult and nymph mortality. Broad-spectrum on pear psylla natural enemies.
	diflubenzuron Dimilin 2L	48 fl oz	12 h	14 d	15	2-3	

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear psylla	fenpyroximate FujiiMite SC	1-2 pt	12 h	14 d	21A	1-2	
	pyridaben Nexter 75WSB	6.6-10.67 oz	12 h	7 d	21A	3-4	
	kaolin clay Surround WP	50 lb	4 h	0 d		3-4	Kaolin clay residues used after June may be difficult to remove from fruit when packing, especially red or soft skin varieties. Organic
	petroleum oil, summer + cinnamon oil petroleum oil, summer + Cinnerate	1-2 gal 48-64 fl oz	4 h	0 d		1-3	Marking has been seen only when applied after June turn down. 200 GPA sprays can increase likelihood of marking. Contact only, requires repeat sprays.
	spirotetramat Ultror	10-14 fl oz	24 h	7 d	23	2-4	Time Ultror applications 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. It kills feeding nymphs and must be applied before eggs hatch. Selective on pear psylla; compatible with natural enemies.
Pear rust mite	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6	4	Broad-spectrum on mite and pear psylla predators.
	spirodiclofen Envior 2SC	16-18 fl oz	12 h	7 d	23	4	
	fenpyroximate FujiiMite SC	2 pt	12 h	14 d	21A	NR	
	cyflumetofen Nealta	13.7 fl oz	12 h	7 d	25	3-4	Effective against mites and has low impacts on natural enemies.
	pyridaben Nexter 75WSB	10.67 oz	12 h	7 d	21A	3	
	fenbutatin oxide Vendex 50WP	1-1.5 lb	48 h	14 d	12B	2-4	
Pear slug	thiamethoxam Actara	5.5 oz	12 h	14 d/35 d	4A	NR	
	chlorantraniliprole Altacor	4.5 oz	4 h	5 d	28	NR	
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	NR	

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre		REI	PHI	MOA	Eff.	Notes
Pear slug	spinetoram Delegate WG	6 oz	4 h	7 d	5		NR	
	fenpyroximate FujiMite SC	2 pt	12 h	14 d	21A		NR	
	spinosad Success	4 fl oz	4 h	7 d	5		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 blister mite	abamectin Agri-Mek SC	4.25 fl oz	12 h	28 d	6		NR	Broad-spectrum on mite and pear psylla predators.
	carbaryl carbaryl	0.5-1.5 qt	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.
	Notes: 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	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16		2-3	
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B		3-4	Diazinon is labeled for a maximum of one dormant and one in-season application in pear.
	pyriproxyfen Esteem 35WP	5 oz	12 h	45 d	7C		2-3	Be aware that Esteem has a 45 day PHI.
Disease	Chemical	Rate per Acre		REI	PHI	MOA	Eff.	Notes
Pear mildew	potassium bicarbonate Kaligreen	3 lb	4 h	1 d	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
	fluopyram Luna Privilege	6.84 fl oz	12 h	7 d	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	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	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 4.3 oz. a.i./acre/season. Organic

TABLE CONTINUED

Late spring and summer cont.

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
	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.
Pear scab	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.
	pydiflumetofen + benzovindiflupyr Miravis + Aprovia	3.4 fl oz 5.5 to 7.0 fl oz	12 h	30 d	7	2	Do not follow FRAC group 7 fungicides with other group 7s, such as Aprovia, Fontelis, Luna, Miravis, and Pristine to reduce fungicide resistance development.
Notes: 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.							
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	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 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 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 4.3 oz. a.i./acre/season. Organic
	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
Botrytis-Gray Mold	thiophanate-methyl Topsin M WSB	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 1 fungicides 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.
	thiophanate-methyl Topsin M WSB	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 1 fungicides 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 Granuflo 76WDG	6 lb	48 h	14 d	M3	NR	Because of visible residues, do not use ziram on Asian pears.
Storage Rot (Sphaeropsis, Lambertella, Alternaria)	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 Ph-D	6.2 oz	4 h	0 d	19	3	
	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.

TABLE CONTINUED

Preharvest cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Storage Rots (Sphaeropsis, Lambertella, Alternaria)	thiophanate-methyl Topsin M WSB	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 1 fungicides and do not make sequential applications of FRAC group 1 fungicides per season. Topsin-M is similar to Mertect, used postharvest, therefore careful use is highly recommended.
	ziram Ziram 76DF	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.
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Codling moth	petroleum oil, summer petroleum oil, summer	See Label	4 h	0 d		NR	Organic
Pear psylla	azadirachtin Aza-Direct	See label	4 h	0 d	un	2-3	Selective; compatible with pear psylla natural enemies. Short residues; 7-10 day reapplication intervals may be necessary for control. Severe phytotoxicity may occur if applied to pear cultivars with Comice background. 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.



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 of dormancy and 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. Current resistance management guidelines are available at <https://www.frac.info>

Cherry Powdery Mildew

Powdery mildew, caused by the fungus *Podosphaera cerasi*, 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 50F 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, particularly during the two weeks before harvest. Management of powdery mildew in sweet cherries involves intensive and expensive fungicide application programs. Resistance to Group 3 (DMI) and Group 11 (QoI) fungicides has been documented in the cherry powdery mildew pathosystem. Resistance to Group 7 (SDHI) fungicides has been documented but is of quite limited distribution. Current resistance management guidelines are available at <https://www.frac.info>

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, dead limbs, and woodpiles from the orchard) is the most effective 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.

Spray Schedule

Dormant

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Bacterial canker or gummosis	fixed copper Champ WG	8 lb	24 h	0 d	M1	NR	
	copper hydroxide Kocide 3000	See Label	48 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	Organic
Cutworms	indoxacarb Avaunt	6 oz	12 h	14 d	22	4	
European red mite	clofentezine Apollo 4SC	4-8 fl oz	12 h	21 d	10A	NR	
	petroleum oil- dormant petroleum oil- dormant	1-1.5 % v/v	12 h	none listed		2	Organic
	hexythiazox Savey 50DF	4-6 oz	12 h	28 d	10A	2-4	
Grape mealybug	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	
San Jose scale & Lecanium scale	petroleum oil- dormant petroleum oil- dormant	6 gal	12 h	none listed		NR	Organic
Twospotted 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 (shot-hole)	azoxystrobin Abound	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.
	trifloxystrobin Flint Extra	3-3.8 fl oz	12 h	1 d	11	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	copper hydroxide Kocide 3000	See Label	48 h	0 d	M1	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	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.
	ziram + copper hydroxide Ziram Granuflo 76WDG + Kocide 3000	See Label See Label	48 h	30 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	
Cutworms	indoxacarb Avaunt	6 oz	12 h	14 d	22	4	
Leafrollers (Pandemis)	Bacillus thuringiensis subsp. kurstaki DiPel DF	See label	4 h	0 d	11B2	3	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 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	Organic

TABLE CONTINUED

Prebloom cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis)	spinosad Success	4-8 fl oz	4 h	7 d	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	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	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.
	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.
	metconazole Quash	2.5-3.5 oz	12 h	14 d	3	NR	
Cherry Powdery Mildew	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.
	azoxystrobin Abound	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.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR	Resistance to Group 11 (QoI) fungicides has been documented in the cherry powdery mildew pathosystem.
	trifloxystrobin Flint Extra	2.5-3.8 fl oz	12 h	1 d	11	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	difenoconazole Inspire	7 fl oz	12 h	0 d	3	NR	

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	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	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	3 d	19	NR	Apply every 7-10 days. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7-10 days.
	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.
	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.
	metconazole Quash	3.5-4 oz	12 h	14 d	3	NR	
	quinoxifen Quintec	7 fl oz	12 h	7 d	13	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.
	flutriafol Topguard	6-8 fl oz	12 h	7 d	3	NR	
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d		4	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. Organic
	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.
Notes: Resistance to Group 11 and 3 compounds has been detected in every WA production area. However, resistance was detected in slightly greater than 50% of orchards sampled but not in every orchard. In rare cases isolates were resistant to both Groups 3 and 11. There is also some evidence of spatial variability in the distribution of resistant isolates in specific orchards.							

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Coryneum blight (shothole)	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	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.

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	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.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR	
	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	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 + 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.
	metconazole Quash	2.5-3.5 oz	12 h	14 d	3	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	
Cherry Powdery Mildew	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	sulfur sulfur	20 lb	24 h	none listed	M2	NR	Organic
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	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	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	3 d	19	NR	Apply every 7-10 days. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7-10 days.
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	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.
	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.

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew	metconazole Quash	4 oz	12 h	14 d	3	NR	
	quinoxifen Quintec	7 fl oz	12 h	7 d	13	NR	
	flutriafol Topguard	6-8 fl oz	12 h	7 d	3	NR	
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d		4	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. Organic
	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.
Coryneum blight (shot-hole)	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Fruitree leafroller	chlorantraniliprole Altacor	4.5 oz	4 h	10 d	28	NR	
	spinetoram Delegate WG	4.5-7 oz	4 h	7 d	5	NR	
Grape mealybug	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	3	
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	3	
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	4.5 oz	4 h	10 d	28	4	
	spinetoram Delegate WG	4.5-7 oz	4 h	7 d	5	4	
	Bacillus thuringiensis subsp. kurstaki 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

TABLE CONTINUED

Petal fall cont.

