

# Pest Management Guide for Wine Grapes in Oregon

Photo by Patricia A. Skinkis, © Oregon State University



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## Introduction

This pest management guide is developed for use by vineyard managers in Oregon. It provides recommendations for chemicals, formulations, and usage rates of products that are intended to prevent, manage and control vineyard diseases, insects, weeds, and vertebrate pests. When selecting a pesticide, consider its efficacy and impact on beneficial arthropods, honey bees, and the environment. Not all registered pesticides are listed. These recommendations are based on research, label directions, and vineyard-use experience for Oregon vineyards. For optimum pest control, appropriate selection and timing of chemical application rates, amount of water, and method of application, it is important to have a thorough knowledge of the region and vineyard, as well as cultivars, planting density, vine vigor, canopy characteristics, pest complex, and past pest problems.

This guide does not intend to promote or discriminate between products. Occasionally, new formulations of a product (or similar formulations containing a different concentration of an active ingredient) may be registered and effective for use on grapes and the pests listed on the label. Such products may be used even though they are not included in this guide.

Consult the labels of alternative products to determine whether they offer advantages over the products listed in this guide. Formulations, application rates, and registration status may change. For this reason, the details given in this guide are accurate on the date of release. Determine label rates of all products used on your farm and verify current registration status with the Oregon Department of Agriculture. To do this, visit: [http://oda.state.or.us/dbs/pest\\_productsL2K/search.lasso](http://oda.state.or.us/dbs/pest_productsL2K/search.lasso)

Refer to the pesticide label for instructions on the use of the specific product. The label is a legal document for the product 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 frequently asked about the chemical control of insects and diseases are, “How much chemical do I use per acre?” and “What is the least amount of water per acre I will need to apply in my concentrate sprayer?” Table 1 (page 5) offers suggestion for the amount of formulated product to use per acre. This amount is 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.

A lower amount of total chemical material (volume) may be needed for vineyards with smaller canopies, 1- to 4-year-old vineyards, and locations with less severe pest infestations. A higher volume (within label limits) may be required for large vines with dense canopies, or in mature vines experiencing heavy pest pressure.



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## Management Strategies by Vine Growth Stage

**Dormant** (before budbreak, April, stage 00)

**Delayed dormant** (stages 1-13)

**Shoots 1-5 inches long** (stages 9-14)

**Shoots 6 inches long** (stages 14-15)

**Prebloom** (stage 17)

**Bloom** (stages 61-69)

**Postbloom** (stage 71)

**Late spring, bloom through set** (stages 65-70)

**Summer** (late June/July, stages 71-77)

**Late summer** (July/August, stages 76-81)

**Beginning of berry touch** (stage 77)

**Véraison** (stage 81)

**Preharvest** (stages 81-88)

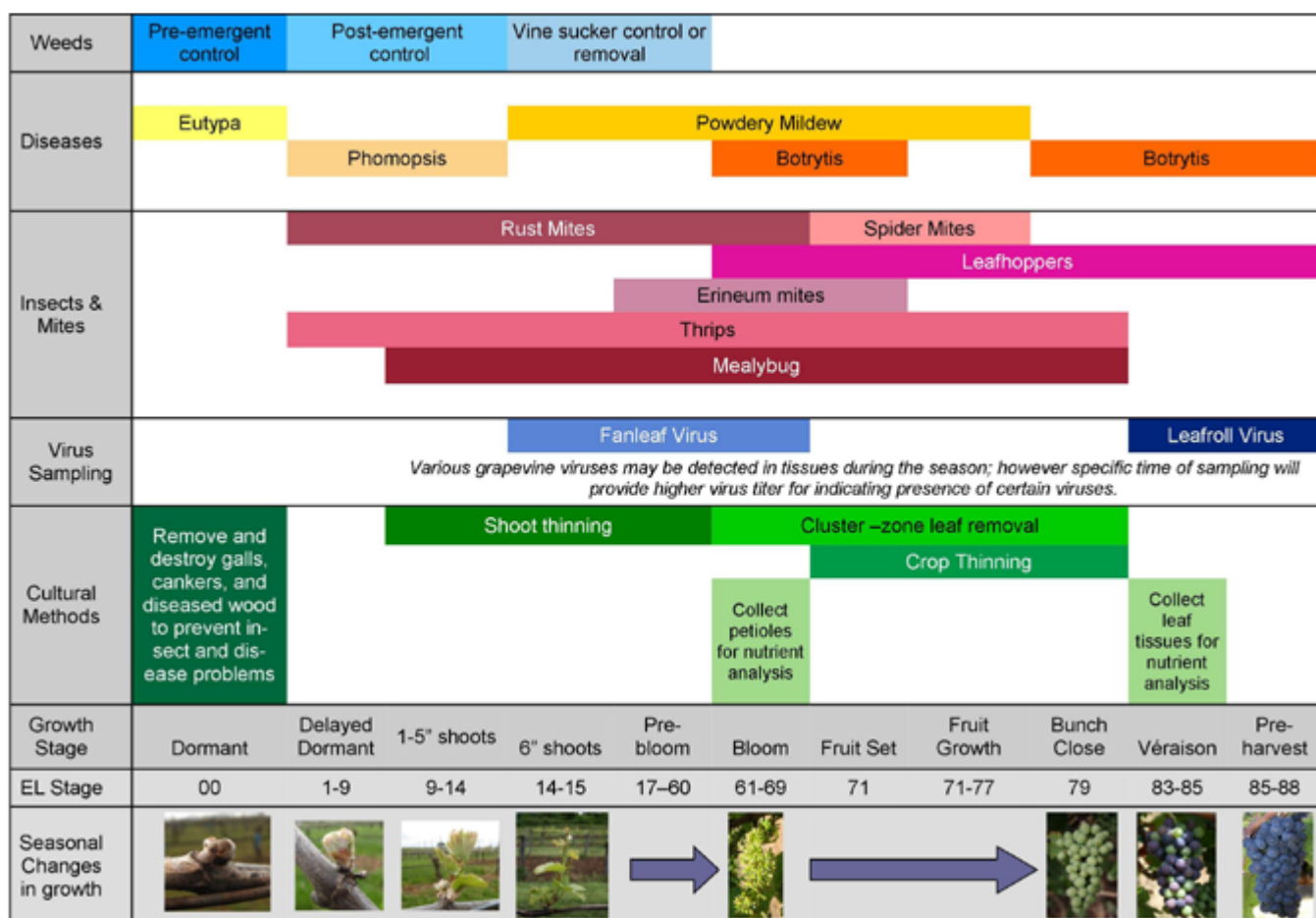


Figure by Patricia A. Skinkis, © Oregon State University.

Figure 1. Seasonal timing for vineyard management of weeds, diseases, insect and mite pests. This figure includes only the main pests of concern across all of Oregon's grape growing regions. Principal growth stages are based on the extended BBCH-scale.

Many insecticide labels indicate the minimum amount of water needed per acre to apply concentrate sprays, as well as how to calculate the amount of chemical needed per acre in a concentrate sprayer. Read and follow the product label before spraying.

Some label directions may indicate dilute applications. Also, be sure to do the following:

- Make sure tank mixes of pesticides are compatible. For example, the elevated pH of some boron spray solutions weakens many insecticides.
- 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

In vineyards, pest management timing should coincide with vine phenology (growth stage), pest presence and population, and climate conditions.

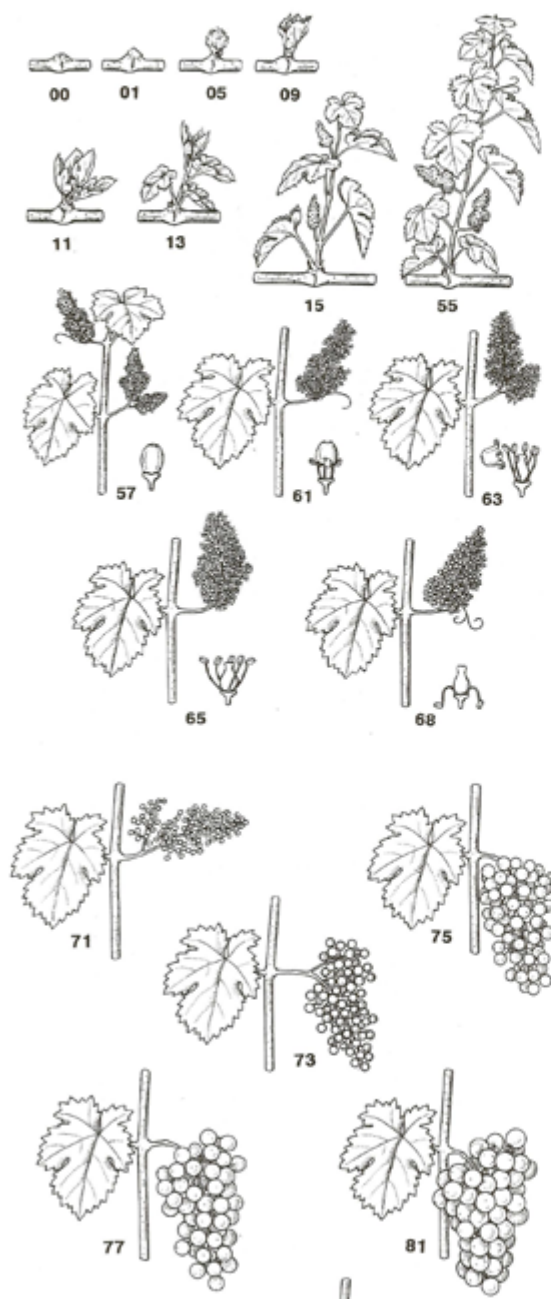
The seasonal layout used in this guide is based on vine phenology throughout the year. At each stage, we refer to a number and descriptor for vine growth.

Figure 1 provides an overview of the season, management timing, and growth stage. Please refer to the specific growth stages illustrated in Figure 2 (page 4).

These stages also should be used in vineyard management record-keeping.



## Principal Growth Stages of Grapevines—Extended BBCH Scale



Principal growth Stage	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	"Wooly bud": brown wool visible on bud
	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
5: Inflorescence Emerges	53	Inflorescence clearly visible
	55	Inflorescence swelling: flowers pressed together
	57	Flowers separate; inflorescence developed
6: Flowering	61	10% caps fallen
	65	50% caps fallen
	68	80% caps fallen
7: Fruit Development	71	Fruit set: fruit begins to form, flower remains lost
	73	BB-sized berries
	75	Pea-sized berries
	77	Berries begin to touch in cluster
	79	Bunch closure; berries touching
8: Berry Ripening	81	Ripening begins (véraison): berries begin to color
	85	Softening of berries
	89	Berries ripe, harvest

Figure 2. Principal growth stage scheme for grapes, adapted from *Phenological Growth Stages and BBCH-Identification Key of Grapevine in BBCH Monograph*, Meier 1997. (Lorenz et al. 1994)

## Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

This table provides information on some of the more effective pesticides currently on the market, along with their application rates. Not all pesticides are listed. Amounts are listed either by product formulation or by active ingredient (ai) as noted. Appropriate timing of applications listed below are designed for growers who choose to use chemical controls for disease, insect and weed management. Footnotes are listed on page 20. Remember these points:

1. Insect/mite pests only occasionally pose an economic impact on vineyards in Oregon, depending on pest and region. Do not use insecticide sprays unless a problem is known to cause a negative economic impact and pest pressure has reached an economically damaging threshold.
2. Alternative control strategies may be available.<sup>4</sup> Be aware that 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 the Crop Data Management Systems (CDMS) website: <http://www.cdms.net/LabelsMsds/LMDefault.aspx>

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
<b>Dormant (before bud-break, April, stage 00)</b>		
<b>Dormant-Season Weed Control</b>		
Casoron 4G/dichlobenil <sup>15, 20</sup>	4 to 6 lb ai	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 4 weeks, preferably the winter after planting. Results of Oregon-based research over 9 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.
Diruon 4L/diuron <sup>6</sup>	1.6 to 3.2 lb ai	Winter application that persists in soil. Apply in winter as single application, or half doses in October and March. Use only when vines are dormant or they will suffer damage. Do not apply on very sandy or gravelly soils. Use only in vineyards that are at least 3 years old and with trunk diameters less than 1.5 inches.
Devrinol 50 DF/napropamide <sup>3</sup>	4 lb ai	Apply fall through spring before weeds germinate. Irrigation or shallow incorporation is recommended for treatments made November through February if no rain falls within 3 weeks after 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. Apply once per season. 35-day PHI.
Solicam DF/norflurazon <sup>12</sup>	2 to 4 lb ai	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 2 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 <sup>3</sup>	2 to 6 lb ai	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. 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.

