

Hazelnut

2018 Pest Management Guide for the Willamette Valley

EM 8328 · Revised March 2018

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The chemicals, formulations, and rates listed for insect, mite, and disease control are among the best recommendations based on label directions, research, and orchard use experience. Only a thorough knowledge of the orchard, its cultivar, tree size and density, canopy characteristics, pest complex, and past pest problems will enable you to correctly select chemicals, rates, amount of water used per acre, and method of application for optimum pest control. Occasionally, different formulations of a product or like formulations containing a different amount of active ingredient also are registered and effective for use on the pests listed. These products also may be used; we do not intend to discriminate against them. You may wish to consult their labels and determine whether their use confers advantages over the products listed in this guide.

Always refer to the pesticide label for use instructions. It is the legal document regarding use patterns. Two questions frequently are asked about the chemical control of insects and diseases: “How much chemical do I use per acre?” and “What is the least amount of water I need per acre to apply in my concentrate sprayer?” The tables below suggests an amount of formulated product (not active ingredient) to use per acre. This amount is based on a “typical” middle-aged and density orchard with moderate pest pressure. It takes less spray to get good coverage on an orchard with immature trees with limited canopy, but this does not affect the rate of application by volume. For most ground-applied applications, apply products in a minimum of 100 gallons of water per acre (GPA). For larger canopies, 150 to 200 GPA of water can improve

coverage and efficacy greatly. Always calibrate sprayers to tree size to improve coverage, reduce waste, and avoid drift.

CHECK LABEL BEFORE SPRAYING!

Also:

1. Make sure any tank-mixes of pesticides are compatible. When in doubt make a sample mixture in a jar to evaluate compatibility. In some cases the mixture may not react, but efficacy may be compromised. For example, elevated pH of boron spray solution can weaken insecticides
2. Use adjuvants and spreader stickers with caution.
3. See table on fungicide effectiveness for Eastern filbert blight, page 18.
4. Rotate pesticides by mode of action (group); do not become reliant on a single group for control.

Stages

Dormant Season (Stages 1–2)

Stage 1a—Flowering. Female stigmas outside buds.
From red dot to spider stage.

Stage 1b—Flowering. Male catkins just before elongation and pollen shed.

Stage 2—Dormant buds.

Mid-March (buddbreak) (Stages 3–5)

Stage 3—Bud swelling.

Stage 4—Buddbreak. Green leaf tips showing.

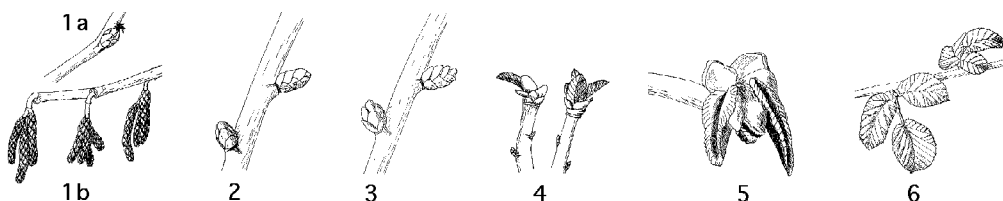
Stage 5—Advanced buddbreak. Highly susceptible to Eastern filbert blight.

March–April

Stage 6—Early shoot elongation. First leaves fully open.

Not shown

April–May; May–June; July–August; late August–September



Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Hazelnut Pest Control Recommendations

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Dormant Season (Stages 1–2)

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
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Eastern filbert blight

Note: Scout orchards and remove and destroy all cankered wood prior to budbreak. Burning or chipping of pruned, infected branches is an acceptable practice. Fungicides should not be applied prior to budbreak.

Mid-March (budbreak) (Stages 3–5) (see footnote 5, page 15)

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
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Eastern filbert blight (see footnotes 6, 7, and 8, page 15, and Table 3, page 18)

Abound	azoxystrobin	12 fl oz	Group 11 fungicide. Use on a 10-day schedule. Do not use with silicone-based surfactants. 4-hour reentry. 45-day PHI.
Aframe Plus	azoxystrobin + propiconazole	14–21 fl oz	Group 3+11 fungicide. See footnote 6, page 15. Do not use more than 2 consecutive applications. 12-hour reentry. 60-day PHI.
Bravo Weather Stik	chlorothalonil	4 pt	Group M5 fungicide. 12-hour reentry. 120-day PHI.
Bumper 41.8EC	propiconazole	5–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.
Cabrio EG	pyraclostrobin	9.5 oz	Group 11 fungicide. Use with a spreader sticker. Do not use more than 2 consecutive applications. 12-hour reentry.
Copper-Count-N	copper ammonium carbonate	8–12 qt	Group M1 fungicide. 48-hour reentry.
Echo 90DF	chlorothalonil	3.25 lb	Group M5 fungicide. Can be mixed with other fungicides. 12-hour reentry. 120-day PHI.
Gem 500SC	copper hydroxide	7–10.5 lb	Group M1 fungicide. Add 1 pt HMO per 100 gal of water. 48-hour reentry.
Inspire Super	difenoconazole + cyprodinil	16–20 fl oz	Group 3 + 9 fungicide. 12-hour reentry. 14-day PHI.
Kocide 3000	copper hydroxide	7–10.5 lb	Group M1 fungicide. Add 1 pt HMO per 100 gal of water. 48-hour reentry.
Merivon	fluxapyroxad + pyraclostrobin	5–6.5 fl oz	Group 7 + 11 fungicide. Do not use with EC or oil-based products. 12-hour reentry. 14-day PHI.
NuCop 50DF	copper hydroxide	8–12 lb	Group M1 fungicide. Add 1 pt HMO per 100 gal of water. 48-hour reentry.
Procure 480SC	triflumizole	4–6 fl oz	Group 3 fungicide. 12-hour reentry. 18-day PHI.
Propi-Max EC	propiconazole	4–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.

Mid-March (budbreak)(Stage 3–5) continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—Mid-March (budbreak) (Stages 3–5) (see footnote 5, page 15)

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Eastern filbert blight (see footnotes 6, 7, and 8, page 15, and Table 3, page 18) (continued)			
Quadris Top	azoxystrobin + difenoconazole	12–14 fl oz	Group 3 + 11 fungicide. Do not use within 45 days of harvest. 12-hour reentry.
Quash	metconazole	3.5 oz	Group 3 fungicide. Use with a surfactant. 12-hour reentry. 25-day PHI.
Quilt Xcel	azoxystrobin + propiconazole	14–21 fl oz	Group 3 + 11 fungicide. 12-hour reentry. 60-day PHI.
Stratego	propiconazole + trifloxystrobin	12–15.4 fl oz	Group 3 + 11 fungicide. Do not confuse this with a similar product called Stratego YLD, which may be phytotoxic to hazelnuts. 12-hour reentry. 60-day PHI.
Tilt	propiconazole	5–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.
Topguard	flutriafol	14 fl oz	Group 3 fungicide. Use of an adjuvant may result in Plant Growth Regulation (PGR) effects. 12-hour reentry. 14-day PHI.
Topguard EQ	flutriafol + azoxystrobin	5–8 fl oz	Group 3 + 11 fungicide. Do not use with silicone surfactants. 45-day PHI. 12-hr reentry.
Trionic 4 SC	triflumizole	4–6 fl oz	Group 3 fungicide. 12-hour reentry. 18-day PHI.
Unicorn DF	tebuconazole + sulfur	3–5 lb	Group 3 + M2 fungicide. 24-hour reentry. 35-day PHI.
Willowood Azoxy 2SC	azoxystrobin	6–12 fl oz	Group 11 fungicide. Use on a 10-day schedule. Do not use with silicone surfactants. 4-hour reentry. 45-day PHI.
Ziram 76 DF	ziram	3–8 lb	Group M3 fungicide. 48-hour reentry. Do not use after May.