Insect	Chemical	Rate per Acre			REI	PHI	MOA	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR		NR	Organic
	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.
	spinosad Success	4-8 fl oz	4 h	7 d	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	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.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR			
	captan Captan 50WP	4 lb	24 h	0 d	M4	NR			Do not use Captan if using oil for mildew control.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR			
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR			
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR			
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	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.
	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.

TABLE CONTINUED

Shuck fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	metconazole Quash	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.
Cherry Powdery Mildew	azoxystrobin Abound	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.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR	Resistance to Group 11 (QoI) fungicides has been documented in the cherry powdery mildew pathosystem.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	flutianil Gatten Fungicide	See Label	12 h	3 d	U13	NR	Maximum Application Rate: 8.0 fl oz product/A (0.0264 lb ai/A). DO NOT apply more than 4 applications per year. DO NOT exceed a maximum of 0.1056 lbs ai per acre per year. DO NOT apply within 3 days of harvest.
	sulfur sulfur	20 lb	24 h	none listed	M2	NR	Organic
	difenoconazole Inspire	7 fl oz	12 h	0 d	3	NR	
	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	fluopyram Luna Privilege	4.0 - 6.84 fl oz	12 h	0 d	7	NR	
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	pydiflumetofen Miravis	5.1 fl oz	12 h	0 d	7	NR	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	3 d	19	NR	Apply every 7-10 days. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7-10 days.
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	

TABLE CONTINUED

Shuck fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
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.
	metconazole Quash	3.5-4 oz	12 h	14 d	3	NR	
	quinoxifen Quintec	7 fl oz	12 h	7 d	13	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil.
	cyflufenamid Torino	4-8 fl oz	4 h	6 d	U6	4	Do not make more than two (2) applications per year. Do not apply more than once every seven (7) days. Do not exceed a total of 0.106 lbs. active ingredient (16.0 oz. of product) per acre per calendar year. Do not apply within six (6) days of harvest; (PHI = 6 days)
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d		4	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. Organic
Notes: Resistance to Group 11 and 3 compounds has been detected in every WA production area. However, resistance was detected in slightly greater than 50% of orchards sampled but not in every orchard. In rare cases isolates were resistant to both Groups 3 and 11. There is also some evidence of spatial variability in the distribution of resistant isolates in specific orchards.							
Coryneum blight (shothole)	azoxystrobin Abound	11-15 fl oz	4 h	0 d	11	NR	Around 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.
	captan Captan 50WP	4 lb	24 h	0 d	M4	NR	Do not use Captan if using oil for mildew control.
	fluxapyroxad + pyraclostrobin Merivon	4-6.7 fl oz	12 h	0 d	7, 11	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	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.

TABLE CONTINUED

Shuck fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Black cherry aphid	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	NR	
	acetamiprid Assail 70WP	2.3 oz	12 h	7 d	4A	NR	
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	4	
	spinetoram Delegate WG	4.5-7 oz	4 h	7 d	5	4	
	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
	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	Organic
	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.
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	3	
	spinosad Success	4-8 fl oz	4 h	7 d	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.

Late spring and summer

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	captan Captan 50WP	4 lb	24 h	0 d	M4	NR	
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	sulfur sulfur	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury Organic
TABLE CONTINUED							

Late spring and summer cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Brown rot	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	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.
	metconazole Quash	2.5-3.5 oz	12 h	14 d	3	NR	
Cherry Powdery Mildew	azoxystrobin Abound	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.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR	Resistance to Group 11 (QoI) fungicides has been documented in the cherry powdery mildew pathosystem.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	flutianil Gatten Fungicide	See Label	12 h	3 d	U13	NR	Maximum Application Rate: 8.0 fl oz product/A (0.0264 lb ai/A). DO NOT apply more than 4 applications per year. DO NOT exceed a maximum of 0.1056 lbs ai per acre per year. DO NOT apply within 3 days of harvest.
	sulfur sulfur	20 lb	24 h	none listed	M2	NR	Organic
	sulfur sulfur	See Label	24 h	none listed	M2	NR	See label—Potential Fruit and Leaf Injury Organic
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	fluopyram Luna Privilege	4.0 - 6.84 fl oz	12 h	0 d	7	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	

TABLE CONTINUED

Late spring and summer cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	NR	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	3 d	19	NR	Apply every 7–10 days. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7–10 days.
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	
	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.
	metconazole Quash	3.5-4 oz	12 h	14 d	3	NR	
	quinoxifen Quintec	7 fl oz	12 h	7 d	13	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil.
	cyflufenamid Torino	4-8 fl oz	4 h	6 d	U6	4	Do not make more than two (2) applications per year. Do not apply more than once every seven (7) days. Do not exceed a total of 0.106 lbs. active ingredient (16.0 oz. of product) per acre per calendar year. Do not apply within six (6) days of harvest; (PHI = 6 days)
	petroleum oil, summer petroleum oil, summer	1-2 % v/v	4 h	0 d		4	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. Organic
	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.
Notes: Resistance to Group 11 and 3 compounds has been detected in every WA production area. However, resistance was detected in slightly greater than 50% of orchards sampled but not in every orchard. In rare cases isolates were resistant to both Groups 3 and 11. There is also some evidence of spatial variability in the distribution of resistant isolates in specific orchards.							

TABLE CONTINUED

Late spring and summer cont.

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	
Grape mealybug	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	3	
	acetamiprid Assail 70WP	3.4 oz	12 h	7 d	4A	3	
	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	3	
	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	3	
	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	4	
Leafrollers (Pandemis, Obliquebanded)	spinetoram Delegate WG	4.5-7 oz	4 h	7 d	5	4	
	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
	spinosad Entrust SC	4-8 fl oz	4 h	7 d	5	NR	Organic
	pyriproxifen Esteem 35WP	4-5 oz	12 h	14 d	7C	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.
Peachtree Borer	spinosad Success	4-8 fl oz	4 h	7 d	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.
	Peach Tree Borer pheromone Isomate-P	See Label	none listed	none listed		NR	
Pear slug	chlorantraniliprole Altacor	4.5 oz	4 h	10 d	28	NR	
	spinetoram Delegate WG	4.6 oz	4 h	7 d	5	NR	
	spinosad Success	4 fl oz	4 h	7 d	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.

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Pear slug	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.
San Jose scale & Lecanium scale	buprofezin Centaur WDG	34.5 oz	12 h	14 d	16	4	Oil at delayed dormant is critical to the success of San Jose scale management.
	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.
Shothole borer	esfenvalerate Asana XL	14.5 fl oz	12 h	14 d	3A	4	Sanitation is the most effective management for shothole borer.
Spider mites	bifenazate Acramite 50WS	1 lb	12 h	3 d	un	4	
	spirodiclofen Envior 2SC	18 fl oz	12 h	7 d	23	3-4	
	hexythiazox Onager	12-24 fl oz	12 h	7 d	10A	NR	
	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	NR	Apply sprays in early May.
	etoxazole Zeal Miticide 1 72WSP	3 oz	12 h	7 d	10B	3-4	
Spotted-wing drosophila	spinetoram Delegate WG	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
	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). Activity against spotted-wing drosophila is only a few days.
	spinosad Success	8 fl oz	4 h	7 d	5	NR	
	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.
Western cherry fruit fly	imidacloprid Admire Pro	1.4-2.1 fl oz	12 h	7 d	4A	NR	
	acetamiprid Assail 70WP	2.3-3.4 fl oz	12 h	7 d	4A	NR	

TABLE CONTINUED

Late spring and summer *cont.*

Insect	Chemical	Rate per Acre			REI	PHI	MOA	Eff.	Notes
Western cherry fruit fly	spinetoram Delegate WG	4-4.5 oz	4 h	7 d	5	NR			
	spinosad Entrust SC	4.8-6 fl oz	4 h	7 d	5	NR		Organic	
	spinosad GF-120 NF Naturalyte	20 fl oz	4 h	0 d	5	NR			This is a spinosad formulation registered specifically for management of Tephritid 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. For application method, see label. Organic
	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). Activity against spotted-wing drosophila is only a few days.
	carbaryl Sevin XLR Plus	4 pt	12 h	3 d	1A	NR			WARNING: Multiple applications of carbaryl may cause mite problems.
	spinosad Success	4-6 fl oz	4 h	7 d	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.

Preharvest and harvest

Disease	Chemical	Rate per Acre			REI	PHI	MOA	Eff.	Notes
Brown rot	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR			
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR			
	fluopyram + trifloxystrobin Luna Sensation	5-5.6 fl oz	12 h	1 d	7, 11	NR			
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR			
TABLE CONTINUED									

Preharvest and harvest *cont.*

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.
	metconazole Quash	2.5-3.5 oz	12 h	14 d	3	NR	
Cherry Powdery Mildew	Notes: See label—Potential Fruit and Leaf Injury						
	azoxystrobin Abound	11-15 fl oz	4 h	0 d	11	NR	Azoxystrobin is extremely toxic to certain apple varieties. See label for further information.
	pyraclostrobin Cabrio	9.5 oz	12 h	0 d	11	NR	Resistance to Group 11 (QoI) fungicides has been documented in the cherry powdery mildew pathosystem.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	NR	
	difenoconazole Inspire	See Label	12 h	0 d	3	NR	
	potassium bicarbonate Kaligreen	See Label	4 h	1 d	NC	NR	Organic
	fluopyram Luna Privilege	4.0 - 6.84 fl oz	12 h	0 d	7	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	
	pydiflumetofen Miravis	5.1 fl oz	12 h	0 d	7	NR	
	polyoxin D zinc salt OSO 5%SC	13 fl oz	4 h	3 d	19	NR	Apply every 7–10 days. Organic
	polyoxin D zinc salt Ph-D	6.2 oz	4 h	0 d	19	NR	Apply every 7–10 days.
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	NR	
	triflumizole Procure 480SC	16 fl oz	12 h	1 d	3	NR	
	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.

