

2023

PEST MANAGEMENT GUIDE FOR WINE GRAPES IN OREGON



Photo: Patricia A. Skinkis, © Oregon State University

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This guide is for managers of commercial vineyards in Oregon. It provides recommendations for chemicals, formulations and usage rates of products that are intended to prevent and, manage vineyard diseases, insects, mites and weeds. When considering a pesticide, evaluate its efficacy and its impact on beneficial insects, pollinators and the environment. Not all registered pesticides are listed in this guide. These recommendations are based on research, label directions and vineyard-use experience for Oregon.

It is important to relate pest knowledge with that of grapevine phenology, or growth stage, and the current seasonal climate. Pest control starts with correctly identifying the pest — whether it is a weed, insect or disease — as well as understanding how that pest

develops in relation to the crop and the season. All of these parameters will help determine the stages at which the pest is most susceptible to control measures. This is true whether those control measures are cultural (canopy management, soil tillage, etc.) or chemical applications (fungicide, insecticide or herbicide).

Cultivar, planting density, vine vigor, canopy characteristics, pest complex and pest history are important for optimizing pest control decisions. Consider timing, application rate, method and volume to optimally target the pest and improve the efficacy of management measures.

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Table 1. Seasonal timing for monitoring and managing weeds, insects, mites and diseases in vineyards

Main pests of concern across Oregon’s grape-growing regions are included. Growth stages and BBCH-scale are based on the extended BBCH-scale (Table 2, page 3).

Weeds	Pre-emergent control	Post-emergent control	Vine sucker control or removal								
Diseases	Trunk diseases	Phomopsis			Powdery mildew			Botrytis		Botrytis	
	Eriophyid mites (bud, rust, erineum)		Spider mites		Leafhoppers						
Insects and mites	Erineum mites		Thrips								
	Mealybugs										
			Fanleaf						Leafroll		
Virus sampling	Red blotch										
	Multiple grapevine viruses may exist in tissues; however, specific time of sampling will provide higher virus titer for indicating presence of certain viruses. The most ideal time for virus sampling of red blotch and leafroll viruses is post harvest or during dormancy (October or later).										
Cultural methods	Remove and destroy galls, cankers, and diseased wood to prevent insect and disease problems	Shoot thinning			Cluster - zone leaf removal						
				Cluster thinning		Collect tissues for nutrient analysis				Collect tissue for nutrient analysis	
Growth stage	Dormant	Delayed dormant	1-5" shoots	6" shoots	Pre-bloom	Bloom	Fruit set	Fruit growth	Bunch close	Véraison	Pre-harvest
BBCH scale	00	1-9	9-14	14-15	17-60	61-69	71	71-77	79	83-85	85-88
Seasonal changes in growth											

This guide includes trade name products and services as illustrations only. Oregon State University does not endorse these products and services or intend to discriminate against products and services not mentioned.

Occasionally, new formulations of a product (or similar formulations containing a different concentration of an active ingredient) may be registered for use on grapes and the pests listed on the label but may not be listed in this guide. Consult the labels of alternative products to determine whether they offer advantages over the products listed in this guide. Product formulations, application rates and registration status may change at any time. The details in this guide are accurate to the knowledge of the authors just prior to publication. Determine label rates of all products used on your vineyard and verify current registration status with the Oregon Department of Agriculture at http://oda.state.or.us/dbs/pest_productsL2K/search.lasso.

Refer to the pesticide label for instructions on the use of a specific product. The product label is a legal document that explains effective rates and methods for its use. Using the product in ways other than those described on the label is a violation of the law.

Two questions are frequently asked about the chemical control of pests:

- “How much chemical do I use per acre?”
- “What is the least amount of water per acre I will need to apply using my spray tank?”

Tables 3 (page 4) and 5 (page 28) offer suggestions for formulated product to use per acre. Rates are based on a 7- to 15-year-old producing vineyard planted at a moderate density (5-foot vine spacing, 7-foot row spacing) with moderate pest pressure.

Some locations may need a lower amount of chemical material or volume. These include vineyards early in the growing season when canopies are smaller; vineyards with smaller canopies; vineyards that are 1

to 4 years old; and locations with less severe pest pressure and infestations. A higher volume or rate (within label limits) may be required later in the growing season, in vineyards with large vine canopies and when there is high pest pressure.

Some insecticide labels indicate water volume needed per acre to apply dilute or concentrated sprays associated with specific application techniques, such as dilute aerial applications. Be sure to read the label to determine how to calculate the amount of chemical needed per acre.

Make sure tank-mixes of pesticides are compatible. For example, an elevated pH of some boron spray solutions can weaken many insecticides, leading to lower efficacy.

Use adjuvants and spreader-stickers with caution. Most contact herbicides applied to growing weeds require a surfactant or adjuvant to maximize efficacy.

Vineyard pest management timing

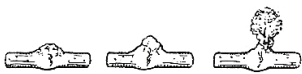

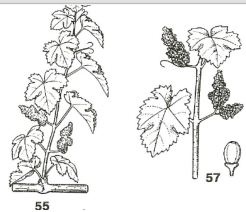
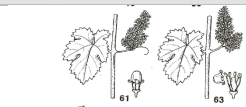


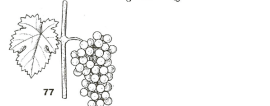
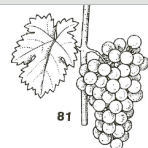
The seasonal layout used in this guide is based on vine phenology throughout the year. Optimal pest management should be timed to coincide with vine phenology, pest presence, pest population levels and climate conditions.

At each vine phenology stage, we refer to a descriptor for vine growth and the corresponding growth stage number.

Table 3 (page 4) provides an overview of the seasonal growth stages and management timing. Please refer to the specific growth stages illustrated in Table 2.

Use these growth stage numbers and descriptors in vineyard management record keeping; they provide a standardized method to report data for historical reference.

Table 2. Principal growth stages

CODE	DESCRIPTION	
0 Bud development		
00	Dormant: winter buds pointed or rounded and bud scales closed, depending on cultivar	
01	Buds beginning to swell	
03	End of bud-swell. Buds swollen but not green.	
05	“Woolly bud”: brown wool visible on bud	00 01 05
07	Beginning of bud-break; green shoot tips just visible	
08	Bud-break; green shoot tips clearly visible	
1 Leaf development		
11	First leaf unfolded away from shoot	
12	Second leaf unfolded	
13	Three leaves unfolded	
1_	Stages continue with additional leaves unfolded	11 13 15
5 Inflorescence emerges		
53	Inflorescence clearly visible	
55	Inflorescence swelling: flowers pressed together	
57	Flowers separate; inflorescence developed	55 57
6 Flowering		
61	10% caps fallen	
65	50% caps fallen	
68	80% caps fallen	65 68
7 Fruit development		
71	Fruit set: fruit begins to form, flower remains lost	
73	BB-sized berries	
75	Pea-sized berries	71 75
77	Berries begin to touch in cluster	73 77
79	Bunch closure; berries touching	
8 Berry ripening		
81	Ripening begins (véraison): berries begin to color	
85	Softening of berries	81
89	Berries ripe; harvest	

Principal Growth Stage Scheme for Grapes, adapted from the Phenological Growth Stages and BBCH-Identification Key of Grapevine in BBCH Monograph, Meier 1997

Table 3. Seasonal vineyard pest management: weeds, insects, mites and fungal diseases

This table provides information on some of the effective pesticides with current labels on the market. These products include those that may be conducive to a variety of farming programs, including conventional, sustainable, organic and biodynamic programs. However, no designation is provided for specific certification-approved spray programs. Be sure to check with your farm certification agency (see pages 34–36) for approved and prohibited products. Not all commercially available pesticides are listed. Products are listed with their application rates, mode of action group, re-entry interval, preharvest interval and important considerations. The application rates are listed in units provided by the product label or by active ingredient, or ai. Footnotes on pages 26–27 provide further information. Remember these points:

- Alternative, nonchemical management strategies such as cultural practices (leaf removal, vigor control, etc.) may be possible, allowing for no-chemical or reduced-chemical use for certain pests. See remarks throughout and footnote 5, page 27.
- Depending on the region, insect and mite pests only occasionally pose an economic impact in Oregon vineyards. Do not use insecticide sprays unless the insect or mite pest has been identified, a negative economic impact is probable, and pest pressure has reached an action threshold.
- Pesticide labels are subject to alteration or cancellation at any time; always consult a current product label for usage and application rates. You can access labels from various online sources, including:
 - PICOL – Pesticide Information Center online database, <https://picol.cahnrs.wsu.edu/>
 - Crop Data Management Systems, <https://www.cdms.net/>
 You can access labels from various online sources; see “Pest Management Resources” on pages 34–36.
- Contact the Oregon Department of Agriculture at 503-986-4635 or pesticide-expert@oda.state.or.us for more questions about pesticide registration and legal use of products.

KEY TO TABLES

REI Re-entry interval
PHI Preharvest interval
ai Active ingredient

Group codes: These refer to the product’s mode of action classification. These group codes are designated by the following:

- WSSA: Weed Science Society of America
- FRAC: Fungicide Resistance Action Committee
- IRAC: Insecticide Resistance Action Committee

DORMANT: Before bud break, stage 00

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Dormant-season weed control					
Aim EC/carfentrazone-ethyl	0.016–0.031 lb ai (1–2 fl oz/A)	14	12 hr	3 d	Burndown broadleaf herbicide. The use of nonionic surfactants or methylated seed oil adjuvants is recommended. Apply postharvest until bloom as a directed application to actively growing weeds less than 4 inches high or to rosettes less than 3 inches in diameter. Tank mix with other herbicides to broaden the spectrum of other contact herbicides or to reduce the selection pressure for glyphosate-resistant weeds when applying glyphosate. Do not exceed 7.9 fl oz/A per year.
Alion/indaziflam	0.045–0.065 lb ai (3.5–5.0 fl oz) Refer to label for soil organic matter-based rates	29	12 hr	14 d	Rate is dependent on percent of soil organic matter. Apply in fall to early spring to firmed soil that does not have cracks. Begin applications three years after vines have been planted and exhibiting good growth and vigor. Ensure that the grapes have 6 inches of soil barrier between the soil surface and the root system. Existing vegetation must be controlled with glyphosate or burndown herbicides, such as glufosinate or paraquat. Rainfall or irrigation of 0.25 inch or more within three weeks of application is required for maximum efficacy. Avoid direct contact with vine foliage, green bark or roots. Do not apply to sand or soil that is more than 20% gravel. Clean spray tank thoroughly after use. Provides long-term pre-emergent control of most annual weeds. Controls annual broadleaf and grass weeds, but perennial weeds are controlled from seedlings only. Do not exceed 5.0 fl oz/A per year.
Casoron 4G/dichlobenil	4–6 lb ai (100-150 lb)	20	12 hr	—	Apply fall through spring, before weeds germinate, or apply foliar-active herbicide to control existing vegetation. Apply prior to a cold rain to reduce losses due to volatilization. Weigh and uniformly distribute exact quantities over precisely measured areas to ensure accurate applications. Use in vineyards established at least four weeks, preferably the winter after planting. Results of Oregon-based research over nine years suggest perennial weeds can be suppressed with 4-, 3-, and 2-lb ai/A rates applied during three consecutive years. Grazing livestock is prohibited. Useful for controlling perennial weeds such as Canada thistle (at 6 lb ai/A rate).

DORMANT: Before bud break, stage 00

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Chateau SW/flumioxazin	Refer to label for condition-based rates	14	12 hr	60 d	Rates depend on organic matter, soil type, weed population, and pre- or postemergent control. Residual or postemergent weed control can be achieved by adjusting rates or by using tank-mixes (see label). Do not apply to vines established less than two years, unless they are trained 3 feet high or protected by nonporous wraps. Vines can be planted within two months of application in newly established vineyards. Follow the most restrictive label requirements and avoid direct or indirect spray contact with foliage or green bark. Do not exceed 24 oz/A per year.
Devrinol DF-XT/ napropamide	4 lb ai (8 lb)	15	24 hr	70 d	Apply fall through spring before weeds germinate. Irrigation or shallow incorporation is recommended for treatments made November through February if no rain falls within three weeks of application. Irrigate within 24 hours to wet soil 2 to 4 inches deep if applied March through October. Shallow mechanical incorporation enhances activity. Excessive plant residues on soil surface reduce performance. Do not apply more than once per season.
Diuron 4L/diuron	1.6–3.2 lb ai (1.6–3.2 qt).	7	12 hr	—	Winter application that persists in soil. Apply in winter as single application, or half doses in October and March. Minimum treatment interval is 90 days. Use only when vines are dormant, or they will suffer damage. Do not apply on very sandy or gravelly soils or soils with less than 1% organic matter. Use only in vineyards that are at least three years old and with trunk diameters greater than 1.5 inches. Do not exceed two applications or 8 quarts/A per year.
Gamma/tiafenacil	0.02–0.06 lb ai (0.5–1.5 oz)	14	12 h	7 d	Postemergence non-selective herbicide for broadleaf and grass control. Must use with methylated seed oil or crop oil and ammonium sulfate for best results. This herbicide is best used when weeds are less than 6 inches tall. Apply only to vines older than 2 years. Direct spray toward base of vines, avoiding direct plant contact. Do not exceed 4.5 oz/A/year.
Goal 2XL/oxyfluorfen	0.5–2 lb ai (2–8 pts) Refer to label for pre- and post- emergence rates	14	24 hr	NA	Controls broadleaf weeds pre- and postemergence depending on rate of application and weed species. Apply only to healthy vineyards. Vines should be trained to a trellis, and the canopy should be 3 feet above the soil surface in vineyards where this product will be used. Direct spray toward base of vines, avoiding direct plant contact. Acts as a contact herbicide, either directly on broadleaf weeds or at soil surface as weeds emerge. Do not apply more than 1.5 lb ai (6 pints)/A per year when applied as broadcast or banded. Do not apply between bud swell and final harvest.
Kerb SC/pronamide	1–2 lb ai (2.5–5 pts)	3	24 hr	—	A restricted-use pesticide. Apply postharvest only once in fall or winter, preferably October to December when air temperatures are 55°F or below. Use lower rates on annual grasses and course-textured soils; higher rates on perennial grasses, such as quackgrass and fine-textured soils. Requires moisture from rain or irrigation for activation. Use only on vineyards established at least one year or to spring-planted grapes established at least six months. No more than 2 lb ai/A and one application per year.
Mission/flazasulfuron	0.033–0.0450 lb ai (2.14–2.85 oz)	2	12 hr	75 d	Pre- and postemergence control of broadleaves and grass weeds up to 4 inches tall, and before grasses tiller. Use of an adjuvant is recommended for postemergence applications. Controls many grasses and broadleaf weeds, including annual ryegrass, common mallow, wild carrot, clover and willowherb. Apply as a directed spray to the soil beneath the vines to prevent injury to the foliage and bark of young vines. Use only on vines at least three years old. A protective sleeve is required for third-year vines. Must be activated with rainfall or irrigation of 0.25 to 0.5 inch for pre-emergent control. Pre-emergent efficacy is best if applied to bare soil. Do not disturb the soil after activation. Do not exceed two applications or 0.09 lb ai/A per year. The minimum retreatment interval is three months.