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Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Goal 2XL/oxyfluorfen <sup>14</sup>	0.5 to 1.5 lb ai	Controls broadleaf weeds pre- and post-emergence depending on rate of application and weed species. Apply only to healthy vineyards. Vines should be trained to a trellis and should be 3 feet above the soil surface in vineyards where this product will be used. Direct the 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.
Kerb 50W/pronamide <sup>3</sup>	1 to 4 lb ai	A restricted-use pesticide. Apply 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 light soil textures; 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 1 year or to spring-planted grapes established at least six months. No more than 4 lb ai/A and one application per year.
Matrix FNV/rimsulfuron <sup>2</sup>	0.063 lb ai or 1 oz ai (4 oz/A product)	Preemergence or postemergence control depending on species. Preemergence control is best if soil is moist at time of application and receives 0.5 inch of rain or irrigation within 2 weeks after application. Do not disturb the soil after application or weed control will be compromised. Preemergence control of puncturevine, quackgrass, mallow and common dandelion from seed; suppression of yellow nutsedge. Preharvest interval is 14 days. Avoid spray contact with foliage or fruit (except undesirable suckers) or drift onto adjacent crops. Clean spray tank carefully. Minimize contact with fruit or foliage.
Princep Caliber 90/simazine <sup>5</sup>	1.98 to 3.96 lb ai	Apply in winter as single application, or apply half doses in October and March. Reduce rate or rotate with other herbicides after achieving weed control. Requires surface moisture to activate. Use in vineyards at least 3 years after establishment. Do not apply more than 4 lb ai/A per 12-month period. Do not apply on very sandy or gravelly soils.
Trifluralin 4 EC/trifluralin <sup>3</sup>	0.22 to 0.86 lb ai (0.5 to 2.0 lb product)	Check label for specific rates suited to soil type. Apply and immediately incorporate 1 to 2 inches deep, using equipment that will not injure roots. 60-day PHI.
<b>Mealybug and other scale insects</b>		Currently, the most often-used and most effective pesticides for mealybugs are not optimal during this period. For more effective timing, action should begin during the delayed-dormant period.
<b>Crown gall and Eutypa dieback</b>		Remove and destroy galled or cankered vines. Bring up suckers only if well below the damaged area and above the graft union on grafted vines. If you are making large cuts when retraining vines, consider leaving long stubs to be cut away in the summer when conditions are dry (double pruning).
Mettle 125 ME + adjuvant	5 fl oz in 25 to 50 gal water/A	Spray onto cuts within 24 hours of pruning. A second spray 2 weeks later is recommended. Do not use more than 10 oz/A per year for this and in-season powdery mildew treatments. 12-hour reentry. <b>Note:</b> This is for canker diseases only, not crown gall.

**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

<b>Insect, weed, or disease control/materials</b>	<b>Amount (ai or formulated) material/A</b>	<b>Remarks and minimum days from last application to harvest (PHI)</b>
Rally 40 WSP + adjuvant	5 oz in 50 gal water/A	Spray onto cuts within 24 hours of pruning. A second spray 2 weeks later is recommended. Do not use more than 24 oz/A per year for this and in-season powdery mildew treatments. 24-hour reentry. <b>Note:</b> This is for canker diseases only, not crown gall.
Topsin M WSB + adjuvant	1.5 lb in 50 gal water/A	Spray onto cuts within 24 hours of pruning. A second spray 2 weeks later is recommended. May also be used at 3.2 oz/1 gal water and painted onto the surface of large pruning cuts. Use when rain is not expected after application. SLN OR-100003. 2-day reentry. <b>Note:</b> This is for canker diseases only, not crown gall.
<b>Powdery mildew</b>		The application of lime sulfur during the dormant season or micronized sulfur at 100% budbreak 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.
<b>Phomopsis cane and leaf spot</b>		Remove canes that are bleached or showing symptoms of this disease during dormant pruning. <sup>7</sup>
<b>Delayed dormant (Stages 1-13) Apply from before budbreak up to the time shoots are 4 inches long</b>		
<b>Early Spring Weed Control</b>		
Matran EC, Matratec/clove or clove leaf oil	5 to 8%	Use on annual weeds from emergence to 6 inches in height. OMRI listed (organic approved) and WSDA approved herbicide for in-crop use. Avoid contact with grape foliage. Performance may be erratic depending on environmental conditions. Bright sunlight improves efficacy. No preharvest or reentry interval.
Chateau/flumioxazin <sup>14</sup>	Refer to label for condition-based rates	Rates conditioned on organic matter, soil type, and weed population. Consult label for details. Direct spray within vine row to weed foliage; add burn-down herbicide listed on label if weeds are established. Residual or postemergence weed control can be achieved by adjusting rates or by using labeled tank-mixes (see label). Do not apply to vines established less than 1 year unless protected by nonporous wraps, grow tubes, or waxed containers. Do not make sequential applications within 30 days; do not harvest fruit within 1 year of treatment. Follow the most restrictive label requirements, and avoid direct or indirect spray contact with foliage or green bark.
Rely 200/glufosinate ammonium <sup>10</sup>	0.75 to 1.25 lb ai	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. 14-day PHI.
Roundup and other product names/ glyphosate <sup>9</sup>	Consult label	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 3 years old. When repeat applications are needed, do not exceed 10.6 lb ai/A in 1 year. Alternate weed management to avoid weed resistance. 14-day PHI.
glyphosate wiper solution/several products	Prepare a 33% solution of product	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. 14-day PHI.

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Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Green Match/limonene from lemongrass oil	14 or 20% product	Use higher 20% dilution rate for spot treatment of weeds that are difficult to control. Effective on annual weeds. Use up to fruit set, but when weeds are less than 6 inches in height. Broad spectrum, non-selective and contact. Ensure good coverage for control. Leaf damage is visible within hours. Cool weather may slow activity. No re-entry interval. Do not apply to grape foliage as it will be damaged. Do not exceed 8.5 gal/A in a 12-month period. OMRI listed, NOP compliant, and WSDA approved organic burn-down herbicide for use in crop and non-crop sites. 7-day PHI on bearing grapes.
paraquat <sup>22</sup>	Consult label	A restricted-use pesticide. Apply when weeds are growing vigorously, and new growth is 1 to 6 inches in height. 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.
Poast/sethoxydim <sup>1</sup>	0.28 to 0.47 lb ai (1.5 to 2.5 pints/A)	Identify susceptible grasses and apply at optimum growth stage listed on label. Add 2 pints/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. Do not exceed 5 pints/A per season. 12 hour REI and 50-day PHI.
<b>Cutworms (grape leafroller, orange tortrix, and omnivorous leaffolder)</b>		For all products, thorough coverage of vines and immediate basal area is important. Cutworms are particularly troublesome in vineyards with heavy broadleaf and grass weeds.
Sevin 4F/carbaryl	1 to 2 quarts	Do not apply more than 10 lb ai/A per year (no more than 5 applications). 6-day REI; 7-day PHI.
Danitol 2.4 EC/fenopropathin	10.6 to 21.3 fl oz	<b>A restricted-use pesticide.</b> Use at the delayed dormant to budbreak stage to prevent movement of cutworms onto newly emerging buds and shoots. Apply as directed barrier 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 exceed 0.8 lb ai per season. 21-day PHI.
Lannate LV/methomyl	1.5 to 3 pints	<b>A restricted use pesticide.</b> Do not apply more than 5 times per season. 7-day REI. 14-day PHI for winegrapes.
Imidan 70W/phosmet	1 to 2.1 lb	Apply as a prebloom spray only. Apply no more than 3 times per season. Apply no more than 6.5 lb product/A per year. 14-day REI and 7-day PHI. PHI is 14 days when rate exceeds 1.3 lb/A.
Delegate WG/spinetoram	3 to 5 oz	Re-treatment interval 4 days. Do not make more than five applications per season (not to exceed 0.305 lb ai/A or 19.5 oz product/A per year). 7-day PHI.
Success or Entrust/spinosad	4 to 8 fl oz (Success) 1.25 to 2.5 oz (Entrust)	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, and do not make more than 5 applications per year. Entrust is approved for organic production.
<b>Note:</b> Carbaryl, methomyl, and phosmet are broad-spectrum insecticides. Their use on foliage may adversely affect biocontrol agents (beneficial insects and mites), resulting in secondary outbreaks of spider mites and other pests. Apply insecticides to the trunks, wire and posts, avoiding foliage as much as possible. Apply late in the day to maximize contact toxicity to nocturnal larvae.		



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Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Grape rust and bud mite (eriophyid mites) and spider mites		
Envior 2 SC/spirodiclofen	16 to 34 fl oz	One application per crop season allowed; 18 fl oz maximum allowed per crop season. 14-day PHI. For best results, adequate canopy surface area should be available for maximum coverage and contact with tissues.
JMS Stylet oil	1 to 2 gal/100 gal water	Do not use within 2 weeks of a sulfur application, near freezing temperatures, above 90°F, or when foliage is wet. Do not use copper and oil together when fruit present.
M-Pede	1 to 2 gal/100 gal water	Do not use within 3 days of a sulfur application. OMRI listed for organic production. 12 hr REI.
sulfur (micronized sulfur)	Check label	Repeat as necessary at 7- to 14-day intervals, depending on label. All sulfur products listed have rates given in formulated product.
Kumulus DF	2 to 10 lb	
Microthiol Disperss	3 to 10 lb	
<b>Note:</b> Rust mites may cause stunted growth early in the spring. Feeding damage is believed to start when buds begin to swell and expand, shortly after the wooly bud stage and when mites are moving from surrounding overwintering sites (outer bud scales, bark, and crevices on trunks and cordons). There is a greater chance of mite contact with pesticides and increased efficacy of sulfur with increased temperature and emergence in spring. Sulfur may be less effective during cold air temperatures (below 50°F). Bud mites are different from rust mites as they persist within buds during winter, and they can destroy bud tissues before bud-break. Bud mites have been found in limited locations In Oregon. Rust mites are more commonly found in vineyards experiencing mite-related stunting. High spray volumes and good coverage are essential early in the season to control rust mites in vineyards where rust mites were identified the previous year. Winter bud dissections may also be used to determine whether pesticide applications are warranted. Making one spray application just after bud break and then another 7 to 14 days later are the best recommendations to date to control emerging mites. Oils and other contact insecticides may be more effective under cool spring conditions. Sulfur has been found to be more effective at reducing grape rust mite populations on young tissue when combined with an adjuvant.		
Thrips		May cause scarring on newly developing shoots similar to that of early-season rust mite. Monitor for presence before action. Where thrips are a problem, they are generally managed early season, prior to bloom.
Surround WP/kaolin clay	25 to 50 lb product	The preferred rate is 25 lb of product in 50 gal/A water. For suppression only. Supplemental controls may be needed for complete control. Make 1 or 2 applications 7 days apart, starting at bud-break. Approved for organic production.
Delegate WG/spinetoram	3 to 5 oz	Do not apply more than 5 times per crop year (not to exceed 0.305 lb ai/A). Do not space applications closer than 4 days. 7-day PHI.
Entrust or Success/spinosad	4 to 8 oz (Success) 1.25 to 2.5 oz (Entrust)	Do not exceed 0.45 lb ai/A per year (9 oz product/A Entrust or 29 oz product/A Success). 7-day PHI. Entrust is approved for organic production.
Phylloxera		Before treating, check that phylloxera is present by sampling during the previous season. If sampling of soil and roots of grapevines show presence, take action during the early part of the following season. Note that soil drenches are generally ineffective for eradication due to poor penetration, especially in clay soils. <sup>6</sup>
Enzone/sodium tetrathiocarbonate	See label; changes with method of application.	Fumigant. Best if used pre-planting or prior to re-planting of a vineyard. This may require multiple treatments per year for efficacy and will kill all biota within the treatment zone. Cautionary statements are detailed on product label.