TABLE CONTINUED

Preharvest and harvest *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Cherry Powdery Mildew	metconazole Quash	3.5-4 oz	12 h	14 d	3	NR	
	quinoxifen Quintec	7 fl oz	12 h	7 d	13	NR	
	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	NR	Place into solution before adding oil. See remarks in shuck fall section.
	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.
	Notes: Resistance to Group 11 and 3 compounds has been detected in every WA production area. However, resistance was detected in slightly greater than 50% of orchards sampled but not in every orchard. In rare cases isolates were resistant to both Groups 3 and 11. There is also some evidence of spatial variability in the distribution of resistant isolates in specific orchards.						
Notes: See label—Potential Fruit and Leaf Injury							
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Spotted-wing drosophila	spinetoram Delegate WG	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
	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.
	spinosad Success	8 fl oz	4 h	7 d	5	NR	
	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.
Western cherry fruit fly	imidacloprid Admire Pro	1.4-2.8 fl oz	12 h	7 d	4A	NR	
	spinetoram Delegate WG	4-4.5 oz	4 h	7 d	5	NR	
	spinosad Entrust SC	4-6 fl oz	4 h	7 d	5	NR	Organic

TABLE CONTINUED

Preharvest and harvest *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Western cherry fruit fly	spinosad GF-120 NF Naturalyte	20 fl oz	4 h	0 d	5	NR	This is a spinosad formulation registered specifically for management of Tephritid 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
	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.
	carbaryl Sevin XLR Plus	4 pt	12 h	3 d	1A	NR	WARNING: Multiple applications of carbaryl may cause mite problems.
	spinosad Success	4-6 fl oz	4 h	7 d	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.

Postharvest

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafhoppers cherry	thiamethoxam Actara	2.75 oz	12 h	14 d	4A	2-4	Actara at 2.75 oz/100gal resulted in 100% mortality of <i>C. reductus</i> leafhoppers 24 hours after treatment 2020 WA trial [Nottingham, 2020]. Actara maintains good control past 24 hours after treatments at 60-80% mortality [Nottingham 2021]. Actara had more than 80% control in 10 CA trials, above 50% in 2 CA trials and 30-50% in 1 CA trial [Van Steenwyk 1988, 1989, 1990, 2002, 2003] Generally thought to be good on nymphs and poor on adults.
	imidacloprid Admire Pro	2.8 fl oz	12 h	7 d	4A	1-4	Admire Pro has had mixed success in lab bioassays on <i>C. reductus</i> , from 73-100% mortality in direct sprays to 15% by residues [Nottingham 2020-2022]. Provado rated as high efficacy on White apple leafhopper in WA trials. Provado provided 8%, 20%, 34%, 69%, 30%, 34%, 51% and 73% control in eight California trials [Van Steenwyk 1988, 2000, 2001]. Many generics now available. E.g. Macho, Asada, Midash Forte.

TABLE CONTINUED

Postharvest cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafhoppers cherry	abamectin Agri-Mek SC	See Label	12 h	21 d	6	2-4	Generally thought to be good on nymphs and poor on adults. Rated excellent control White apple leafhopper nymphs West Virginia [Hogmire 1999]. 50% control nymphs and adults New York [Reisig 1995].
	esfenvalerate Asana XL	2-5.8 fl oz	12 h	14 d	3A	3-4	Asana resulted in 98-100% mortality of <i>C. reductus</i> leafhoppers 24 hours after treatment in 2 WA trials [Nottingham 2020, Nottingham 2022]. Asana's efficacy drops to around 50% within 24 hours of treatment [Nottingham 2021]. Asana had 80-90% control in 8 CA trials and 50-79% in 1 CA trial [Van Steenwyk 1987, 1989, 1990, 2002].
	acetamiprid Assail 70WP	1.7 oz	12 h	7 d	4A	1-2	Assail had 20, 25, 40 and 52% control in four California trials [Van Steenwyk 2002]. Generally higher efficacy on younger instar nymphs.
	indoxacarb Avaunt	6 oz	12 h	14 d	22	3-4	Rated good to high efficacy on White apple leafhopper in WA.
	azadirachtin Aza-Direct	1-2 pt	4 h	0 d	un	1-3	Aza-direct at 32oz provided 62%, 78% control of white apple leafhopper and 63%, 25% of potato leaf hopper in apples [Wise 2002]. Azadirect 32oz provided 64% of control for potato leafhopper nymphs [Harding 2019]. Organic
	Azadirachtin, Pyrethrin Azera	56 fl oz	12 h	0 d		3	Azera (premix of pyrethrins 1.4% and azadirachtin 1.2%) achieved 100% mortality of <i>C. reductus</i> 24 hours after treatment in 2020 WA trial [Nottingham 2020-2021]. Residual control is unknown. Azera 40oz provided 64% of control for potato leafhopper nymphs [Harding 2020]. Organic
	tolfenpyrad Bexar	21 fl oz	12 h	14 d	21A	NR	Additional testing is needed, but an initial lab bioassay showed 65% mortality of <i>C. reductus</i> [Nottingham 2020-2021].
	diatomaceous earth Celite 610	50 lb	none listed	none listed	particle film	3-4	Celite reduced leafhoppers from colonizing leaves compared to 1% oil by 50% and to untreated checks by 85% in 4 experiments [Nottingham 2021]. Organic
	cinnamon oil Cinnerate	32 fl oz	none listed	0 d	unknown	3	67 % mortality of <i>C. reductus</i> in 2020 WA trial [Nottingham 2020].

TABLE CONTINUED

Postharvest cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafhoppers cherry	fenpropathrin Danitol 2.4EC	18 fl oz	24 h	3 d	3	2-4	It is generally recommended that no more than 2 Danitol 2.4 EC apps per season. Danitol had 68-94% control in four California trials at 0.2 and 0.4 lb AI/a [Steenwyk 1993].
	spinosad Entrust SC	8 fl oz	4 h	7 d	5	1-2	32% control of C. reductus in 2020 WA trial [Nottingham 2020]. Organic
	malathion Malathion 5EC	2.8 pt	12 h apricot/cherry/pear 24 h peach/nectarine	3 d	1B	NR	Additional testing is needed, but an initial lab bioassay showed 100% mortality of C. reductus [Nottingham 2020-2021].
	azadirachtin Neemix 4.5%L	16 fl oz	4 h	0 d	un	1-3	Neemix was not different than the check for controlling of C. reductus [Nottingham 2021]. Neemix at 3.5 and 7 fl oz provided little control compared to the check (Sevin) for white apple leafhoppers for first or second generations [Beers 1995]. Neemix 4.5 at 8 oz provided 67% control potato leafhopper adults 7 days after treatment [Patton 2002]. Organic
	spinosad Success	2-2.7 fl oz	4 h	7 d	5	3	Rated as good efficacy on White apple leafhopper in WA.
	kaolin clay Surround WP	25-50 lb	4 h	0 d		3-4	Kaolin confuses insects where they don't recognize the plants to feed. Two initial post-harvest applications, followed by monthly reapplication of Surround at 50 lb/A reduced leafhopper numbers 20-80% in traps in 2020 WA study [Northfield 2020]. Kaolin reduced leafhoppers from colonizing leaves compared to 1% oil by 50% and to untreated checks by 85% [Nottingham 2021]. Kaolin reduced disease transmission of Pierces disease by glassy winged sharpshooters better than conventional products in one trial [25]. 100% control of white apple leafhoppers [Wise 2002]. Surround + Trilogy 49% control potato leafhopper adults 7 days after treatment [Patton 2002]. Organic
	sulfoxaflor Transform	2.75 oz	24 h	7 d	4C	3-4	Laboratory bioassays show 85-95% mortality of C. reductus [Nottingham 2021].
	petroleum oil, summer petroleum oil, summer	2 gal	4 h	0 d		3	Oil at 1% reduced leafhoppers in choice tests by 75% [Nottingham 2021] Oil at 2% reduced White apple leafhopper oviposition resulting in fewer nymphs [Fernandez 2001]. Organic

TABLE CONTINUED

Postharvest cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafhoppers cherry	lambda-cyhalothrin Warrior II	2.56 fl oz	24 h	14 d	3	NR	95% control potato leafhoppers [Laub 2003]. For potato leafhoppers Warrior II CS at 1.9 fl oz had number 40% lower than untreated control (not sig.) [Kuhar 2009]

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	fixed copper Champ WG	See Label	24 h	0 d	M1	NR	
	copper hydroxide Kocide 3000	See Label	48 h	0 d	M1	NR	
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Leafhoppers cherry	carbaryl carbaryl	3 qt	12 h	3 d	1A	2-4	Can cause leaf-drop in Canadian varieties. Use fall only. Sevin had 50-90% in 5 CA. [Van Steenwyk 1988].