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DORMANT: Before bud break, stage 00

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Princep Caliber 90/simazine	2–4 lb ai (2.2–4.4 lb)	5	12 hr	—	Apply in winter as single application. Reduce rate or rotate with other herbicides after achieving weed control. Requires surface moisture to activate. Do not use in vineyards less than three years old, or crop damage may occur. Do not apply more than once or more than 4 lb ai/A per 12-month period. Do not apply on very sandy or gravelly soils.
Solicam DF/norflurazon	1–3.9 lb ai (1.25–5.0 lb)	12	12 hr	60 d	Rate depends on soil textures; consult the label. Apply to weed-free soil in fall to early spring when soil surface is reasonably free from plant residue. Requires ample rain to activate. Do not use on grapes established less than two years in the field. Do not use on gravelly, sandy, or loamy sand soils. Wait three months before attempting to plant any cover crop.
Surflan A.S./oryzalin	2–6 lb ai (2–6 qt)	3	24 hr	—	Apply late fall or early spring to bare soil or after existing weedy vegetation has been destroyed by tillage, or tank mix with nonselective herbicides, such as glyphosate. Use higher rates or split treatments, and apply in fall and spring for longer residual control. Minimum retreatment interval is 2.5 months. Apply before rainfall or irrigate with at least 0.5 inch of water or rain to activate herbicide (1 or more inches in fine soil with high organic matter content). Do not use on soils with more than 5% organic matter. Shallow cultivation can provide control of newly germinated weeds without reducing herbicide activity. Do not apply more than 12 lb ai/A per year.
Trifluralin 4 EC/trifluralin	0.5–2 lb ai (1–4 pt)	3	12 hr	60 d	Check label for specific rates suited to soil type. Apply before transplanting or prior to periods of weed germination, or immediately after existing weeds are controlled. Apply and immediately incorporate 1 to 2 inches deep, using equipment that will not injure roots.
Venue/pyraflufen	0.0040–0.0053 lb ai (3–4 fl oz)	14	12 hr	0 d	This product is a contact, nonselective, broadleaf herbicide. Use of an adjuvant is recommended. Avoid contact with desirable foliage, green bark or fruit. Apply postharvest until bloom as a directed application to actively growing weeds less than 4 inches high or to rosettes less than 3 inches in diameter. Do not exceed 6.8 fl oz/A per year for weed control between harvest and pre-bloom. Tank mix with other herbicides to broaden the spectrum of other contact herbicides or to reduce the selection pressure for glyphosate-resistant weeds when applying glyphosate. Will control willow weed (a weed that is often not controlled by glyphosate) that is 3 to 6 inches tall. This product can also be used to control suckers, but do not exceed 6.8 fl oz/A per year when using for sucker control.
Zeus XC/sulfentrazone	0.25–0.375 lb ai (8–12 fl oz)	14	12 hr	3 d	Apply to grapes that have been established for a minimum of three years. Apply as a dormant application in fall through bloom the next spring. If applied after bloom, a shielded sprayer must be used. The product should be applied as a uniform broadcast soil application to vineyard floors and furrows, or as a uniform band directed at the base of the vines. Precipitation of at least 0.5 inch is required for activation and residual control. For enhanced burndown of emerged weeds, carfentrazone, glufosinate, and glyphosate can be added. May tank mix with other labeled herbicides to broaden weed control spectrum. Do not apply to frozen soils. Avoid direct and indirect contact with green foliage or bark. Wrap with nonporous wrap material to keep spray solution off of green tissues. Do not exceed 0.375 lb ai/A (12 fl oz/A) per year.

Mealybugs and other scale insects: The most effective pesticides for mealybugs are not optimal during the dormant period. For more effective timing, action should begin during the delayed-dormant period. It is important to ask supplying nurseries about hot-water and other insecticide treatments before establishing vineyards. Thoroughly inspect a few random vines within new shipments for mealybugs within the root and under the bark. Be sure to use pheromone-baited sticky traps in vineyards. These traps should be placed within the first few seasons in order to identify if mealybugs are present and to take management steps if needed to limit the population. Mealybugs and other scale insects are known vectors of grapevine leafroll virus.

Crown gall, Eutypa dieback and other trunk diseases

Remove and destroy galled or cankered vines. Train up suckers only if originating well below the damaged area and above the graft union on grafted vines. For prevention of trunk disease infection: If you are making large cuts when retraining vines, consider leaving long stubs to be cut away in the summer, when conditions are dry, to allow healing and prevent infection (known as delayed, double, or pre-pruning).

Bio-Tam 2.0	1 lb in 25 to 50 gal water	BM02	4 hr	NA	Use within 24 hours of pruning and again in 2 weeks for high risk vineyards due to surrounding disease pressure and/or favorable weather conditions.
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DORMANT: Before bud break, stage 00

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Mettle 125 ME/tetraconazole + adjuvant	5 fl oz in 25 to 50 gal water/A	3	12 hr	14 d	Spray onto cuts within 24 hours of pruning. A second spray two weeks later is recommended. Do not use more than 10 oz/A per year for this and in-season powdery mildew treatments. Note: for canker diseases only, not crown gall.
Rally 40 WSP/myclobutanil + adjuvant	5 oz in 50 gal water	3	24 hr	NA	Spray onto cuts within 24 hours of pruning. A second spray two weeks later is recommended. Do not use more than 24 oz/A per year for this and in-season powdery mildew treatments. Note: for canker diseases only, not crown gall.
Topsin 4.5 FL/thiophanate-methyl + adjuvant	30 fl oz in 50 gal water	1	2 d	NA	Spray onto cuts within 24 hours of pruning. A second spray two weeks later is recommended. May also be used at 4 fl oz/1 gal water and painted onto the surface of large pruning cuts. Use when rain is not expected after application. Note: This is for canker diseases only, not crown gall.
Wound sealants: B-Lock, Spur Shield or Vitiseal	—	—	—	—	These products are not considered pesticides. Use on pruning wound within 24 hours after making the pruning cuts.

Powdery mildew

The application of lime sulfur during the dormant season or micronized sulfur at 100% bud break has reduced early season inoculum in California and New York. However, the application of these materials may not provide an economic benefit in the Willamette Valley of Oregon.

Phomopsis cane and leaf spot: Remove canes that are bleached or showing symptoms of this disease during dormant pruning.

DELAYED DORMANT: Stages 1–13

Apply from before bud break up to the time shoots are 4 inches long

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Early spring weed control					
glyphosate wiper solution/ several products	Prepare a 33% solution of product	9	4 hr	14 d	See label rate and time of application, particularly for perennial weed control. Mix product to 33% solution, as directed on label, and wipe weeds. Use appropriate equipment. Avoid contact with grape foliage.
paraquat	Consult label	22	24 hr	0 d	Restricted-use pesticide. Apply when weeds are growing vigorously and new growth is 1 to 6 inches high. Apply as a directed-shielded spray toward base of vines. Add a nonionic surfactant or crop oil concentrate according to label; avoid anionic formulations that react in the tank to form insoluble precipitates. Avoid windy conditions. Consult labels for current safety measures and recommendations.
Poast/sethoxydim	0.47 lb ai, (2.5 pt)	1	12 hr	50 d	Identify susceptible grasses and apply at optimum growth stage listed on label. Rate varies with weed species. Add 2 pt/A of a nonphytotoxic crop oil concentrate to improve leaf absorption. Control is often erratic on grasses stunted or stressed by drought, high temperatures, or low fertility. Resistant grasses include annual bluegrass and all fine fescues; quackgrass can be suppressed. Minimum retreatment interval is 14 days. Do not exceed 5 pt/A per season.
Rely 280/glufosinate ammonium	0.87–1.5 lb ai, (48–82 fl oz)	10	12 hr	14 d	Apply to actively growing weeds as directed spray or spot treatment, according to stage of weed growth. Avoid drift to or treatment of desirable foliage or green bark during establishment year. Do not exceed 4.5 lb ai/A per year.
Roundup and other product names/ glyphosate	Consult label	9	4 hr	14 d	See label for rate and time of application, especially for perennial weeds. Do not allow mist to contact green foliage, green bark, suckers or vines and renewals less than three years old. When repeat applications are needed, do not exceed label rate. Alternate weed management to avoid weed resistance.

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DELAYED DORMANT: Stages 1–13

Apply from before bud break up to the time shoots are 4 inches long

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Zeus XC/sulfentrazone	0.25–0.375 lb ai/A, (8–12 oz/A)	14	12 hr	3 d	Apply to grapes that have been established for a minimum of three years. Apply as a dormant application in fall through bloom the next spring. If applied after bloom, a shielded sprayer must be used. The product should be applied as a uniform broadcast soil application to vineyard floors and furrows or as a uniform band directed at the base of the vines. Precipitation of at least 0.5 inch is required for activation and residual control. For enhanced burndown of emerged weeds, carfentrazone, glufosinate and glyphosate can be added. May tank mix with other labeled herbicides to broaden weed control spectrum. Do not apply to frozen soils. Avoid direct and indirect contact with green foliage or bark. Wrap trunks with nonporous wrap material to keep spray solution off of green tissues. Do not exceed 0.375 lb ai/A (12 fl oz/A) per year.
<p>Cutworms (climbing, spotted, redbacked, winter) and other Lepidoptera larvae (grape leafroller, orange tortrix, and omnivorous leafroller) Early management of cutworms is important, especially in newly established vineyards. For all products, thorough coverage of vines and trunks at the soil surface is important. Cutworms can cause damage to either the vines (newly emerging buds/shoots) or vineyard floor vegetation (including cover crops such as clover, grasses, and broadleaf and grass weeds). The climbing, spotted and redbacked cutworm species can cause damage by feeding on newly emerging buds and young shoots in vineyards. While the winter cutworm has less ability to climb up the vine, it was found (fall 2012 and winter 2016) in high populations causing damage to vineyard floor vegetation. For more details on cutworm management, see “Grape – Cutworm” in the Pacific Northwest Insect Management Guide, https://pnwhandbooks.org/insect, and OSU Extension publication <i>Winter Cutworm: A New Pest Threat in Oregon</i>, EM 9139, https://catalog.extension.oregonstate.edu/em9139.</p>					
Altacor/chlorantraniliprole	3–4.5 oz	28	4 hr	14 d	Thorough coverage is important for pest control; do not use water volume less than 30 gal/A. Do not apply more than three applications per season of any Group 28 products to avoid resistance. Do not apply more than 4.6 oz (0.2 lb a.i.) per acre per calendar year.
Brigade 2 EC/bifenthrin	3.2–6.4 fl oz	3A	12 hr	30 d	A restricted-use pesticide. Use as a barrier spray during the delayed-dormant to bud-break stage to prevent movement of cutworms to newly emerging buds and shoots. Apply as a directed spray at the vine-soil interface, making sure to obtain good spray coverage of trunks and posts. Adequate water volume should be used for thorough coverage. Do not apply less than 25 gallons with ground equipment. Do not apply more than 0.1 lb ai/A per year. Do not make more than 1 application per year.
Danitol 2.4 EC/fenoproprathin	5.33–10.67 fl oz	3	24 hr	21 d	A restricted-use pesticide. Use as a barrier spray during the delayed-dormant to bud-break stage to prevent movement of cutworms to newly emerging buds and shoots. Apply as a directed spray at the vine-soil interface, making sure to obtain good spray coverage of trunks and posts. Adequate water volume should be used for thorough coverage. Minimum retreatment interval is seven days. Do not exceed 42.6 fl oz/A or two applications per season.
Delegate WG/spinetoram	3–5 oz	5	4 hr	3 d	Treatment interval 4 days. Do not make more than two consecutive applications of Group 5 products or apply more than five total applications of this product per season (not to exceed 0.305 lb ai/A or 19.5 oz product/A per year).
Sevin XLR Plus/carbaryl	2 quarts; 2 lb ai	1A	6 d	7 d	Do not apply more than 10 lb ai/A per year (no more than five applications). Observe bee caution. Do not apply if weeds or cover crop are in bloom. To minimize nontarget effects, use spot treatments applied only to affected areas.
Success or Entrust/spinosad	4–8 fl oz (Success) 1.25–2.5 oz (Entrust)	5	4 hr	7 d	Treat when pests appear. Heavy infestations may require repeated applications. Do not exceed 0.45 lb ai/A per year of spinosad (9 oz/A of Entrust or 29 fl oz/A of Success). Do not make consecutive sprays of Group 5 products. Do not exceed three applications in a 30-day period (allow at least five days between applications), and do not make more than five applications per year.

CONTINUED ON PAGE 9

DELAYED DORMANT: Stages 1–13

Apply from before bud break up to the time shoots are 4 inches long

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Grape rust and bud mites (eriophyid mites), and spider mites					
Note: Rust mites may cause stunted shoot growth and tissue scarring in early spring. Be aware that other factors (e.g., nutrient deficiencies, vine stress, thrips, and climatic conditions such as spring frost) can cause similar symptoms of stunting and distorted growth in spring. Monitor vines closely for symptoms and examine for presence (microscopic size will require >40X magnification). Damage begins as mites become active during warming temperatures, moving from overwintering sites (outer bud scales or bark) onto green tissue. This period of migration offers the chance to target these mites using contact pesticides more effectively. High spray volumes and good coverage are essential early in the season to manage rust mites in vineyards where high late season pressure was observed the previous year and presence is verified in the late dormant period or pre-bud break. Making one spray application at bud break and then 7 to 14 days later is the best recommendation to control mite populations. Oils and contact miticides may be more effective than sulfur during cool conditions in spring. Sulfur is more effective at reducing grape rust mite populations when used in a spray mixed with an adjuvant. Bud mites are different from rust mites, as they are found within buds during winter, and their feeding can destroy bud tissues before bud break. Bud mites have been less common in Oregon vineyards and are more difficult to control with pesticides. Spider mites (e.g., McDaniel, two-spotted spider mites, Willamette, and yellow) may cause damage during the growing season to grape leaves but are not consistently a problem. However, problems can arise when: 1) their predators are killed off by overuse of sulfur or broad-spectrum insecticides or miticides; 2) conditions are hot, dry, and dusty; and 3) plants are under water stress.					
Envidor 2 SC/spirodiclofen	16–34 fl oz	23	12 hr	14 d	One application per season allowed; 34 fl oz maximum allowed per crop season. For best results, adequate canopy surface area should be available for maximum coverage and contact. Use the higher dosage rate when mite pressure is high and environmental conditions favor continued pressure. Only use if there is evidence of high pest populations.
JMS Stylet oil/paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	Do not use within 10 days of a sulfur application, when air temperature is near freezing or above 90°F, or when foliage is wet. Minimum retreatment interval is 10 days. Restrictions on tank-mixes.
M-Pede/potassium salts of fatty acids	1–2 gal/100 gal water	UN	12 hr	0 d	Do not use within three days of a sulfur application.
sulfur (micronized sulfur)	Check label	UN	24 hr	—	Repeat as necessary based on mite presence. All sulfur products listed have rates given in formulated product.
Microthiol Disperss	3–10 lb	UN	24 hr	0 d	
Thiolux	3–10 lb	UN	24 hr	0 d	
Thrips					
May cause scarring, stunting and shoot dieback on newly developing shoots and leaves that appear similar to that of early season rust mite damage. Monitor for presence before spraying. Where thrips are a problem, they are generally managed early season, prior to bloom. Consider avoiding mowing or tilling cover crop/vegetation on the vineyard floor during spring when populations are high, as they may move into the vine canopy.					
Delegate WG/spinetoram	3–5 oz	5	4 hr	3 d	Do not make more than two consecutive applications of Group 5 products or apply more than three total applications of this product per season for thrips. Control of thrips may improve with addition of horticultural oil as an adjuvant. Do not space applications closer than four days.
Entrust or Success/spinosad	1.25–2.5 oz (Entrust) 4–8 oz (Success)	5	4 hr	7 d	Do not exceed 0.45 lb ai/A per year (9 oz product/A Entrust or 29 oz product/A Success) or five applications per year. Do not make more than two consecutive sprays of Group 5 products. Allow at least five days between applications, and do not exceed three applications in a 30-day period.
Surround (various formulations)/kaolin clay	12–50 lb product	UN	4 hr	0 d	The preferred rate is 0.25–0.5 lb of product per 1 gal water/A. For suppression only. Supplemental controls may be needed for complete control. Make one or two applications seven days apart, starting at bud break.
Phylloxera					
Before treating, check that phylloxera is present by sampling soil and vine roots during late summer through the postharvest period. If sampling shows presence the year prior, consider applying product in the following season. Note that soil drench treatments may result in variable levels of control and are generally ineffective for eradication due to poor soil penetration, such as in clay soils. Soil drench applications require adequate soil moisture and repeat applications each year to control phylloxera, and chemical management is a short-term management option. Longer-term cultural practices, such as use of resistant rootstocks, are preferred. Note that all products listed below are in the same chemical class and can lead to resistance in the phylloxera population if overused. See later stages for materials and remarks. See footnote 5, page 27.					
Admire Pro/imidacloprid (soil)	7–14 fl oz	4A	12 hr	30 d	Soil application. Soil moisture content must be high for this product to work. Do not exceed 14 fl oz/A (0.5 lb ai/A) per year. Remove all weeds prior to treatment.
Belay (clothianidin)	6–12 fl oz	4A	12 hr	30 d	Soil application. Apply through irrigation system to ensure access to the root zone. Do not apply more than 0.2 lb ai per year.

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DELAYED DORMANT: Stages 1–13

Apply from before bud break up to the time shoots are 4 inches long

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Platinum 75 SG/thiamethox- am (soil)	2.67–5.67 oz	4A	12 hr	60 d	Can be applied through drip- or micro-irrigation lines. The vineyard must be irrigated to field capacity to ensure proper absorption into actively growing roots. The higher rate may provide some control during the following season. This compound has good water solubility compared with other systemic, root-applied compounds. Do not exceed 5.67 oz/A (0.266 lb ai/A) per season.
Venom (dinotefuran)	5.0–7.5 oz	4A	12 hr	28 d	Make only one application per season. Apply with ample water for uniform coverage (10–100 gal/A) or apply through drip irrigation at the end of the irrigation schedule to avoid moving the product past the root zone.