March–April

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Bud mites (see footnote 3, page 15)			
Abamectin 0.15EC	abamectin	10–20 oz	Group 6 insecticide. Restricted use. Translaminar activity. Do not apply more than twice per season. See also Agri-Mek. Do not make aerial applications. 12-hour reentry. 21-day PHI.
Bexar	tolfenpyrad	27 oz	Group 21A insecticide. No more than 1 application per season. Do not make aerial applications. Maintain a 25 ft buffer strip. See 2(ee) label for hazelnut. 12-hour reentry. 14-day PHI.
Envidor 2SC	spirodiclofen	16–34 fl oz	Group 23 miticide. No more than 1 application per season. Do not make aerial applications. Minimum of 100 GPA. 12-hour reentry. 7-day PHI.
Fujimite XLO	fenpyroximate	2–4 pt	Group 21A insecticide. No more than 2 applications per season. Do not make aerial applications. Minimum of 100 GPA. 12-hour reentry. 14-day PHI.
Lime sulfur (BSP)	calcium polysulfide	12 gal	Minimum 100 GPA. 48-hour reentry.

March–April continues on next page

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CONTINUED—March–April

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Bud mites (see footnote 3, page 15) (continued)			
Nexter	pyridaben	10.62 oz	Group 21 miticide. Do not make aerial applications. Do not apply more than twice per season, with a minimum of 30 days between applications. 12-hour reentry. 7-day PHI.
Sulforix (BSP)	calcium polysulfide	3 gal	Minimum of 100 GPA. 48-hour reentry.

Winter moth, omnivorous leaf-tier

Note: Larvae can damage young trees by feeding on developing buds, leaving a distinct skeletonization pattern on leaves. Sprays are triggered only when >20% of terminals are infested. Because of the early timing for this spray, application of these chemicals now may not adequately control filbert and obliquebanded leafrollers, which become active slightly later.

<i>Bacillus thuringiensis</i> <i>kurstaki</i> (Btk)	bacterium	See label rates.	Multiple formulations available. OMRI approved for organic use. Spray when larvae first detected. Apply with a sticker. 0-day PHI.
Dimilin 2L	diflubenzuron	8–16 oz	Group 15 insecticide. Use a minimum of 50 gal water/A. Restricted use. Can use up to 4 applications per season (64 fl oz maximum per season). 12-hour reentry. 28-day PHI.
Intrepid 2F	methoxyfenozide	8–16 oz	Group 18 insecticide (IGR). Apply at or just prior to egg hatch. 4-hour reentry. 14-day PHI.
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.
Proclaim	emamectin benzoate	3.2–4.8 oz	Group 6 insecticide. Restricted use. Targets small larvae. 12-hour reentry. 14-day PHI.

Stage 6 (early shoot elongation)

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Eastern filbert blight (see footnotes 6, 7, and 8, page 15, and Table 3, page 18)			
Abound	azoxystrobin	12 fl oz	Group 11 fungicide. See footnote 9, page 15. Use on a 10-day schedule. Do not use with silicone-based surfactants. 4-hour reentry. 45-day PHI.
Aframe Plus	azoxystrobin + propiconazole	14–21 oz	Group 3+11 fungicide. See footnote 6, page 15. Do not use more than 2 consecutive applications. 12-hour reentry. 60-day PHI.
Bravo Weather Stik	chlorothalonil	4 pt	Group M5 fungicide. 12-hour reentry. 120-day PHI.
Bumper 41.8EC	propiconazole	5–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.
Cabrio EG	pyraclostrobin	9.5 oz	Group 11 fungicide. Do not use more than 2 consecutive applications. 12-hour reentry.
Copper-Count-N	copper ammonium carbonate	8–12 qt	Group M1 fungicide. 48-hour reentry.

Stage 6 (early shoot elongation) continues on next page

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CONTINUED—Stage 6 (early shoot elongation)

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Eastern filbert blight (see footnotes 6, 7, and 8, page 15, and Table 3, page 18) (continued)			
Echo 90 DF	chlorothalonil	3.25 lb	Group M5 fungicide. Can be mixed with other fungicides. 12-hour reentry. 120-day PHI.
Gem 500SC	trifloxystrobin	1.9–3.8 oz	Group 11 fungicide. 12-hour reentry. 60-day PHI.
Inspire Super	difenoconazole + cyprodinil	16–20 fl oz	Group 3 + 9 fungicide. 12-hour reentry. 14-day PHI.
Kocide 3000	copper hydroxide	7–10.5 lb	Group M1 fungicide. Add 1 pt HMO per 100 gal water. 48-hour reentry.
Merivon	fluxapyroxad + pyraclostrobin	5–6.5 fl oz	Group 7 + 11 fungicide. Do not use with EC or oil-based products. 12-hour reentry. 14-day PHI.
NuCop 50DF	copper hydroxide	8–12 lb	Group M1 fungicide. Add 1 pt HMO per 100 gal water. 48-hour reentry.
Procure 480SC	triflumizole	4–6 fl oz	Group 3 fungicide. 12-hour reentry. 18-day PHI.
Propi-Max EC	propiconazole	4–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.
Quadris Top	azoxystrobin + difenoconazole	12–14 fl oz	Group 3 + 11 fungicide. Do not use within 45 days of harvest. 12-hour reentry.
Quash	metconazole	3.5 oz	Group 3 fungicide. Use with a surfactant. 12-hour reentry. 25-day PHI.
Quilt Xcel	azoxystrobin + propiconazole	14–21 fl oz	Group 3 + 11 fungicide. 12-hour reentry. 60-day PHI.
Stratego	propiconazole + trifloxystrobin	12–15.4 fl oz	Group 3 + 11 fungicide. Do not confuse this with a similar product called Stratego YLD, which may be phytotoxic to hazelnuts. 12-hour reentry. 60-day PHI.
Tilt	propiconazole	5–8 fl oz	Group 3 fungicide. See footnote 6, page 15. 12-hour reentry.
Topguard	flutriafol	14 fl oz	Group 3 fungicide. Use of an adjuvant may result in Plant Growth Regulation (PGR) effects. 12-hour reentry. 14-day PHI.
Topguard EQ	flutriafol + azoxystrobin	5–8 fl oz	Group 3 + 11 fungicide. Do not use with silicone surfactants. 12-hr reentry. 45-day PHI.
Trionic 4 SC	triflumizole	4–6 fl oz	Group 3 fungicide. 12-hour reentry. 18-day PHI.
Unicorn DF	tebuconazole + sulfur	3–5 lb	Group 3 + M2 fungicide. 24-hour reentry. 35-day PHI.
Willowood Azoxy 2SC	azoxystrobin	6–12 fl oz	Group 11 fungicide. Do not use with silicone surfactants. See footnote 9, page 15. Use on a 10-day schedule. 4-hour reentry. 45-day PHI.
Ziram 76 DF	ziram	3–8 lb	Group M3 fungicide. 48-hour reentry. Do not use after May.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