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 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 of dormancy and 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. Current resistance management guidelines are available at <https://www.frac.info>

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, dead limbs, and woodpiles from the orchard) is the most effective 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.

Spray Schedule

Dormant

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

Delayed dormant

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
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	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	
	petroleum oil- dormant petroleum oil- dormant	1-1.25 % v/v	12 h	none listed		peach, nectarine, apricot, plum	NR	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.

Prebloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Prebloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot	NR	
	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	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	
Coryneum blight (shothole)	azoxystrobin Abound	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.
	chlorothalonil Bravo Ultrex	See Label	12 h	none listed	M5	peach, nectarine, apricot	NR	
	captan Captan 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	NR	
	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.

TABLE CONTINUED

Prebloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shothole)	myclobutanil Rally 40WSP	5 oz	24 h	0 d	3	peach, nectarine, apricot, plum	NR	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	nectarine	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	
	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	spinetoram Delegate WG	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.
	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
	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

Prebloom cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	spinosad Success	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.
	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; + E-8-DODECEN-1-YL ACETATE; Z-8-DODECEN-1- OL; Z-8-DODECEN-1-YL ACETATE CheckMate OFM Dispense	See Label	none listed	none listed		peach, nectarine, apricot, plum	NR	Organic
Peach twig borer	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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.
	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

TABLE CONTINUED

Prebloom cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Peach twig borer	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 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
	spinosad Success	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 silver mite	propargite Omite 30WS	5 lb	2 d/sweet cherry, 5 d nectarine	14 d	12C	nectarine	NR	

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Bloom

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound	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.
	captan Captan 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	
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	

TABLE CONTINUED

Bloom cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	peach, nectarine, apricot, plum	NR	
	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.
	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.
	metconazole Quash	4 oz	12 h	14 d	3	apricot	NR	
Coryneum blight (shothole)	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	peach, nectarine	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. 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	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.

TABLE CONTINUED

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	captan Captan 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	
	sulfur Golden Micronized + Sulfur 92%	See Label	24 h	none listed	M2	peach	NR	Do not apply to apricots. Organic
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	peach, nectarine, apricot, plum	NR	
	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.
	metconazole Quash	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.
	iprodione Rovral 4F	1-2 pt	24 h	none listed	2	apricot	NR	
	azoxystrobin Abound	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 *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shothole)	chlorothalonil Bravo Ultrex	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	
	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11,7	peach, nectarine, apricot, plum	NR	
	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.
Powdery Mildew (Stone Fruit)	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	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	2.5-3.5 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
TABLE CONTINUED								

Petal fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit)	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.
Notes: Do not apply to apricots.								
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Grape mealybug, mealy plum aphid, leaf curl plum aphid	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, 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.
	spinetoram Delegate WG	4.5-7 oz	4 h	see note	5	peach, plum	4	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
	Bacillus thuringiensis subsp. kurstaki DiPel DF	See Label	4 h	0 d	11B2	peach, nectarine, apricot, plum	3	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	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	3	

TABLE CONTINUED

Petal fall *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	spinosad Success	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.
	chlorantraniliprole Altacor	4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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
	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
Peach twig borer	spinosad Success	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.
	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot	NR	
	spinetoram Delegate WG	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

Petal fall cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
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
	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
	phosmet Imidan 70W	4.25 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
	spinosad Success	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 WG	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	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	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.
	captan Captan 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	
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	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	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	azoxystrobin Abound	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.
Coryneum blight (shothole)	captan Captan 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	

TABLE CONTINUED

Shuck fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Coryneum blight (shot-hole)	pydiflumetofen Miravis	3.4 - 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	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.
	ziram Ziram Granuflo 76WDG	6 lb	48 h	30 d	M3	peach, nectarine, apricot	NR	
Powdery Mildew (Stone Fruit)	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	sulfur sulfur	See Label	24 h	none listed	M2	peach	NR	Organic
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	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	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.

TABLE CONTINUED

Shuck fall cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit)	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 d		peach, nectarine, plum	NR	Do not apply to apricots. Organic
	Notes: Do not apply to apricots.							
	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)	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	spinetoram Delegate WG	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.
	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. 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. The product is a stomach poison so complete coverage is very important for efficacy. Organic
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, apricot, plum	3	
	spinosad Success	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.								

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	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.
	captan Captan 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	
	sulfur sulfur	See Label	24 h	none listed	M2	peach, plum	NR	Apply 2-3 weeks after shuck fall. Do not apply to apricots. Organic
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	pyraclostrobin + boscalid Pristine	10.5-14.5 oz	12 h	0 d	11, 7	peach, nectarine, apricot, plum	NR	
	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	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
	azoxystrobin Abound	11-15 fl oz	4 h	0 d	11	peach, nectarine, apricot, plum	NR	
Powdery Mildew (Stone Fruit)	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	

TABLE CONTINUED

Summer cont.

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Powdery Mildew (Stone Fruit)	sulfur sulfur	See Label	24 h	none listed	M2	peach, nectarine, plum	NR	Apply 2–3 weeks after shuck fall. Do not apply to apricots. Organic
	pydiflumetofen Miravis	3.4 – 5.1 fl oz	12 h	0 d	7	peach, nectarine	NR	
	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	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	
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	See Label	48 h	0 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. Organic
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	4	
	spinetoram Delegate WG	4.5-7 oz	4 h	see note	5	peach, nectarine, apricot, plum	4	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.
	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

TABLE CONTINUED

Summer cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Leafrollers (Pandemis, Obliquebanded)	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	3	
	spinosad Success	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.							
McDaniel spider mite, twospotted spider mite, European red mite	carbaryl Sevin XLR Plus	2-3 qt	12 h	3 d	1A	apricot	NR	
	bifenazate 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.
	spirodiclofen Envirdor 2SC	18 fl oz	12 h	7 d	23	peach, nectarine, apricot, plum	NR	
	hexythiazox Savey 50DF	3-6 oz	12 h	28 d	10A	peach, nectarine, apricot, plum	2-4	
	fenbutatin oxide Vendex 50WP	1-2 lb	48 h	14 d	12B	peach, nectarine, plum	NR	

TABLE CONTINUED

Summer cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
McDaniel spider mite, twospotted spider mite, European red mite	propargite Omite 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	4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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
	phosmet Imidan 70W	3-4.25 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
	methoxyfenozide Intrepid 2F	10-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	NR	
	carbaryl Sevin XLR Plus	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	
	spinosad Success	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.

TABLE CONTINUED

Summer cont.

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Peach twig borer	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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.
	phosmet Imidan 70W	4 lb	7 d	14 d	1B	peach, nectarine, apricot, plum	NR	
	methoxyfenozide Intrepid 2F	8-16 fl oz	4 h	7 d	18A	peach, nectarine, apricot, plum	NR	
	carbaryl Sevin XLR Plus	2-3 qt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR	
	spinosad Success	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			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.
San Jose scale	diazinon Diazinon 50W	4 lb	4 d	21 d	1B	peach, nectarine, apricot, plum	3-4	
Shothole borer	esfenvalerate Asana XL	14.5 fl oz	12 h	14 d	3A	peach, nectarine, apricot, plum	4	Sanitation is the most effective management for shothole borer.

TABLE CONTINUED

Summer cont.

Insect	Chemical	Rate per Acre		REI	PHI	MOA	Crops	Eff.	Notes
White apple leafhopper	carbaryl carbaryl	2 pt	12 h	3 d	1A	peach, nectarine, apricot, plum	NR		
Peach silver mite	propargite 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.

Preharvest and harvest

Disease	Chemical	Rate per Acre		REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	azoxystrobin Abound	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.
	captan Captan 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		
	sulfur sulfur	See Label	24 h	none listed	M2	peach, nectarine	NR		Organic
	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.

TABLE CONTINUED

Preharvest and harvest *cont.*

Disease	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Brown rot	metconazole Quash	2.5-4 oz	12 h	14 d	3	peach, nectarine, apricot, plum	NR	
Powdery Mildew (Stone Fruit)	azoxystrobin Abound	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.
	penthiopyrad Fontelis	14-20 fl oz	12 h	0 d	7	peach, nectarine, apricot, plum	NR	
	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	0 d		peach, nectarine, plum	NR	Do not apply to apricots Organic
Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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

TABLE CONTINUED

Preharvest and harvest *cont.*

Insect	Chemical	Rate per Acre	REI	PHI	MOA	Crops	Eff.	Notes
Oriental fruit moth	spinosad Success	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	chlorantraniliprole Altacor	3-4.5 oz	4 h	10 d	28	peach, nectarine, apricot, plum	NR	
	spinetoram Delegate WG	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	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 primary 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 four types of apple sunburn: (i) Sunburn Necrosis, (ii) Sunburn Browning, (iii) Photo-Oxidative Sunburn, and (iv) Storage 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 effectively as leaves. It is important to remember that fruit temperature can be considerably higher (20 - 30°F) than the ambient air temperature.

Sunburn Necrosis occurs when fruit surface temperature exceeds 125°F for as little as 10 minutes, causing cell death and brown or black lesions. This type of sunburn can be exacerbated by low humidity.

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.

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 include hand thinning, selective picking, branch movement, summer pruning, and postharvest transit.