Mealybugs, scale and other insects

The majority of contact insecticides are ineffective during periods when mealybugs are protected by bark or within crevices. For systemic insecticides, adequate actively growing leaf tissue is important for the active ingredients to be absorbed by the plant in order to manage the insect. Make sure that the timing of insecticide applications takes these factors into consideration. Ants that feed on mealybug and scale honeydew secretions must be controlled in order for beneficial organisms to aid in control of mealybugs. Products listed below are for mealybug, scale, and other insects, not ants.

Admire Pro/imidacloprid	7–14 fl oz (soil application rate)	4A	12 hr	30 d	Do not apply more than 14 fl oz/A per year. Apply in one or two drip irrigations between bud break and pea-size stage of berry development. Applications should be done on a 30- to 45-day interval. Consult label for restrictions.
Applaud/buprofezin	9–12 oz (varies by pest)	16	12 hr	7 d	No more than two applications per season; do not apply more than 24 oz or 1.5 lb ai/A per year. Allow 14 days between applications. Use rate of 9 to 12 oz for mealybug and leafhopper. Use rate of 12 oz for scale. May be applied to soil or vine, see label.
Platinum 75 SG/thiame- thoxam	2.67–5.67 oz	4A	12 hr	60 d	Can be applied through low-pressure dripper or micro-irrigation lines. Ensure that the vineyard is irrigated to field capacity before application to ensure proper absorption into actively growing roots. The higher rate may result in some control during the following season. This compound has good water solubility compared with other systemic, root-applied compounds. Do not exceed 5.67 fl oz/A (0.266 lb ai/A) per season.
Superior-type oil/mineral oil (several brands)	Varies	NC	Varies	Varies	Consult label for rates. Do not apply oil after bud break as a means to control mealybugs.

SHOOTS 1–5 INCHES LONG: Stages 9–14

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Phomopsis cane and leaf spot: This disease may be called “dead arm” on some labels.					
Mixed group fungicides					
Luna Sensation /fluopyram + trifloxystrobin	7.0 fl oz	7 + 11	12 hr	45 d	Do not use for phomopsis if planning to use for other diseases later in the growing season.
Miravis Prime / pydiflumetofen + fludioxonil	9.2-13.4 fl oz	7 + 12	12 hr	14 d	Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	8–12.5 oz	7 + 11	varies	14 d	Do not make more than two consecutive applications. Do not use for this disease if planning to use for other diseases later in the growing season. The REI varies with vineyard activities; consult label.
Quadris Top /azoxystrobin + difenoconazole	12–14 fl oz	11 + 3	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 11 products.
TopGuard EQ /azoxystrobin + flutriafol	8 fl oz	11 + 3	12 hr	14 d	Do not apply with silicon-based surfactants.

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Single group fungicides					
Abound or Quadris/ azoxystrobin	10–15.5 fl oz	11	4 hr	14 d	Do not apply with silicon-based surfactants. Do not make more than two consecutive applications of Group 11 products.
Aprovia /benzovindiflupyr	8.6–10.5 fl oz	7	12 hr	21 d	Apply at bud break (before shoots are 0.5 inches) with a second application when shoots are 5–6 inches. Use with an adjuvant. Do not make more than two consecutive applications of Group 7 products.
Cevya/mefentrifluconazole	4–5 fl oz	3	12 hr	14 d	Do not use on V. labrusca grapes or hybrids.
Captan 80WDG	1.25–2.5 lb	M4	48 hr	0 d	Do not use with oil. Check label for rates.
Dithane M45 /mancozeb	1.5–2.5 lb	M3	24 hr	66 d	
Flint Extra /trifloxystrobin	3.5-3.8 fl oz	11	12 hr	14 d	Do not make more than two consecutive applications. See footnote 9, page 27.
Penncozeb 75DF /mancozeb	1.5–2.5 lb	M3	24 hr	66 d	
Sovran /kresoxim-methyl	3.2–4.8 oz	11	12 hr	14d	Do not make more than two consecutive applications. See footnote 10, page 27.
Ziram 76 DF	3–4 lb	M3	48 hr	NA	Do not apply after bloom.

Branch, cane or twig borer

While chemicals are registered for use on these insects, the borers are often difficult to control with pesticides because they are hidden inside canes. Be sure that adults, larvae or both can be directly controlled before pursuing the use of an insecticide.

DiPel DF /Bacillus thuringiensis	0.5–2 lb	11A	4 hr	0 d	Biological insecticide. Rate depends on insect; be sure to check label. The pest must feed on this product to be affected. Apply on a four- to five-day schedule as new larvae emerge.
Sevin Brand XLR Plus/ carbaryl	1–2 quarts (1–2 lb ai)	1A	6 d	7 d	Chemical control normally is not necessary if cultural practices, such as removal of pruned wood, are observed. If large populations of adults occur in the vineyard (late April to early June), carbaryl applied two to three times at seven- to 10-day intervals has given control. Do not use more than five applications per year at seven-day intervals, or more than 10 quarts/A. Bee caution: Do not use when cover crop is blooming. See footnote 5, page 27.

Cutworms (climbing, spotted, redbacked, winter) and other Lepidopteran insects (grape leafroller, orange tortrix and omnivorous leafroller)

See materials and remarks for earlier growth stages. Ideally these insects are controlled earlier through thorough scouting, thus allowing for more optimal timing of insecticide applications.

Thrips: See materials and remarks for earlier growth stages.

Spider mites: See materials and remarks for earlier growth stages.

Envidor 2 SC/spirodiclofen	16–34 fl oz	23	12 hr	14 d	One application (maximum of 34 fl oz) is allowed per season. For best results, adequate canopy surface area should be available for maximum coverage and contact. Use the higher dose rate when mite pressure is high and environmental conditions (hot and dry) are favored. Relatively safe to mite predators.
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Mealybugs, scale and other insects: See materials and remarks for earlier growth stages.

Weed control

See “Delayed Dormant,” page 7, for a list of herbicides. Time applications with weed and vine growth stage in mind. Some herbicides can be applied into early spring (post-bud break) and into the growing season.

SHOOTS 6 INCHES LONG: Stages 14–15

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Vine sucker control					
Aim EC/carfentrazone-ethyl	Up to 0.03 lb ai (2 fl oz)	14	12 hr	3 d	Apply to young, green suckers. Care must be taken to avoid drift into the canopy or onto fruit. Adjuvant will improve sucker control. Can be mixed with other sucker-control herbicides.
Gamma/tiafenacil	0.02–0.06 lb ai (0.5–1.5 oz)	14	12 h	7 d	Provides excellent sucker control when suckers are less than 6 inches long. Suckers can be retreated after 14 days. Must add adjuvant for optimum results. Apply only to vines older than 2 years. Direct spray toward base of vines, avoiding direct plant contact. Do not exceed 4.5 oz/A/year.

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SHOOTS 6 INCHES LONG: Stages 14–15

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
GoalTender/oxyfluorfen	0.25–0.5 lb ai (0.5–1.0 pt)	14	24 hr	60 d	Apply in a 3-foot band directed at suckers emerging from the trunk base. Apply when suckers are less than 12 inches in length. Immature, expanding leaves at time of contact are most susceptible. Complete sucker control requires removing canes by hand. The highest rate or a second application may be required for acceptable control or suppression of grape suckers. Do not apply more than 1.5 lb (3 pt)ai/A per season. Applications can be made up to three weeks after bloom. Use a minimum of 50 gallons of water per treated acre. May tank mix with glufosinate.
Venue/pyraflufen	0.004–0.053 lb ai (3–4 fl oz)	14	12 hr	0 d	Apply as a directed application to actively growing suckers. Adjuvant will improve sucker control. Do not use more than two applications per season.

Powdery mildew, grape erineum mite, grape rust mite

Below are products listed for dual efficacy in controlling both powdery mildew and eriophid mites (erineum and rust mites). For powdery mildew control considerations, See Table 4 (pages 28–29) and Table 5 (page 29).

JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	Do not use within a certain number of days before or after sulfur application, in near-freezing temperatures, above 90°F or when foliage is wet. Restrictions on tank-mixes; see label.
M-Pede /potassium salts of fatty acids	1–2 gal/100 gal water	28/UN	12 hr	0 d	Do not use within a certain number of days before or after of a sulfur application. See label for details.
sulfur	Check labels				Repeat as necessary at 10- to 14-day intervals for powdery mildew control. Secondary benefit of sulfur is control of erineum mites and grape rust mites. Wettable sulfur seems to be more effective in controlling the grape erineum mite than flowable
Microthiol Disperss	3–10 lb	M2/UN	24 hr	—	
Thiolux	3–10 lb	M2/UN	24 hr	—	

Powdery mildew only

JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	Do not use within two weeks of a sulfur application, in near-freezing temperatures, above 90°F or when foliage is wet. Restrictions on tank-mixes; see label.
Rex Lime Sulfur	0.5 to 0.75 gal/100 gal water	M2	48 hr	0 d	Do not use dormant season rates.
sulfur	Check labels	M2			Repeat as necessary at 10- to 14-day intervals. Do not apply less than 3 lb/A for adequate control of powdery mildew. See footnotes 1–3, page 26.
Microthiol Disperss	3–10 lb	M2	24 hr	—	
Thiolux	3–10 lb	M2	24 hr	—	

Mealybugs, scale and other insects

See materials and remarks for earlier growth stages. Follow-up treatments may be necessary during this period depending on pest pressure.

Movento /spirotetramat	6–8 fl oz	23	24 hr	7 d	Do not apply more than 12.5 fl oz/A per season. Use an adjuvant to obtain effective, full-canopy applications for this systemic product. A high-quality adjuvant should be used, but the adjuvant Induce is prohibited when clusters are present. Interval between applications is 30 days.
Rex Lime Sulfur	0.5-0.75 gal/100 gal water	UN	48 hr	0 d	Apply when new shoots are 4–6 inches long.

Phylloxera

See remarks for earlier growth stages and footnote 6, page 27.

Thrips

Where thrips are a problem, they are generally managed early season, prior to bloom. See materials and remarks for earlier growth stages.

Yellow jackets

Control of wasps can be managed by trapping. Ongoing effort needs to start in spring and continue into fall, especially if the yellow jacket population was large the previous year. In spring, there is a 30- to 45-day period when new queens first emerge, before they build nests. Trapping queens during this period has the potential to provide an overall reduction in the yellow jacket population for the season. A greater number of traps may reduce the likelihood of pest numbers building up later in the season. Use appropriate baits or traps for species present.

PREBLOOM: Stage 17

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Cutworms Cutworm control is most effective when conducted prior to bloom; this is the period in which they can cause the most damage. See materials and remarks listed for earlier growth stages.					
Mealybugs, scale and other insects See materials and remarks for earlier growth stages.					
Thrips See materials and remarks for earlier growth stages. Where thrips are a problem, they are generally managed early season, prior to bloom.					
Grape rust and bud mite (eriophyid mites), and spider mites					
JMS Stylet oil /paraffinic oil	1-2 gal/100 gal water	NC	4 hr	0 d	Do not use within two weeks of a sulfur application. Restrictions on tank-mixes; see label.
M-Pede /potassium salts of fatty acids	1-2 gal/100 gal water	NC	12 hr	0 d	Do not use within three days of a sulfur application.
sulfur	Check labels				Formulated product rate shown for sulfur products. Repeat as necessary at 10- to 14-day intervals. Wettable sulfur seems to be more effective in controlling the grape erineum mite than the flowable sulfur formulations. See footnote 1, page 26.
Microthiol Disperss	3-10 lb	UN	24 hr	—	
Thiolux	3-10 lb	UN	24 hr	—	
Phylloxera Foliar applied insecticides (shown below) have greater efficacy when applied to adequate canopy (at least 2 feet of shoot growth). See additional materials and remarks for other growth stages. See footnote 6, page 27.					
Movento /spirotetramat	6-8 fl oz	23	24 hr	7d	Do not apply more than 12.5 fl oz/A per season. Use an adjuvant to obtain effective full canopy applications. A high-quality adjuvant should be used, but the adjuvant Induce is prohibited when clusters are present. Ensure application when there is adequate canopy for uptake through tissues. Interval between applications is 30 days.
Powdery mildew Fungicide resistance exists in the powdery mildew population throughout Oregon, especially for fungicides in the groups 3, 7 and 11. For this reason, it is best to alternate or tank mix materials from different fungicide groups (FRAC code) with different modes of action. The products listed below are in order of the most highly recommended (mixed group products) to those that may have limited efficacy if not tank-mixed with other products. In all cases, limit applications from any specific group to two or fewer sprays per season to avoid fungicide resistance development in your vineyard. See Table 4 (pages 28-29) and Table 5 (page 29).					
Mixed group fungicides					
Inspire Super /cyprodinil + difenoconazole	16-20 fl oz	3 + 9	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 3 or Group 9 products.
Luna Experience /fluopyram + tebuconazole	6.0-8.6 fl oz	3 + 7	varies	45 d	The REI varies for vineyards: 5-day REI for hand labor of the canes/canopy and 12-hr REI for other activities. Do not exceed 34 fl oz/A per year. Allowed at this stage of berry development if wines are intended for domestic market. If wines are intended for export, do not use past 12-leaf stage.
Merivon /fluxapyroxad + pyraclostrobin	4-5.5 fl oz	7 + 11	12 hr	14 d	Do not mix with any other materials. Do not make more than two consecutive applications of this or other Group 7 or Group 11 products.
Miravis Prime / pydiflumetofen + fludioxonil	9.2-13.4 fl oz	7 + 12	12 hr	14 d	Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	8-12.5 oz	7 + 11	varies	14 d	The REI varies for vineyards based on labor activities; consult label.
Quadris Top /azoxystrobin + difenoconazole	12-14 fl oz	11 + 3	12 hr	14 d	
TopGuard EQ/azoxystrobin + flutriafol	5-6 fl oz	3 + 11	12 hr	14 d	Do not apply with silicon-based surfactants.
Single group fungicides					
Aprovia /benzovindiflupyr	8.6-10.5 fl oz	7	12 hr	21 d	Do not make more than two consecutive applications of Group 7 products.

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PREBLOOM: Stage 17

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Cevya/mefentrifluconazole	4–5 fl oz	3	12 hr	14 d	Do not use on <i>V. labrusca</i> grapes or hybrids.
Flint Extra /trifloxystrobin	3.0-3.5 fl oz	11	12 hr	14 d	Do not make more than two consecutive applications. See footnote 9, page 27.
Gatten /flutianil	6.4 fl oz	U13	12 hr	14 d	
JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	Do not use within 10 days of a sulfur application. Restrictions on tank-mixes; see label.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code).
Mettle 125 ME / tetraconazole	3–5 fl oz	3	varies	14 d	The REI varies for vineyard activities; consult label.
Oso 5% SC /polyoxin D	6.5–13 fl oz	19	4 hr	0 d	
Procure 480SC /triflumizole	4–8 fl oz	3	12 hr	7 d	
Prolivo 300 SC /pyriofenone	4–5 fl oz	50	4 hr	0 d	
Quintec /quinoxifen	4–6.6 oz	13	12 hr	21 d	A surfactant is not required when used alone, but a non-ionic surfactant is preferred if needed for tank-mixes.
Rally 40WSP /myclobutanil	3–5 oz	3	24 hr	14 d	
Rex Lime Sulfur	0.5–0.75 gal/100 gal water	M2	48 hr	0 d	Do not use dormant season rates.
Sovran /kresoxim-methyl	3.2–4.8 oz	11	12 hr	14 d	Do not make more than two consecutive applications. See footnote 10, page 27.
sulfur					
Microthiol Disperss	3–10 lb	M2	24 hr	—	Repeat as necessary at 7- to 10-day intervals. Do not apply less than 3 lb/A for adequate control of powdery mildew. See footnotes 1–3, page 26.
Thiolux	3–10 lb	M2	24 hr	0 d	
Torino /cyflufenamid	3.4 or 6.8 oz	U6	4 hr	3 d	Do not make more than two applications per year at the low rate, or do not apply more than once at the high rate. PHI for high rate is 7 days.
Trionic 4 SC /triflumizole	4–8 fl oz	3	12 hr	7 d	
Vivando /metrafenone	10.3–15.4 fl oz	50	12 hr	14 d	Do not use with oil. Minimum interval between applications is 14 days. Do not make more than two consecutive applications of this or other Group 50 products.

Eutypa dieback, Bot canker and other wood rot diseases

Scout for vines showing symptoms of these diseases. Mark for removal in summer, during dry weather, or during the dormant season. Removal during rainfall early in the season can lead to further spread of the disease.

Weed control

Refer to Delayed dormant, page 7, for list of herbicides. Time applications with weed species and vine growth in mind. Some herbicides can be applied into early spring (post-bud break) and into the season.