April–May

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Filbert leafroller			
<i>Note:</i> Filbert leafroller eggs hatch in late March and early April during warm weather. No treatments are necessary below 20 to 25 percent infestation rate on terminal leaf clusters. Natural enemies typically provide good control of leafrollers.			
Altacor	chlorantraniliprole	3–4.5 oz	Group 28 insecticide. No more than 4 applications per season. 4-hour reentry. 10-day PHI.
Ambush 25W	permethrin	12.8–25.6 oz	Group 3A insecticide. Restricted use. Do not graze treated orchards. Extremely toxic to fish and aquatic habitat. Do not apply more than 1.6 lb ai/A per season. 24-hour reentry. 14-day PHI.
Asana XL	esfenvalerate	9.6–19.2 oz	Group 3A insecticide. Restricted use. Do not apply a second spray within 3 weeks of the first. Do not apply more than 0.2 lb ai/A per season. Do not graze livestock in treated orchards. 24-hour reentry. 21-day PHI.
Aza-Direct	azadirachtin	16–32 oz	Botanical extract of the neem tree. OMRI approved for organic use. 4-hour reentry. 0-day PHI.
<i>Bacillus thuringiensis</i> <i>kurstaki</i> (Btk)	bacterium	See label rates.	Multiple formulations available. OMRI approved for organic use. Spray when larvae first detected. Apply with a sticker. 0-day PHI.
Brigade WSB	bifenthrin	0.05–0.2 lb ai/A (8–32 fl oz)	Group 3A insecticide. Restricted use. 12-hour reentry. 7-day PHI.
Cobalt	chlorpyrifos + lambda cyhalothrin	22–57 oz	Group 1B + 3A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Delegate WG	spinetoram	4.5–7 oz	Group 5 insecticide. 4-hour reentry. 7-day PHI.
Diazinon AG 500	diazinon	1 pt	Group 1B insecticide. Restricted use. Apply in dilute spray (250–400 gal/A). No more than 1 application per season. 18-day reentry. 45-day PHI.
Dimilin 2L	diflubenzuron	8–16 oz	Group 15 insecticide. Restricted use. Use a minimum of 50 gal water/A. Can use up to 4 applications per season (64 fl oz maximum per season). 12-hour reentry. 28-day PHI.
Entrust	spinosad	1.25–3 oz	Group 5 insecticide. OMRI approved for organic use. No more than 9 oz per season. 24-hour reentry. 1-day PHI.
Intrepid 2F	methoxyfenozide	8–16 oz	Group 18 insecticide (IGR). Apply at or just prior to egg hatch. 4-hour reentry. 14-day PHI.
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. Restricted use. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.
Pounce 25 WP	permethrin	12.8–16 oz	Group 3A insecticide. Restricted use. Do not graze treated orchards. Do not apply more than 1.6 lb ai/A per season. 24-hour reentry. 14-day PHI.

April–May continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—April–May

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Filbert leafroller (continued)			
Proclaim	emamectin benzoate	3.2–4.8 oz	Group 6 insecticide. Restricted use. Targets small larvae. 12-hour reentry. 14-day PHI.
Sevin XLR Plus	carbaryl	2–5 qt	Group 1A insecticide. Make first application during egg hatch. Sevin may cause rapid increase of aphid populations 3-4 weeks after application. 4F and 80S formulations also available. 12-hour reentry. 14-day PHI.
Success Naturalyte Insect Control	spinosad	4–10 oz	Group 5 insecticide. 24-hour reentry. 14-day PHI.
Warrior II	lambda-cyhalothrin	1.28–2.56 fl oz	Group 3A insecticide. Restricted use. Apply no more than 7.68 oz after bloom. 24-hour reentry. 14-day PHI.

Filbert aphid, hazelnut aphid

Note: Some products are very toxic to pollinators, avoid applications when bees are actively foraging on honeydew or weeds on orchard floors, minimize drift to adjacent beehives or flowering crops. When possible, rely on biological control from the aphid parasitoid *Trioxys pallidus*.

Admire Pro	imidacloprid	1.2–2.4 oz	Group 4A insecticide. Can be applied as soil application through chemigation system, rates and restrictions differ for this application, see label. Generic labels available. 12-hour reentry. 7-day PHI.
Assail 70WP	acetamiprid	1.1–4.1 oz	Group 4A insecticide. The higher rate may be needed for control in mature orchards with full canopies. No more than 4 applications per season. 12-hour reentry. 14-day PHI.
Belay	clothianadin	3–6 oz	Group 4A insecticide. Low rate for low infestation and/or smaller trees. No more than 0.2 lb AI per year. 12-hour reentry. 21-day PHI.
Cobalt	chlorpyrifos + lambda cyhalothrin	22–57 oz	Group 1B + 3A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Leverage 2.7	beta-cyfluthrin + imidacloprid	3.8–5.1 oz	Group 3 + 4A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. Leverage 360 is also available. 12-hour reentry. 14-day PHI.
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. Restricted use. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.
Movento	spirotetramat	6–9 oz	Group 23 insecticide. Toxic to aquatic organisms. Minimum interval between treatments is 14 days. Limited to 21.5 oz per year. 24-hour reentry. 7-day PHI.
Sivanto 200 SL	flupyradifurone	7–10.5 oz	Group 4D insecticide. Minimum interval between treatments is 14 days. Limited to 28 oz per year. 4-hour reentry. 7-day PHI.
Surround WP	kaolin clay	50–75 lb	Suppression only. OMRI approved for organic use. 4-hour reentry. 0-day PHI.

April–May continues on next page

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CONTINUED—April–May

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Omnivorous leaftier, winter moth (if present)			
<i>Note:</i> Primarily pests during orchard establishment, see note for March–April.			
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. Restricted use. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.

May–June

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
To increase nut set			
<i>Note:</i> These are rates for foliar-applied sprays. Consult labels for soil-applied rates. For maximum effect, apply boron from mid- to late May. Do not tank-mix with insecticides.			
Borosol 10	Boron	1–3 pt	—
Solubor	Boron	5 lb	—

Filbertworm

Note: See footnote 4, page 15, on use of pheromone traps.

Isomate FBW ring	E,E-8,10-dodecadienyl acetate	0.01–5 g/ day/ha	Pheromone dispensers for filbertworm mating disruption. OMRI approved for organic use. Apply before first flight of moths at a minimum of 20 dispensers per acre in the upper 1/3 of canopy. Monitor trap captures carefully.
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Pacific flatheaded borer

Note: A serious pest that mostly affects trees in their first leaf. Adults lay eggs on trunks, and larvae feed below the bark, sometimes girdling the tree. This is an emerging issue, so efficacy of these treatments is not established for hazelnuts. Adults generally emerge and begin egg laying in early June but may be out slightly earlier in May. Prevent sunburn by painting trunks with diluted white latex paint, manage weeds, and prevent water stress.

Admire Pro	imidacloprid	1.2–2.4 oz	Group 4A insecticide. Systemic activity. Can be applied as soil application through chemigation system, rates and restrictions differ for this application, see label. If applied as drench allow adequate time for uptake prior to beetle emergence. Generic labels available. 12-hour reentry. 7-day PHI.
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. Restricted use. Can be used as a trunk spray. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.