Storage Sunburn symptoms typically develop after harvest, within the first few months of cold storage. Fruit may appear completely normal at harvest, but can develop a brown discoloration during storage, especially on the sun-exposed side of the fruit. Much like other types of sunburn, storage sunburn is associated exposure to excess heat and light stress during the growing season.

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 three categories: (1) Kaolin clay-based particle films (e.g. Surround WP) (2) Calcium carbonate-based particle films (e.g. Eclipse, Diffusion, MicroCal), and (3) 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. 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.

NOTE: Most sunburn protectants have limited compatibility for tank-mixing with other products; carefully consult individual product labels regarding options for tank mixing and best practices for product use.

	Chemical	Rate per Acre	Notes
Apple Sunburn	calcium carbonate Diffusion	2 - 4 gal	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.
	calcium carbonate Diffusion O	2 - 4 gal	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. Organic
	calcium carbonate Eclipse	2.5 - 3 gal	Re-apply as needed to maintain adequate coverage as fruit grows.
	calcium carbonate Microcal	2.5 - 3 gal	Re-apply as needed to maintain adequate coverage as fruit grows.
	calcium carbonate Oasis O	2 - 4 gal	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. Organic
	fruit protectant Parka	1 gal	Do not mix with or spray near applications of Captan, sulfur, lime sulfur, oil, or surfactants. Consult product label for more information.
	calcium carbonate Purshade	2 - 3 gal	Apply 3-10 days before heat event and repeat every 2-4 weeks as needed. Do not spray to runoff.
	fruit protectant Raynox	2.5 gal	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 deg F.
	fruit protectant Raynox Organic Sunburn Protectant	3 gal	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. Organic
	kaolin clay Surround WP	25 - 50 lb	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. Organic



Cherry Rain Cracking

Rain-Induced Cherry Cracking is often the greatest single cause of sweet cherry 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, somewhat akin to a water balloon bursting after being overfilled. 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 via mass flow through cuticular cracks and other surface structures. As water penetration 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 airstream 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 benchmark 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 WFFRC at tinyurl.com/cracking-test.

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

Chemical		Rate per Acre	Notes
Cherry Rain Cracking	fruit protectant Parka	1-2-1 gal	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.
	fruit protectant RainGard	102 (102) fl oz	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 in 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 over-cropped; 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 (weather.wsu.edu).

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 + petroleum oil, summer lime sulfur/calcium polysulfide + petroleum oil, summer	1-3 % v/v 1-1.5 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide + fish oil lime sulfur/calcium polysulfide + fish oil	1-3 % v/v 2 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	6-12 % v/v	48 h	none listed	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
Easy to thin varieties including Red Delicious, Gala, Braeburn, Cripps Pink, Jonagold, Granny Smith, Honeycrisp	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	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
	lime sulfur/calcium polysulfide lime sulfur/calcium polysulfide	4-10 % v/v	48 h	none listed	Organic
	lime sulfur/calcium polysulfide + fish oil lime sulfur/calcium polysulfide + fish oil	1-2 % v/v 2 % 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	ACC Accede	23 - 46 fl oz	12 hours	none listed	Accede is labeled for application at timings as early as king bloom, but is more effective when sprayed at 15-20 mm fruitlet size. Use of a non-ionic surfactant may increase efficacy. See the product label for more guidance.
	NAD Amid-Thin W	2.4-8 oz	48 h	2 d	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).
	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 L	0.5 - 4 fl oz	48 h	2 d	See NAA comments for Fruitone N.
	NAA Fruitone N	1.2-8 oz	48 h	2 d	NAA (K-Salt Fruit Fix, 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.

TABLE CONTINUED

Postbloom thinning on apples *cont.*

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
	NAA K-Salt Fruit Fix 200	0.48-4.8 fl oz	48 h	2 d	See NAA comments for Fruitone N.
	6-BA MaxCel	48-128 fl oz	12 h	86 d	See notes for Exilis 9.5SC.
	ethephon Motivate	1.5-6 pt	48/72 h	7 d	Ethephon 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 ethephon 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 ethephon.
	NAA PoMaxa	0.5-4 fl oz	48 h	2 d	See NAA comments for Fruitone N.
	ABA ProTone SG	6.6 - 33.1 oz	4 h	none listed	Target upper portions of tree canopy and apply during slow-drying conditions for better results. ABA may cause significant leaf yellowing and/or abscission. Organic
	NAA Refine 3.5 WSG	5 - 20 ppm	48 h	2 d	See NAA comments for Fruitone N.
	Notes: 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.				

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 9.5 SC	9.6 - 25.6 fl oz	12 h	86 d	
	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.
	ABA ProTone SG	6.6 - 33.1 oz	4 h	none listed	Target upper portions of tree canopy and apply during slow-drying conditions for better results. ABA may cause significant leaf yellowing and/or abscission. Organic
Bartlett, Bosc	NAD Amid-Thin W	1.6-8 oz	48 h	2 d	
	NAA Fruitone L	4 - 8 fl oz	48 h	2 d	See label for details
	NAA PoMaxa	4 fl oz	48 h	48 h	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.
Bartlett, Bosc, Comice	NAA Fruitone N	12-20 oz	48 h	2 d	
	NAA K-Salt Fruit Fix 200	8-12 fl oz	48 h	2 d	

TABLE CONTINUED

Postbloom thinning on pears *cont.*

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
	NAA Refine 3.5 WSG	12 - 20 oz	48 h	2 d	
	NAA Refine 6.25L	8-12 fl oz	48 h	2 d	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.

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	48/72 h	7 d	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. Ethephon may not promote color when warm weather persists late in the season. Ethephon may not improve color on poor-coloring varieties and standard strains; it is less effective on interior, shaded fruit. Caution: Ethephon 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.
To decrease preharvest fruit drop, delay watercore and improve harvest maturity management	AVG ReTain	0.73 - 1.46 lb	12 h	7 d	

TABLE CONTINUED

Apples - bearing cont.

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
	Notes: 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 ReTain. 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 ReTain application. To minimize foaming of spray mixture, fill spray tank with half the amount of water needed for the final spray volume, add ReTain (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.				
To increase fruit size	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.
	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.
To prevent preharvest fruit drop (apples)	NAA Fruitone L	8 - 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 PoMaxa	See Label	48 h	2 d	
	NAA Refine 24.2L	4-8 fl oz	48 h	2 d	
	NAA Refine 6.25L	16-32 fl oz	48 h	2 d	

TABLE CONTINUED

Apples - bearing cont.

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To decrease preharvest fruit drop, delay watercore and improve harvest maturity management	Notes: NAA (K-Salt Fruit Fix, 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 longer, typy Red Delicious	Gibberellins A4A7 + BA Perlan	1 - 2 pt	4 h	none listed	
	Gibberellins A4A7 + BA Promalin	1 - 2 pt	4 h	none listed	
	Notes: "Type" of Red Delicious is generally defined by the Length/Diameter (L/D) ratio of the fruit. Perceived improvements of "typiness" can be due to relatively long and/or relatively narrow fruit. Research trials in WA have shown that improvements in Red Delicious L/D ratios from use of Promalin or Perlan are often due to reduced fruit diameter rather than increased fruit length. Growers concerned about production of small fruit should be careful with use of these products.				
To promote return bloom	NAA Fruitone L	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	
	NAA PoMaxa	2-8 fl oz	48 h	2 d	
	NAA Refine 6.25L	1.2 - 4.8 fl oz	48 h	2 d	

TABLE CONTINUED

Apples - bearing cont.

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To promote return bloom	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, Fruitone, 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 reduce return bloom (to mitigate biennial bearing)	Gibberellins A4A7 Arrange	25 - 200 ppm	4 hours		To help suppress biennial bearing of apple, apply Arrange in the "off" or light-cropping year of the biennial cycle to reduce the amount of bloom in the subsequent growing season (the "on" or heavy-cropping year of the biennial cycle). Application of Arrange to trees with heavy crop loads may aggravate the severity of biennial bearing; hand gun applications to individual trees in blocks with significant tree-to-tree crop load variability may be advisable. Multiple applications of smaller doses of Arrange may be more efficacious than a single application at a higher rate. Trees in severe alternation may not respond as clearly as trees in moderate alternation. Consult the product label for more information. Organic
To suppress fruit russet	Gibberellins A4A7 Novagib 5L	4.0 - 6.6 fl oz	4 h	none listed	Organic
	Gibberellins A4A7 ProVide 10SG	2.1-3.5 oz	4 h	none listed	Organic
	prohexadione calcium Apogee PGR	6-24 oz	12 h	45 d	
	prohexadione calcium Kudos 27.5 WDG	6-20 oz	12 h	45 d	
Vegetative growth control in apple					

TABLE CONTINUED

Apples - bearing cont.

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
Vegetative growth control in apple	Notes: Prohexadione calcium (Apogee, Kudos 27.5WDG) is a potent inhibitor of gibberellin biosynthesis, resulting in reduced shoot growth and overall tree vigor. Applications should only be made to trees of moderate to high vigor. Treatment with prohexadione calcium may encourage formation of terminal shoot buds, causing an arrest of shoot elongation; if terminal buds do not form, those shoots may experience a second flush of growth later in the season which can be difficult to with subsequent applications unless coverage has been maintained throughout the season with repeat applications. 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 1 inch in length. 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. 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. CAUTION: Do not mix prohexadione calcium with any spray products containing calcium or in water with naturally high calcium levels; the efficacy of the prohexadione calcium will likely be reduced. If "hard" water must be used, 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 before spraying.				