BLOOM: Stages 61–69 See footnote 8, page 27

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Powdery mildew					
Powdery mildew is a significant concern during this time and should be prevented with the use of fungicides. Fungicide products are best used early in bloom, from stages 61 to 65, which is 10–50% cap fall. Use products at the shortest recommended intervals during this period. Fungicide application does not create problems with fruit set. Fungicide resistance exists in the powdery mildew population throughout Oregon, especially for fungicides in the groups 3, 7 and 11. For this reason, it is best to alternate or tank mix materials from different fungicide groups (FRAC code) with different modes of action. The products are listed below in order of the most highly recommended (mixed group products) to those that may have limited efficacy if not tank-mixed with other products. In all cases, limit applications from any specific group to two or fewer sprays per season to avoid fungicide resistance development in your vineyard. See Table 4 (pages 28–29) and Table 5 (page 29).					
Mixed group fungicides					
Aprovia Top/difenoconazole + benzovindiflupry	8.5-13.5 fl oz	3 + 7	12 hr	21 d	
Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 3 or Group 9 products. Group 9 products have not worked as well in Willamette Valley trials and are not recommended at bloom. However, they have shown good efficacy in southern Oregon trials.
Luna Experience /fluopyram + tebuconazole	6–8.6 fl oz	3 + 7	varies	45 d	The REI varies for vineyards: five-day for hand labor of the canes/canopy and 12-hr for other activities. Allowed at this stage of berry development if wines are intended for domestic market. If wines are intended for export, do not use at this stage (cannot be used past 12-leaf stage).
Luna Sensation /fluopyram + trifloxystrobin	7.0 fl oz	7 + 11	12 hr	14 d	Do not use for powdery mildew control if already used for Botrytis bunch rot control.
Merivon /fluxapyroxad + pyraclostrobin	4–5.5 fl oz	7 + 11	12 hr	14 d	Do not mix with any other materials. Do not make more than two consecutive applications of this or other Group 7 or Group 11 products.
Miravis Prime / pydiflumetofen + fludioxonil	9.2–13.4 fl oz	7 + 12	12-hr	14 d	Do not use for powdery mildew control if already used for Botrytis bunch rot control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	8–12.5 oz	7 + 11	varies	14 d	The REI varies with vineyard activities; consult label. Do not make more than two consecutive applications.
Quadris Top /azoxystrobin + difenoconazole	12–14 fl oz	3 + 11	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 11 products.
TopGuard EQ /azoxystrobin + flutriafol	5–6 fl oz	3 + 11	12 hr	14 d	Do not apply with silicon-based surfactants.
Single group products					
Abound or Quadris/ azoxystrobin	10-15.5 fl oz	11	4-hr	14 d	Tank mix with a different fungicide group (FRAC code), but do not use with silicone-based surfactants.
Aprovia /benzovindiflupyr	8.6–10.5 fl oz	7	12 hr	21 d	Tank mix with a different fungicide group (FRAC code) and an adjuvant.
Cevya/mefentrifluconazole	4–5 fl oz	3	12 hr	14 d	Do not use on <i>V. labrusca</i> grapes or hybrids.
Flint Extra/trifloxystrobin	3.0-3.5 fl oz	11	12 hr	14 d	Do not make more than two consecutive applications. See footnote 9, page 27.
Gatten /flutianil	6.4 fl oz	U13	12-hr	14 d	
Horticultural oils such as JMS Stylet oil, SuffOil, Trilogy	1–2 gal/100 gal water	NC	4 hr	0 d	May be used as an adjuvant with other fungicides. Do not use within 10 days of a sulfur application.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code).
Mettle 125 ME / tetraconazole	3–5 fl oz	3	varies	14 d	The REI varies for vineyard activities; consult label. The 3-ounce rate is only for use in tank-mixes with a non-Group 3 fungicide that is labeled for powdery mildew control.
Prolivo 300 SC /pyriofenone	4–5 fl oz	50	4 hr	0 d	Do not make more than two consecutive applications of this or other Group 50 products.

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BLOOM: Stages 61–69 See footnote 8, page 27

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Procure 480SC /triflumizole	4–8 fl oz	3	12 hr	7 d	Tank mix with a different fungicide group (FRAC code).
Quintec /quinoxifen	4–6.6 oz	13	12 hr	21 d	A surfactant is not required when used alone, but a non-ionic surfactant is preferred if needed for tank-mixes. Do not make more than two consecutive applications of this or other Group 13 products.
Rally 40WSP /myclobutanil	3–5 oz	3	24 hr	14 d	Tank mix with a different fungicide group (FRAC code).
Rhyme / flutriafol	4–5 fl oz	3	varies	14 d	Tank mix with a different fungicide group (FRAC code). Re-entry interval varies by vineyard task; see label.
Sovran /kresoxim-methyl	3.2–4.8 oz	11	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not make more than two consecutive applications. See footnote 10, page 27.
sulfur					Repeat as necessary at 7- to 10-day intervals. Do not apply less than 3 lb/A for adequate control of powdery mildew. See footnotes 1–3, page 26.
Microthiol Disperss	3–10 lb	M2	24 hr	—	
Thiolux	3-10 lb	M2	24 hr	---	
Trionic 4 SC /triflumizole	4–8 fl oz	3	12 hr	7 d	Tank mix with a different fungicide group (FRAC code).
Torino /cyflufenamid	3.4 or 6.8 oz	U6	4 hr	3 d	Do not make more than two applications per year at the low rate, or apply only once per year at the high rate. PHI for high rate is 7 days.
Vivando /metrafenone	10.3–15.4 fl oz	50	12 hr	14 d	Do not use with oil. Minimum interval between applications is 14 days. Do not make more than two consecutive applications of this or other Group 50 products.

Botrytis bunch rot

Bloom is a critical time for preventing Botrytis bunch rot development. Flower caps and aborted flowers/berries that remain in the cluster may become infected and lay latent until conditions become suitable for fungal growth during berry ripening. In western Oregon, clusters affected by Botrytis often appear to be rotting from within, and this can be avoided by applying the right fungicides and well-timed canopy management at bloom and again at bunch closure. Cultural control: Cluster-zone leaf removal is an important cultural practice for Botrytis prevention, as it will increase spray penetration, increase air flow to prevent infection early in the season, and help reduce persistence of caps and other floral parts post-bloom that may otherwise favor initial Botrytis bunch rot infections. This practice is critical for high vigor vineyards with large canopy size and large leaves. This practice is also important in vineyards where there are fewer products available (such as in organic and biodynamic production). Oregon research shows that early leaf removal (from bloom to pea-size stage) does not cause reduction in grape yield or result in fruit sunburn. Late leaf removal (near véraison or later) can cause sunburn, particularly when combined with hot, dry weather.

Chemical control: Applications prior to rain events is more important than specific growth stages. For many of the products listed, do not apply more than two consecutive applications in a season. This is to avoid development of disease resistance to those products. See Table 4 (pages 28–29) and Table 5 (page 29). For areas where both powdery mildew and Botrytis bunch rot are problems, selecting fungicides that are effective against both diseases is a good strategy.

Mixed group fungicides

Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not use for Botrytis bunch rot control if it was used for powdery mildew. Do not make more than two consecutive applications of this or other Group 3 or Group 9 products.
Luna Sensation /fluopyram + trifloxystrobin	7.0 fl oz	7 + 11	12 hr	45 d	Do not use for bunch rot control if already used for powdery mildew control. Do not exceed 27.1 fl oz/A per year.
Miravis Prime / pydiflumetofen + fludioxonil	10.3–13.4 fl oz	7 + 12	12 hr	14 d	Do not use for bunch rot control if already used for powdery mildew control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	18.5–23 oz	7 + 11	varies	14 d	Higher rate based on supplemental label. Do not use for Botrytis bunch rot control if used for powdery mildew. The REI varies with vineyard activities; consult label.
Switch 62.5 WG /cyprodinil + fludioxonil	11–14 oz	9 + 12	12 hr	7 d	Do not use with an adjuvant.

Single group products

Captan 80WDG	2.5 lb	M4	48 hr	0 d	Do not use with oil.
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BLOOM: Stages 61–69 See footnote 8, page 27

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Elevate 50WDG / fenhexamid	1 lb	17	12 hr	0 d	Do not make more than two consecutive applications. Do not use more than 3 lb/A per season. See footnote 3, page 26.
Endura /boscalid	8 oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not use more than two times per year. Do not use for Botrytis bunch rot control if Pristine was used for powdery mildew.
Intuity /mandestrobin	6 fl oz	11	12 hr	10 d	Efficacy in the Pacific Northwest is unknown. Do not use on American grape species or hybrids (<i>V. labrusca</i> varieties). Do not make consecutive applications of this or other Group 11 products.
JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	May aid Botrytis bunch rot control if used for powdery mildew. Tank mix with another fungicide. Do not use within 10 days of a sulfur application.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). See footnote 4, page 27.
Rovral 4F /iprodione (generic products are available)	1.5–2 pt	2	48 hr	7 d	Application rate varies with vine stages. Consult label. Tank mix with another fungicide from a different group (FRAC code). Do not use more than twice per season. Rates below 1.5 pt/A are not effective. See footnote 4, page 27.
Scala SC /pyrimethanil	9–18 fl oz	9	12 hr	7 d	See footnote 4, page 27.
Vanguard /cyprodinil	5–10 oz	9	12 hr	7 d	See footnote 4, page 27.

Mealybugs, scale and other insects

See materials and remarks for earlier growth stages.

Vine sucker control

Aim EC/carfentrazone-ethyl	Up to 0.03 lb ai (2 fl oz)	14	12 hr	3 d	Apply to young, green suckers. Care must be taken to avoid drift into the canopy or onto fruit. Adjuvant will improve sucker control. Can be mixed with other sucker-control herbicides.
Gamma/tiafenacil	0.02–0.06 lb ai (0.5–1.5 oz)	14	12 h	7 d	Postemergence non-selective herbicide for broadleaf and grass control. Must add methylated seed oil or crop oil and ammonium sulfate for best results. Better performance when treating weed less than 6 inches tall. Apply only to vines older than 2 years. Direct spray toward base of vines, avoiding direct plant contact. Do not exceed 4.5 oz/A/year.
GoalTender /oxyfluorfen	0.25–0.5 lb ai (0.5–1 pt)	14	24 hr	60 d	Apply in a 3-foot band directed at suckers emerging from the trunk base. Apply when suckers are less than 12 inches in length. Immature, expanding leaves at time of contact are most susceptible. Complete sucker control requires removing canes by hand. The highest rate or a second application may be required for acceptable control or suppression of grape suckers. Do not apply more than 1.5 lb ai/A (3 pt/A) per season. Applications can be made up to three weeks after bloom. Use a minimum of 50 gallons of water per treated acre. May tank mix with glufosinate.

Weed control

See “Dormant,” page 4, and “Delayed dormant,” page 7, for a list of herbicides and timing of applications with weed and vine growth in mind. Some herbicides can be applied into early spring (post-bud break) and into the season, based on application use and weed age. Could consider use of Alion, Chateau, Matrix or Zeus at this stage.

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LATE SPRING, BLOOM THROUGH FRUIT SET: Stages 65–70

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Powdery mildew					
Powdery mildew is a significant concern during this time and should be prevented with the use of fungicides. Fungicide resistance exists in the powdery mildew population throughout Oregon, especially for fungicides in the groups 3, 7 and 11. For this reason, it is best to alternate or tank mix materials from different fungicide groups (FRAC code) with different modes of action. The products are listed below in order of the most highly recommended (mixed group products) to those that may have limited efficacy if not tank-mixed with other products. In all cases, limit applications from any specific group to two or fewer sprays per season to avoid fungicide resistance development in your vineyard. See Table 4 (pages 28–29) and Table 5 (page 29).					
Mixed group fungicides					
Aprovia Top/difenoconazole + benzovindiflupry	8.5-13.5 fl oz	3 + 7	12 hr	21 d	
Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 3 or Group 9 products. Do not exceed 80 fl oz/A per year. Group 9 products are not recommended for the Willamette Valley at bloom, but they have been shown to be effective in southern Oregon trials where disease pressure or climatic conditions differ.
Luna Experience /fluopyram + tebuconazole	6–8.6 fl oz	3 + 7	varies	45 d	The REI varies for vineyards: five-day for hand labor of the canes/canopy and 12-hr for other activities. Do not apply after the peppercorn size stage of berry development if wines are being produced for domestic market. If wines are intended for export, do not use at this stage (cannot be used past 12-leaf stage).
Luna Sensation /fluopyram + trifloxystrobin	7.0 fl oz	7 + 11	12 hr	45 d	Do not use for powdery mildew control if already used for Botrytis bunch rot control. Do not use after the BB size stage of berry development (BBCH 73).
Merivon /fluxapyroxad + pyraclostrobin	4–5.5 fl oz	7 + 11	12 hr	14 d	Do not mix with any other materials. Do not make more than two consecutive applications of this or other Group 7 or Group 11 products.
Miravis Prime /pydiflumetofen + fludioxonil	9.2–13.4 fl oz	7 + 12	12 hr	14 d	Do not use for powdery mildew control if already used for Botrytis bunch rot control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	8–12.5 oz	7 + 11	varies	14 d	The REI varies with vineyard activities; consult label. Do not make more than two consecutive applications.
Quadris Top /azoxystrobin + difenoconazole	12–14 fl oz	3 + 11	12 hr	14 d	Do not make more than two consecutive applications of this or other Group 11 products.
TopGuard EQ /azoxystrobin + flutriafol	5–6 fl oz	3 + 11	12 hr	14 d	Do not apply with silicon-based surfactants.
Single group products					
Abound or Quadris /azoxystrobin	10–15.5 fl oz	11	4 hr	14 d	Tank mix with a different fungicide group (FRAC code). Product is component of Quadris Top or Topguard EQ. Do not apply with silicon-based surfactants. Do not make more than two consecutive applications of this or other Group 11 products. Do not exceed 90 fl oz/A per year.
Aprovia /benzovindiflupyr	8.6–10.5 fl oz	7	12 hr	21 d	Use with an adjuvant and tank mix with a different fungicide group (FRAC code).
Cevya/mefentrifluconazole	4–5 fl oz	3	12 hr	14 d	Do not use on <i>V. labrusca</i> grapes or hybrids.
Endura/boscalid	4.5 oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not use to control powdery mildew if it was used for Botrytis bunch rot control or if using Pristine, which also contains this chemical.
Flint Extra/trifloxystrobin	3 - 3.5 fl oz	11	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not make more than two consecutive applications. See footnote 9, page 27.
Gatten /flutianil	6.4 fl oz	U13	12-hr	14 d	

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LATE SPRING, BLOOM THROUGH FRUIT SET: Stages 65–70

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
HMOs such as JMS Stylet oil, SuffOil, Trilogy	1–2 gal/100 gal water	NC	4 hr	0 d	Do not use within 10 days of a sulfur application.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code).
Mettle 125 ME / tetraconazole	3–5 fl oz	3	varies	14 d	Do not use more than 10 fl oz/A per year. The REI varies for vineyard activities; consult label. The 3-ounce rate is only for use in tank-mixtures with a non-FRAC 3 fungicide that is labeled for powdery mildew control.
Oso 5% SC /polyoxin D	6.5–13 fl oz	19	4 hr	0 d	
Ph-D WDG /polyoxin D	6.2 oz	19	4 hr	0 d	Use with an adjuvant.
Procure 480SC /triflumizole	4–8 fl oz	3	12 hr	7 d	Tank mix with a different fungicide group (FRAC code).
Prolivo 300 SC /pyriofenone	4–5 fl oz	50	4 hr	0 d	Do not make more than two consecutive applications of this or other Group 50 products.
Quintec /quinoxifen	4–6.6 oz	13	12 hr	21 d	A surfactant is not required when used alone, but a non-ionic surfactant is preferred if needed for tank-mixes. Do not make more than two consecutive applications of this or other Group 13 products.
Rally 40WSP /myclobutanil	3–5 oz	3	24 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not exceed 1.5 lb (24 oz)/A per year.
Rex Lime Sulfur	0.5 to 0.75 gal/100 gal water	M2	48 hr	0 d	Do not use dormant season rates.
Rhyme /flutriafol	5 fl oz	3	varies	14 d	Tank mix with a different fungicide group (FRAC code). REI varies from 12 hr to 5 d depending on vineyard task; see label.
Sovran /kresoxim-methyl	3.2–4.8 oz	11	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). Do not make more than two consecutive applications. See footnote 10, page 27. Do not make more than two consecutive applications.
sulfur					Repeat as necessary at 7- to 10-day intervals. Do not apply less than 3 lb/A for adequate control of powdery mildew. See footnotes 1 and 2, page 26.
Microthiol Disperss	3–10 lb	M2	24 hr	—	
Thiolux	3-10 lb	M2	24 hr	—	
Orius 20 AQ/tebuconazole	8.6 oz	3	12 hr	14 d	Tank mix with a different fungicide group (FRAC code).
Torino /cyflufenamid	3.4 or 6.8 oz	U6	4 hr	3 d	Do not make more than two applications per year at the low rate, or do not apply more than once per year at the high rate. PHI for high rate is 7 days.
Trionic 4 SC /triflumizole	4–8 fl oz	3	12 hr	7 d	Tank mix with a different fungicide group (FRAC code).
Vivando /metrafenone	10.3–15.4 fl oz	50	12 hr	14 d	Do not use with oil. Minimum interval between applications is 14 days. Do not make more than two consecutive applications of this or other Group 50 products.