May–June continues on next page

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CONTINUED—May–June

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Obliquebanded and filbert leafroller			
<i>Note:</i> Larvae primarily feed on leaves but also can cause damage by feeding between husk and nut. Severe infestations on young trees may affect growth. Inspect under husks for larvae between mid-June and late July. Use pheromone traps and degree-day (DD) models to time applications. No treatments are necessary below 20 to 25 percent infestation rate on terminal leaf clusters. Trap captures of >40 moths/week and larvae detected on nuts indicate damaging levels. Natural enemies typically provide good control of mature leafroller larvae, avoid treatment when larvae are mature.			
Altacor	chlorantraniliprole	3–4.5 oz	Group 28 insecticide. No more than 4 applications per season, 4-hour reentry. 10-day PHI.
Baythroid XL	beta-cyfluthrin	2.4–2.8 oz	Group 3 insecticide. 12-hour reentry. 14-day PHI.
<i>Bacillus thuringiensis kurstaki</i> (Btk)	bacterium	See label rates.	Multiple formulations available. Spray when larvae first detected. OMRI approved for organic use. Apply with a sticker. 0-day PHI.
Cobalt	chlorpyrifos + lambda cyhalothrin	22–57 oz	Group 1B + 3A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Delegate WG	spinetoram	4.5–7 oz	Group 5 insecticide. Apply at or just prior to egg hatch (50% egg hatch at 585 DD). Do not apply more than 3 consecutive treatments of group 5 materials. Target larvae. 4-hour reentry. 1-day PHI.
Dimilin 2L	diflubenzuron	8–16 oz	Group 15 insecticide. Use a minimum of 50 gal water/A. Restricted use. Can use up to 4 applications per season (64 fl oz maximum per season). 12-hour reentry. 28-day PHI.
Entrust	spinosad	1.25–3 oz	Group 5 insecticide. OMRI approved for organic use. No more than 9 oz per season. 24-hour reentry. 1-day PHI.
Intrepid 2F	methoxyfenozide	8–16 oz	Group 18 insecticide. Apply during peak egg laying or early egg hatch (200–400 DD). Reapply 10–18 days later (500–700 DD). Generics available. 4-hour reentry. 7-day PHI.
Lorsban 75WG/4E	chlorpyrifos	2–2.67 lb/3–4 pt	Group 1B insecticide. Restricted use. No more than 3 applications per season. Do not graze livestock in treated orchards. Extremely toxic to fish. Toxic to birds and wildlife. 24-hour reentry. 14-day PHI.
Success Naturalyte Insect Control	spinosad	4–10 oz	Group 5 insecticide. 24-hour reentry. 14-day PHI.
Spider mites, rust mites			
<i>Note:</i> Look for webbing and brown discoloration (“bronzing”) on the underside of leaves during the summer. Spider and rust mite problems may be a symptom of overreliance on broad-spectrum chemistries, including pyrethroids and organophosphates. Mite outbreaks are also associated with water stressed trees. Rotate action groups and do not apply below the minimum rate to avoid development of resistance.			
Acramite 50WS	bifenazate	0.75–1.5 lb	Group un (unclassified) miticide. Use only once per season. 12-hour reentry. 14-day PHI.
Envidor 2 SC	spirodiclofen	16–34 fl oz	Group 23 miticide. No more than 1 application per season. Do not make aerial applications. Minimum of 100 GPA. 12-hour reentry. 7-day PHI.

May–June continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—May–June

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Spider mites, rust mites (continued)			
Fujimite XLO	fenpyroximate	2–4 pt	Group 21A insecticide. No more than 2 applications per season. Do not make aerial applications. Minimum of 100 GPA. 12-hour reentry. 14-day PHI.
Nealta	cyflumetofen	13.7 oz	Group 25 miticide. Do not reapply at less than 14-day interval. Minimum of 100 GPA. No more than 27.4 oz/season. 12-hour-reentry. 7-day PHI.
Nexter	pyridaben	10.62 oz	Group 21 miticide. Do not make aerial applications. No more than 2 applications per season, with a minimum of 30 days between applications. 12-hour reentry. 7-day PHI.
Savey 50DF	hexythiazox	3–6 oz	Group 10A miticide. No more than 1 application per season. Apply before population build-up, does not control adult mites. 12-hour reentry. 28-day PHI.
Zeal	etoxazole	2–3 oz	Group 10B miticide. Apply while spider mite populations are low. No more than 1 application per season. 12-hour reentry. 28-day PHI.

July–August

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Scale			
<i>Note:</i> Several scale species can infest hazelnut orchards, but lecanium scale is most common. Severe infestations can produce abundant honeydew that is colonized by sooty mold, inhibiting photosynthesis and causing leaf drop. Time sprays for the emergence of crawlers, or the active immatures that emerge from the larger bodied females in early summer (late June–July). Avoid applications when bees are actively foraging on honeydew			
Admire Pro	imidacloprid	1.2–2.4 oz	Group 4A insecticide. Systemic activity. Can be applied as soil application through chemigation system, rates and restrictions differ for this application, see label. Generic labels available. 12-hour reentry. 7-day PHI.
Aza-Direct	azadirachtin	16–32 oz	Botanical extract of the neem tree. OMRI approved for organic use. 4-hour reentry. 0-day PHI.
Belay	clothianadin	6 oz	Group 4A insecticide. No more than 0.2 lb AI per year. 12-hour reentry. 21-day PHI.
Brigade WSB	bifenthrin	8–32 oz	Group 3A insecticide. Restricted use. Do not graze livestock on treated cover crops. Highly toxic to bees and toxic to fish and aquatic invertebrates. 12-hour reentry. 7-day PHI.
Centaur WDG	buprofezin	1.5–2.0 lb	Group 16 insecticide. No more than one application per season. 12-hour reentry. 60-day PHI.

July–August continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—July–August

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Scale (continued)			
Esteem 35 WP	pyriproxyfen	4–5 oz	Group 7C insecticide. Note: This treatment should be timed well ahead scale egg laying as this insect growth regulator suppresses egg development, see label. No more than 2 applications per season. Generics available. 12-hour reentry. 21-day PHI.
Movento	spirotetramat	6–9 oz	Group 23 insecticide. Toxic to aquatic organisms. Minimum interval between treatments is 14 days. Limited to 21.5 oz per year. 24-hour reentry. 7-day PHI.

Brown marmorated stink bug (BMSB)

Note: BMSB is an increasing problem on hazelnuts in the Willamette Valley. BMSB may pose a risk to nut quality, causing corking/decay if feeding occurs on developed kernels. Monitor for BMSB using pheromone traps, timed visual counts, or beating trays. Populations tend to build up as harvest approaches, but BMSB also feed on vegetative growth early in the season and may build up in the orchard. Eggs and nymphs are found from May to September. Note that border sprays and Alternate Row Middle (ARM) treatments can provide BMSB control while reducing impacts on natural enemies and potentially preventing flaring of secondary pests (mites, aphids, scale).

See: *Brown Marmorated Stink Bug* (EM 9054), *Monitoring for Brown Marmorated Stink Bug* (EM 9138), “EMERGING PEST: Brown Marmorated Stink Bug—A Pending Threat to Pacific Northwest Agriculture” in *PNW Insect Management Handbook*, and *How to Recognize Brown Marmorated Stink Bug Damage in Commercial Hazelnuts* (EM 9102), available through the OSU Extension Publications Catalog (<https://catalog.extension.oregonstate.edu/>).

Admire Pro	imidacloprid	1.2–2.4 oz	Group 4A insecticide. Can be applied as soil application through chemigation system, rates and restrictions differ for this application, see label. Generic labels available. 12-hour reentry. 7-day PHI.
Ambush 25W	permethrin	12.8–25.6 oz	Group 3A insecticide. Restricted use. Do not graze treated orchards. Extremely toxic to fish and aquatic habitat. Do not apply more than 1.6 lb ai/A per season. 24-hour reentry. 14-day PHI.
Baythroid XL	beta-cyfluthrin	2–2.4 oz	Group 3 insecticide. 12-hour reentry. 14-day PHI.
Belay	clothianidin	6 oz	Group 4A insecticide. No more than 0.2lb AI per year. 12-hour reentry. 21-day PHI.
Brigade WSB	bifenthrin	8–32 oz	Group 3A insecticide. Restricted use. Do not graze livestock on treated cover crops. Highly toxic to bees and toxic to fish and aquatic invertebrates. 12-hour reentry. 7-day PHI.
Cobalt	chlorpyrifos + lambda cyhalothrin	22–57 oz	Group 1B + 3A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Danitol	fenpropathrin	10.6–21.3 oz	Group 3 insecticide. Restricted use. No more than 2 applications recommended, no more than 0.8 lb AI allowed per season. 24-hour reentry. 3-day PHI.
Declare	gamma-cyhalothrin	1.02–2.05 oz	Group 3A insecticide. Restricted use. No more than 0.08 lb AI per year. 24-hour reentry. 14-day PHI.