**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Platinum 75 SG/thiamethoxam	2.67 to 5.67 oz	Can be applied through dripper or microirrigation lines. The vineyard must be irrigated to field capacity before application in order to ensure proper absorption into actively growing roots. The higher rate may give a second season of control. This compound has good water solubility compared to other systemic root-applied compounds. 60-day PHI. Do not exceed 0.266 lb ai/A per season.
<b>Mealybugs and scale insects</b>		
Applaud 70 DF/buprofezin	9 to 12 oz	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. Do not apply within 7 days of harvest.
Admire Pro/imidacloprid	10 to 14 fl oz	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. Consult label for restrictions. PHI 30 days.
Provado Solupak/imidacloprid	0.8 to 1 oz	Do not use more than 2 oz/A (0.1 lb ai/A) per year. Allow 14 days between sprays. 0-day PHI.
Imidan 70W/phosmet	2.1 lb	Apply as a delayed dormant (pre-budbreak) spray with a spreader sticker. Do not apply more than 6.5 lb/A per season. Note that rate changes with timing of spray. The rate shown here is for the delayed dormant application.
Platinum/thiamethoxam	8 to 17 fl oz	Can be applied through dripper or microirrigation lines. Assure that the vineyard is irrigated to field capacity before application to ensure proper absorption into actively growing roots. The higher rate may give a second season of control. This compound has good water solubility compared with other systemic root-applied compounds. 60-day PHI. Do not exceed 17 fl oz/A (0.266 lb ai/A) per season.
<b>Shoots 1-5 inches long (stages 9-14)</b>		
<b>Phomopsis cane and leaf spot</b>		This disease may be called “dead arm” on some labels.
Abound	10 to 15.5 oz	14-day PHI. Do not apply with silicon based surfactants.
Adament 50 WG	6 oz	Combines group 3 and 11 fungicides. 14-day PHI. <sup>9</sup>
Captan 80WDG	2.5 lb	0-day PHI.
Dithane DF/75% mancozeb	1.2 to 2 lb	66-day PHI.
Flint 50WG	3 oz	Do not make more than two consecutive applications. 14-day PHI.
Penncozeb 75DF	1.2 to 2 lb	66-day PHI.
Pristine	8 to 12.5 oz	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. 14-day PHI.
Quadris Top	12 to 14 fl oz	Do not make more than two consecutive applications. 14-day PHI.
Sovran	3.2 to 4.8 oz	Do not make more than two consecutive applications. 14-day PHI. <sup>10</sup>
Ziram 76 DF	3 to 4 lb	—
<b>Branch, cane, or twig borer</b>		While chemicals are registered for use on these borers, the borers are often protected from chemical controls because of location inside of canes. Be sure that adults and/or caterpillars are able to be directly controlled before pursuing these chemical controls.

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Insect, weed, or disease control/materials		Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Dipel DF/ <i>Bacillus thuringiensis</i>		0.5 to 2 lb	The pest must feed on this product to be affected. Apply on 4- to 5-day schedule as new caterpillars emerge. Also available as organic compound.
Sevin 4F/carbaryl		1 to 2 quarts (1 to 2 lb ai)	Chemical control normally is not necessary if cultural practices, such as removal of pruning wood, are observed. If large populations of adults occur in vineyard (late April-early June), carbaryl applied 2 to 3 times at 7- to 10-day intervals has given control. Do not use more than 5 applications per year at 7-day intervals, or more than 10 quarts/A. 7-day PHI. <sup>4</sup>
<b>Cutworms, grape leafroller, orange tortrix, and omnivorous leaffolder</b>			See materials and remarks for earlier growth stages.
<b>Thrips</b>			See materials and remarks for earlier growth stages. Where thrips are a problem, they are generally managed early season, prior to bloom.
<b>Spider mites</b>			See materials and remarks for earlier growth stages.
Envior 2 SC/spirodiclofen		16 to 34 fl oz	One application per crop 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 with tissues. Labeled for rust mites and erineum mite. 14-day PHI.
<b>Grape mealybug and scales</b>			See materials and remarks for earlier growth stages.
<b>Weed control</b>			See "Delayed Dormant" section for 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 season.
<b>Shoots 6 inches long (stages 14-15)</b>			
<b>Vine Sucker Control</b>			
Goal Tender/oxyfluorfen		0.25 to 0.5 lb ai	Apply in a 3-ft band directed at suckers emerging from plant base up to 12 inches tall. 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 per season. 60-day PHI. Applications can be made up to 3 weeks after bloom. Use a minimum of 50 gallons of water per treated acre. May tank mix with glufosinate.
<b>Powdery mildew, grape erineum mite, rust mite</b>			See Table 2 (page 22) and Figure 3 (page 24)
JMS Stylet oil		1 to 2 gal/100 gal water	Do not use within 2 weeks of a sulfur application, near freezing temperatures, above 90°F, or when foliage is wet.
M-Pede		1 to 2 gal/100 gal water	Do not use within 3 days of a sulfur application.
Sulfur		Check labels	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. Sulfur's activity is effective from 57° to 83°F. <sup>1,2</sup>
Cosavet DF		2 to 5 lb	
Kumulus DF		2 to 10 lb	
Microthiol Disperss		3 to 10 lb	
<b>Powdery mildew only</b>			See Table 2 (page 22) and Figure 3 (page 24)
Abound		10 to 15.5 oz	Do not apply more than two sequential sprays before alternating with a fungicide that has a different mode of action. Do not apply with silicon based surfactants. 14-day PHI.

**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

<b>Insect, weed, or disease control/materials</b>	<b>Amount (ai or formulated) material/A</b>	<b>Remarks and minimum days from last application to harvest (PHI)</b>
Adament 50 WG	3 to 4 oz	Combination of group 3 and 11 fungicides. 14-day PHI. <sup>9</sup>
Kaligreen	2.5 to 5 lb	Supplemental to a normal program only when powdery mildew is first observed.
M-Pede	1 to 2 gal/100 gal water	Do not use within 3 days of a sulfur application.
Ph-D WDG	6.2 oz	0-day PHI
Pristine	8 to 12.5 oz	14-day PHI
Sovran	3.2 to 4.8 oz	Do not make more than two consecutive applications. 14-day PHI. <sup>10</sup>
Sulfur	Check labels	Repeat as necessary at 10- to 14-day intervals. Sulfur's activity is effective from 57 to 83°F. <sup>1,2</sup>
Cosavet DF	2 to 5 lb	
Kumulus DF	2 to 10 lb	
Microthiol Disperss	3 to 10 lb	
Thiosperse	6 to 20 lb	
<b>Mealybugs and scale insects</b>		See materials and remarks for earlier growth stages.
Movento/spirotetramat	6 to 8 fl oz	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. Ensure application when there is adequate canopy for uptake through tissues. Interval between applications is 30 days. 7-day PHI.
<b>Phylloxera</b>		See materials and remarks for earlier growth stages. <sup>6</sup>
Movento/spirotetramat	6 to 8 fl oz	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. Ensure application when there is adequate canopy for uptake through tissues. Interval between applications is 30 days. 7-day PHI.
<b>Thrips</b>		Where thrips are a problem, they are generally managed early season, prior to bloom.
<b>Yellowjackets</b>		Control of wasps can be managed by: <ul style="list-style-type: none"> <li>• Trapping: Ongoing effort needs to start in spring and continue into fall, especially if the yellowjacket 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 yellowjacket population for the season. A greater number of traps may reduce the likelihood of pest numbers building up later in the season. One trap/A is adequate in spring. For optimal control, follow instructions on the product and labels.</li> <li>• Early-season removal of nests</li> <li>• Spraying the nest or nesting site with an insecticide labeled for that use.</li> </ul>
<b>Prebloom (stage 17)</b>		
<b>Cutworms</b>		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.
<b>Mealybugs and scale insects</b>		See materials and remarks for earlier growth stages.



**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

Insect, weed, or disease control/materials		Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
<b>Thrips</b>			See materials and remarks for earlier growth stages. Where thrips are a problem, they are generally managed early season, prior to bloom.
<b>Grape bud and rust mite</b>			
JMS Stylet oil	1 to 2 gal/100 gal water		Do not use within 10 days of a sulfur application.
M-Pede	1 to 2 gal/100 gal water		Do not use within 3 days of a sulfur application.
Sulfur 80 to 90%	check labels		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. <sup>1,2</sup> Formulated product rate shown for sulfur products.
Cosavet DF	2 to 5 lb		
Kumulus DM	2 to 10 lb		
Microthiol Disperss	3 to 10 lb		
<b>Phylloxera</b>			See materials and remarks for earlier growth stages. <sup>6</sup>
<b>Powdery mildew</b>			See Table 2 (page 22) and Figure 3 (page 24)
Abound	10 to 15.5 oz		14-day PHI. Do not apply with silicon based surfactants.
Adament 50 WG	3 to 4 oz		Combination of a group 3 and 11 fungicide. 14-day PHI. <sup>9</sup>
Flint 50WG	1.5 to 2 oz		Do not make more than two consecutive applications. Do not apply more than 4 times per year. 14-day PHI. <sup>9</sup>
JMS Stylet oil	1 to 2 gal/100 gal water		Do not use within 10 days of a sulfur application.
Kaligreen	2.5 to 5 lb		Supplemental to a normal program only when powdery mildew is first observed. 1-day PHI.
Mettle 125 ME	3 to 5 fl oz		Do not use more than 10 fl oz/A per year. 14-day PHI.
M-Pede	1 to 2 gal/100 gal water		Do not use within 3 days of a sulfur application. Use as a supplement to a normal program.
Ph-D WDG	6.2 fl oz		0-day PHI
Pristine	8 to 12.5 oz		14-day PHI
Procure 480SC	4 to 8 fl oz		Do not use more than 32 fl oz/A per year. 7-day PHI.
Quadris Top	10 to 12 fl oz		Combination of a group 3 and 11 fungicide. 14-day PHI.
Quintec	3 to 6.6 oz		Do not apply more than 5 times per year. A surfactant is not required when used alone but a non-ionic surfactant is preferred if needed for tank mixes. 14-day PHI.
Rally 40WSP	3 to 5 oz		Do not apply more than 1.5 lb/A per year. 14-day PHI.
Regalia	2 to 4 qt/100 gal water		Supplemental to a normal program only when powdery mildew is first observed.
Rubigan EC	2 oz		Do not apply more than 19 oz/A per year. Must have a minimum concentration of 2 oz/100 gal and use a surfactant. Use lower rates early in the season. 30-day PHI. <sup>5</sup>
Sovran	3.2 to 4.8 oz		Do not make more than two consecutive applications. 14-day PHI. <sup>10</sup>
Sulfur	Check label		Repeat as necessary at 7- to 10-day intervals. Sulfur's activity is effective from 57 to 83°F. <sup>1,2</sup>
Cosavet DF	2 to 5 lb		
Kumulus DF	2 to 10 lb		
Microthiol Disperss	3 to 10 lb		
Thiosperse	6 to 20 lb		
tebuconazole products			Do not apply more than 2 lb per year. 14-day PHI.
Elite 45 WP	4 oz		
Orius 45 DF	4 oz		

Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Tebuzol 45 DF	4 oz	
Unicorn DF	1.75 to 2.5 lb	Includes sulfur in the formulation.
Vivando	10.3 to 15.4 fl oz	14-day PHI.
<b>Eutypa dieback</b>		Scout for vines showing symptoms of this disease. Mark for removal in summer, during dry weather or during the dormant season. Removal earlier in the season, when rainfall is available, can lead to further spread of the disease.
<b>Weed control</b>		Refer to previous sections (Delayed Dormant) for list of herbicides. Time applications with weed and vine growth in mind. Some herbicides can be applied into early spring post-bud break, and into the season.
<b>Bloom (stages 61-69).<sup>7</sup></b>		
<b>Powdery mildew</b>		See Table 3 (page 23) and Figure 2 (page 4)
Abound	10 to 15.5 oz	14-day PHI. Do not apply with silicon based surfactants.
Adament 50 WG	3 to 4 oz	Combination of a group 3 and 11 fungicide. 14-day PHI. <sup>9</sup>
Flint 50WG	1.5 to 2 oz	Do not make more than two consecutive applications. Do not apply more than 4 times per year. 14-day PHI. <sup>9</sup>
HMOs such as JMS Stylet oil, Saf-T-Side, SuffOil, Trilogy	1 to 2 gal/100 gal water	Do not use within 10 days of a sulfur application.
Mettle 125 ME	3 to 5 fl oz	14-day PHI. Do not use more than 10 fl oz/A per year.
Pristine	8 to 12.5 oz	14-day PHI.
Procure 480SC	4 to 8 fl oz	Do not use more than 32 fl oz/A per year. 7-day PHI.
Quadris Top	10 to 12 fl oz	Combination of a group 3 and 11 fungicide. 14-day PHI.
Quintec	3 to 6.6 oz	Do not apply more than 5 times per year. A surfactant is not required when used alone but a non-ionic surfactant is preferred if needed for tank mixes. 14-day PHI.
Rally 40WSP	3 to 5 oz	Do not apply more than 1.5 lb/A per year. 14-day PHI.
Rubigan EC	4 to 6 oz	Do not apply more than 19 oz/A per year. Must have a minimum concentration of 2 oz/100 gal. Use lower rates early in the growing season. 30-day PHI. <sup>5</sup>
Sovran	3.2 to 4 oz	Do not make more than two consecutive applications. 14-day PHI. <sup>10</sup>
Sulfur	Check labels	Repeat as necessary at 7- to 10-day intervals. Sulfur's activity is effective from 57 to 83°F. <sup>1,2</sup>
Cosavet DF	2 to 5 lb	
Kumulus DF	2 to 10 lb	
Microthiol Disperss	3 to 10 lb	
Thiosperse	6 to 20 lb	
tebuconazole products		
Elite 45 WP	4 oz	Do not apply more than 2 lb per year. 14-day PHI.
Orius 45 DF	4 oz	
Tebuzol 45 DF	4 oz	
Unicorn DF	1.75 to 2.5 lb	Includes sulfur in the formulation.
Vivando	10.3 to 15.4 fl oz	14-day PHI

**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

<b>Insect, weed, or disease control/materials</b>	<b>Amount (ai or formulated) material/A</b>	<b>Remarks and minimum days from last application to harvest (PHI)</b>
<b>Botrytis bunch rot</b>		See Table 2 (page 22) and Figure 3 (page 24)
Captan 80WDG	2.5 lb	Do not use with oil. 0-day PHI.
Elevate 50WDG	1 lb	Do not use more than 3 lb/A per season. 0-day PHI. <sup>3</sup>
Endura	8 oz	Do not use more than 2 times per year. Do not use for bunch rot control if Pristine was used for powdery mildew. 14-day PHI.
Inspire Super	16 to 20 fl oz	Combination of a group 3 and 9 fungicide. Do not use for bunch rot control if it was used for powdery mildew. 14-day PHI.
JMS Stylet oil	1 to 2 gal/100 gal water	May aid botrytis control. Tank mix with another fungicide. Do not use within 10 days of a sulfur application.
Pristine	18.5 to 23 oz	Higher rate based on supplemental label. Combination of a group 7 and 11 fungicide. Do not use for bunch rot control if it was used for powdery mildew. 14-day PHI.
Rovral 4F	1 to 2 pt	Do not use more than twice per season. 7-day PHI. <sup>3</sup>
Scala SC	9 to 18 oz	7-day PHI. <sup>3</sup>
Switch 62.5 WG	11 to 14 oz	Combination of a group 9 and 12 fungicide. Do not use with adjuvant. 7-day PHI.
Vangard 75WG	5 to 10 oz	Buffer to a pH of 5 to 7 when tank mixing with Rovral. 7-day PHI. <sup>3</sup>
<b>Mealybug and scale insects</b>		See materials and remarks for earlier growth stages.
<b>Vine sucker control</b>		
Goal Tender/oxyfluorfen	0.25 to 0.5 lb/A	Apply in a 3-ft band directed at suckers emerging from plant base up to 12 inches tall. 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 per season. 60-day PHI. Applications can be made up to 3 weeks after bloom. Use a minimum of 50 gallons of water per treated acre. May tank mix with glufosinate.
<b>Weed control</b>		Refer to “Delayed Dormant” section for 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.
<b>Postbloom (stage 71)</b>		
<b>Botrytis bunch rot</b>		See Table 2 (page 22) and Figure 3 (page 24)
<b>Cluster-zone leaf removal</b>		
Removing the basal leaves that cover the flower/grape cluster 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-fruit set that may otherwise serve as breeding-grounds for initial botrytis infections. Early leaf removal should not result in sunburning of fruit if climatic conditions are not subject to high temperatures and sunlight intensity. Late leaf removal (near véraison or later) can cause sunburning, particularly when combined with hot, dry weather.		
<b>Late spring, bloom through berry set (stages 65-70)</b>		
<b>Powdery mildew</b>		See Table 2 (page 22) and Figure 3 (page 24). Use materials at shortest recommended intervals during this period. Fungicides are not a problem when used during bloom, but powdery mildew is.

Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Abound	10 to 15.5 oz	14-day PHI. Do not apply with silicon based surfactants.
Adament 50 WG	3 to 4 oz	Combination of a group 3 and 11 fungicide. 14-day PHI. <sup>9</sup>
Flint 50WG	1.5 to 2 oz	Do not make more than two consecutive applications. Do not apply more than 4 times per year. 14-day PHI. <sup>9</sup>
HMOs such as JMS Stylet oil, Saf-T-Side, SuffOil, Trilogy	1 to 2 gal/100 gal water	Do not use within 10 days of a sulfur application.
Kaligreen	2 to 3 lb	Supplemental to a normal program only when powdery mildew is first observed. 1-day PHI.
Mettle 125 ME	3 to 5 fl oz	Do not use more than 10 fl oz/A per year. 14-day PHI.
M-Pede	1 to 2 gal/100 gal water	Do not use within 3 days of a sulfur application. Use as a supplement to a normal program.
Ph-D WDG	6.2 oz	0-day PHI.
Pristine	8 to 12.5 oz	14-day PHI.
Procure 480SC	4 to 8 fl oz	Do not use more than 32 fl oz/A per year. 7-day PHI.
Quadris Top	10 to 12 fl oz	Combination of a group 3 and 11 fungicide. 14-day PHI.
Quintec	3 to 6.6 oz	Do not apply more than 5 times per year. A surfactant is not required when used alone but a non-ionic surfactant is preferred if needed for tank mixes. 14-day PHI.
Rally 40WSP	3 to 5 oz	Do not apply more than 1.5 lb/A per year. 14-day PHI.
Regalia	2 to 4 qt/100 gal water	Supplemental to a normal program only when powdery mildew is first observed.
Rubigan EC	4 to 6 oz	Do not apply more than 19 oz/A per year. Must have a minimum concentration of 2 oz/100 gal and use a surfactant. Use lower rates early in growing season. 30-day PHI. <sup>5</sup>
Sovran	3.2 to 4.8 oz	Do not make more than two consecutive applications. 14-day PHI. <sup>10</sup>
sulfur	Check label	Repeat as necessary at 7- to 10-day intervals. Sulfur is most effective from 57-83°F. <sup>1,2</sup>
Cosavet DF	2 to 5 lb	
Kumulus DF	2 to 10lb	
Microthiol Disperss	3 to 10 lb	
Thiosperse	6 to 20 lb	
tebuconazole products		Do not apply more than 2 lb per year. 14-day PHI.
Elite 45 WP	4 oz	
Orius 45 DF	4 oz	
Tebuzol 45 DF	4 oz	
Unicorn DF	1.75 to 2.5 lb	Includes sulfur in the formulation.
Vivando	10.3 to 15.4 fl oz	14-day PHI.
<b>Black vine weevil</b>		This pest is rarely an economic problem in Oregon. But, it can pose serious risk of damage to young vineyards.
Aza-Direct/azadirachtin	16 to 32 fl oz.	This is a neem oil product. It is approved for organic use. For best results, apply 7-10 days apart. For heavy pest pressure, use up to 56 fl oz/A. OMRI listed for organic production.
Brigade 2 EC/bifenthrin	6.4 fl oz	<b>Restricted-use pesticide.</b> Do not apply more than 6.4 fl oz/A per season. Thorough coverage is essential. 30-day PHI.



Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Surround/kaolin clay	20 to 50 lb/100 gal water	This is a kaolin clay product. It is approved for organic production and used for suppression only. Rate of use depends on canopy size; consult the product label.
<b>Branch and twig borers</b>		See materials and remarks for earlier growth stages.
<b>Grape erineum mite</b>		The leaf strain of erineum mite has not shown any economic effect on grapes in Oregon. Sulfur used earlier for mildew control should adequately control this pest.
<b>Leafhopper</b>		Several compounds are registered for use on leafhoppers in grapes. A list of compounds that are regularly used is presented below.
Assail 70 WP/acetamiprid	1.1 to 2.3 oz	Rates are dependent on formulation. Do not exceed two applications per season (4.6 oz product/A per year limit). Allow at least 14 days between applications. 3-day PHI.
Baythroid XL/β-cyfluthrin	2.4 to 3.2 fl oz	<b>Restricted-use pesticide.</b> Do not apply more than 2.3 fl oz/A (0.1 lb ai/A) per season. 3-day PHI.
Applaud 70 DF/buprofezin	9.0 to 12.0 oz	Use 50 to 200 gal/A water. Do not exceed two applications per season (24.0 oz /A), and allow 14 days between applications. 30-day PHI.
Danitol 2.4 EC/fenopropathin	5.3 to 10.3 fl oz	<b>Restricted-use pesticide.</b> Apply with 25 to 200 gal water/A to ensure good coverage; 7-day spray interval. Apply when pest populations highest. For resistance management, it is best not to use more than two sprays per season. 21-day PHI. Do not exceed 0.8 lb ai/A per season (42.66 oz product/A per year).
Admire Pro/imidacloprid	7 to 14 fl oz	Apply in one or two drip irrigations between bud-break and pea-sized berry stages. See label for restrictions. Do not apply more than 0.5 lb ai/A per year. Frequent use of imidacloprid will lead to spider mite outbreaks. 30-day PHI.
Provado Solupak/imidacloprid	0.8 to 1.0 oz	Do not exceed 2.0 oz/A per year. Allow 14 days between applications. Also labeled for mealybug control. 0-day PHI.
M-Pede	2% solution	Consult label for rates. 0-day PHI. OMRI listed for organic production.
Surround WP/kaolin clay	25 to 50 lb product	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. Approved for organic production.
Actara/thiamethoxam	1.5 to 3.5 oz	Do not exceed 7 oz/A (0.109 lb ai/A) per season. Allow 14 days between applications. 5-day PHI.
<b>Phylloxera</b>		See materials and remarks for earlier growth stages. <sup>6</sup>
Movento/spirotetramat	6.0 to 8.0 fl oz	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. Ensure application when there is adequate canopy for uptake through tissues. Interval between applications is 30 days. 7-day PHI.
<b>Stink bugs</b>		The products listed below provide control for several different species of stink bug, including the Brown Marmorated Stink Bug.
Aza-direct/azadirachtin	8 to 16 fl oz	Apply as a foliar spray. Under very heavy infestation, 0.04 lb ai/A can be used. Approved for organic use.

Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Scorpion 35 SL/dinotefuran	2 to 5 fl oz	Use high water volume to ensure good coverage and control. Start spraying once pest activity is noticed and/or thresholds are reached but before a large population has established (contact local Extension for thresholds in your area). Do not apply within 7 days of prior application, and do not exceed 10.25 fl oz/A per season. Do not apply within 1 day of harvest.
Pyganic EC 1.4II/pyrethrins	16 to 64 fl oz	Use with 100 gal water/A for conventional airblast sprayers. Approved for organic production. <b>Note:</b> they are highly toxic to aquatic organisms and runoff/drift should be avoided as much as possible. OMRI listed for organic production.
<b>Thrips</b>		See materials and remarks for earlier growth stages.
<b>Summer (late June and July, stages 71-77)</b>		
<b>Powdery mildew</b>		See Table 2 (page 22) and Figure 3 (page 24). See materials and remarks for "Late spring, bloom through set" stage.
<b>Spider mites</b>		
Acramite-50WS/bifenazate	0.75 to 1 lb	5-day worker reentry interval for certain activities. Make only one application per season. 14-day PHI.
Vendex 50WP/fenbutatin-oxide	1 to 2.5 lb	<b>Restricted-use pesticide.</b> Apply when mites first appear. Do not use more than twice per season (4 lb ai/A per year) 28-day PHI.
Fujimite 5EC/fenpyroximate	1.5 to 2 pt	Apply in a minimum of 50 gal water/A. Do not apply more than 2 applications, or 2 pints product/A per season (0.1 lb ai/A per year). Not for use through irrigation systems. 14-day PHI.
M-Pede/insecticidal soap	1.5 to 2 gal/100 gal water	Do not use within 3 days of sulfur application.
Omite 30WS/propargite	5 to 9 lb	16-day worker reentry interval. Do not use more than twice per season. 21-day PHI.
Nexter/pyridaben	5.2 to 10.67 oz	Rate depends on target mite. Do not apply more than twice per season. Allow a minimum of 30 days between applications. Harmful to predatory mites. 7-day PHI.
Envior 2 SC/spirodiclofen	16 to 34 fl oz	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). 14-day PHI.
<b>Phylloxera</b>		
Voliam Flexi/thiamethoxam + chlorantraniliprole	4.5 oz	Apply when pest populations are increasing (summer). Do not use more than 2 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. 14-day PHI.
<b>Late summer (July to August, stages 76-81)</b>		
<b>Powdery mildew</b>		See Table 2 (page 22) and Figure 3 (page 24). See materials and remarks for "Late spring, bloom through set" stage. Pay close attention to pre-harvest restrictions (PHI).
<b>Grape mealybug</b>		See materials and remarks for earlier growth stages.
<b>Thrips</b>		See materials and remarks for earlier growth stages.
<b>Leafhoppers</b>		See materials and remarks for earlier growth stages.
<b>Spider mites</b>		See materials and remarks for earlier growth stages.

Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
<b>Grape rust mite</b>		See materials and remarks for earlier growth stages.
<b>Yellowjackets</b>		See materials and remarks for earlier growth stages.
<b>Beginning of berry touch (Stage 77)</b>		
<b>Botrytis bunch rot</b>		See Table 2 (page 22) and Figure 3 (page 24)
Captan 80 WDG	2.5 lb	Do not use with oil. 0-day PHI.
Elevate 50 WDG	1 lb	Do not use more than 3 lb/A per season. 0-day PHI. <sup>3</sup>
Endura	8 oz	Do not use more than 2 times per year. Do not use for bunch rot control if Pristine was used for powdery mildew. 14-day PHI.
Inspire Super	16 to 20 fl oz	Combination of a group 3 and 9 fungicide. Do not use for bunch rot control if it was used for powdery mildew. 14-day PHI.
JMS Stylet oil	1 to 2 gal/100 gal water	May aid botrytis control if used for powdery mildew. Tank mix with another fungicide.
Rovral 4F	1 to 2 pt	Do not use more than twice per season. 7-day PHI. <sup>3</sup>
Scala SC	9 to 18 oz	7-day PHI. <sup>3</sup>
Switch 62.5 WG	11 to 14 oz	Do not use with an adjuvant. Combination of a group 9 and 12 fungicide. 7-day PHI.
<b>Véraison (Stage 81)</b>		
<b>Botrytis bunch rot</b>		See Table 2 (page 22) and Figure 3 (page 24)
Captan 80WDG	2.5 lb	Do not use with oil. 0-day PHI.
Elevate 50WDG	1 lb	Do not use more than 3 lb/A per season. 0-day PHI. <sup>3</sup>
Endura	8 oz	Do not use more than 2 times per year. Do not use for bunch rot control if Pristine was used for powdery mildew. 14-day PHI.
Inspire Super	16 to 20 fl oz	Combination of a group 3 and 9 fungicide. Do not use for bunch rot control if it was used for powdery mildew. 14-day PHI.
JMS Stylet oil	1 to 2 gal/100 gal water	May aid botrytis control if used for powdery mildew. Tank mix with another fungicide.
Pristine	18.5 to 23 oz	Higher rate based on supplemental label. Combination of a group 7 and 11 fungicide. Do not use for bunch rot control if it was used for powdery mildew. 14-day PHI.
Rovral 4F	1 to 2 pt	Do not use more than twice per season. 7-day PHI. <sup>3</sup>
Scala SC	9 to 18 oz	7-day PHI. <sup>3</sup>
Switch 62.5 WG	11 to 14 oz	Do not use with an adjuvant. Combination of a group 9 and 12 fungicide. 7-day PHI.
<b>Preharvest (Stages 81-88)</b>		
<b>Botrytis bunch rot</b>		See Table 2 (page 22) and Figure 3 (page 24)
Botran 75W	2 lb	Fruit marking can occur on some cultivars when combined with sulfur. 14-day REI.
Captan 80 WDG	2.5 lb	Do not use with oil. 0-day PHI.
Elevate 50 WDG	1 lb	Do not use more than 3 lb/A per season. 0-day PHI. <sup>3</sup>
Endura	8 oz	Do not use more than 2 times per year. Do not use for bunch rot control if Pristine was used for powdery mildew. 14-day PHI.
Inspire Super	16 to 20 fl oz	Combination of a group 3 and 9 fungicide. Do not use for bunch rot control if used for powdery mildew. 14-day PHI.

**Table 1. Seasonal Vineyard Pest Management: Diseases, Insects, and Weeds**

Insect, weed, or disease control/materials	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Pristine	8 to 10.5 oz	Do not make more than two consecutive applications. Combination of a group 7 and 11 fungicide. Do not use for bunch rot control if used for powdery mildew. 14-day PHI.
Rovral 4F	1 to 2 pints	Do not use more than twice per season. 7-day PHI. <sup>3</sup>
Scala SC	9 to 18 oz	7-day PHI. <sup>3</sup>
Switch 62.5 WG	11 to 14 oz	Do not use with an adjuvant. Combination of a group 9 and 12 fungicide. 7-day PHI.
Vangard 75WG	5 to 10 oz	Buffer to a pH of 5 to 7 when tank mixing with Rovral. 7-day PHI. <sup>3</sup>
<b>Leafhoppers</b>		See materials and remarks for earlier growth stages.
<b>Leafroll virus</b>		If you are concerned about vines exhibiting combined symptoms often associated with leafroll virus, such as low vigor, lack of ripening, curled leaves and red leaf discoloration (of red cultivars), collect samples for tissue virus analysis. These samples should consist of petioles from the oldest leaves, collected in August to September. Submit samples to a virus testing lab for verification. Samples may be submitted directly to the OSU Plant Clinic ( <a href="http://plant-clinic.bpp.oregonstate.edu">http://plant-clinic.bpp.oregonstate.edu</a> ). Sample submission forms can be found online. Also determine the presence of potential insect vectors of the virus (i.e., mealybugs). This can be done using commercially available pheromone traps and physical sampling. Consult the following Extension publications on mealybug scouting: EM 8985, EM 8990 and EM 8998-E.
<b>Phylloxera</b>		Scout for possible infestations. Note that soil drenches are generally ineffective for eradication due to poor penetration, especially in clay soils. <sup>6</sup>
<b>Spotted Wing Drosophila (SWD) and vinegar flies</b>		Initial data from research in Oregon show that winegrapes are not susceptible to economic damage from this pest. For ID and monitoring, consult EM 8991-E and EM 9021, OSU Extension Publications on this pest. Growers are not encouraged to spray pesticides unless crop has positive ID and larval infestations. For further information, visit: <a href="http://swd.hort.oregonstate.edu">http://swd.hort.oregonstate.edu</a> . To obtain the aforementioned publications, visit: <a href="http://extension.oregonstate.edu/catalog/">http://extension.oregonstate.edu/catalog/</a>
<b>Yellowjackets</b>		See materials and remarks for earlier growth stages.

## Table 1 Footnotes

- <sup>1</sup> The sulfur spray schedule listed is not intended for use on *Vitis labrusca*, some American *Vitis* species, or some interspecific hybrid cultivars, which 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 can withstand sulfur applications (at lower rates) above 85°F if there is no major short-term change in the daily maximum. Once vines are acclimated to higher temperatures, the chance of burn is greatly reduced.
- <sup>2</sup> Control of powdery mildew in susceptible *Vitis vinifera* cultivars involves the regular application of fungicides. It is impossible to give an exact schedule since the timing, intensity, and frequency of applications depends on weather, vine growth, and potential inoculum due to previous infestations, which vary from year to year and region to region. (See Table 2, page 22, and Figure 3, page 24.) Early-season weather in the Willamette Valley is often cold and rainy, which is not conducive to powdery mildew. However, the transition period between the heavy spring rains and the dry summer months is ideal for the start of powdery mildew epidemics. By that time of the year, a powdery mildew prevention program already should have been implemented, and the interval between applications shortened to accommodate these environmental conditions that may lead to an infection. In the valleys of southern Oregon, this period may start much earlier in the growing season. The length of the period of powdery mildew infestation can change from year to year with variations in weather.



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. Berries are most susceptible at bloom and shortly after. During the growing season, the developing berries become resistant to new infections when they reach 8°Brix. Some sporulation can occur on berries with established infections up to 15°Brix. However, shoots can still be infected and continue to produce overwintering inoculum through harvest.

The use of fungicides containing sulfur or lime sulfur during dormancy or at budbreak 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, however, when attempting to bring a vineyard with severe powdery mildew the prior year back into production.

Fungicides vary as to the length of time they are effective at preventing infection by powdery mildew. A range of 7-14 days usually is given for sulfur, and 14 to 21 days for Group 3 fungicides such as Rally or Rubigan and for Group 11 fungicides such as Abound or Flint. Use the shorter interval during rapid vine growth early in the season or when weather conditions are favorable for powdery mildew development. Careful planning also 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 take into account early vine growth, weather conditions that favor powdery mildew, and the properties of the various fungicides available for use.

Several programs that monitor the weather and can help growers make fungicide application decisions are available. These programs have been effective in western Oregon.