Black vine weevils

This pest can be an economic problem in young vineyards due to potential for extensive damage by black vine weevil larvae. However, it is rare in Oregon. Areas previously planted to strawberries are potentially higher risk. Before planting new vineyards, inspect the roots of a random sample of vines before planting.

Aza-Direct /azadirachtin	1–3.5 pt	UN	4 hr	0 d	Apply 7 to 10 days apart. For heavy pest pressure, use up to 3.5 pt.
Brigade 2EC /bifenthrin	6.4 fl oz (-0.1 lb ai)	3A	12 hr	30 d	Restricted-use pesticide. Do not apply more than once per season. Thorough coverage is essential.

Branch, cane and twig borers

See materials and remarks for earlier growth stages.

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LATE SPRING, BLOOM THROUGH FRUIT SET: Stages 65–70

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Grape erineum (blister) mites					
These mites are not typically an economic pest on grapes in Oregon. However, certain conditions may lead to high populations, which may reduce yield if they are found damaging flower clusters prebloom. Sulfur used in spring for grape powdery mildew control should manage this pest. However, erineum mites have become more prevalent in vineyards where little to no sulfur has been used in spring. One published research study suggests that erineum mite may be a potential vector of grapevine Pinot Gris virus; however, research is ongoing and no recommendations are in place for control of this pest as a virus vector.					
Leafhoppers, sharpshooters and other xylem-feeding insects					
Leafhoppers can cause significant damage to the grapevine canopy, reducing vine photosynthesis, particularly in warmer, arid regions of the state (southern and eastern Oregon). Scout vineyards for leafhoppers to determine if management is necessary. Management action is recommended when an average of 20 nymphs are found per leaf. Efforts should be made to protect beneficial insects, such as the egg parasitic wasp <i>Anagrus</i> sp. that keeps leafhopper populations in check. For more details on leafhopper management, see "Grape-Leafhopper" in the <i>PNW Insect Handbook</i> , https://pnwhandbooks.org/insect/small-fruit/grape/grape-leafhopper . Note: Xylem-feeding insects, such as some leafhoppers, sharpshooters, spittlebugs or froghoppers, can vector certain diseases such as Pierce's disease (bacterium = <i>Xylella fastidiosa</i>) in grape and affects a variety of other hosts. Several compounds are registered for use on leafhoppers in grapes. A list of compounds that are regularly used is presented below.					
Actara/thiamethoxam	1.5–3.5 oz	4A	12 hr	5 d	Do not exceed 7 oz/A (0.109 lb ai/A) per season. Allow 14 days between applications. Take precautions to prevent nontarget effects on pollinators and bees.
Admire Pro/imidacloprid	7–14 fl oz	4A	12 hr	varies	Soil and foliar application methods allowed. Refer to label for rates and restrictions. Chemigation should be applied between bud break and pea-sized berry stages. See label for restrictions. Frequent use of imidacloprid may lead to spider mite outbreaks. 0-day PHI for foliar applications and 30-day PHI for soil/chemigation applications. Take precautions to minimize nontarget effects on pollinators and bees.
Applaud /buprofezin	9–12 oz	16	12 hr	7 d	No more than two applications per season; do not apply more than 24 oz or 1.05 lb ai/A per year. Allow 14 days between applications. Apply when the leafhoppers are at the early nymph stage.
Assail 30 SG/acetamiprid	2.1–4.5 oz	4A	12 hr	3 d	Do not exceed two applications per season (9.0 oz product/A per year limit). Allow at least 14 days between applications.
Baythroid XL/β-cyfluthrin	1.6–3.2 fl oz	3A	12 hr	3 d	Restricted-use pesticide. Do not apply more than 0.025 lb ai/A (3.2 fl oz/A) per 14-day interval or 0.1 lb ai/A (12.8 fl oz/A) per season.
Danitol 2.4 EC/ fenoprophathin	5.33–21.33 fl oz (varies by pest)	3	24 hr	21 d	Restricted-use pesticide. Do not exceed 0.8 lb ai/A per season (42.66 oz product/A per year). Apply with 25 to 200 gal water/A to ensure good coverage; seven-day spray interval. Apply when pest populations are highest. For resistance management, it is best not to use more than two sprays per season.
Fujimite SC/fenpyroximate	1–2 pts	21A	12 hr	14 d	Apply in a minimum of 50 gal water/A. Do not apply more than two applications or 2 pt product/A per season (0.1 lb ai/A per year). Do not make consecutive applications. Use higher rate for more dense canopies. Not for use through irrigation systems.
M-Pede/potassium salts of fatty acids	1–2 gal/100 gal water)	NC	12 hr	0 d	Consult label for rates. Do not use within three days of a sulfur application.
Surround (various formulations)/kaolin clay	12.5–50 lb product	UN	4 hr	0 d	The preferred rate is 25 lb of product in 50 gal/A water. Suppression only; supplemental controls may be needed for complete control. Apply at least two to three applications at 7- to 14-day intervals. May not adhere to berries well before véraison, and late-season applications may affect harvest parameters.
Phylloxera					
Foliar applied insecticides (shown below) have greater efficacy when applied to adequate canopy (at least 2 feet of shoot growth). See additional materials and remarks for other growth stages. See footnote 6, page 27.					
Movento/spirotriamet	6–8 fl oz	23	24 hr	7 d	Do not apply more than 12.5 fl oz/A per season. Use an adjuvant to obtain effective full canopy applications. A high-quality adjuvant should be used, but the adjuvant Induce is prohibited on grapes. Interval between applications is 30 days.

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LATE SPRING, BLOOM THROUGH FRUIT SET: Stages 65–70

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Stink bugs, including brown marmorated stink bug The products listed below provide control for several different species of stink bug, including brown marmorated stink bug (BMSB). If damaging populations have been found in the vineyard, early season control is recommended. For more information on the identification of this pest, see OSU Extension publications <i>Brown Marmorated Stink Bug</i> , EM 9054, https://catalog.extension.oregonstate.edu/em9054 , and <i>El Chinche Apestoso Marrón Marmolado</i> , EM 9054-S, https://catalog.extension.oregonstate.edu/em9054s .					
Aza-direct/azadirachtin	1–3.5 pts	UN	4 hr	0 d	Apply as a foliar spray. Under very heavy infestation, 3.5 pts can be used.
Pyganic EC 5.0II/pyrethrins	15.6 fl oz	3A	12 hr	0 d	Use with 100 gal water/A for conventional airblast sprayers. Do not wait until plants are heavily infested to treat. Note: Product is highly toxic to aquatic organisms, so avoid runoff/drift as much as possible. Take precautions to prevent nontarget effects on pollinators and bees. Refer to label for PHI.
Thrips: See materials and remarks for earlier growth stages.					

POSTBLOOM: Stage 71

Botrytis bunch rot

See remarks for earlier growth stages. See Table 4 (pages 28–29), Table 5 (page 29) and Table 6 (page 30).

SUMMER: Fruit growth, stages 71–77

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Powdery mildew See Table 4 (pages 27–28) and Table 5 (page 28). See materials and remarks for “Late spring, bloom through fruit set” stage. In addition to products listed in previous stages, other products listed below may be used to supplement the spray program. However, these should not be used as stand-alone products, and they do not have efficacy in managing a powdery mildew outbreak (epidemic).					
<i>Bacillus</i> sp. (Aviv, Double Nickel, Lifegard, Serenade, Sonata, Stargus, Theia)	Varies	BM02	4-hr	0 d	Use as a supplement to a regular fungicide program. May need to be applied prior to disease development. Check labels before tank mixing with products like sulfur.
Fracture or Problad Verde/BLAD	20.5–24.4 fl oz	BM01	4 hr	1 d	Use as a supplement to a regular fungicide program. Reapply if rain occurs within 12 hours of application.
Kaligreen (and generics)/bicarbonates	2.5–5 lb	NC	4 hr	1 d	Use as a supplement to a regular fungicide program; apply only when powdery mildew is first observed. NC=FRAC code not classified
M-Pede/potassium salts of fatty acids	1-2 gal/100 gal water	NC	12 hr	0 d	Do not use within three days of sulfur application. Use as a supplement to a normal program.
Prev-Am Ultra/sodium tetraborohydrate decahydrate	50 fl oz/100 gal water	NC	12 hr	0 d	Do not use within 14 days of a sulfur application, when ambient temperatures are above 90°F, or when plants are under heat or water stress.
Regalia/plant extract	1-4 qt	P5	4 hr	0 d	Use as a supplement to a regular fungicide program.
Vacciplant/laminarin	14-16 fl oz	P4	4 hr	0 d	Use as a supplement to a regular fungicide program.
Spider mites					
Acramite-50WS/bifenazate	0.75–1 lb	UN	varies	14 d	Make only one application per season. Relatively safe to mite predators.
Agri-Mek SC/abamectin	1.75–3.5 fl oz	6	12 hr	28 d	Restricted-use pesticide. Must be used with a non-ionic adjuvant. Apply when spider mites first appear and before exceeding five mites per leaf. Do not apply more than 7.0 fl oz per season or make more than two applications of any product containing abamectin.

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Envirdor 2 SC/spirodiclofen	16–34 fl oz	23	12 hr	14 d	Rate depends on target mite species. Apply with at least 100 gal/A of water for adequate coverage. Do not use more than once per season (do not exceed 34 fl oz/A). Relatively safe to mite predators.
Fujimite SC/fenpyroximate	1.5–2 pt	21A	12 hr	14 d	Apply in a minimum of 50 gal water/A. Do not apply more than two applications or 2 pt product/A per season (0.1 lb ai/A per year). Do not make consecutive applications. Use higher rate for more dense canopies. Not for use through irrigation systems.
Nealta (cyflumetofen)	13.7 fl oz	25	12 hr	14 d	Apply at the first sign of mites. Controls all life stages from egg to adult. Do not use more than two applications/year (max use 27.4 fl oz/year). Do not make sequential applications. Apply with a minimum of 50 gallons of water/acre to ensure good coverage. Sprays are compatible with beneficial insects.
M-Pede/potassium salts of fatty acids	1–2 gal/100 gal water (1–2% v/v)	NC	12 hr	0 d	Do not use within three days of sulfur application.
Nexter Miticide/pyridaben	4.4–10.67 oz	21	12 hr	7 d	Do not apply more than twice or more than 10.67 oz/A per season. Allow a minimum of 30 days between applications. Harmful to predatory mites.
Omite 30WS/propargite	5–9 lb	12C	Varies	21 d	Restricted-use pesticide. REI varies with vineyard activities. Minimum reapplication interval is 21 days. Apply higher rates only when infestations are high or have been historically high. Do not use more than twice per season.
Vendex 50WP/fenbutatin-oxide	1–2.5 lb	12B	48 hr	28 d	Restricted-use pesticide. Apply when mites first appear. Do not use more than twice per season (4 lb /A per year) Do not spray in less than 21-day intervals.
Phylloxera					
Voliam Flexi/thiamethoxam + chlorantraniliprole	4.5 oz	4A + 28	12 hr	14 d	Apply before pest populations reach damaging levels (summer). Do not use more than two applications per season (not to exceed 9 oz of product/A = 0.109 lb ai/A of thiamethoxam or 0.2 lb ai/A of chlorantraniliprole products). Do not use an adjuvant. Do not apply through an irrigation system. Allow 14 days between applications. This product is harmful to bees and other insect pollinators.

LATE SUMMER: Pea-size berries to véraison, stages 75–81

Powdery mildew See Table 4 (pages 27–28) and Table 5 (page 28). See materials and remarks for “Late spring, bloom through set” stage (page 17). Pay close attention to preharvest restrictions (PHI).
Mealybugs, scale and other insects See materials and remarks for earlier growth stages.
Thrips See materials and remarks for earlier growth stages.
Leafhoppers See materials and remarks for earlier growth stages.
Spider mites See materials and remarks for earlier growth stages.
Stink bugs, including Brown marmorated stinkbug See materials and remarks for earlier growth stages.

BEGINNING OF BERRY TOUCH: Stage 77

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Botrytis bunch rot Bunch closure is the second critical application period for preventing Botrytis bunch rot development. See remarks for earlier growth stages. See Table 4 (pages 28–29) and Table 5 (page 29).					
Mixed group fungicides					
Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not use for Botrytis bunch rot control if used for powdery mildew control. Do not make more than two consecutive applications of this or other Group 3 or Group 9 products.
Miravis Prime / pydiflumetofen + fludioxonil	10.3-13.4 fl oz	7 + 12	12 hr	14 d	Do not use for bunch rot control if already used for powdery mildew control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Switch 62.5 WG /cyprodinil + fludioxonil	11–14 oz	9 + 12	12 hr	7 d	Do not use with an adjuvant.
Single group fungicides					
Captan 80 WDG	2.5 lb	M4	48 hr	0 d	Do not use with oil.
Elevate 50 WDG / fenhexamid	1 lb	17	12 hr	0 d	Do not make more than two consecutive applications. Do not use more than 3 lb/A per season. See footnote 4, page 27.
Endura /boscalid	8 oz	7	12 hr	14 d	Do not use more than three times per year or exceed 24 oz/A per year. Do not use for Botrytis bunch rot control if Pristine was used for powdery mildew.
Intuity/mandestrobin	6 fl oz	11	12 hr	10 d	Efficacy in the PNW is unknown. Do not use on American (<i>V. labrusca</i>) varieties. Do not exceed 18 fl oz/A per year. Do not make consecutive applications of this or other Group 11 products.
JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	May aid Botrytis bunch rot control if used for powdery mildew. Tank mix with another fungicide. Do not use within 10 days of a sulfur application.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	Tank mix with a different fungicide group (FRAC code). See footnote 4, page 27.
Rovral 4F /iprodione (generic products are available)	1.5–2 pt	2	48 hr	7 d	Application rate varies with vine stages. Consult label. Do not use more than twice per season. Rates below 1.5 pt/A are not effective. See footnote 4, page 27.
Scala SC /pyrimethanil	9–18 oz	9	12 hr	7 d	See footnote 4, page 27.
Leafhoppers See materials and remarks for earlier growth stages.					
Spider mites See materials and remarks for earlier growth stages.					
Stink bugs, including Brown marmorated stinkbug See materials and remarks for earlier growth stages.					

VÉRAISON: Stage 81

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Botrytis bunch rot Spray applications should have been conducted at earlier stages (bloom and bunch closure), especially for western Oregon. Botrytis bunch rot control should not begin at this stage unless in more arid regions of the state, and only if rain is in the forecast. See remarks for earlier growth stages regarding resistance management. Avoid beginning fruit-zone leaf removal for control of Botrytis at this stage, as it may lead to sunburn. See Table 4 (pages 28–29), Table 5 (page 29) and Table 6 (page 30).					

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VÉRAISON: Stage 81

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Mixed group fungicides					
Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not use for Botrytis bunch rot control if used for powdery mildew control. Do not make more than two consecutive applications of this or other Group 3 or Group 9 products.
Miravis Prime / pydiflumetofen + fludioxonil	10.3-13.4 fl oz	7 + 12	12 hr	14 d	Do not use for bunch rot control if already used for powdery mildew control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	18.5–23 oz	7 + 11	varies	14 d	Higher rate based on supplemental label. Do not use for Botrytis bunch rot control if used for powdery mildew control. The REI varies with vineyard activities, consult label.
Switch 62.5 WG /cyprodinil + fludioxonil	11–14 oz	9 + 12	12 hr	7 d	Do not use with an adjuvant. Do not exceed 56 oz/A per year.
Single group fungicides					
Elevate 50WDG / fenhexamid	1 lb	17	12 hr	0 d	Do not make more than two consecutive applications. Do not use more than 3 lb/A per season. See footnote 4, page 27.
Endura /boscalid	8 oz	7	12 hr	14 d	Do not use more than two times per year. Do not use for Botrytis bunch rot control if Pristine was used for powdery mildew.
Intuity /mandestrobin	6 fl oz	11	12 hr	10 d	Efficacy in the PNW is unknown. Do not use on <i>V. labrusca</i> types. Do not make consecutive applications of this or other Group 11 products.
JMS Stylet oil /paraffinic oil	1–2 gal/100 gal water	NC	4 hr	0 d	May aid Botrytis bunch rot control if used for powdery mildew. Tank mix with another fungicide. Do not use within 10 days of a sulfur application.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	See footnote 4, page 27.
Rovral 4F /iprodione (generic products are available)	1.5–2 pt	2	48 hr	7 d	Tank mix with another fungicide from a different group (FRAC code). Do not make more than four applications per season or exceed 8 pints/A per year Rates below 1.5 pt/A are not effective. See footnote 4, page 27.
Scala SC /pyrimethanil	9–18 fl oz	9	12 hr	7 d	See footnote 4, page 27. Do not exceed 36 fl oz/A per year.
Leafhoppers See materials and remarks for earlier growth stages.					
Spider mites See materials and remarks for earlier growth stages.					
Stink bugs, including Brown marmorated stinkbug See materials and remarks for earlier growth stages.					