July–August continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Brown marmorated stink bug (BMSB) (continued)			
DoubleTake	diflubenzuron + lambda-cyhalothrin	4–5 oz	Group 15 + group 3A insecticide. Restricted use. Do not exceed 4 applications per growing season. Premix product, see label as no more than 0.12 lb lambda-cyhalothrin is allowed per season. Use the higher rate for longer residual control, high pest population, low crop load, larger trees, or heavy/dense foliage. Reapply at 21-day intervals under sustained pest pressure. 24-hour reentry. 28-day PHI.
Endigo ZC	lambda-cyhalothrin + thiamethoxam	5–6 oz	Group 3A + group 4A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Leverage 360	beta-cyfluthrin + imidacloprid	2.8 oz	Group 3A + 4A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 12-hour reentry. 14-day PHI.
Mustang Maxx	zeta-cypermethrin	3.2–4 oz	Group 3A insecticide. Restricted use. Applications must be 7 days apart. No more than 0.125 lb AI per season. 12-hour reentry. 7-day PHI.
Proaxis	gamma-cyhalothrin	2.56–5.12 oz	Group 3A insecticide. Restricted use. No more than 0.08 lb AI per year. 24-hour reentry. 14-day PHI.
Surround WP	Kaolin clay	50–75 lb	Suppression only. OMRI approved for organic use. 4-hour reentry. 0-day PHI.
Tombstone	cyfluthrin	2–2.4 oz	Group 3A insecticide. Restricted use. Maximum of 2.8 oz per season. 12-hour reentry. 14-day PHI.
Warrior II	lambda-cyhalothrin	1.28–2.56 oz	Group 3A insecticide. Restricted use. Generics available. Do not apply more than 0.12 lb (7.68 fl oz or 0.48 pt of product)/acre post bloom. 24-hour reentry. 12-day PHI.

Filbertworm

Note: See footnote 4, page 15, on use of pheromone traps.

Altacor	chlorantraniliprole	3–4.5 oz	Group 28 insecticide. Do not apply more than 4 applications per season, 4-hour reentry. 10-day PHI.
Ambush 25W	permethrin	12.8–25.6 oz	Group 3A insecticide. Restricted use. Do not graze treated orchards. Extremely toxic to fish and aquatic habitat. Do not apply more than 1.6 lb ai/A per season. 24-hour reentry. 14-day PHI.
Asana XL	esfenvalerate	9.6–19.2 oz	Group 3A insecticide. Restricted use. Do not apply a second spray within 3 weeks of the first. Do not apply more than 0.2 lb ai/A per season. Do not graze livestock in treated orchards. 24-hour reentry. 21-day PHI.
Assail 70WP	acetamiprid	1.1–4.1 oz	Group 4A insecticide. The higher rate may be needed for control in mature orchards with full canopies. No more than 4 applications per season. 12-hour reentry. 14-day PHI.

July–August continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—July–August

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Filbertworm (continued)			
Baythroid XL	beta-cyfluthrin	2–2.4 oz	Group 3 insecticide. 12-hour reentry. 14-day PHI.
Brigade WSB	bifenthrin	8–32 oz	Group 3A insecticide. Restricted use. Do not graze livestock on treated cover crops. Highly toxic to bees and toxic to fish and aquatic invertebrates. 12-hour reentry. 7-day PHI.
Cobalt	chlorpyrifos + lambda cyhalothrin	22–57 oz	Group 1B + 3A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 24-hour reentry. 14-day PHI.
Delegate WG	spinetoram	4.5–7 oz	Group 5 insecticide. Apply at or just prior to egg hatch to target emergent larvae (955 DD). Do not apply more than 3 consecutive treatments of group 5 materials. 4-hour reentry. 1-day PHI.
Declare	gamma-cyhalothrin	1.02–2.05 oz	Group 3A insecticide. Restricted use. No more than 0.08 lb AI per year. 24-hour reentry. 14-day PHI.
Dimilin 2L	diflubenzuron	12–16 oz	Group 15 insecticide. Restricted use. Apply at or just prior to egg hatch (955 DD). 12-hour reentry. 28-day PHI.
Entrust	spinosad	1.25–3 oz	Group 5 insecticide. OMRI approved for organic use. No more than 9 oz per season. 24-hour reentry. 1-day PHI.
Fastac CS	alpha-cypermethrin	3.2–3.8 oz	Group 3A insecticide. Restricted use. Do not exceed 11.4 fl oz/A per season. 12-hour reentry. 7-day PHI.
Intrepid 2F	methoxyfenozide	8–16 oz	Group 18 insecticide. See also Troubadour 2F. Apply at or just prior to egg hatch (955 DD). 4-hour reentry. 14-day PHI.
Leverage 360	beta-cyfluthrin + imidacloprid	2.8 oz	Group 3A + 4A insecticide. Restricted use. Premix product, see label as both AIs have cumulative limits/season. 12-hour reentry. 14-day PHI.
Pounce 25 WP	permethrin	12.8–16 oz	Group 3A insecticide. Restricted use. Do not graze treated orchards. Do not apply more than 1.6 lb ai/A per season. 24-hour reentry. 14-day PHI.
Proaxis	gamma-cyhalothrin	2.56–5.12 oz	Group 3A insecticide. Restricted use. No more than 0.08 lb AI per year. 24-hour reentry. 14-day PHI.
Proclaim	emamectin benzoate	3.2–4.8 oz	Group 6 insecticide. Restricted use. Apply at or just prior to egg hatch (955 DD). 12-hour reentry. 14-day PHI.
Success Naturalyte Insect Control	spinosad	4–8 oz	Group 5 insecticide. Apply at or just prior to egg hatch to target emergent larvae (955 DD). Do not apply more than 3 consecutive treatments of group 5 materials. Entrust is the OMRI-approved formulation for organic use. 24-hour reentry. 14-day PHI.
Surround WP	Kaolin clay	50–75 lb	Suppression only. OMRI approved for organic use. 4-hour reentry. 0-day PHI.
Warrior II	lambda-cyhalothrin	1.28–2.56 fl oz	Group 3A insecticide. Generics available. Do not apply more than 0.12 lb (7.68 fl oz or 0.48 pt of product)/A post bloom. 24-hour reentry. 14-day PHI.

July–August continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

CONTINUED—July–August

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Eastern filbert blight			
none	—		Scout orchards and remove and destroy all infected wood prior to budbreak.

Late August–September

Pest or disease/ Material	Active ingredient (AI)	Application rate/acre	Comments/Reentry interval/Preharvest interval (PHI)
Bacterial blight			
Note: An important spray for young filberts (less than 10 years old). Apply coppers after harvest and before fall rains. If heavy rains occur, repeat application when three-fourths of the leaves have dropped			
Badge X2	copper oxychloride + copper hydroxide	7–12 lb	48-hour reentry.
Bordeaux 6-3-100	copper sulfate + hydrated lime	—	24-hour reentry. See footnote 2, page 15.
Champ Dry Prill	copper hydroxide	11–16 lb	Add 1 pt horticultural mineral oil (HMO) per 100 gal water. 48-hour reentry.
C-O-C-S WDG	copper oxychloride + copper sulfate	11.6 lb	Add 1 pt HMO per 100 gal water. 48-hour reentry.
Copper-Count-N	copper ammonium complex	8–12 qt	48-hour reentry.
Cuprofix Ultra 40 Disperss	copper sulfate	10–15 lb	48-hour reentry.
Kocide 3000	copper hydroxide	7–10.5 lb	Add 1 pt HMO per 100 gal water. 48-hour reentry.
Nordox 75WG	cuprous oxide	8–13 lb	12-hour reentry.
NuCop 50DF	copper hydroxide	8–12 lb	Add 1 pt HMO per 100 gal water. 48-hour reentry.
Kernel molds			
none	—		Harvesting before fall rains and keeping full totes dry or shielded from rain have been associated with reduced mold counts.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Footnotes