- <sup>3</sup> Fungal pathogen resistance to Elevate, Rovral, Scala, or Vangard is highly likely if only one of these products is used exclusively to control the disease. Applications at bunch close and/or véraison are the most important for disease control. Tank mix or alternate materials that have a different mode of action. Switch is already a mix of two different fungicides.
- <sup>4</sup> This publication lists chemicals as well as some other methods of pest control. It is intended to serve as a supplement to the pest management chapters published in *Oregon Viticulture* (2003). These chapters offer more complete descriptions of pests and cultural methods of pest control. This book can be purchased online through the OSU Bookstore: <http://www.osubookstore.com>
- <sup>5</sup> High rates of Rubigan early in the season may cause a burning of the leaf margin.
- <sup>6</sup> Symptoms of phylloxera infestation include low vigor, chlorotic foliage, lack of fruit ripening, and early leaf drop. Symptomatic vines appear in a lens-shaped area of the vineyard, and the size of the affected area will increase 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 control for this pest. Avoid movement of soil and plant materials from infested vineyards to uninfested, own-rooted vineyards to prevent spread. Refer to *Grape Phylloxera: Biology & Management in the Pacific Northwest* (2009) available online at: <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19539/ec1463-e.pdf>
- <sup>7</sup> Pruning during the dormant season alone should control phomopsis cane and leaf spot in most vineyards.
- <sup>8</sup> Use materials at shortest recommended intervals during this period. Other products not listed also are registered for powdery mildew control. They are not recommended due to resistance problems (Topsin) or lack of efficacy in research conducted in the Pacific Northwest (Kalgreen).
- <sup>9</sup> Do not use Flint on Concord (*Vitis labrusca*) grapes.
- <sup>10</sup> Sovran drift may injure some sweet cherry cultivars such as Van; be very careful when spraying near cherry orchards.
- <sup>11</sup> Herbicide Warning: Using herbicides that contain 2,4-D or similar materials on farms involves risk, not only to the crop to which it is applied but also to crops in nearby fields. Grapevines are particularly sensitive to phenoxy herbicide damage. Phenoxy herbicides (ALS inhibitors) are synthetic plant hormones that can severely impact vine leaf and canopy development, as well as flowering and fruit set if application/drift occurs at critical times at or before bloom. However, there may be instances in which guidance in 2,4-D use will enhance weed control with minimal chance for crop injury. Be careful to clean all 2,4-D from your equipment, or use separate sprayers to avoid possible crop injury. Never use a volatile formulation of 2,4-D or similar material. Buy only a product that lists the intended crop on the label.
- <sup>12</sup> Important note on herbicides: Herbicides must be applied at exactly the correct rate and time to selectively control weeds with minimal chance for injuring vines. You will get more consistent results by reading the label and other information about the proper application and timing of each herbicide. Suggested rates listed in this guide are stated as pounds of active ingredient per acre (lb ai/A) or pounds of acid equivalent per acre (lb ae/A). See the product label for specific amounts of a particular formulation to apply per treated acre.
- <sup>13</sup> For band applications of herbicides under vine rows, reduce the quantity of herbicide applied proportionally to the area within the row actually sprayed. Numerous tank mixes are labeled for vineyard use, or growers can assume responsibility and mix products unless the label prohibits mixing.
- <sup>14</sup> Livestock grazing in vineyards often is prohibited if herbicides have been applied for weed control.
- <sup>15</sup> Herbicide site of action group numbers. Alternating herbicides used with different sites of action will reduce the potential of developing resistance.

**Table 2. Effectiveness of Fungicides for Control of Grape Diseases**

Fungicide	Fungicide group	Phomopsis cane and leaf spot	Powdery mildew	Botrytis bunch rot
Adament	Group 3 + 11	Fair to good	Excellent	Slight to fair
azoxystrobin (Abound)	Group 11	Fair to good	Excellent	Slight to fair
captan (Captan, Captec)	Group M4	Excellent	Not effective	Fair
cyprodinil (Vanguard)	Group 9	Not effective	Not effective	Good
DCNA (Botran)	Group 14	?	Not effective	Slight
Endura	Group 7	Not effective	Excellent	Good to excellent
fenarimol (Rubigan, Vintage)	Group 3	Not effective	Good	Not effective
fenhexamid (Elevate)	Group 17	Not effective	Not effective	Good to excellent
fixed copper (several formulations)	Group M1	Slight	Moderate	Slight to none
HMOs (JMS)	Not classified	Not effective	Good	Slight
Inspire Super	Group 3 + 9	None to slight	Good	Excellent
iprodione (Rovral, Nevado)	Group 2	Not effective	Not effective	Slight to fair
kresoxim-methyl (Sovran)	Group 11	Good	Excellent	Slight to fair
mancozeb (Dithane, Manzate, Penncozeb)	Group M3	Excellent	Not effective	Not effective
myclobutanil (Rally)	Group 3	Not effective	Good	Not effective
polyoxin-D (Ph-D)	Group 19	?	Good	Fair to good
potassium bicarbonates (Kaligreen)	Not classified	Not effective	Slight	Slight
Pristine	Group 11 and 7	Good	Excellent	Good
Quadris Top	Group 3 and 11	Fair to good	Excellent	Slight to fair
Quintec	Group 13	Not effective	Excellent	Not effective
Regalia	Not classified	Not effective	Fair to good	Not effective
Scala	Group 9	Not effective	None	Good
soap (M-Pede)	Not classified	?	Good	?
sulfur (several formulations)	Group M2	Slight	Good to excellent	Not effective
Switch	Group 9 + 12	Not effective	Not effective	Good
tebuconazole (Elite, Orius, Tebucon, Tebuzol)	Group 3	Not effective	Good	Not effective
tetriconazole (Mettle)	Group 3	Not effective	Excellent	Not effective
triadimefon (Bayleton)	Group 3	Not effective	Good	Not effective
trifloxystrobin (Flint)	Group 11	Fair	Excellent	Slight to fair
triflumizol (Procure)	Group 3	Not effective	Excellent	Not effective
Unicorn	Group 3 + M2	Slight	Good to excellent	Not effective
Vivando	Unknown	Not effective	Excellent	Not effective
ziram (Ziram)	Group M2	Good	Not effective	Slight

**Follow the R.U.L.E.S. for fungicide stewardship:**

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

For more information about fungicides registered for use on grapes, and their specific modes of action, consult the following OSU Extension publication: *How to Reduce the Risk of Pesticide Resistance in Winegrape Pests in Oregon*, EM 8968, which is available online at: <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20555/em8968.pdf>

## Powdery Mildew Strategy

The powdery mildew spray program is based on sulfur, alternated with fungicides of various groups: DMI (Group 3), Quintec (Group 13) or strobilurin (Group 11).

The activity of sulfur is effective from 57° to 83°F. Short (7-day) spray intervals and high rates 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 a DMI (Group 3) fungicide (Elite, Mettle, Procure, Rally, or Rubigan), Quintec (Group 13), or a strobilurin (Group 11) fungicide (Abound, Flint, or Sovran) between sulfur applications. Rally resistance is suspected in the Willamette Valley. New York recommends tank mixing group 3 or group 11 fungicides with sulfur. M-Pede or JMS Stylet oil can be used to slow an infection when protectant fungicides fail to provide complete control.

**CAUTION:** Stylet oil cannot be used within 10 days of a sulfur application, and M-Pede cannot be used within 3 days of a sulfur application.

- Several products may already contain two different fungicides such as Adament, Inspire Super, Pristine, Quadris Top, or Unicorn. These also may be used in rotation, but be careful not to rotate them with products that contain the same fungicide group.
- 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 Strategy

- Cultural control practices alone have been as effective against bunch rot as fungicides alone, particularly during years of dry weather during harvest.
- Rain events dictate incidence and severity of bunch rot observed. Use rain forecasts to guide applications during bloom and pre-harvest.
- Fungicides work best when used **before** a rain event.
- Primary products to consider in rotation and/or for tank mixing include Elevate, Endura, Scala, Switch (a mix of contact and systemic fungicides) and Vangard.
- JMS stylet oil can be tank mixed with Rovral.

## Table 3. Botrytis Bunch Rot of Grapes

*Botrytis cinerea* will infect grape berries from 53°F with as few as four hours of berry wetness. However, the number of berries infected rises with increased hours of berry wetness. The following table is based on a *botrytis* infection model (Broome, J.C., et al., 1996. Development of an infection model for botrytis bunch rot of grapes based on wetness duration and temperature. *Phytopathology* 85:97-102). Fungicide applications are to be initiated after a medium risk occurs during the growing season.

Temperature (°C)	Temperature (°F)	Minimum number of hours of berry wetness* (Medium risk)	Minimum 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.

## Pests that Require Pre-Plant Action and Continued Prevention

Some pests cause fundamental problems in vineyard survivability and can't be managed through cultural practices or pesticide spray programs as can the disease, insect, and weed pests described above. On pages 24 and 25 are some major considerations with regard to two vineyard pests: viruses and nematodes. Both should be considered prior to planting a vineyard and in sustainability and longevity of vineyard blocks once established.

Growth Stage	Dormant— Early growth	6" shoots	Pre-bloom	Bloom	Fruit Set	Fruit Growth (summer)	Véraison	Pre-harvest
EL Stage	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)	DMI, Quintec, or strobilurin		Sulfur: high rate (7 days)	DMI, Quintec, or strobilurin	Sulfur: half rate (7-14 days)	DMI, Quintec or strobilurin
Supplemental Applications		M-Pede or JMS Stylet Oil; Use caution with sulfur.						
Cultural Methods		Shoot thinning and positioning			Pull leaves in cluster-zone	Shoot positioning and hedging		
	BOTRYTIS							
Primary Applications				Spray if necessary (rainy weather)			Critical to spray at bunch closure (EL 79) and véraison (EL81-83).	Spray if necessary
	During these stages, rotate and/or tank mix fungicides listed in this document so that no product is used more than two times per season to prevent fungicide resistance from developing. Always use a different material than was used for the previous application.							
Supplemental Applications			Botran, copper, Captan, Abound, Flint, Pristine, Rovral or Sovran can be considered based on weather and cultivar susceptibility to Botrytis.					
Cultural Methods		Shoot thinning and positioning			Pull leaves in cluster-zone	Shoot positioning and hedging		

Figure 3. Example strategy for powdery mildew and botrytis control.

## Grapevine Viruses

Several grapevine viruses can be detrimental to vineyard productivity. Many viruses found in infected vineyards in Oregon were already in the vines when they were planted. Some of the problematic viruses include Grapevine leafroll-associated virus (GLRaV), Grapevine fanleaf virus, and Rupestris stem pitting associated virus.

Not all viruses are equally destructive. In general, grapevine response to viruses can include reduced growth, late or irregular fruit ripening, reduced yield, chlorosis, reduced photosynthesis rates, and general decline. Some viruses may even cause incompatibility between rootstock and scion, leading to rejection and death of the vine. Vine viruses have no cure, so prevention is the key. Growers are advised to purchase and plant certified clean plant materials when establishing vineyards. Certified plants are tested to ensure they are free from specific known grapevine viruses. Not all grapevines sold by nurseries are certified. If vines are not certified, there is no guarantee they are free from viruses. Because detection methods for viruses are increasingly precise, and because new strains of viruses are being identified, there is no way to guarantee that certified plant materials will be free

from all viruses. Nevertheless, the first line of defense is to purchase certified stock from nurseries. Be sure to purchase vines from reputable nurseries, and ask about certified stock when developing your order. Order all plant materials well in advance to ensure availability. To identify reputable nurseries, contact your local OSU Extension Service office. For a list of certified nurseries in Oregon and Washington, see: <http://wine.wsu.edu/research-extension/nwgf/certified/>

Finally, certain insects and nematodes can vector (carry) viruses and infect healthy vines. Preventing infestation and movement of insect pests can help reduce the spread of viruses.

If you suspect virus in your vineyard, submit samples to a virus testing lab. See Figure 1 (page 3) for timing of sample collection. To determine whether your vineyard has Grapevine leafroll associated viruses, it is best to sample later in the season; older leaf tissues or stem tissues should be collected and submitted. Rupestris stem pitting associated virus can also be detected in late season sampling. Grapevine fanleaf virus is best detected in tissues during the spring.