PREHARVEST: Stages 81–88

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Botrytis bunch rot Proper control of Botrytis bunch rot should be conducted earlier in the season (at bloom and bunch closure) to avoid disease development that initiates inside the cluster, which is most commonly found in western Oregon vineyards. See remarks for earlier growth stages regarding resistance management. See Table 4 (pages 27–28), Table 5 (page 28) and Table 6 (page 30). Use chemical control at this stage only if rain is in the forecast.					
Mixed group fungicides					
Inspire Super /cyprodinil + difenoconazole	16–20 fl oz	3 + 9	12 hr	14 d	Do not use for Botrytis bunch rot control if used for powdery mildew. Do not make more than two consecutive applications of this or other Group 3 or Group 9 products.

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PREHARVEST: Stages 81–88

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
Miravis Prime / pydiflumetofen + fludioxonil	10.3–13.4 fl oz	7 + 12	12-hr	14 d	Do not use for bunch rot control if already used for powdery mildew control. Do not make more than two consecutive applications of Group 7 or Group 12 products.
Pristine /boscalid + pyraclostrobin	18.5–23 oz	7 + 11	varies	14 d	Do not make more than two consecutive applications. Do not use for Botrytis bunch rot control if used for powdery mildew. The REI varies with vineyard activities, consult label.
Switch 62.5 WG /cyprodinil + fludioxonil	11–14 oz	9 + 12	12 hr	7 d	Do not use with an adjuvant.
Single group fungicides					
Elevate 50 WDG / fenhexamid	1 lb	17	12 hr	0 d	Do not make more than two consecutive applications. Do not use more than 3 lb/A per season. See footnote 4, page 27.
Endura /boscalid	8 oz	7	12 hr	14 d	Do not use more than two times per year. Do not use for Botrytis bunch rot control if Pristine was used for powdery mildew.
Intuity /mandestrobin	6 fl oz	11	12 hr	10 d	Efficacy in the Pacific Northwest is unknown. Do not use on <i>V. labrusca</i> types. Do not make consecutive applications of this or other Group 11 products.
Kenja 400 SC /isofetamid	20–22 fl oz	7	12 hr	14 d	See footnote 4, page 27.
Oso 5% SC /polyoxin D	3.75–13 fl oz	19	4 hr	7 d	The product label has a 0 d PHI, but instructions for pre-harvest Botrytis control indicate an application 7 d prior to harvest.
Rovral 4F /iprodione (generic products are available)	1.5–2 pt	2	48 hr	7 d	Tank mix with another fungicide from a different group (FRAC code). Do not use more than twice per season. Rates below 1.5 pt/A are not effective. See footnote 4, page 27.
Scala SC /pyrimethanil	9–18 fl oz	9	12 hr	7 d	See footnote 4, page 27.
Vanguard /cyprodinil	5–10 oz	9	12 hr	7 d	See footnote 4, page 27.

Stink bugs, including brown marmorated stink bug

BMSBs have been found in areas of the north Willamette Valley within commercial farms and may pose a concern for growers at harvest. Wine quality can be compromised due to a wine taint caused by defense volatiles released by BMSBs when disturbed during wine processing. For more information on the identification of this pest, see *Brown Marmorated Stink Bug*, EM 9054, <https://catalog.extension.oregonstate.edu/em9054>, and *El Chinche Apestoso Marrón Marmorado*, EM 9054-S, <https://catalog.extension.oregonstate.edu/em9054s>.

Lady beetles

The multicolored Asian lady beetle (MALB) and other lady beetle species are not economic pests of importance for Oregon grape and wine producers. However, they have been found in grape clusters at harvest (as they seek shelter and feed on late season grapes) and may be of concern to growers. If there are significant populations present during harvest and processing, they can cause off aromas that can lead to wine taint. If large populations of these beetles are found preharvest, consult a local OSU Extension horticulturist or entomologist to determine if population levels warrant management.

Leafhoppers

See materials and remarks for earlier growth stages.

Viruses: Grapevine leafroll virus and Red blotch disease

Symptoms of viruses can be similar, including reddening of leaves of red-fruited cultivars and delayed ripening (any cultivar). Learn more about symptoms by reading “Grape Virus Diseases” in the *PNW Disease Management Handbook*, <https://pnwhandbooks.org/plantdisease/host-disease/grape-vitis-spp-virus-diseases>. Vines exhibiting virus symptoms should be tested for multiple viruses. Collect tissue samples (petioles from the oldest leaves, base of the shoot) from symptomatic vines during fruit ripening or postharvest; samples can also be selected from dormant shoots at pruning. See Table 1 (page 2) for potential sampling time points based on the specific virus of concern. Submit samples to a lab that conducts grapevine virus testing, making sure to follow their sampling protocols. Also, determine the presence of potential insect vectors of the virus (e.g., mealybugs and scale insects for grapevine leafroll virus and treehoppers for grapevine red blotch virus). See the following OSU Extension publications for tips on how to scout for and manage viruses and vectors: *Field Monitoring for Leafroll Virus and Mealybug in Pacific Northwest Vineyards*, EM 8985, <https://catalog.extension.oregonstate.edu/em8985>, and *Monitoreo del virus del enrollamiento de la hoja y de los piojos harinosos en los viñedos del Noroeste Pacífico*, EM8985-S, <https://catalog.extension.oregonstate.edu/em8985s>; *Prevention and Management of Grapevine Leafroll Virus and Mealybugs in Oregon Vineyards*, EM 8990, <https://catalog.extension.oregonstate.edu/em8990>, and *Prevençión y manejo del virus del enrollamiento de la hoja y de los piojos harinosos en viñedos del estado de Oregon*, EM 8990-S, <https://catalog.extension.oregonstate.edu/em8990s>; and *Trapping and Identifying Mealybugs in Oregon Vineyards*, EM 8998, <https://catalog.extension.oregonstate.edu/em8998>. There are no current recommendations for insecticides to control potential vectors of Red Blotch Disease. Learn more about Red Blotch Disease at <https://extension.oregonstate.edu/crop-production/wine-grapes/red-blotch-disease>.

Phylloxera

Before treating, check that phylloxera is present by sampling soil and vine roots during late summer through the postharvest period. If sampling shows presence, take action during spring of the following season. Note that soil drench treatments may result in variable levels of control and are generally ineffective for eradication due to poor penetration, especially in clay soils. See footnote 6, page 27.

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PREHARVEST: Stages 81–88

Pest and product/ active ingredient	Amount of material/A	Group: WSSA, FRAC, IRAC	REI	PHI	Remarks
<p>Spotted-wing drosophila Grapes are less susceptible to economic damage by SWD in the Pacific Northwest compared to other berry crops, and treatment with pesticides may not be necessary. Researchers at Oregon State University have been working on SWD for many years and have numerous resources for pest identification and methods for cultural and chemical control. See these resources before resorting to chemical control.</p> <p>SWD identification and monitoring <i>Monitoring Techniques for Spotted-wing Drosophila</i> (EM 9267), https://catalog.extension.oregonstate.edu/em9267 <i>Recognize Fruit Damage from Spotted Wing Drosophila</i> (EM 9021), https://catalog.extension.oregonstate.edu/em9021 <i>A Detailed Guide for Testing Fruit for the Presence of Spotted Wing Drosophila (SWD) Larvae</i> (EM 9096), https://catalog.extension.oregonstate.edu/em9096 <i>Spotted Wing Drosophila: A Quick, 7-Step Guide to Detecting SWD Larvae in Fruit</i> (EM 9097), https://catalog.extension.oregonstate.edu/em9097</p> <p>Cultural and biocontrol methods <i>Cultural Control Strategies to Manage Spotted-wing Drosophila</i> (EM 9262), https://catalog.extension.oregonstate.edu/em9262 <i>Biocontrol of Spotted-wing Drosophila</i> (EM 9269), https://catalog.extension.oregonstate.edu/em9269 <i>Potential Impacts of Irrigation and Biocontrol on Spotted-wing Drosophila Populations</i> (EM 9268), https://catalog.extension.oregonstate.edu/em9068</p> <p>Chemical control methods <i>Improved Chemical Control Strategies for Spotted-wing Drosophila (Spray applications)</i>, EM 9266), https://catalog.extension.oregonstate.edu/em9266 <i>Optimizing Chemical Control of Spotted-wing Drosophila (Product efficacy)</i>, EM 9265), https://catalog.extension.oregonstate.edu/em9265</p> <p>If significant infestation is creating problems in vineyards, the products listed below can be used to manage adult stages of SWD.</p>					
Danitol 2.4 EC/ fenpropathrin	10.67–21.33 fl oz	3	24 hr	21 d	Restricted-use pesticide. Do not exceed two applications per season. Toxic to bees and should not be used when bees are foraging. Toxic to fish and other aquatic invertebrates. Synthetic pyrethroids may achieve high mortality of SWD and can provide about 10 to 14 days residual control in the field. Do not exceed 42.67 fl oz/A or two applications per season.
pyrethrin (several brands)	Consult label	—	—	—	Provides good control of SWD but has no residual activity. Toxic to bees; do not apply when bees are foraging. Highly toxic to fish. Refer to product label for PHI.
Success or Entrust/spinosad	4–8 fl oz (Success) or 1.25–2.5 (Entrust)	5	4 hr	3 d	Do not exceed 0.45 lb ai/A per year (9 oz product/A Entrust or 29 oz product/A Success) or five applications per year. Do not make more than two consecutive sprays of Group 5 products. Allow at least five days between applications, and do not exceed three applications in a 30-day period. May achieve high mortality of SWD and provide about five to seven days residual control in the field. Toxic to bees for three hours following treatment. Do not apply when bees are foraging.
<p>Yellow jackets See materials and remarks for earlier growth stages.</p>					

TABLE 3 FOOTNOTES

1. The sulfur spray schedule listed is not intended for use on *Vitis labrusca*, some American *Vitis* species or some interspecific hybrid cultivars, as they are genetically sensitive to sulfur even at low temperatures. Sulfur products used for powdery mildew control can burn foliage of any grapevine, whether *Vitis vinifera* or other *Vitis* spp., when applied above 85°F. The relationship is correlated with increases in the daily maximum temperature within a few days after application. Grapes in California and other warm production regions can withstand sulfur applications (at lower rates) above 85°F if there is no major short-term change in the daily high temperature. Once vines are acclimated to higher temperatures, the chance of burn is greatly reduced.
2. Sulfur applications should cease within 35 days of harvest to minimize the risk of residual sulfur being present on grapes at harvest. Residual sulfur present on the skin of red grapes can result in increased hydrogen sulfide production during fermentation. Sulfur residues are less problematic on white grapes since grape skins are not present during fermentation, and clarification of the juice prior to fermentation will reduce sulfur content to acceptable levels. Wettable powder formulations are less likely to result in hydrogen sulfide in the wine than micronized formulations.
3. Control of powdery mildew in susceptible *Vitis vinifera* cultivars involves the regular application of fungicides. It is impossible to give an exact, pre-determined schedule since the timing, intensity and frequency of applications depends on vine growth, weather and potential inoculum due to previous infestations, all of which vary from site to site, year to year and region to region. (See Table 4, pages 28–29, and Table 5, page 29.) Early season weather in the Willamette Valley is often cold and rainy, which is not conducive to powdery mildew epidemics. By that time of the year, a powdery mildew prevention program should already be implemented, and the interval between applications should be shortened to accommodate rapid vine growth and environmental conditions that may lead to an infection.

The powdery mildew infection period may start earlier in warmer regions of southern and eastern Oregon than in cooler regions of the Willamette Valley. The length of the powdery mildew infestation period can change from year to year with variations in weather and vine growth.

All green portions of the vine are susceptible to infection by the powdery mildew fungus. At times of rapid vine growth, shoots can outgrow their chemical protection and quickly be susceptible to new infections. This is especially true if you are using sulfur. Flowers and berries are most susceptible at bloom and shortly after, so it is important that you monitor bloom of grapevines closely when managing disease. Later in the growing season the berries become resistant to new infections when they reach ~8°Brix. Some fungal sporulation can occur on berries with established infections up to 15°Brix. However, shoots can still be infected and continue to produce overwintering inoculum, or spores, through harvest.

The use of fungicides containing sulfur or lime sulfur during dormancy or at bud break has not been economically practical. The rates needed are excessive, and the resulting control must be supplemented with a regular full-season program. Acceptable control can be achieved without these dormant or delayed-dormant applications. You may want to consider these sprays if you are attempting to bring a vineyard back into production following a year with severe powdery mildew.

Fungicides vary as to the length of time they are effective at preventing infection by powdery mildew and thus vary as to when they need to be reapplied. A range of seven to 14 days is usually given for sulfur; 14 to 21 days for Group 3 fungicides (such as Rally) and for Group 11 fungicides (such as Abound or Flint). Use the shorter interval under any of the following conditions: 1) rapid vine growth early in the season, 2) during bloom, and 3) when weather conditions are favorable for powdery mildew development. Careful planning will avoid the use of too much chemical, as many of the fungicides have seasonal limits on how much can be used. Your overall spray schedule should consider early vine growth, weather conditions that favor powdery mildew, and the properties of various fungicides available for use.

There are several disease modeling programs that monitor the weather and can help growers make fungicide application decisions. Such models are available online through USPEST.org.

4. Fungal pathogens have a high likelihood of developing resistance to fungicides if only one product or chemistry class (i.e., one mode of action group = one FRAC code) is used exclusively to control the disease. Applications at bunch close or véraison or both are the most important for disease control. Bloom applications are important when the weather is wet. Tank mix or alternate materials that have a different mode of action (different FRAC code).
5. This publication lists chemical products and some non-chemical methods of pest control. It is intended to serve as a supplement to other pest management guides, including *Field Guide for Integrated Pest Management in Pacific Northwest Vineyards*, PNW 644, <https://catalog.extension.oregonstate.edu/pnw644>, and the *Pacific Northwest Pest Management Handbooks*, <https://pnwhandbooks.org>, including the Plant Disease, Insect and Weed handbooks. These resources provide more complete descriptions of pests and cultural methods of pest control in vineyards.
6. Symptoms of phylloxera infestation include low vigor, chlorotic foliage, reduced yields, lack of fruit ripening and early leaf fall. Symptomatic vines appear in a lens-shaped (oval) area of the vineyard, and the size of the affected area increases annually. To verify infestation, you must inspect vine roots for the pest. Population levels are highest in mid- to late summer. There is no effective chemical product that can be used for complete control of this pest. Avoid movement of soil and plant materials from infested vineyards to noninfested, own-rooted vineyards to prevent spread. Refer to *Grape Phylloxera: Biology and Management in the Pacific Northwest*, EC 1463, <https://catalog.extension.oregonstate.edu/ec1463>.
7. Pruning during the dormant season alone should control Phomopsis cane and leaf spot in most vineyards in Oregon.
8. Use materials at shortest recommended intervals during this period. Other products are not listed but are registered for powdery mildew control. However, they are not recommended due to resistance problems (such as Topsin), lack of efficacy in research conducted in the Pacific Northwest, or only indicate suppression rather than control of the disease (such as Intuity). In some cases some products are listed for use only in certain conditions.
9. Do not use Flint, Luna Experience, or Luna Sensation on Concord or other sensitive American grape varieties (*Vitis labrusca*).
10. Sovran drift may injure some sweet cherry cultivars such as Van; be very careful when spraying near cherry orchards.
11. Descriptions for all herbicides listed in this guide include the Weed Science Society of America mode of action. These groups are used to distinguish herbicide products so that growers can alternate products to prevent resistance development in weed populations.
12. Important note on herbicide use: Herbicides must be applied at exactly the correct rate and time to selectively control weeds with minimal chance of injuring vines. You will get more consistent results when making applications based on the information found on the product label (such as timing, rate and target weeds). See Table 7, page 31, for more details. Suggested rates listed in this guide are stated as pounds of active ingredient per acre (lb ai/A). See the product label for specific amounts of a particular formulation to apply per treated acre.
13. For band applications of herbicides under vine rows, reduce the quantity of herbicide applied proportional to the actual area within the row being treated. Numerous tank-mixes are labeled for vineyard use, or growers can assume responsibility and mix products, unless the label prohibits mixing.
14. Livestock grazing in vineyards is often prohibited if herbicides have been applied for weed control.