1. More than one type of formulation is available for most insecticides. For instance, Lorsban is marketed as a 50 percent wettable powder (Lorsban 50WP) as well as an emulsifiable concentrate (Lorsban 4E). Lower rates can be used on smaller trees.
2. Thoroughly spray the trunks and lower scaffolds as well as upper branches. Bordeaux 6-6-100 means 6 pounds of copper sulfate plus 6 pounds of hydrated lime in 100 gallons of water. In any bordeaux formula, the ingredients always are listed in the same order—copper sulfate, hydrated lime, then gallons of water.
3. The time to apply insecticide for big bud mite depends on the timing of the mite migration which depends on factors such as orchard location, variety, and weather. Use a 20x hand lens or microscope to determine whether mites are migrating from blasted buds to new buds. Research has shown that the most effective treatment timing is when 50 percent of mites have migrated out of blasted buds. Movement occurs with daily max temps above 59°F or average temps of 48°F, particularly during long-term warming trends. Tanglefoot, Stickem Special, petroleum jelly, duct tape, or double-sided scotch tape applied in bands above and below buds infested with big bud mite will trap and hold migrating mites. Beginning in March, inspect weekly for migrating mites. Complete spray coverage is necessary. Use no less than 100 gallons of water per acre. Do not graze livestock in treated orchards or make aerial applications of any of the products registered for bud mite in Oregon. Excessive use of pyrethroids or other broad-spectrum materials for other pests may lead to bud mite problems (in susceptible varieties) because of loss of biological control.
4. Pheromone traps are available to detect and monitor flight activity of filbertworm moths. They have been successfully used to time cover sprays. Place pheromone traps in the upper third of the tree canopy in early June prior to moth emergence, typically in mid-June. Apply insecticides 8–12 days after filbertworm moths emerge in your area to target larvae emerging from eggs prior to nut penetration (first egg hatch occurs when 955 degree days have accumulated after April 1). A second application usually is necessary in 2–3 weeks. A repeat spray may be necessary if heavy rainfall occurs a day or two after application and the label allows it. Second and third sprays may be necessary and should be made if pheromone traps continue to catch moths 2–3 weeks after a spray. Spray when two or three moths are collected per trap or if any one trap has caught five moths. See also Table 2, page 18.
5. All fungicides should be applied beginning or just before budbreak. Continue applications at 2-week intervals to cover an 8-week susceptibility period (four applications total).
6. Products that contain propiconazole, such as Bumper, Propi-Max, Quilt Xcel, or Tilt, may result in smaller, thicker, greener leaves and shortened internodes, but trees will grow out of this condition within 2 weeks of the last application. These products have eradicant activity if applied at higher rates within 72 hours of infection.
7. Several materials are registered for Eastern filbert blight management but are **not** recommended. These include Luna Privilege, Luna Experience, Luna Sensation, OxiDate, Pristine, Previsto, and Regalia.
 - Luna Privilege is registered but was ineffective in field tests.
 - Luna Experience is legal to use but not recommended since only the group 3 chemistry in this prepackaged mix is effective. The other chemical, Luna Privilege, was ineffective in field tests. The effective group 3 chemistry is available alone as Tebucon or Tebuzol, which are recommended.
 - Luna Sensation is legal to use but not recommended since only the group 11 chemistry in this prepackaged mix is effective. The other chemical, Luna Privilege, was ineffective in field tests. The effective group 11 chemistry is available alone as Gem, which is recommended.
 - Pristine is not recommended since only the group 11 chemistry in this prepackaged mix is effective. The other chemical was ineffective in field tests. The effective group 11 chemistry is available alone as Cabrio EG, which is recommended.
 - Regalia is registered but was not effective in tests in western Oregon.
 - Although OxiDate is registered, it will not control this disease due to its short residual activity.
8. Cultivars with the single dominant gene for resistance to EFB (Gasaway), such as Jefferson or McDonald, need protection the first spring after planting when located near heavily infected orchards.
9. Sprayers used for Abound, Aframe Plus, Quadris Top, Topguard EQ, or Willowood Azoxy should not be used on apples such as Gala, Cox's Orange Pippin, and McIntosh. Even a small amount of drift or residue can severely impact these apple trees.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Table 1. Quick Reference Guide to Herbicides Labeled for Use in Fruit and Nut Crops

- Shaded boxes indicate the herbicide is labeled for use in that crop.
- Nonbearing (NB) indicates the herbicide is labeled only for crops that will not be harvested for 1 year (365-day preharvest interval).
- Herbicides in *bold*, *italic* type are recommended for new plantings.
- For more complete information, please refer to the *PNW Weed Management Handbook*: <http://pnwhandbooks.org/weed/>.

Ingredient common name (herbicide mode of action)	Product name example	Nuts			Pome fruits		Stone fruits						Rates
		Chestnut	Hazelnut	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum	Prune	
Applications that are soil active (herbicides in italics and bold are recommended for new plantings)													
diuron (7)	Karmex												1.6 to 3.2 lb ai/A (2 to 4 lb/A Karmex 80DF)
dichlobenil (20)	Casoron												4 to 6 lb ai/A (100 to 150 lb/A Casoron); apply in cold and wet weather.
<i>isoxaben</i> (21)	Trellis SC				NB	NB	NB	NB	NB	NB	NB	NB	0.5 to 1 lb ai/A (0.66 to 1.33 lb/A product)
indaziflam (29)	Alion												0.046 to 0.085 lb ai/A (3.5 to 6.5 oz/A product) depending on soil texture.
<i>mesotrione</i> (27)	Broadworks												0.093 to 0.187 lb ai/A (3 to 6 fl. oz/A product)
<i>napropamide</i> (3)	Devrinol												4 lb ai/A (8 lb/A)
norflurazon (12)	Solicam												1.95 to 3.98 lb ai/A (2.5 to 5 lb/A Solicam)
<i>oryzalin</i> (3)	Surflan												2 to 6 lb ai/A (2 to 6 quarts/A Surflan)
<i>pendimethalin</i> (3)	Prowl												Prowl H ₂ O: 1.9 to 6 lb ai/A (2 to 6.3 quarts/A) depending on desired length of weed control and crop.
<i>pronamide</i> (3)	Kerb												1 to 4 lb ai/A (2 to 8 lb/A) depending on species present and soil texture.
simazine (5)	Princep												See product label for rates. Princep Caliber 90 is a Special Local Needs label (OR-080038) for sweet cherries only.
sulfentrazone (14)	Zeus XC/ Petra 4SC												0.125 to 0.375 lb ai/A (4 to 12 oz/A) depending on soil classification; established 3 years.
terbacil (5)	Sinbar WDG				NB		NB	NB			NB		0.4 to 0.8 lb ai/A (0.5 to 1 lb/A), newly established; 2 to 4 lb/A Sinbar, bearing, depending on soil type.
<i>trifluralin</i> (3)	Treflan 4L/EC		NB										0.5 to 1 lb ai/A (1 to 2 pints/A Treflan 4L)
trifluralin (3)+ <i>isoxaben</i> (21)+ oxyfluorfen (14)	Showcase	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	2.5 to 5 lb ai/A (100 to 200 lb/A Showcase)
Applications that are soil and foliar active													
flazasulfuron (2)	Mission												0.033 to 0.045 lb ai/A (2.14 to 2.85 oz/A)
flumioxazin (14)	Chateau SW/ WDG												0.188 to 0.38 lb ai/A (6 to 12 oz/A Chateau WDG). Slight differences in rates and uses in SW and WDG labels.
oxyfluorfen (14)	Goal 2XL												1.25 to 2 lb ai/A (5 to 8 pints/A Goal 2XL)
oxyfluorfen (14) + penoxsulam (2)	Pindar GT				*	*	*	*	*	*	*	*	1.47 lb ai/A oxyfluorfen + 0.015 lbs ai/A penoxsulam (1.5 to 3 pints/A) *Until March 2019