Apples non bearing

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To promote lateral branching (1-3 in terminal growth)	Gibberellins A4A7 + BA Perlan	125 - 500 ppm	4 h	none listed	
	Gibberellins A4A7 + BA Promalin	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)	Gibberellins A4A7 + BA Perlan	5000 - 7500 ppm	4 h	none listed	
	Gibberellins A4A7 + BA Promalin	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)	NAA Fruitone L	8 - 32 fl oz	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 PoMaxa	See Label	48 h	2 d	
	AVG ReTain	0.73 lb	12 h	7 d	Apply ReTain 1-2 weeks before start of normal harvest. Follow label instructions.
	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.
NAA Refine 6.25L					
Notes: NAA (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.					

TABLE CONTINUED

Pears - bearing cont.

Symptom/Behaviour	Chemical	Rate per Acre	REI	PHI	Notes
To prevent preharvest fruit drop (Anjou, Bartlett, Bosc)	Notes: AVG or aminoethoxyvinylglycine (ReTain) 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 ReTain has been set at 7 days before harvest. ReTain should be applied to pears once at 7-16 days 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). If weather conditions are not favorable for ReTain 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 ReTain with NAA or ethephon are discouraged because these products may counteract the ethylene inhibition produced by ReTain. 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. 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 ReTain application. To minimize foaming of spray mixture, fill spray tank with half the amount of water needed for the final spray volume, add ReTain (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.				

Stone Fruit Plant Growth Regulator Programs

To Delay Fruit Maturity - Sweet Cherries

The normal harvest period for sweet cherries can be extended by 3-7 days with use of **GA3 (ProGibb, Falgro)**. These products may increase cherry fruit size and color due to this extension of the growing season. GA3 products are also known to help preserve bright green color in cherry stems and increase fruit firmness, both of which can help extend the storage season for harvested fruit.

GA3 products may be applied as a single spray of 16-48 grams active ingredient per acre when fruit is light green to straw colored. ProGibb 4% and ProGibb 40%WSG may be applied once or twice prior to harvest; please consult product labels for further guidance. Falgro 4L and Falgro 20SP may be sprayed in multiple applications at reduced rates; please consult product labels for further guidance.

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	0.35 - 8.4 oz	4 h	0 d	Organic
	GA3 Falgro 4L	2 - 48 fl oz	4 h	0 d	Organic
	GA ProGibb 4%	16 - 32 fl oz	4 h	0 d	Organic
	GA3 ProGibb 40%WSG	1.4 - 4.3 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	indaziflam Alion	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.
	dichlobenil Casoron 4G	11-150 lb	12 h	none listed	20/L	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.

TABLE CONTINUED

Seasonal Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	oxyfluorfen Goal 2XL	2-6 pt	24 h	see note	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 when the seedling weeds have less than four leaves. 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		14	NR	See comments for Goal 2XL.
	pronamide Kerb SC	See Label	24 h	see note	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 must be applied in the fall after harvest. Apply 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.

TABLE CONTINUED

Seasonal Weed Control cont.

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	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.
	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.
	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.

TABLE CONTINUED

Seasonal Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	terbacil Sinbar 80WDG	2 lb	12 h		5	NR	WSSA Group 5: Photosystem II inhibitor. Terbacil is labeled for the pre-emergence control of annual weeds in non-bearing 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.
	norflurazon Solicam DF	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.

TABLE CONTINUED

Seasonal Weed Control cont.

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	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.

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	48 h	14 d	4	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 run-off. 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.

Temporary Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Broadleaf weeds	pyraflufen-ethyl Venue	1-4 fl oz	12 h	0 d	14	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.
Grass and/or broadleaf weeds	Paraquat dichloride Paraquat dichloride		24 h			NR	
	glufosinate-ammonium Rely 280	1.28-2.56 qt	12 h	14 d	10	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 *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds							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	
Notes: WSSA Group 22: photosystem I electron diverter. PHI for apple is 150 days. For pears none listed. See entry for Bonedry.							

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.

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



Weed Control Stone Fruit

Seasonal Weed Control

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	indaziflam Alion	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.
	dichlobenil Casoron 4G	11-150 lb	12 h	none listed	20/L	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.

TABLE CONTINUED

Seasonal Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	oxyfluorfen Goal 2XL	2-6 pt	24 h	see note	14	NR	WSSA Group 14: protoporphyrinogen oxidase (PPO) inhibitor. Pre-emergent and early post-emergent control of broadleaf weeds in dormant orchards. May require a tank-mix partner for grass control. It is most effective as a post-emergent when the seedling weeds have less than four leaves. 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. Moisture within 3 to 4 weeks will enhance pre-emergence herbicide activity.
	oxyfluorfen GoalTender	1-3 pt	24 h		14	NR	See comments for Goal 2XL.
	pronamide Kerb SC	See Label	24 h	see note	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.

TABLE CONTINUED

Seasonal Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	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.
	norflurazon Solicam DF	2.5-5 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. 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. 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.

TABLE CONTINUED

Seasonal Weed Control cont.

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Grass and/or broadleaf weeds	oryzalin Surflan AS	2-6 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. It is only labeled for non-bearing trees. 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.

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	48 h	40 d	4	NR	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.

TABLE CONTINUED

Temporary Weed Control *cont.*

Weed	Chemical	Rate per Acre	REI	PHI	MOA	Eff.	Notes
Broadleaf weeds	clopyralid Stinger	0.33-0.67 pt	12 h	30 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.
	pyraflufen-ethyl Venue	1-4 fl oz	12 h	0 d	14	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.
Grass and/or broadleaf weeds	Paraquat dichloride Paraquat dichloride		24 h			NR	
	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.

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.



Applications

Adequate nutrient management requires a good understanding of the orchard local conditions, soil type, irrigation systems, tree demand and nutrient supply or availability. Many factors should be considered when developing a nutrient management plan for the orchard. See **Tree Fruit Soil Fertility and Plant Nutrition in**

Cropping Orchards in Central Washington<treefruit.wsu.edu> for details about how to create a fertility plan for your orchard. The following tables are designed only to help you translate general recommendations into amounts for example common products.

Major Nutrient Managements

Boron deficiency

Apply deficiency rates only if boron deficiency appears during growing season. Small annual foliar application is recommended. Optimal timing is during bloom for most tree fruit, and any time of year is appropriate for apples. Keep adequate levels in the soil for root growth. Excess of boron can lead to severe toxicity and application rate should be carefully calculated. Fertigation can also lead to uneven distribution and toxicity (around leaks/junctions) and is not recommended. The commercial guideline for soil application of B in Washington is a surface-broadcast application of 3 lb actual B per acre, made once every three years. The suggested foliar spray rate is 1.0 lb B/acre for B-deficient orchards. Soil application is suggested if the soil test level is below 0.5 mg/kg or if B deficiency symptoms are present (Peryea, 2004).

Boron maintenance

Prepink to pink or postharvest timing is preferred. Apply amount equivalent to 0.5 pound actual B per acre.

Calcium (bitterpit of apples)

Calcium (bitterpit of apples): 2-4lb/A per application. Make 6 to 12 applications from early June to Late August. 5 to 15 lbs of actual Ca per season is recommended which equals 15 to 50 pounds of calcium chloride per acre per season. Calcium in the form of calcium chloride is recommended because of its proven effectiveness and lower cost. See Penn State Extension's useful calculator for comparing calcium chloride to other sources of calcium, as it is important to make sure you develop a season-long program for applying sufficient total amounts of elemental calcium. Rate Recommendations Actual Ca lb/A per season Actual Ca lb/A Expected Results 4-5 This is the lowest rate that should be used. It will give some control of bitter pit and corking, will cause no leaf burning and is not likely to enhance storage. 6-8 Should give good control of preharvest physiological disorders. It should not cause any significant leaf injury and will probably not enhance fruit storage life. 9-11 Should give

excellent control of corking and bitter pitting and should be the intermediate rate. It may enhance fruit storage life and should result in almost no leaf injury. 12-14 The highest rate that should be used. Should give outstanding control of corking and bitter pit. May result in some enhanced storage life. Courtesy Dr. Rob Crassweller, Penn State Extension.

Calcium (cherry fruit firmness and reduced cracking)

Six weekly sprays of Ca(NO3)2 or chelated Ca sources (Ca2+ at 0.1-0.15%) between pit hardening and harvest has been shown to increase calcium quantity in fruit and post harvest quality (Wang, 2016). Greater than 0.2% Ca2+ increases risk of leaf burning and reducing fruit size. Fruit applications do not replace, but only augment, good management of soil Ca, irrigation and root health.

Magnesium deficiency

Apply in June. Repeat in July if necessary. Do not apply after August 1. Follow manufacturer's label for labeled product rates.

Nitrogen deficiency

Apply only as needed to apples or cherries. Not effective on pear or other stone fruits and can cause injury.