Table 4. Effectiveness of fungicides for control of grape diseases

Ratings provided below are relative rankings based on labeled application rates, good spray coverage and proper spray timing. Actual levels of disease control in practice are influenced by these factors in addition to cultivar susceptibility, disease pressure, resistant pathogens, weather conditions, and the other fungicides used to control diseases in the vineyard.

Fungicide	Fungicide group (FRAC code)*	Phomopsis cane and leaf spot	Powdery mildew	Botrytis bunch rot
Products with single active ingredient				
iprodione (Rovral, Nevado)	2	Not effective	Not effective	Good**
flutriafol (Rhyme)	3	?	Good**	Slight-fair
mefentrifluconazole (Cevya)	3	Good	Good to excellent	Not effective
myclobutanil (Rally)	3	Not effective	Good**	Not effective
tebuconazole (Orius, Tebucon)	3	Not effective	Fair-good**	Not effective
tetriconazole (Mettle)	3	Not effective	Good**	Not effective
triflumizol (Procure, Trionic)	3	Not effective	Good**	Not effective
boscalid (Endura)	7	Not effective	Good-excellent**	Fair-Good**
isofetamid (Kenja)	7	Not effective	Good-excellent**	Good**
benzovindiflupyr (Aprovia)	7	Good	Good-excellent**	Slight**
cyprodinil (Vangard)	9	Not effective	Not effective	Good**
pyrimethanil (Scala)	9	Not effective	None	Good**
azoxystrobin (Abound, Quadris)	11	Fair-good	Good**	Slight-fair
kresoxim-methyl (Sovran)	11	Good	Good**	Slight-fair
mandestrobin (Intuity)	11	?	Poor to moderate	?
trifloxystrobin (Flint)	11	Fair	Good**	Slight-fair
quinoxifen (Quintec)	13	Not effective	Excellent**	Not effective
fenhexamid (Elevate)	17	Not effective	Not effective	Good**
polyoxin-D (Ph-D, Oso)	19	?	Fair-good	Fair-good
fixed copper (several formulations)	M1	Slight	Moderate	Slight-none
sulfur (several formulations)	M2	Slight	Good-excellent	Not effective
ziram (Ziram)	M2	Good	Not effective	Slight
mancozeb (Dithane, Manzate, Penncozeb)	M3	Excellent	Not effective	Not effective
captan (Captan, Captec)	M4	Excellent	Not effective	Fair
potassium bicarbonates (Kaligreen, Milstop)	NC	Not effective	Slight	Slight
BLAD (Fracture, Problad Verde)	BM01	Not effective	Slight	?
Horticultural Mineral Oils (HMOs) (JMS Stylet Oil)	NC	Not effective	Good	Slight
Regalia	P5	Not effective	Fair-good	Not effective
soap (M-Pede, Prev-Am)	NC	?	Good	?
cyflufenamid (Torino)	U6	Not effective	Excellent**	Not effective
metrafenone (Vivando)	50	Not effective	Excellent**	Not effective
pyriofenone (Prolivo)	50	Not effective	Excellent**	Not effective
flutianil (Gatten)	U13	? (Not effective)	Good	? (Not effective)
<i>Bacillus</i> sp. (Aviv, Double Nickel, Lifeguard, Serenade, Sonata, Stargus, Theia)	BM02	?	Slight-Good	Slight

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Fungicide	Fungicide group (FRAC code)*	Phomopsis cane and leaf spot	Powdery mildew	Botrytis bunch rot
Products with multiple active ingredients				
Aprovia Top	3 + 7	?	Good**	Fair-good**
Inspire Super	3 + 9	None-slight	Good**	Good**
Luna Experience	3 + 7	?	Good**	Fair-good**
Luna Sensation	7 + 11	?	Good**	Fair-good**
Merivon	7 + 11	Good	Good –excellent**	Good**
Pristine	11 + 7	Good	Good**	Fair-good**
Miravis Prime	7 + 12	?	Good**	Good**
Quadris Top	3 + 11	Fair-good	Good**	Slight-fair**
Switch	9 + 12	Not effective	Not effective	Excellent**
TopGuard EQ	3 + 11	Fair-good	Good**	Slight-fair**

*FRAC codes are those designated by the Fungicide Resistance Action Committee based on the active ingredient mode of action. Specific codes include: M=multi-site activity, NC=activity not specified, U=unknown mode of action, BM=biologicals with multiple modes of action.

? = no information available.

**Resistant pathogens will lower the effectiveness of these fungicides. Yellow highlight indicates resistance has been detected while blue highlight indicates resistance is suspected or possible, especially if used frequently in the past.

Table 5. Example strategy for powdery mildew and Botrytis bunch rot control

Growth stage	Dormant—early growth	6" shoots	Pre-bloom	Bloom	Fruit set	Fruit growth (summer)	Véraison	Pre-harvest
BBCH scale	00-12	14-15	17-60	61-69	71	71-79	83-85	85-88
POWDERY MILDEW								
Primary applications		Sulfur: high label rate (7-10 days)	Products from groups 13, 50 or U6 alone or in mixes with other FRAC groups. ^a		Sulfur: high label rate (7-10 days) ^b	Groups 13, 50 or U6, alone or mixed with other groups ^a	Sulfur: half rate (7-14 days) ^b	Groups 13, 50 or U6, alone or mixed with other groups
Supplemental applications	M-Pede or JMS Stylet Oil: Use caution if applying after sulfur; do not mix with sulfur.							
Cultural methods		Shoot thinning and positioning; sucker removal			Pull leaves in cluster-zone of dense canopies	Hedge dense canopies or regulate growth through irrigation		
BOTRYTIS								
Primary applications				Critical to spray at bloom (western OR)		Critical to spray at bunch closure (BBCH 77-79).	Use cultural control methods; spray only if necessary	
<i>Cultural methods to reduce canopy density and shading should be used with chemical applications to prevent Botrytis. Rotate and/or tank mix fungicides that have different mode of action (FRAC) groups so that no product is used more than two times per season to prevent fungicide resistance. Always use a product with a different FRAC group than was used for the previous application.</i>								
Supplemental applications	Fungicides that have <i>Botrytis</i> efficacy can be considered based on weather and cultivar susceptibility to <i>Botrytis</i> . Heed warnings under "primary applications."							
Cultural methods		Shoot thinning and positioning			Pull leaves in cluster-zone	Hedge or manage growth with irrigation	Pull leaves in cluster-zone	

^aSpray intervals: Watch growth rates closely and reapply as needed based on the amount of growth. Grapevine growth rates tend to be high in early summer in some areas of the state and when vines are grown under full irrigation. Shorten the application window to 14 days in high-growth-rate situations.

^bSulfur: To avoid foliar burn or phytotoxicity, adhere to cautionary statements on the product label for air temperatures at application and in the days to follow.

Powdery mildew and Botrytis strategies

See Table 5, page 29

Powdery mildew

Unfortunately, powdery mildew has formed resistance to various fungicide groups, including FRAC 3, 7 and 11. FRAC 3 and strobilurins (FRAC 11) have been confirmed throughout Oregon. Resistance to FRAC 7 is suspected. The example powdery mildew spray program provided is based on sulfur and uses synthetic fungicides that avoid these three fungicide classes or tank mixes with other fungicide classes. Sulfur is alternated with fungicides such as Torino (FRAC U6), Vivando/Prolivo (FRAC 50), Quintec (FRAC 13), or combination products that contain multiple modes of action. Tank mixing fungicides from different groups is also a successful strategy if using single mode of action products. If the same spray program is used for multiple years and control failure is observed, switch to fungicide products with different FRAC groups from what was used in previous years or those that have low resistance development (i.e., M2, UN).

Short (seven-day) spray intervals and high rates of sulfur are used during the most critical infection periods near bloom and post-fruit set. Spray adjuvants may improve efficacy of sulfur. Alternate the use of Torino (FRAC U6), Vivando/Prolivo (FRAC 50), or Quintec (FRAC 13) between sulfur applications. We recommend tank mixing sulfur with fungicides that are at a high risk of resistance development, such as FRAC 3, 7 and 11.

M-Pede or JMS Stylet oil can be used to slow an infection when protectant fungicides fail to provide complete control. However, oils or soaps cannot be used within a certain number of days after sulfur application; check labels for specific intervals.

Several fungicide products may already contain two different fungicide groups, such as Aprovia Top, Inspire Super, Luna Experience, Luna Sensation, Miravis Prime, Pristine, Quadris, and Topguard EQ. These also may be used in rotation, but be careful not to rotate them with products that contain the same fungicide groups (FRAC codes). Resistance to one or both components is possible.

Potassium bicarbonate-based materials could be used to supplement a normal, season-long program. They will not eradicate powdery mildew once an epidemic has started.

Botrytis bunch rot

Cultural practices are critical for the effective control of Botrytis. Managing vine vigor and reducing canopy density are key. This can be done through use of competitive cover cropping (reduced tillage) to reduce vigor and proper shoot thinning, hedging and leaf removal to reduce canopy density in areas of the Willamette Valley. In more arid regions of eastern and southern Oregon, canopy density and vigor are managed by irrigation management, and canopy management is only applied if large canopies are grown.

Cluster zone leaf removal that is well timed (applied early in the growing season, not past bunch closure) has been just as effective against Botrytis bunch rot as fungicides alone, particularly during years of dry weather during harvest.

Rain events dictate incidence and severity of Botrytis bunch rot observed. Use rain forecasts to guide applications during bloom and from véraison to harvest. Fungicides should be applied before a rain event. In western Oregon, it is a safe bet to apply a fungicide at bloom since it is common to have rain events from bloom to fruit set. This will help avoid issues of later season Botrytis development.

Primary fungicides to consider in rotation, for tank mixing or both include Rovral (or generics, FRAC 2), Scala or Vanguard

(FRAC 9), Miravis Prime (FRAC 7 + 12) or Switch (FRAC 9 + 12). Resistance to Rovral, Elevate and Endura (Kenja or Aprovia, FRAC 7) have been widely detected in the PNW on Botrytis infested small fruit crops. In the absence of testing, your historical use of any at-risk fungicide will be the best predictor of potential resistance.

JMS stylet oil can be tank mixed with Rovral.

A higher rate of FRAC 2 materials may be needed for adequate control. For example, Rovral should not be used below the 1.5 pt/A rate.

Table 6. Botrytis bunch rot of grapes

Botrytis cinerea will infect grape berries from 53°F with as few as four hours of berry wetness. The number of berries infected rises with increased hours of berry wetness. This table is based on a Botrytis bunch rot infection model. Apply fungicides after a medium risk occurs during the growing season.

Temperature (°C)	Temperature (°F)	Min. number of hours of berry wetness* (medium risk)	Min. number of hours of berry wetness* (high risk)
30	86	28.8	32.2
29	84.2	22.4	25.9
28	82.4	19.0	22.1
27	80.6	16.9	19.5
26	78.8	15.3	17.8
25	77	14.3	16.5
24	75.2	13.5	15.6
23	73.4	13.0	15.0
22	71.6	12.6	14.7
21	69.8	12.5	14.5
20	68	12.5	14.4
19	66.2	12.6	14.6
18	64.4	12.9	14.9
17	62.6	13.4	15.5
16	60.8	14.1	16.3
15	59	15.1	17.4
14	57.2	16.5	19.1
13	55.4	18.5	21.4
12	53.6	21.5	24.9

*If berries are dry for fewer than four hours, the wet periods are considered one event. If berries are dry for more than four hours, the wet periods are considered separate events.

Follow the 'RULES' for fungicide stewardship

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

Table 7. Seasonal use of herbicides based on active ingredient

Seasonal timing of herbicide use is based on vine phenology and climatic conditions, such as rainfall and soil moisture. Postharvest interval (PHI) is listed in days. Special remarks are listed after the product ingredient.

Herbicide type/active ingredient	Remarks	WSSA Group	PHI	Dormant					Prebloom/Bloom/Fruit set to preharvest					Harvest	
				Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		Sept
				Fall		00				1-60		61-69		71-88	
Soil-active (pre-emergent use)															
dichlobenil		20	-	x	x	x	x	x							
diuron	Apply in winter as single application or split	7	-	x	x	x	x	x							
indaziflam	Rainfall needed	29	14	x	x	x	x	x							
isoxaben		21	60	x	x	x	x	x	x						
napropamide		15	35	x	x	x	x	x	x						
norflurazon		12	60	x	x	x	x	x	x						
oryzalin	Needs rainfall/soil moisture	3	0	x	x	x	x	x	x						
oxyfluorfen	Dormant/from bloom to 14 days before harvest	14	60	x	x	x	x	x	x	x	x		x	x	x
pendimethalin	Any time after harvest, dormant,	3	0	x	x	x	x	x	x						
pronamide	In fall after harvest but before	3	-	x	x										
simazine	Harvest to spring	5	-	x	x	x	x	x	x						
trifluralin		3	60	x	x	x	x	x	x	x	x	x	x	x	
Contact/translocated															
carfentrazone	May use all year; use caution to avoid spotting on fruit	14	3	x	x	x	x	x	x	x	x	x	x	x	x
clethodim	Nonbearing vineyards	1	365	x	x	x	x	x	x	x	x	x	x	x	x
diquat	Nonbearing vineyards	22	365	x	x	x	x	x	x	x	x	x	x	x	x
fluzifop	Nonbearing vineyards	1	365	x	x	x	x	x	x	x	x	x	x	x	x
glufosinate		10	14	x	x	x	x	x	x	x	x	x	x	x	x
glyphosate	Do not apply when green foliage is in the spray zone	9	14	x	x	x	x	x	x	x	x	x			
paraquat		22	na	x	x	x	x	x							
pyraflufen	Postharvest, dormant	14	0	x	x	x	x	x							
sethoxydim	Anytime when weeds are actively growing	1	50					x	x	x	x	x	x		
tiafenacil	Anytime when weeds are actively growing	14	7	x	x	x	x	x	x	x	x	x	x	x	x x x
Soil and foliar active															
flazasulfuron	spring	2	75	x	x	x	x	x	x	x	x	x			
flumioxazin	Shielded sprayers required from budbreak to harvest	14	60	x	x	x	x	x	x						
oxyfluorfen	Dormant to prebloom; from fruit set to 14 days before harvest	14	60	x	x	x	x	x	x	x			x	x	x
sulfentrazone	Fall through bloom, or after bloom with a shielded sprayer	14	3	x	x	x	x	x	x	x	x				

Weed management: preplant and vineyard establishment

Table 8 highlights the herbicide products available for weed control during preplant and vineyard establishment (termed “nonbearing” on the labels). Herbicide use is often contingent upon the age of the vineyard. Some products can only be used in nonbearing vineyards, or have restrictions relative to the first harvest year. Read product labels closely to ensure proper use of the product.

Other herbicide recommendations for bearing vineyards are listed in Table 3 (pages 4–7).

Table 8. Weed control, preplant and establishment years

Weed control timing and herbicide product/ active ingredient	Amount of material/A	Group (WSSA)	REI	PHI	Remarks
Preplanting (year 0)					
Reglone/diquat dibromide	24–32 oz	22	24 hr	1 yr	For use in nonbearing vineyards only. Apply to completely cover foliage of rapidly growing weeds. Add a nonionic surfactant. Best control when weeds are 1 to 6 inches high.
Roundup and other products/ glyphosate	Consult label	9	4 hr	14 d	Apply to weeds at least 10 days before planting the crop. Use highest rate on field bindweed. Rain within six hours after application may reduce effectiveness. Do not apply if weeds are in mature growth stages (e.g., producing seeds) or under stress from drought.
Treflan/trifluralin	0.5–1 lb ai	3	12 hr	60 d	Apply pre-plant and incorporate immediately by cross-disking or rototilling. Use lower rates on sandy soils or soil containing low organic matter levels, and use higher rates in soils with 2% to 10% organic matter. See label for detailed rate guidelines.
New plantings (years 1–3)					
Devrinol DF-XT/ napropamide	4 lb ai	15	24 hr	70 d	Pre-emergent herbicide. Apply after planting to firm soil, with no debris, before weeds germinate. Shallow tillage improves activity. Avoid exposure of transplant roots contacting soil. Light-sensitive and can photo-decompose after four days. Do not leave on soil surface for more than three weeks in winter (fall to early spring) or 24 hours in other times of year. XT formulation may allow longer times to incorporation without reducing efficacy. Low residual activity. Only one application can be made annually.
Envoy Plus/clethodim	Consult label	1	24 hr	1 yr	For use in nonbearing vineyards only where the vines will not bear fruit for at least one year following application. Apply to actively growing grass weeds, including annual bluegrass, at growth stage listed on label. Read label carefully for adjuvant instructions and for information about effects of rain within one hour, applications of other pesticides, or cultivation. Do not apply more than 64 fl oz/A per season.
Fusilade DX (OR)/ fluzazifop	Varies, see label	1	12 hr	50 d	Can be applied to bearing grapes under supplemental label. Apply to actively growing grasses, or within seven days of irrigation as a directed spray with 1% crop oil or 0.25% nonionic surfactant. Identify grass weeds and adjust rates, depending on susceptibility and stage of growth, as label instructs. Results often are erratic on grasses stressed from lack of vigor, drought, high temperature or low fertility. More mature grasses and quackgrass can be controlled but may require two applications. Annual bluegrass and all fine fescues resist treatment. Do not apply more than 24 fl oz/A per application. Do not exceed 72 fl oz/A per season. Applications must be at minimum 14 days apart.
Goal 2XL/oxyfluorfen	0.25–0.5 lb ai (1-2 pts product)	14	24 hr	60 d	Rate varies based on weed species. Apply only to vineyards with healthy vines and while dormant. Direct the spray toward the base of vines, avoiding direct plant contact. Use only on vines that are trained to a trellis and are at least 3 feet above the soil surface. Acts on contact, either directly on broadleaf weeds or at soil surface as weeds emerge. Controls broadleaf weeds pre- and postemergence, depending on rate of application and weed species.
Poast/sethoxydim	0.28–0.47 lb ai (1.5–2.5 qt product)	1	12 hr	50 d	Rate varies based on weed species. Identify susceptible grasses and apply at optimum growth stage listed on label. Add 2 pt/A of a non-phytotoxic crop oil concentrate to improve leaf absorption. Control often is erratic on grasses stunted or stressed from drought, high temperatures, or low fertility. Resistant grasses include annual bluegrass and all fine fescues; quackgrass can be suppressed. Do not exceed 5 pt/A per season.