Table 1 continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Ingredient common name (herbicide mode of action)	Product name example	Nuts			Pome fruits		Stone fruits					Rates
		Chestnut	Hazelnut	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum	
CONTINUED—Applications that are soil and foliar active												
rimsulfuron (2)	Matrix											0.063 lb ai/A (4 oz/A Matrix FNV per year)
saflufenacil (14)	Treevix											0.045 lb ai/A (1 oz/A)
Postemergence contact and translocated herbicides												
2,4-D (4)	Saber											Green sucker control in hazelnuts: 0.7 to 0.95 lb ai/A (1.5 to 2 pints/A Saber)
ammonium nonanoate	Axxe											6 to 15% v/v (volume/volume); OMRI certified
ammoniated soap of fatty acids	Final-San-O											14 to 26 fl oz/gallon. Apply prior to planting or non-cropped areas.
caprylic acid + capric acid	Suppress											6 to 9% v/v (volume/volume); OMRI listed
carfentrazone (14)	Aim EC											Green sucker control in hazelnuts: 0.031 lb ai/A (2 fl oz/A Aim EC)
clethodim (1)	Select Max		NB	NB	NB	NB	NB	NB		NB	NB	0.06 to 0.125 lb ai/A (6 to 8 oz/A Select Max)
clopyralid (4)	Stinger											Apples: 0.094 to 0.25 lb ae/A (0.25 to 0.66 pints/A Stinger) Others: 0.12 to 0.25 lb ae/A (0.33 to 0.66 pints/A Stinger)
clove oil+ cinnamon oil	Weed Zap											5% v/v/ (volume/volume). OMRI listed.
diquat (22)	Reglone		NB	NB	NB	NB	NB	NB	NB	NB	NB	0.375 to 0.5 lb ai/A (1.5 to 2 pints/A)
fluazifop (1)	Fusilade DX		NB	NB	NB	NB						0.25 to 0.375 lb ai/A (16 to 24 oz/A Fusilade DX). Refer to specific grassy weeds listed on label.
glufosinate (10)	Rely 280											0.88 to 1.5 lb ai/A (1.5 to 2.5 quarts/A Rely 280); sucker control: 1.75 quarts/A. Do not make spot spray applications to suckers.
glyphosate (9)	Roundup											General weed control and grass suppression in row middles; read label carefully for crops listed and geographic location.
halosulfuron (2)	Sandea											Pome Fruit: 0.035 to 0.094 lb ai/A (0.75 to 2 oz/A); Nut crops: 0.031 to 0.063 lb ai/A (2/3 to 1 1/3 oz/A)
paraquat (22)	Gramoxone SL 2.0											Green sucker control in hazelnuts: 0.625 to 1 lb cation/A (2.5 to 4 pints/A Gramoxone 2.0 SL; 1.7 to 2.7 pints/A Firestorm)
pyraflufen (14)	Venue											0.001 to 0.005 lb ai/A (0.7 to 4 fl oz/A product). Green sucker control in hazelnuts: 3 to 4 fl oz/A.
sethoxydim (1)	Poast								NB	NB	NB	Grass suppression in row middles: 0.28 to 0.47 lb ai/A (1.5 to 2.5 pints/A product)

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Table 2. Hazelnut IPM Sampling Methods and Action Thresholds

Insect	Sampling period	Sampling method	Action threshold
European winter moth	Larvae: March 15–May 31	3 terminals/tree and 3 leaf clusters/terminal. Each terminal is a sampling unit.	20% infestation
Big bud mite	April	In mid-April, place Tanglefoot on twigs surrounding blasted buds. Check for extremely small, white, cigar-shaped mites with a 20x hand lens.	When consistent mite movement is observed, which usually occurs with budbreak
Omnivorous leaftier	April 15–June	3 bud clusters/tree.	5% infestation
Filbert aphid	April 1–Sept. 30	3 terminals/tree—newest fully expanded leaf on each terminal.	April—20/leaf May—30/leaf June—40/leaf July—40/leaf with an increasing population
Obliquebanded leafroller (OBLR) and filbert leafroller	Larvae: April–August Adult: Mid-May–Sept.	Larvae: 3 terminals/tree and 3 leaf clusters/terminal. Each terminal is a sampling unit. Adult: Pheromone trap for each 5 acres; 6-ft height.	Larvae: 20%–25% infestation Adult: 40 moths/week and find second-generation OBLR larvae feeding on nuts
Filbertworm	June–Sept.	Adult: Pheromone traps—4 for first 10 acres and 1 for each additional 4 acres. Place traps in the upper third of the canopy by mid-June.	2–3 moths per trap or 5 moths in any one trap

Table 3. Effectiveness of Fungicides for Eastern Filbert Blight Management*

Fungicide trade name	Common name	Fungicide group #	EFB control	Use with surfactant
Abound	azoxystrobin	11	Fair–Good	Yes, but avoid silicone-based products
Aframe Plus	azoxystrobin + propiconazole	3 + 11	Fair–Good	Yes, but avoid silicone-based products
Bravo	chlorothalonil	M5	Excellent	No
Bumper	propiconazole	3	Good–Excellent	Yes
Cabrio	pyraclostrobin	11	Excellent	Yes
Copper-Count-N	copper ammonium carbonate	M1	Good	?

Table 3 continues on next page

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Table 3. Effectiveness of Fungicides for Eastern Filbert Blight Management* (cont'd)

Echo	chlorothalonil	M5	Excellent	No
Gem	trifloxystrobin	11	Good–Excellent	Yes
Inspire Super	difenoconazole + cyprodinil	3 + 9	Good	OK
Kocide	copper hydroxide	M1	Good	Yes
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	Good	OK
Nu-Cop	copper hydroxide	M1	Good	Yes
Ph-D	polyoxin D	19	Fair	Yes
Procure	triflumizole	3	Fair–Good	Yes
Propi-Max	propiconazole	3	Good–Excellent	Yes
Quadris Top	azoxystrobin + difenoconazole	3 + 11	Good–Excellent	Yes, but consult label
Quash	metconazole	3	Good	Yes
Quilt Xcel	azoxystrobin + propiconazole	3 + 11	Excellent	Yes
Stratego	propiconazole + trifloxystrobin	3 + 11	Excellent	Yes
Tilt	propiconazole	3	Good–Excellent	Yes
TopGuard	flutriafol	3	Good	No
TopGuard EQ	flutriafol + azoxystrobin	3 + 11	Good	Yes, but avoid silicone-based products
Trionic	triflumizole	3	Fair–Good	Yes
Unicorn	tebuconazole + sulfur	3 + M2	Good	Yes
Willowood Azoxy 2SC	azoxystrobin	11	Fair–Good	Yes, but avoid silicone-based products
Ziram	ziram	M3	Excellent	Yes

*These ratings are relative rankings based on full application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions. Possible ratings for disease control include none, slight, fair, good, or excellent.

Strategies for Using Fungicides for Management of Eastern Filbert Blight

Fungicides have been useful to suppress or delay development of eastern filbert blight (EFB) in an orchard of susceptible cultivars like Ennis or Barcelona. Cultivars, such as Jefferson or McDonald, with the single dominant gene for resistance only need protection the first spring after planting, when located near heavily infected orchards. Fungicides will not remove or eliminate cankers from the tree.

Fungicides are best used to protect susceptible tissue in the spring at budbreak and for the next 8 weeks. Most fungicides will last 2 weeks before another application is needed. This means a total of four applications starting with the first at budbreak. Although hazelnuts are still susceptible after this period, additional applications have not resulted in consistent, significant disease control.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. Materials are not listed in order of preference.

Because of fungicide resistance issues and resulting label requirements, you may not be able to use the same fungicide for all four applications. Since the EFB fungus has a long (2-year) life cycle, the resistance risk is already low relative to other diseases (such as powdery mildew). Strategies to further minimize this risk include alternating and/or tank-mixing fungicides with different modes of action. The modes of action for fungicides have been categorized, grouped, and assigned numbers by the Fungicide Resistance Action Committee (FRAC) such as “group M5” (see Table 3, page 18).