Zinc deficiency

Annual foliar applications are recommended in calcareous or high pH soils. Preferred timing is late dormant (stone fruit), silver-tip (apples and pears), and post-harvest (all tree fruits except for apricot). Zinc sprays should be avoided during the growing season unless deficiency symptoms occur. Zinc sulfates are common but can cause tissue damage when temperatures are greater than 85 °F after the application. Zinc sulfate is also not compatible with dormant oil or lime sulfur. Zinc chelates are also available and are less likely to cause russet. If little leaf and/or rosette are present, use deficiency rates. The deficiency rates for Zn sulfate or Zn oxysulfate are 14 pounds actual Zn per acre (dormant timing sprays) and 9 pounds actual Zn per acre (postharvest). Use the label rate if applying Zn chelates late dormant or postharvest; however, the label rate often will not supply enough Zn for Washington orchard needs. If sprays are applied during the growing season, use only 2 to 4 lb actual Zn as Zn sulfate or Zn oxysulfate per acre (non-bearing trees only) or the label rate of an appropriate Zn chelate (bearing or non-bearing trees). Because Zn deficiency is so widespread in Washington orchards, WSU recommends that Zn be applied every year in the form of Zn maintenance sprays even if little leaf or rosette are absent. The maintenance rates for Zn sulfate or Zn oxysulfate are 2 to 4 lb actual Zn per acre for both late dormant and postharvest sprays. Use the label rate if Zn chelates are applied. There is little justification for applying a maintenance Zn spray during the growing season (Peryea, 1995).

Dormant/Delayed Dormant

Nutrient Management		Chemical	Rate per Acre	Notes
Zinc deficiency	zinc sulfate, dry, 36% Zn		40 lb	Dormant spray only. Dissolve in hot water before adding to spray tank.
	zinc chelate or organic complex		See Label	

TABLE CONTINUED

Dormant/Delayed Dormant *cont.*

Nutrient Management		Chemical	Rate per Acre	Notes
Zinc deficiency, non-bearing trees		basic zinc sulfate, liquid, 20-25% Zn	See Label	
		zinc sulfate, liquid, 10-12% zinc	12 gal	
		basic zinc sulfate, dry, 50-52% Zn	6-12 lb	Dormant spray only. Dissolve in hot water before adding to spray tank. Oil free sprays are more effective.
Zinc maintenance		zinc sulfate, dry, 36% Zn	6 gal	
		basic zinc sulfate, dry, 50-52% Zn	6-12 lb	Dormant spray only. Dissolve in hot water before adding to spray tank. Oil free sprays are more effective.
		zinc sulfate, liquid, 10-12% zinc	2-4 gal	
		zinc chelate or organic complex	See Label	
		basic zinc sulfate, liquid, 20-25% Zn	See Label	

Prepink/Pink

Nutrient Management		Chemical	Rate per Acre	Notes
Boron deficiency		boric acid, dry, 17% B	6 lb	
		boric acid liquid, 10% B	1 gal	
		sodium borate, dry, 16.5-20.5% B	5-6 lb	
Boron maintenance		boric acid liquid, 10% B	2 qt	
		boric acid, dry, 17% B	3 lb	
		sodium borate, dry, 16.5-20.5% B	2.5-3 lb	

Bloom

Nutrient Management	Chemical	Rate per Acre	Notes
Nitrogen and sulfur maintenance	ammonium thiosulfate, liquid, 12%N, 25%S	See Label	

Postbloom

Nutrient Management	Chemical	Rate per Acre	Notes
Boron deficiency	sodium borate, dry, 16.5-20.5% B	5-6 lb	Apply only if boron deficiency appears during growing season. Apply amount equivalent to 1.0 pound actual B per acre.
	boric acid liquid, 10% B	1 gal	
	boric acid, dry, 17% B	6 lb	
Boron maintenance	sodium borate, dry, 16.5-20.5% B	2.5-3 lb	Prepink to pink or postharvest timing is preferred. Apply amount equivalent to 0.5 pound actual B per acre.
	boric acid liquid, 10% B	2 qt	
	boric acid, dry, 17% B	3 lb	
Calcium (bitterpit of apples)	calcium chloride, dry, 34-36% Ca	2-4 lb	
Calcium (cherry fruit firmness and reduced cracking)	calcium nitrate fertilizer grade		
Calcium (pear alfalfa greening, Anjou cork spot)Calcium (pear alfalfa greening, Anjou cork spot)	calcium chloride, dry, 34-36% Ca	4 lb	Apply four applications from early June to August. Dilute sprays are most effective. Can cause fruit injury.
Copper Deficiency	copper chelate or organic complex		Follow manufacturer's label. May be incompatible with calcium chloride. Can cause fruit injury.
	basic copper sulfate, liquid		
Iron (lime induced chlorosis)	iron chelate or organic complex	See Label	
Magnesium deficiency	magnesium sulfate		Apply in June. Repeat in July if necessary. Do not apply after August 1. Follow manufacturer's label for labeled product rates.
	magnesium chelate or organic complex		Apply in June. Repeat in July if necessary. Do not apply after August 1. Follow manufacturer's label for labeled product rates.
	magnesium nitrate 0.4LC	6-12 gal	
	magnesium nitrate, dry, 13.5% Mg	20-40 lb	
Nitrogen deficiency	urea	2-10 lb	Apply only as needed to apples or cherries. Not effective on pear or other stone fruits and can cause injury.

TABLE CONTINUED

Postbloom *cont.*

Nutrient Management	Chemical	Rate per Acre	Notes
Zinc deficiency, bearing trees	zinc chelate or organic complex		Follow manufacturer's label.
Zinc deficiency, non-bearing trees	basic zinc sulfate, dry, 50-52% Zn	6-12 lb	Dormant spray only. Dissolve in hot water before adding to spray tank. Oil free sprays are more effective.
	basic zinc sulfate, liquid, 20-25% Zn	See Label	
	zinc chelate or organic complex	See Label	
	zinc sulfate, liquid, 10-12% zinc	2-4 gal	Can cause injury, particularly on stone fruits. Follow manufacturer's label for labeled products.
Zinc maintenance	zinc sulfate, dry, 36% Zn	6-12 lb	Can cause injury, particularly on stone fruits. Follow manufacturer's label for labeled products.
	zinc sulfate, dry, 36% Zn	6 gal	

Pesticide Timing Recommendations for Pollinator Protection

See PNW591, *How to Reduce Bee Poisoning from Pesticides*, for further information.

Website—<https://pubs.extension.wsu.edu/how-to-reduce-bee-poisoning-from-pesticides>

Revisions to toxicity table

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

Actara 25WDG (thiamethoxam) Admire 2F (imidacloprid) Admire Pro 4.6L (imidacloprid) Ambush 25WP (permethrin) Asana XL (esfenvalerate) Belay 50WDG (clothianidin) Belt 4SC (flubendiamide) Blush (prohydrojasmon) Captan 50WP (captan) Closer SC (sulfoxaflor) Clutch 50WDG (clothianidin) Danitol 2.4EC (fenpropathrin) Diazinon 50W (diazinon) Diazinon AG500 (diazinon) Dimethoate 2.67EC (dimethoate) Dimethoate 4EC (dimethoate)	Envidor 2SC (spiroticlofen) Exirel (cyantraniliprole) Imidan 70W (phosmet) Lorsban 75WG (chlorpyrifos) Lorsban 75WG - trunk spray (chlorpyrifos) Lorsban Advanced (chlorpyrifos) Lorsban Advanced - trunk spray (chlorpyrifos) Malathion ULV (malathion) Movento 2L (spirotetramat) Pounce 3.2EC (permethrin) Proaxis 0.5L (gamma-cyhalothrin) Proclaim 55G (emamectin benzoate) Provado 1.6F (imidacloprid) Rimon 0.83EC (novaluron) Rovral 4F (iprodione) Rovral 50W (iprodione)	Seven RP4 - chemical thinning (carbaryl) Sevin 4F (carbaryl) Sevin 4F-chemical thinning (carbaryl) Sevin 4F-chemical thinning (carbaryl) Sevin 80 WSP (carbaryl) Sevin XLR Plus (carbaryl) Sevin XLR Plus - chemical thinning (carbaryl) Supracide 25W (methidathion) Supracide 2E (methidathion) Ultor 1.25L (spirotetramat) Warrior 1CS (lambda-cyhalothrin) Warrior II (lambda-cyhalothrin) Ziram 76DF (ziram) Ziram Granuflo 76WDG (ziram)
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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) Assail 30SG (acetamiprid) Assail 70WP (acetamiprid) Carzol 92SP (formetanate hydrochloride)	Confirm 2F (tebufenozide) Epi-Mek 0.15EC (abamectin) Malathion Aquamul 8 (malathion) TriStar 30SG (acetamiprid)	TriStar 8.5 SL (acetamiprid) Vydate 2L (oxamyl)
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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) Avaunt 30DG (indoxacarb) Aza-Direct 1.2%L (azadirachtin) Battalion 0.2EC (deltamethrin) Calypso 4F (thiacloprid) Delegate 25WG (spinetoram) Entrust 80W (spinosad)	Entrust SC (spinosad) GF-120 0.02% Bait (spinosad) Lannate 90SP (methomyl) Lannate LV 2.4L (methomyl) Neemix 4.5%L (azadirachtin) Nexter 75WSB (pyridaben) petroleum oil- dormant	petroleum oil-summer PyGanic 1.4EC (pyrethrins) PyGanic 5EC (pyrethrins) Success 2F (spinosad) TriTek (petroleum oil, summer)
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IV—May be applied to blooming plants at any time