Some testing labs have panels of assays to detect various viruses; inquire with each lab regarding



these tests. Be sure to follow appropriate sampling timing and methods to submit tissue for specific tests. The lab you choose should provide you with sampling methods and submission. Be aware that PCR (Polymerase Chain Reaction) testing can be more definitive than ELISA (Enzyme-Linked Immunosorbent Assay) tests.

## Plant-Parasitic Nematodes of Grape

Several plant-parasitic nematodes can be detrimental to vineyard productivity. In western Oregon, the ring nematode (*Mesocriconema xenoplax*) is the most commonly encountered plant-parasitic nematode. It was found in 85% of surveyed vineyards. Many of these vineyards had high population densities of the ring nematode, which may have had an impact on the establishment and growth of young vines. The ring nematode is a migratory ectoparasite that feeds on the roots of vines.

Another migratory ectoparasite commonly encountered in western and eastern Oregon is the dagger nematode (*Xiphinema americanum*). Direct feeding on grape roots by this pest may not result in direct damage to the plant, but damage can occur if it transmits tomato ringspot virus to the grapevines.

Another nematode of economic importance in Oregon vineyards is the root-knot nematode (*Meloidogyne hapla*). This nematode is more commonly found in vineyards in eastern Oregon. The root-knot nematode is a sedentary endoparasite that invades roots and causes them to gall, reducing the plant's ability to take up water and nutrients.

Other nematodes reported to be associated with grapevines in Oregon include root lesion (*Pratylenchus* spp.) and pin (*Paratylenchus* spp.).

Once a plant-parasitic nematode population is established in a vineyard it is very difficult to eliminate. Therefore, prevention is critical. Only planting stock certified free from plant-parasitic nematodes should be used. Care should be taken not to transport nematodes from vineyard to vineyard on dirty equipment. Prior to establishing a vineyard, soil samples should be collected and sent to a commercial nematode diagnostics laboratory to determine if plant-parasitic nematodes are present and, if so, at what density. In eastern Oregon the best time to sample for nematodes is in the fall, while in western Oregon *X. americanum* populations tend to be at their highest in the spring. The only time when broad-spectrum fumigants can be applied to manage plant-parasitic nematode populations is prior to establishing vines. Significant changes in fumigant labels were made during 2010 and 2011. Prior to fumigation, consult the EPA website for more information about buffer zones, fumigant management plants, and other important regulations: [http://epa.gov/pesticides/reregistration/soil\\_fumigants](http://epa.gov/pesticides/reregistration/soil_fumigants)

Rootstock selection is another key consideration prior to establishing a vineyard, if plant-parasitic nematodes are detected. Information about rootstocks resistant to nematodes found in Oregon grapevines is available only for the ring nematode. In research experiments, the rootstock 420A was the only rootstock that remained resistant to the ring nematode over time.

Once a vineyard is established there are few post-plant management practices that consistently and effectively reduce plant-parasitic nematode damage to established vines.

**Table 4. Control of Vertebrate Pests in Grapes**

Control method or product	Time of application	Remarks
<b>Birds (late summer, fall—during ripening)</b>		
<b>Netting</b>	Before grapes ripen	Place on each side of canopy or drape over canopy; support above vines on a frame. Remove just before harvest. Labor costs may be high. Net costs \$800/A or more. Add labor costs for installation and removal. Net life: 7-15 years. Nearly 100% effective if applied appropriately.
<b>Predators</b>	Before grapes ripen	Raptors have been used with limited efficacy in some vineyard sites. They take a long time to establish residence (nesting) in the vineyard and can be costly. Consider consulting a professional to use raptor perches.

Table 4. Control of Vertebrate Pests in Grapes

Control method or product	Time of application	Remarks
<b>Scare devices and hazing</b>	Before damage occurs	Place in vineyard: distress calls, exploder guns, cracker shells, foil, kites, eye spot balloons. The USDA-APHIS (Animal and Plant Health Inspection Service) can be a valuable resource for management of wildlife damage to agricultural crops. Contact a local or regional specialist for assistance: <a href="http://www.aphis.usda.gov/wildlife_damage/">http://www.aphis.usda.gov/wildlife_damage/</a>
<b>Shooting and other direct control</b>	Before grapes ripen	It's illegal to shoot migratory birds without a permit from the U.S. Fish and Wildlife Service. See comment above about APHIS.
<b>Deer (spring, fall)</b>		
<b>Repellents</b>		
Repel Deer-Away/Thiram (tetramethylthiram disulfide)	—	Spray on shoots browsed by deer. Repeat applications are necessary as new shoots grow. Most repellents require reapplication following precipitation.
Blood meal, human hair, soaps	—	Deer may become habituated to smells.
<b>Fences</b>		
• Electric (several strands, 6 to 8 ft high) • Woven wire (6 in woven wire to 7 ft high, topped with barbed wire)	—	Height of fence may need to be 8 feet or higher in areas where topography creates crossing opportunities.
<b>Ground squirrels</b>		
<b>Trapping</b>		
#110 Conibear trap	—	Don't use in areas frequented by pets or children.
<b>Gassing</b>		
Rotox AP or AT <sup>1</sup>		
The Giant Destroyer/sodium nitrate + sulfur + carbon Dexol/potassium nitrate	—	Close burrows in morning, reopen, place toxin in burrow, and reclose. Repeat daily until activity ceases.
<b>Poison baiting</b>		Place bait in runways and burrow openings. Bait may poison nontarget animals. Apply baits only in bait stations in areas inaccessible to pets and children. Refill stations daily until bait no longer is consumed. Bury or burn all carcasses. Restrict all grazing animals from pastures for at least 30 days after completing baiting operations.
Ramik Green/diaphacinone 0.005%	—	Check legal use dates: <a href="http://www.oregon.gov/ODA/PEST/">http://www.oregon.gov/ODA/PEST/</a>
Zinc phosphide 2% <sup>1</sup>	—	Check legal use dates: <a href="http://www.oregon.gov/ODA/PEST/">http://www.oregon.gov/ODA/PEST/</a>
ORCO Patrol Ground Squirrel Bait and other brands/chlorophacinone 0.0005%	—	—
zinc phosphide <sup>1</sup>	When voles are active	Check legal use dates <a href="http://www.oregon.gov/ODA/PEST/">http://www.oregon.gov/ODA/PEST/</a>
<b>Mountain beaver</b>		
<b>Trapping</b>		
#110 Conibear	Preferably before breeding in spring	Most trapping will occur October–February.
<b>Pocket gophers</b>		
<b>Trapping</b>		
Victor or Macabee, cinch trap	Autumn or spring	See footnote 3 on page 27

Table 4. Control of Vertebrate Pests in Grapes

Control method or product	Time of application	Remarks
<b>Poison baiting</b>		Apply in fresh burrow systems and check for reinvasion. Poisons are mixed with seeds and impregnated with wax. Place in main runways.
chlorophacinone	Late winter, early spring	—
diphacinone	Late winter, early spring	—
strychnine <sup>1,2</sup>	Late winter, early spring	—
zinc phosphide <sup>1</sup>	When voles are active	Check legal use dates <a href="http://www.oregon.gov/ODA/PEST/">http://www.oregon.gov/ODA/PEST/</a>
<b>Mechanical burrow baiting</b>		
1 oz strychnine <sup>1,2</sup> in steam-crushed oat or milo grains added to 10 lb grain (1 to 2 lb bait/A)	Late winter, early spring	Use burrow builder for large areas. <sup>3</sup> Build tunnels 6 to 10 inches deep in moist soil. Dispense bait every 5 to 10 feet in burrows 20 to 30 feet apart.
<b>Gassing</b>		Not recommended for sandy or dry soils. Two cartridges or small piles of pellets per tunnel. If you use gas cartridges, cover breathing holes of burrows.
The Giant Destroyer/sodium nitrate + sulfur + carbon	—	—
Detia Rotox AP (pellets) and AT (tablets)/57% aluminum phosphide <sup>1</sup>	—	—
<b>Propane burner</b>		
0.5 cup dusting sulfur per burrow	—	More effective than gassing. Ignite with propane burner. Avoid inhaling sulfur fumes. Seal all entrances to burrow. Soil should be damp.
<b>Rabbits</b>		
Fencing	—	Use a sturdy small mesh. Most effective when constructed to prevent under-digging. Extend fencing 2 feet above ground and 8 inches below ground.
Vine guards	—	—
<b>Repellents</b>		
Thiram (tetramethylthiram disulfide)	—	Spray on shoots browsed by rabbits. Repeat applications are necessary as new shoots grow.
<b>Voles (meadow mice)</b>		
<b>Hand baiting</b>		Place bait in runways and burrow openings. Bait may poison nontarget animals.
zinc phosphide <sup>1</sup>	When voles are active	Check legal use dates <a href="http://www.oregon.gov/ODA/PEST/">http://www.oregon.gov/ODA/PEST/</a>
<b>Mechanical burrow baiting</b>		
zinc phosphide <sup>1</sup>		Soil must be moist so that artificial runways, 12 to 14 inches deep, remain intact. Build burrows close to trunks on each side of the row.
<sup>1</sup> Restricted use. <sup>2</sup> Check with your farm consultant, farm co-op or local Extension agent for sources; registered for below-ground use only. <sup>3</sup> This publication lists chemicals as well as other methods of pest control. It's intended to serve as a supplement to the pest management chapters published in <i>Oregon Viticulture</i> (2003). These chapters have more complete descriptions of pests and more complete information on cultural methods of pest control. The book is available at: <a href="http://www.osubookstore.com">http://www.osubookstore.com</a>		

## Pest Management Strategies: Pre-Plant and Vineyard Establishment

Prior to planting a vineyard, the land needs to be managed for key pests to achieve successful plant growth in the first few years. We assume a vineyard has been selected based on appropriate suitability and has no limiting nematode populations.

The information in Table 5 (page 28) is meant to supplement other guides with basic vineyard establishment information on soil testing, fence

construction, and more. In this section, we highlight the herbicide products available for weed control during pre-plant and establishment. Other herbicide recommendations for bearing vineyards are listed in Table 2 (page 22).

Herbicide use is often contingent upon the age of the vineyard. Some products can only be used in non-bearing vineyards, or have restrictions with regard to timing and the first harvest year. Read product labels closely to ensure proper use of the product.

**Table 5. Weed Control Pre-Plant and in Establishment Years**

Weed control timing, herbicide materials and site of action group	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
<b>Pre-Planting (year 0)</b>		
Reglone <sup>22</sup> /diquat	24 to 32 oz	For use in non-bearing vineyards only. Apply to completely cover foliage of rapidly growing weeds. Add a nonionic surfactant.
Roundup and other products/glyphosate <sup>9</sup>	Consult label	Apply to weeds at least 10 days before planting the crop. Use highest rate on field bindweed. Rain within 6 hours after application may reduce effectiveness. Do not apply if weeds are under stress from drought, weather, or maturity.
Treflan/trifluralin <sup>3</sup>	0.5 to 1.0 lb ai	Apply pre-plant and incorporate immediately by cross-disking or rototilling. 12-hour reentry. Use lower rates on sandy soils or soil containing low organic matter levels.
<b>New plantings (years 1-3)</b>		
Basagran/bentazon <sup>6</sup>	0.75 to 1.0 lb ai	For use in non-bearing vineyards only. Provides post-emergence control of broadleaf weeds, Canada thistle, yellow nutsedge, and musk thistle either before or during nonbearing stages of vineyard establishment. Two treatments applied 7 to 10 days apart may be required for Canada thistle or yellow nutsedge. Temperatures below 55°F, drought, or rain within 8 hours will reduce activity. Add 2 to 4 pt/A of a crop oil concentrate to enhance activity (see label). Direct sprays toward actively growing weed foliage coinciding with weed size as described on the label. Do not apply within 1 year of anticipated harvest. Do not exceed 4 lb/A total per season.
Prism or Envoy/clethodim <sup>1</sup>	12 to 32 fl oz	For use in non-bearing vineyards only. 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 1 hour, applications of other pesticides, or cultivation. Do not apply more than 64 fl oz/A per season.
Rely/glufosinate <sup>10</sup>	0.75 to 1.25 lb ai	Apply to actively growing weeds as a directed spray or spot treatment. Green tissue or bark must be shielded from contact or injury will occur. Do not exceed 4.5 lb ai/A per season (12 months).