Alternating fungicides with different modes of action has been effective to manage EFB. Research has not identified any one alternating strategy as better than any other strategy. We have 5 fungicide groups to choose from including FRAC groups 3, 11, M5, M3, and M1. It is suggested that the first application be chlorothalonil or ziram (group M5 or M3) followed by your choice of a group 3 or group 11 fungicide. Each of the next two applications would be different from the previous one. An example of this program might be to start with Bravo (or any of its generics, group M5) at bud break, followed by Gem (group 11) 2 weeks later, then Tilt (group 3) 2 weeks after that, and ending with Cabrio (group 11). Use of multisite products such as chlorothalonil (group M5), ziram (group M3) or copper-based (group M1) products for all four applications would also be acceptable.

Do not just alternate fungicides with different trade names as they might have the same mode of action. Some fungicide premixes already are a combination of two fungicides with different modes of action, generally a group 3 and group 11 fungicide. These products cannot be used for every application because they do not allow more than two sequential applications before switching to a different product with a different mode of action. If you use these premixes, you must use an M5, M3, or M1 fungicide

in the rotation. An example of this program might be to start with Bravo (M5) at bud break, followed by Stratego (3 + 11) or QuiltXcel (3 + 11) 2 weeks later, then the same product 2 weeks after that, but ending with Bravo.

You can make your own tank-mixes. Since tank-mixing can be expensive, growers have asked about reducing the rate of each product in the tank. Research to date has shown that a half rate of Echo 90 DF (group M5) tank-mixed with either Tilt (group 3) or Cabrio (group 11) is effective to manage EFB. Combining fungicide resistance theory and research on EFB in Oregon suggests we should use a half rate of chlorothalonil tank-mixed with a full rate of a group 3 fungicide or a half rate of a group 11 fungicide. An example of this program might be:

- 1st application: A full rate of Bravo (M5) at budbreak
- 2nd application, 2 weeks later: A mix of Cabrio (11) plus Echo 90DF (M5), each at half rate
- 3rd application, 2 weeks later: A mix of Tilt (3) at full rate plus Echo 90DF (M5) at half rate
- 4th application, 2 weeks later: A mix of Cabrio (11) plus Echo 90DF (M5), each at half rate

Research has indicated that addition of a surfactant may provide better disease control than using a fungicide alone. Numerous products can break the surface tension of water to get better coverage of plant tissue. They also can help keep the fungicide solution in contact with the plant, reducing wash-off during rain events. Unless otherwise stated on the label, it is recommended to add a surfactant with a fungicide. Copper-based products have traditionally been applied with a horticultural mineral oil. Newer fungicides may be mixed with silicone-based or nonionic surfactants. Be careful, as several fungicides may already come formulated with a surfactant and/or specifically say NOT to add these products. For example, do not add a surfactant to Bravo or Quadris Top.

Table 4. Toxicology information for insecticides used in hazelnuts¹

Hazelnut insecticides/miticides:	Mammalian	Beneficials	Bees ²	Aquatics
Abamectin (Agri-mek)	H	LH	VH	H
Acetamiprid (Assail)	VL	MH	M	L
Azadirachtin (Aza-Direct)	VL	LM	M	M
Bacterium Bacillus thuringiensis kurstaki (Btk)	VL	L	L	L
Bifenthrin (Brigade)	M	H	VH	H
Chlorantraniliprole (Altacor)	VL	M	L	L
Chlorpyrifos (Lorsban)	H	VH	VH	VH
Clothianiden (Belay)	M	--	VH	VL
Cyfluthrin (Tombstone)	L	H	VH	H
Diflubenzuron (Dimilin)	L	M	L	VH
Emamectin benzoate (Proclaim)	H	--	M	L
Esfenvalerate (Asana)	M	H	VH	H
Fenpropathrin (Danitol)	M	H	VH	VH
Fenpyroximate (Fujimite)	L	M	L	VH
Hexythiazox (Savey)	L	L	L	L
Imidacloprid (Admire Pro, generics)	M	MH	VH	L
Lambda-cyhalothrin (Warrior II, generics)	M	H	VH	H
Methoxyfenozide (Intrepid)	VL	L	L	M
Permethrin (Ambush, Pounce)	M	LH	VH	H
Pyridaben (Nexter)	M	M	M	M
Pyriproxyfen (Esteem)	VL	M	L	M
Spinetoram (Delegate)	VL	H	M	L
Spinosad (Entrust, Success)	VL	LM	M	L
Spirodiclofen (Envidor)	VL	L	VH	H

¹ Data sources: UCANR pesticide active ingredients database, National Pesticide Information Center (NPIC), Orchard Pesticide Effects on Natural Enemies Database (OPENED). Ratings are VH=very high, H=high, M=moderate, L=low, VL=very low.

² Hazelnuts are wind pollinated and do not depend on pollinator insects. However, pollinator pesticide hazards still exist when pollinators are foraging on pollen, honeydew, or blooming groundcover in and around hazelnut orchards.

OSU Internet Resources for Plant Protection for Hazelnuts

Information regarding plant protection is available from several sources at OSU. The following listings are excellent examples:

- OSU Integrated Plant Protection Center. Online weather data and degree day information for insect pests and diseases including the filbertworm phenology model (<http://uspest.org/wea/>)
- Eastern filbert blight help page—all the information you need for this disease (<http://oregonstate.edu/dept/botany/epp/EFB/>)
- Pacific Northwest Plant Disease Management Handbook (<https://pnwhandbooks.org/plantdisease>)
- Pacific Northwest Insect Management Handbook (<https://pnwhandbooks.org/insect>)
- Pacific Northwest Weed Management Handbook (<https://pnwhandbooks.org/weed>)

Using Pesticides Safely

Always Read the Label

The single most important approach to pesticide safety is to read the pesticide label before each use and then follow the directions. If still in doubt after reading the label, contact a person qualified to help evaluate the hazard of the chemical and its use. Qualified people include Extension specialists, county educators, pesticide product representatives, and retailers.

Pesticides are toxic and should be handled with care—but can be used safely if you follow recommended precautions. Follow all label requirements, and strongly consider any recommendations for additional personal protective clothing and equipment. In addition to reading and following the label, other major factors in the safe and effective use of pesticides are the pesticide applicator's qualifications, common sense, and positive attitude. Always take all safety precautions when using pesticides.

In case of accidents involving pesticides, see your doctor at once. It will help your doctor to know exactly which pesticide is involved. The label on the container gives this information. Take to the physician the pesticide label or information from the label, such as the product name, registration number of the U.S. Environmental Protection Agency (EPA), common name and percentage of active ingredient, and first aid instructions. If the label cannot be removed, take along the pesticide container (if not contaminated), but do not take it into the hospital or doctor's office.

Pesticide Safety Checklist

- Use pesticides only when necessary and as part of an Integrated Pest Management (IPM) program.
- Always read the label and follow the instructions.
- Do not allow children to play around sprayers or mixing, storage, and disposal areas.
- Wear appropriate protective clothing and equipment.
- Never eat, drink, or smoke while handling pesticides.
- Avoid drift into non-target areas and pesticide runoff into streams, rivers, lakes, irrigation ponds and canals.
- Avoid spilling materials on skin or clothing.
- Have access to clean water, soap, and first aid supplies.
- Keep pesticides in a dry and locked storage area away from food and feed.
- Triple rinse or pressure rinse empty containers and dispose or recycle in accordance with state and local regulations.
- Stay out of recently sprayed areas until the spray has dried, and observe the restricted entry intervals (REI) specified on the pesticide label.
- Follow the pre-harvest interval (PHI) on the pesticide label before harvesting crops or gardens and before allowing livestock to graze fields.

Oregon Poison Center

The Oregon Health & Science University
3181 S.W. Sam Jackson Park Road
Portland, OR 97239
Phone: 1-800-222-1222

If a person has collapsed or is not breathing, dial 911.

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