CONTINUED ON PAGE 33

Weed control timing and herbicide product/ active ingredient	Amount of material/A	Group (WSSA)	REI	PHI	Remarks
Prowl 3.3 or Prowl H20/ pendimethalin	Check labels	3	24 hr	90 d	Pre-emergent herbicide. Apply to newly planted grapes when dormant, before buds swell and after soil settles around vines and cracks are gone. Spray directly on the soil surface below vines. Overhead irrigation or rain is required within seven days for herbicide activation. Weeds are affected as they germinate. For use in either nonbearing vineyards only or in bearing and nonbearing vineyards, depending on product and formulation. Check the label for details.
Rely 280/glufosinate	Check label	10	12 hr	14 d	Apply to actively growing weeds as a directed spray or spot treatment. Rate depends on size of the weeds to be controlled (consult label). Shield green tissue or bark from contact or injury will occur. Do not exceed 4.5 lb ai/A per season (12 months).
Roundup and other products/glyphosate	Check label	9	4 hr	14 d	Apply to actively growing weeds for site preparation or in nonbearing crops one year before first harvest. Avoid contact with green vine foliage or suckers. Follow all precautions on label. To avoid weed resistance, rotate and mix weed control practices.
Snapshot 2.5 TG/ isoxaben + trifluralin	100–200 lb product	3 + 21	12 hr	1 yr	Identify weeds and determine rate of application based on label. For use in nonbearing vineyards only. Apply to weed- and debris-free soil. Do not apply at the time of planting. Soil must be settled with water and free from cracks following transplanting before the product can be used. Activate within 21 days of application using 0.5 inch of water or shallow cultivation before weeds begin to emerge. Follow label instructions for repeat treatments.
Surflan AS/oryzalin	2–6 lb ai (2-6 qt product)	3	24 hr	---	Preemergent herbicide. Apply after transplanting to firm soil before weeds germinate. Requires irrigation, rain or shallow cultivation (1 to 2 inches) to activate. Rate depends on duration of weed control desired. Do not exceed 12 lb ai/A per year.
Trellis SC/isoxaben	Check label	21	12 hr	60 d	Labeled for bearing and nonbearing vineyards. Rate varies based on weed species. Control weeds growing from seeds. Apply before germination of targeted weeds or immediately after cultivation to debris-free soil. Activate with 0.5 inch of water or shallow cultivation before weeds begin to emerge. Chemical stability remains adequate when left on the soil surface for 21 days. Identify weeds and adjust rates according to charts on label. Do not apply to newly transplanted vines until soil has settled and cracks disappear.

Sprayer calibration

It is important that sprayers are properly maintained, calibrated and operated to ensure that the products are applied at the correct rates. All sprayers should be calibrated before the first use each season and periodically during the season to deal with changes in canopy size. Washington State University's Pesticide Application Technology website provides many resources for vineyard spraying, including sprayer calibration: <https://wine.wsu.edu/extension/grapes-vineyards/pesticide-tech/>

Using pesticides safely

Basic elements of safe pesticide use

- Identify the pest (weed, insect, mite, or disease) that needs to be managed. This is required in order to select the correct type of pesticide to achieve the results needed.
- Minimize use of pesticide by timing applications that will allow maximum efficacy based on the biology of the plant and the pest and current environmental conditions. When possible, do targeted applications within affected regions using pesticides that are less persistent and have a narrow range of impact.
- Always read the pesticide label with care. This is the first step in selecting the right material for the job. Never rely on your memory. Before opening the container, pay close attention to warnings and cautions on the label.
- Keep all pesticide and spray materials out of the reach of children, pets and irresponsible persons. Storage outside of the home, away from food and feed, and under lock and key is the safest method.
- Store pesticides only in the original container. Keep tightly closed.
- NEVER smoke, eat or drink while handling pesticides.
- Avoid inhalation or direct contact. Always wear protective clothing and safety devices as recommended on the label.
- Avoid spills. If spills occur, take immediate action to remove contaminated clothing and wash thoroughly.
- After each application, bathe and change to clean clothing. Wash clothing after each use. Always use fresh clothing when starting new application.
- Avoid contamination of fish ponds and water supplies. Cover feed and water containers when treating around livestock or pet areas.
- Keep separate equipment for use with hormone-type herbicides to avoid accidental injury to susceptible plants. Also avoid applications under wind conditions that could create drift to nontarget areas.
- Rinse empty containers three times before disposing of them. Add the rinse to the spray tank and dispose of containers according to local regulations to avoid hazard to humans, animals and the environment.
- Follow label directions for mixing and application to keep residues within the limits prescribed by law.
- Plan ahead. Discuss with your physician the materials you will be using during the season so that they can be prepared to provide the appropriate treatment in case of accidental exposure. If symptoms of illness occur, call the physician or get the patient to a hospital immediately. Always provide the medical personnel with as much information as possible.
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

Always read the label

Pesticide safety starts by reading the pesticide label and following the directions provided on the label. If the label does not provide clear instruction, contact a person qualified to help evaluate the hazard of the chemical and its use. Qualified people include your supervisor, Extension specialists, county educators, pesticide product representatives and retailers.

Pesticides are toxic but can be used safely if you follow recommended precautions. Follow all label requirements and consider additional personal protective clothing and equipment. Other major factors that can influence the safe and effective use of pesticides include the pesticide applicator's qualifications, use of common sense, and a positive attitude.

In case of pesticide accidents, seek medical attention immediately. Be sure that you know which pesticide was involved. The label on the container gives this information. Give the pesticide label or information from the label, such as the product name, registration number of the Environmental Protection Agency, the common name and percentage of active ingredient, and first-aid instructions to the medical professional or individual providing medical assistance. If the label cannot be removed from the product, take a photo of the label with a phone or take along the pesticide container (if not contaminated), but do not take it into a hospital or medical clinic.

Pesticide safety checklist

- Use pesticides only when necessary and as part of an integrated pest management program. Always read the label and follow the instructions.
- Do not allow children near sprayers or pesticide mixing, storage and disposal areas.
- Wear appropriate protective clothing and equipment.
- Avoid drift into nontarget areas and pesticide runoff into waterways (streams, rivers, lakes, irrigation ponds and canals).
- Have access to clean water, soap and first-aid supplies.
- Keep pesticides in a dry and locked storage area away from food and feed.
- 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 preharvest interval (PHI) on the pesticide label before harvesting crops or gardens and before allowing livestock to graze fields.

Oregon Poison Center

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.

Farming certification organizations serving Oregon

Demeter Association

Web: <http://www.demeter-usa.org>

Purpose: The mission of the Demeter Association is to foster, encourage and improve biodynamic methods and practices by certifying growers, processors and manufacturers of biodynamic foodstuffs, and by carrying out other activities and education programs as may be appropriate. Demeter operates exclusively for agricultural and horticultural purposes. Demeter certifies farms as either biodynamic or in conversion to biodynamic.

Evaluation criteria: Demeter certification is in accord with many practices that characterize the certification of organic farms. For example, pesticide use follows the national organic program. However, certain practices are unique to biodynamic agriculture. For technical guidelines and standards, visit: <http://demeter-usa.org/for-farmers/farm-processing-standards.asp>

Food Alliance

Web: <http://foodalliance.org>

Email: info@foodalliance.org

Purpose: Promotes sustainable agriculture by recognizing farmers who produce food in environmentally and socially responsible ways and educating consumers and others in the food system about the benefits of sustainable agriculture.

Evaluation criteria: Certifies a wide variety of farm and ranch products in the Northwest and Midwest. Practices are ranked in a point system with four levels of achievement within each category of evaluation.

International Organization for Biological and Integrated Control of Noxious Animals and Plants

Web: <http://www.iobc-wprs.org>

Purpose: IOBC/WPRS promotes the use of sustainable, environmentally safe, economically feasible and socially acceptable control methods of pests and diseases of agricultural and forestry crops. IOBC/WPRS encourages collaboration in the development and promotion of biological and integrated production systems.

Evaluation criteria: All farms certified by an IOBC-endorsed organization must be supervised and their achievements monitored, evaluated and documented according to international rules. Evaluation is based on farm inspection and submitted farm records.

Evaluation of farm records is based on completeness and plausibility of records taken, nutrient balance (N and P), all agrichemical inputs and all disqualification criteria. All farm records are evaluated regardless of the field inspection. Technical Bulletins detailing guidelines can be ordered.

Low Input Viticulture & Enology

Web: <https://livecertified.org/>

Email: chris@livecertified.org

Purpose: A sustainable agriculture program providing vineyards and wineries with official certification for agricultural practices that are modeled after international standards of integrated production. The intent is to increase vineyard and winery sustainability and best management practices while maintaining fruit and wine quality. Education regarding sustainable production practices is also a component of this program.

Evaluation criteria: It is the intent of the LIVE organization to certify vineyards and wineries that have complied with the requirements of the integrated production program based on best management practices with respect to vineyard efficiency and environmental standards. The success of the program relies on strict adherence to the philosophy and rules of the program. Semiannual site inspections, review of required farm documents, and periodic sampling form the basis for assuring the public that members certified by LIVE have complied with all aspects of the program. Evaluation criteria are based on LIVE Technical Guidelines.

Oregon Department of Agriculture Organic Certification Program

Web: <http://www.oregon.gov/ODA/programs/MarketAccess/MACertification/Pages/NationalOrganicProgram.aspx>

Email: certification@oda.state.or.us

Purpose: This state program administers the regulations outlined by the National Organic Program for agricultural producers who wish to certify their land and agricultural products as “organic” or “made with organic.”

Evaluation criteria: Organic standards outlined by the NOP are enforced. The website has direct links to information from the NOP, including program standards, a national list of approved and prohibited substances, and links to the Organic Material Review Institute. Contents of the National List are based upon a Proposed National List, with annotations, as recommended to the Secretary by the National Organic Standards Board.

Oregon Tilth

Web: <https://tilth.org>

Email: organic@tilth.org

Purpose: Tilth is a nonprofit research and education organization certifying organic farmers, processors, retailers and handlers throughout Oregon, the United States and internationally.

Evaluation criteria: Oregon Tilth provides certification to ensure that the agreed-upon conventions of organic agriculture systems are being practiced. Uses a National List of Allowed and Prohibitive Substances based on the National Organic Program final rule and Organic Production Act of 1990.

Organic Material Review Institute

Web: <http://www.omri.org>

To view the organic materials list online, go to “OMRI Products List.” The list can also be purchased. For direct access to the online searchable list, go to: http://omri.org/OMRI_datatable.php.

Email: web form available at <https://www.omri.org/contact>

Purpose: Provides information about organic materials used in production, processing, and handling. Serves as a reference, providing comprehensive interpretation of materials used on other organization lists.

Evaluation criteria: Rates crop production materials as “Allowed” or “Regulated.” Annual subscriptions are available to receive materials lists, and certifiers can receive certifier subscriber information.

Salmon-Safe

Web: <https://www.salmonsafe.org>

Email: info@salmonsafe.org

Purpose: Works with leading farmers throughout the Northwest to help restore salmon habitat on farmland by planting trees, growing cover crops, improving irrigation systems, and applying natural methods to control weeds and pests.

Evaluation criteria: The certification process can be downloaded online from the website. Salmon-Safe works in collaboration with the certifiers of LIVE and Oregon Tilth, providing additional certification to those who are certified under these organizations.

Pest management resources

Herbicide drift

Preventing Herbicide Drift and Injury to Grapes, EM 8860, <https://catalog.extension.oregonstate.edu/em8860>

Best Management Practices for Managing Herbicide Resistance, PNW 754, <https://catalog.extension.oregonstate.edu/pnw754>

Phylloxera

How to Scout for Grape Phylloxera in Vineyards

<https://extension.oregonstate.edu/video/how-scout-grape-phylloxera-vineyards>

Grape Phylloxera: Biology and Management in the Pacific Northwest, EC 1463-E, <https://catalog.extension.oregonstate.edu/ec1463>

Fungicide resistance

FRAME Network – Fungicide Resistance Assessment, Mitigation and Extension, <https://framenetworks.wsu.edu/>

Vertebrate pest control

Principles of Vertebrate Management, <https://extension.wsu.edu/snohomish/garden/gardening-resources/principles-of-vertebrate-pest-management/>

Attracting Birds of Prey for Rodent Control, EC 1641, <https://catalog.extension.oregonstate.edu/ec1641>

Meadow Voles and Pocket Gophers: Management in Lawns, Gardens, and Croplands, PNW 627, <https://catalog.extension.oregonstate.edu/pnw627>

Nonlethal Bird Deterrent Strategies: Methods for Reducing Fruit Crop Losses in Oregon, EM 9286, <https://catalog.extension.oregonstate.edu/em9286>

Pest management handbooks

A number of useful pest management handbooks are available online, and updated annually. You can view, download or print them for free from the OSU Extension catalog at <https://catalog.extension.oregonstate.edu/>.

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/>

Field Guide for Integrated Pest Management in Pacific Northwest Vineyards
<https://catalog.extension.oregonstate.edu/pnw644>

Relative toxicities of pesticides and miticides to natural enemies and pollinators

Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees (table): <http://www.ipm.ucdavis.edu/PMG/r302900111.html>

Natural Enemies Handbook: An Illustrated Guide to Biological Pest Control, ANR Publication 3386: http://www.ipm.ucdavis.edu/IPMPROJECT/ADS/manual_naturalenemies.html

Pesticide labels and registration information

Chemical registrations for pesticides can change at any time. To be sure that a product is registered for use in Oregon, use one of the following online databases. You can download product labels from many of them.

Oregon Department of Agriculture, Pesticides Program

<http://www.oregon.gov/ODA/programs/Pesticides/Pages/AboutPesticides.aspx>

Search for pesticides registered in Oregon

http://oda.state.or.us/dbs/pest_productsL2K/search.lasso

NPRO — National Pesticide Information Center Product Research Online

<http://npic.orst.edu/NPRO>

PICOL — Pesticide Information Center Online

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

CDMS — Crop Data Management Systems

<http://www.cdms.net>

Agrian Label Look Up

<https://agrian.com/labelcenter/results.cfm>

Worker protection standards, pesticide and farm safety

National Worker Protection Standard Training and Compliance Materials

<http://pesticideresources.org//index.html>

Oregon Fatality Assessment and Evaluation — Farm safety outreach to prevent fatalities

<https://www.ohsu.edu/oregon-fatality-assessment-control-evaluation>

Grape production

Wine grape production — OSU Extension,

<https://extension.oregonstate.edu/crop-production/wine-grapes>

Grape production — WSU Extension,

<https://wine.wsu.edu/extension/grapes-vineyards/>

National Clean Plant Network for Grapes

This website has useful information about the national program to ensure clean, virus-free vines for commercial nurseries. Obtain information on the process of developing clean plants and the importance of using certified grapevine plants when planting vineyards. <http://ncpngrapes.org/>

Trade-name products and services are mentioned as illustrations only. This does not mean that the Oregon State University Extension Service either endorses these products and services or intends to discriminate against products and services not mentioned.

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