Academy (difenoconazole+fludioxonil) Actigard 50WG (acibenzolar-s-methyl) Altacor 35WDG (chlorantraniliprole) Apollo 45C (clofentezine) Bacillus thuringiensis subsp. kurstaki Beleaf 50SG (flonicamid) Cabrio 20EG (pyraclostrobin) Casoron CS (dichlobenil) Centaur 70W (buprofezin) Cueva (copper octanoate) Cyd-X (CM granulosus virus) Dicofol 4E (dicofol) Dimilin 2L (diflubenzuron) DoubleNickel 55 (<i>Bacillus amyloliquefaciens</i> strain D747) Esteem 35WP (pyriproxyfen) Ethrel (ethephon) Fontelis (pen thiopyrad) Fruitone N (NAA) FujiMite 5%EC (fenpyroximate) Golden Micronized Sulfur 92% (sulfur) Intrepid 2F (methoxyfenozide)	K-Salt Fruit Fix 200 (NAA) K-Salt Fruit Fix 800 (NAA) Kanemite 15SC (acequinocyl) Kasumin 2L (kasugamycin) Kudos 27.5 WDG (prohexadione calcium) Kumulus 80DF (sulfur, dry flowable) Luna Privilege (fluopyram) Luna Sensation (fluopyram+trifloxystrobin) M-Pede (potassium salts of fatty acids) Motivate (ethephon) Nealta (cyflumetofen) NovaSource Lime Sulfur - blossom thinner (lime sulfur/calcium polysulfide) Omite 30WS (propargite) Onager 1EC (hexythiazox) OSO 5%SC (polyoxin D zinc salt) Ph-D (polyoxin D zinc salt) PoMaxa (NAA) Previsto (copper hydroxide) Pristine (pyraclostrobin+boscalid) Procure 480SC (triflumizole) Procure 50WS (triflumizole)	Proganic Micronized Sulfur 92% (sulfur, wettable) Rally 40WSP (myclobutanil) Refine 6.25L (NAA) Rex Lime Sulfur (lime sulfur/calcium polysulfide) Rex Lime Sulfur - blossom thinner (lime sulfur/calcium polysulfide) Savey 50DF (hexythiazox) Serenade Max (<i>Bacillus subtilis</i> strain QST 713) Serenade Opti (<i>Bacillus subtilis</i> strain QST 713) Sulforix (lime sulfur/calcium polysulfide) Surround WP (kaolin clay) ThinRite (endothall) Topguard (flutriafol) Trionic 4SC (triflumazole) Unicorn DF (tebuconazole+sulfur) Vangard 75WG (cyprodinil) Vendex 50WP (fenbutatin oxide) Vivando (metrafenone) Zeal 72WDG (etoxazole)
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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 hives are more susceptible to pesticide drift

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.

Relative impact rating ¹													
Trade Name	Compound	WPM ²	Mite predators	ARM ³	Colpoclypeus florus ⁴	Prigallo flavipes ⁴	Lepidopteran parasitoids*	Aphelinus mali	Aphid parasitoids and predators*	Coccinellids ⁵	Lacewings*	Predatory true bugs	Scale insect enemies
Acramite 50WS	bifenazate	L	L				H		L	L	M	L	
Actara 25WDG	thiamethoxam	L ⁸	M	L ⁸			M		L	M	H	H	
Agri-Mek 0.15EC/ Epi-Mek 0.15EC	abamectin	H ⁶	H	H ⁶	M ⁶	L	H		H	M ⁶	L	H	L
Altacor 35WDG	chlorantraniliprole	L ¹⁵	L		L			L ^{14,15}	L	H ¹⁵	H ¹⁵	L	
Ambush 25WP/ Pounce 3.2EC	permethrin	H	H	L	M		H		H	H	H	H	H
Apollo 45C	clofentezine	L	L	L			L		L	L	L	L	L
Asana XL	esfenvalerate	H	H	L	M	M-H	H		H	H	H	H	
Assail	acetamiprid	M-H ¹⁰	M	L	H		H	M-H ¹⁴	H		M	H	H
Avaunt 30DG	indoxacarb	L ⁹	L	L ⁹			M		L	M	L	M	H
Aza-Direct 1.2%L/ Neemix 4.5%L	azadirachtin		L		L		M		L	L	L	L	
Bacillus thuringiensis subsp. kurstaki		L	L	L	L	L	L		L	L	L	L	L
Belt 45C	flubendiamide		L				L		M		L	L	
Calypso 4F	thiacloprid		L	L				M-H ¹⁴	M	H		H	
Carzol 925P	formetanate hydro- chloride	M-H	M	M-H	H		H			L	M	H	
Centaur 70W	buprofezin		L				L		L		L	L	M
Clutch 50WDG	clothianidin		L										
CM granulosis virus		L	L	L	L	L	L	L	L	L	L	L	L
Confirm 2F	tebufenozide		L				L		L	L	L	L	
Danitol 2.4EC	fenpropathrin	H	H				H		H	H	H	H	H
Delegate 25WG	spinetoram	M-H ^{13,15}	M					H ¹⁵	H ¹⁵	L	H ¹⁵	H ¹⁵	
Diazinon	diazinon	L	M	L	H		H		H	H	H	M	
Dimethoate	dimethoate	L-M	H	L	H		M		H	H	H	H	
Dimilin 2L	diflubenzuron		L		H		L		L	L	H	L	M
Entrust 80W	spinosad	M	L		M-H	H	H		M	L	L	L	
Envirdor 25C	spirodiclofen		M				L		L	M	L	M	
Esteem 35WP	pyriproxyfen		L		M		L		L	L	L	L	H
FujiMite 5%EC	fenpyroximate		H	M			H		H	M	M	L	L
Guthion	azinphos methyl	L	M	L	H	L	H	H ¹⁴	H	H	H	M	H
Imidan 70W	phosmet	L	L	L	H	L	H		H	H	L	L	
Intrepid 2F	methoxyfenozide	L	L	L	L	L	L		M	L	L	L	L
Lannate	methomyl	H		L									
lime sulfur/calcium		M-H		H									
polysulfide													
Lorsban	chlorpyrifos	L-M	M	L	H	H	H	H ¹⁴	H	H	H	H	H
Malathion	malathion		M		H		H		H	H	H	H	H
Manzate	mancozeb	H ¹⁵	M		M		M	L ¹⁴	L ¹⁵	M ¹⁵	M ¹⁵	M ¹⁵	L

TABLE CONTINUED

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 "Area-wide 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	WPM ²	Mite predators	ARM ³	Colpoclypeus florus ⁴	Prigallo flavipes ⁴	Lepidopteran parasitoids [*]	Aphelinus mali	Relative impact rating ¹				Scale insect enemies
									Aphid parasitoids and predators [*]	Coccinellids ⁵	Lacewings [*]	Predatory true bugs	
Movento 2L	spirotetramat	H ¹⁵	L					L ¹⁴					
Nexter 75WSB	pyridaben	M	M	H	M-H		H		M	H		H	
petroleum oil-summer		M ^{6,7}	M	L ⁶	L	L			L		L	L	L
potassium salts of fatty acids		M ⁶	H	M ⁶			H		H	L	H	H	
Proclaim 5SG	emamectin benzoate		L				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	M ¹⁵	H ¹⁵	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
Success 2F	spinosad	M	L		M-H	H	H		M	L	L	L	
sulfur, dry flowable		H ¹⁵	M				M	L ¹⁴	L ¹⁵	M ¹⁵	M ¹⁵	M ¹⁵	M
sulfur, wettable		M						L ¹⁴					
Supracide	methidathion		H				H		H	H	H	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
Ultr 1.25L	spirotetramat	H ¹⁵	L					L ¹⁴					
Vendex 50WP	fenbutatin oxide	M	L	H	L		L		L	L	L	L	L
Vydate 2L	oxamyl		H				H		H	M	H	H	H
Warrior	lambda-cyhalothrin	H ¹⁵	H				H	H ¹⁴	H ¹⁵	H ¹⁵	H ¹⁵	H ¹⁵	
Zeal 72WDG	etoxazole		M				M			L	M	M	

¹These ratings are based on acute toxicity of pesticides on natural enemies represented in the groupings shown.

²Rating system: L = low impact, M = moderate impact, H = high impact, – no data available.

³WPM = western predatory mite, *Typhlodromus occidentalis*.

⁴ARM = apple rust mite, *Aculus schlechtendali*. Although ARM is a plant feeding species, its presence is very useful in maintaining populations of *Typhlodromus occidentalis*.

⁵C. florus is a wasp parasitoid of leafrollers; *P. flavipes* is a wasp parasitoid of western tentiform leafminer. See Orchard Pest Management for more information.

⁶Coccinellid data based on bioassays of late instar larvae of *Harmonia axyridis*, *Hippodamia convergens*, and *Coccinella transversoguttata*. Kadin data based on bioassays using *Stethorus punctum*.

⁷Overall negative impact is reduced due to short residual activity.

⁸Spray volume may be important in determining toxicity.

⁹Preliminary data; based on field trials of 4 cover sprays.

¹⁰Preliminary data; based on field trials with a single application.

¹¹The 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.

¹²100% mortality/sterility was caused by exposure to novaluron

¹³Novaluron 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.

¹⁴While this material is toxic to WPM, it is also somewhat miticidal, and thus may not cause flare-ups of mites.

¹⁵Preliminary data, based on laboratory acute toxicity tests.

¹⁶Acute 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 2025 Crop Protection Guide for Tree Fruit in Washington in February 2024.

The next printed edition will be available late February/early March.

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