**Table 5. Weed Control Pre-Plant and in Establishment Years**

Weed control timing, herbicide materials and site of action group	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Roundup and other products/ glyphosate <sup>9</sup>	Consult label	Apply to actively growing weeds either as site preparation or in non-bearing crops 1 year before first harvest. Avoid contact with green vine foliage or suckers. Do not apply more than 12.8 pints product/A per year. Follow all precautions on label. To avoid weed resistance, rotate and mix weed control practices.
Fusilade DX/fluazifop <sup>1</sup>	Refer to label for rate based on grass species to be controlled, 0.25 to 0.375 lb ai/A (16 to 24 oz/A Fusilade)	Can now be applied to bearing grapes under supplemental label. Apply to actively growing grasses, or within 7 days after 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 year. Do not apply twice within 14 days. 50-day PHI.
Snapshot 2.5 TG/isoxaben + trifluralin <sup>3</sup>	100 to 200 lb product	Identify weeds and determine rate of application based on label. For use in non-bearing 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 using 0.5 inch of water or shallow cultivation before weeds begin to emerge. Follow label instructions for repeat treatments.
Gallery T&V 75/isoxaben	0.495 to 0.998 lb ai	Apply after harvest in fall until 6 months before the next harvest or immediately after cultivation to debris-free soil (165-day PHI). Now labeled for both bearing and non-bearing vineyards. Limited to two applications per year, up to 1.33 lb product/A per year. Activate with 0.5 inches 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.
Devrinol 50 DF/napropamide <sup>15</sup>	4 lb ai	Pre-emergent herbicide. Apply after planting to firm soil, before weeds germinate. Requires rain or irrigation the day of treatment to wet the soil 2 to 4 inches deep to reduce degradation by the sun and to activate the herbicide. Where convenient, shallow tillage improves activity. Avoid exposure of transplant roots contacting soil. Light-sensitive and can photo-decompose after 4 days. Low residual activity. Only one application can be made annually. 35-day PHI.
Surflan A.S. (oryzalin) <sup>3</sup>	2 to 6 lb ai	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 per year.



**Table 5. Weed Control Pre-Plant and in Establishment Years**

Weed control timing, herbicide materials and site of action group	Amount (ai or formulated) material/A	Remarks and minimum days from last application to harvest (PHI)
Goal 2XL/oxyfluorfen <sup>14</sup>	1 to 4 lb ai (2 to 8 quarts product)	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 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 post-emergence depending on rate of application and weed species.
Prowl or Pendulum/pendimethalin <sup>3</sup>	2 to 4 lb ai	For use in non-bearing vineyards only. Pre-emergent herbicide. Apply to newly planted grapes before buds swell and after soil settles around vines and cracks are gone. Spray directly on the soil surface in the vine row. Overhead irrigation or rain is required within 7 days for herbicide activation. Affects weeds as they germinate. Do not feed forage or graze livestock.
Poast/sethoxydim <sup>3</sup>	0.28 to 0.47 lb ai (1.5 to 2.5 quarts product)	Identify susceptible grasses and apply at optimum growth stage listed on label. Add 2 pints/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 pints/A per season. 50-day PHI.

## Vineyard Airblast Sprayer Calibration Worksheet

Sprayers must be calibrated at least once per season. This is vital to ensure there is adequate product delivered in applications to the vineyard. Sprayer calibration should be conducted every time there is a significant difference in the desired spray volume (gal/A). For example, early-season applications cover a small canopy and therefore require a lower spray volume for thorough coverage, compared with later applications to a full canopy. This worksheet is intended to take you through the calibration process.

### 1. Determine tractor speed.

Establish a preferred operating speed in a preset gear. Note gear and throttle settings. Fill spray tank half full with water for a speed test. Insert numbers into the equation below then calculate the result.

- A. Measure the length of a vineyard row selected for the test run. (A) \_\_\_\_\_ ft  
 B. Determine the time required to travel the row at the preferred speed. (B) \_\_\_\_\_ sec

$$[(A) \text{ _____ ft} \times 60 \text{ sec/min}] \div [(B) \text{ _____ sec}] = (C) \text{ _____ ft/min preferred tractor speed}$$

### 2. Check spray pressure and spray pattern.

Fill the tank with water. Engage the fan and turn on the manifold, then make a test run in your vineyard at your preferred operating speed. Before you start, observe the spray pattern and turn off nozzles that do not spray the plant canopy. Record the pressure gauge reading while spraying. Visually check the accuracy of your spray pattern and the completeness of your spray coverage by putting water-sensitive paper in the grapevine canopy. Poor or excessive coverage requires adjustment of tractor speed, spray pressure, or nozzle size. If speed or pressure is subsequently adjusted, record the new figures in the appropriate blanks below.

**Spray pressure = (D) \_\_\_\_\_ psi**

### 3. Determine required total nozzle output in gal/min (gpm).

Fill in the following known quantities, insert into the equation below, and calculate the result.

- |                  |   |
|------------------|---|
| (C) _____ ft/min | <b>Preferred tractor speed</b> , measured above             |
| (E) _____ gal/A  | <b>Desired spray volume per acre</b> for thorough coverage. |
|                  | See pesticide label for instructions for use.               |
|                  | Consider differences in canopy size through the season.     |
| (F) _____ ft     | <b>Distance between rows</b>                                |

Calculate required total nozzle output in gal/min:

$$[(C) \text{ _____ ft/min} \times (E) \text{ _____ gal/A} \times (F) \text{ _____ ft}] \div 43,560 \text{ sq ft/A} = (G) \text{ _____ gpm total required nozzle output}$$

### 4. Do you currently have the correct size nozzles in your sprayer?

Determine the expected output of each nozzle at your selected spray pressure (D) from the manufacturer's catalog. Enter output in the spaces below. Enter a zero for nozzles turned off for the upcoming application.

#### Left side

Nozzle #1 \_\_\_\_\_ gal/min  
 Nozzle #2 \_\_\_\_\_ gal/min  
 Nozzle #3 \_\_\_\_\_ gal/min  
 Nozzle #4 \_\_\_\_\_ gal/min  
 Nozzle #5 \_\_\_\_\_ gal/min  
 Nozzle #6 \_\_\_\_\_ gal/min  
 Nozzle #7 \_\_\_\_\_ gal/min

#### Right side

Nozzle #1 \_\_\_\_\_ gal/min  
 Nozzle #2 \_\_\_\_\_ gal/min  
 Nozzle #3 \_\_\_\_\_ gal/min  
 Nozzle #4 \_\_\_\_\_ gal/min  
 Nozzle #5 \_\_\_\_\_ gal/min  
 Nozzle #6 \_\_\_\_\_ gal/min  
 Nozzle #7 \_\_\_\_\_ gal/min

**Left side total \_\_\_\_\_ gal/min + Right side total \_\_\_\_\_ gal/min = (H) \_\_\_\_\_ gpm total expected output**

Compare the total expected output with the total required output.

(G) \_\_\_\_\_ gpm    **Total required output**

(H) \_\_\_\_\_ gpm    **Total expected output**

If the difference between expected and required output is greater than 10%, replace with appropriate disc-core nozzle combinations that will provide the required output at your operating pressure. Keep in mind that all nozzles do not need to have equal output. You may want to have higher output nozzles pointing at the fruit zone of the vines. Remember that total expected output still must equal total required output, so use lower output nozzles elsewhere on the boom. Repeat this procedure on the other side of the sprayer.

### 5. Is your sprayer delivering the desired spray volume?

With the correct discs and cores determined and installed, fill the spray tank with water. Park the sprayer on level ground and mark the water level on the spray tank's sight gauge. Using your preferred tractor speed with the airblast fan engaged and both sides spraying, make a trial application-run down your vineyard test row. Return to the same place and position where you marked the sprayer water level. Using a calibrated 5-gallon container, measure the amount of water required to refill the tank to your mark on the sight gauge. Record as test gallons applied (I).

Fill in the following known quantities, insert into the equation below, and calculate your result.

(A) \_\_\_\_\_ ft    **Length of vineyard test row, recorded above**

(F) \_\_\_\_\_ ft    **Distance between rows, recorded above**

(I) \_\_\_\_\_ gal    **Test gallons applied**

$[43,560 \text{ sq ft} \times (I) \text{ _____ gal}] \div [(F) \text{ _____ ft} \times (A) \text{ _____ ft}] = (J) \text{ _____ gal/A actual spray volume}$

### 6. Compare your actual spray volume with your desired spray volume.

**Actual spray volume:** (J) \_\_\_\_\_ gal/A

**Desired spray volume:** (E) \_\_\_\_\_ gal/A

If the difference is within 10%, the sprayer is properly calibrated. If actual spray volume exceeds desired spray volume by more than 10%, nozzles may be worn and need replacement. Change disc and core accordingly for each nozzle and repeat step 5. If actual spray volume is less than desired spray volume, double check calculations, repeat steps 4, 5, and 6, and replace discs and cores if necessary.

### 7. Prepare the spray mixture.

**Actual spray volume (gal/A), recorded above:** (J) \_\_\_\_\_ gal/A

**Total volume of spray mixture desired:** (K) \_\_\_\_\_ gal

**Pesticide application rate, quantity per acre from the label:** (L) \_\_\_\_\_ (lb, oz, gal, etc.)/A

$[(K) \text{ _____ gal total volume}] \div [(J) \text{ _____ gal/A}] = (M) \text{ _____ acres treated} \times (L) \text{ _____} = \text{quantity of pesticide needed in spray mixture}$

## Pest Management Resources

### OSU Extension Pest Management Guides & Bulletins

#### Phylloxera

**EC 1463-E—Grape Phylloxera: Biology and Management in the Pacific Northwest**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19539/ec1463-e.pdf>

#### Mealybug & Grapevine Leafroll Virus

**EM 8985—Field Monitoring for Grapevine Leafroll Virus and Mealybug in Pacific Northwest Vineyards**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/12260/em8985.pdf>

**EM 8990—Grapevine Leafroll Virus and Mealybug Prevention and Management in Oregon Vineyards**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/13067/em8990.pdf>

**EM 8998—Trapping and Identifying Mealybugs in Oregon Vineyards**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/13751/em8998.pdf>

#### Spotted Wing Drosophila

**EM 8991—A new pest attacking healthy ripening fruit in Oregon: Spotted wing Drosophila**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/13090/em8991.pdf>

**EM 9021—Recognize fruit damage from Spotted Wing Drosophila**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19525/em9021.pdf>

#### Diagnosing poor vine and shoot growth

**EM 8975-E—Grapevine Growth Distortions: A Guide to Identifying Symptoms**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20598/em8975-e.pdf>

#### Pest management handbooks

A number of useful pest management handbooks are available online, and updated annually. They can be ordered from OSU Extension & Experiment Station Communications (e-mail: [puborders@oregonstate.edu](mailto:puborders@oregonstate.edu); phone: 541-737-2513; Web: <http://extension.oregonstate.edu/catalog/>)

**Pacific Northwest Plant Disease Management Handbook**

<http://pnwhandbooks.org/plantdisease/>

Pacific Northwest Insect Management Handbook  
<http://pnwhandbooks.org/insect/>

Pacific Northwest Weed Management Handbook  
<http://pnwhandbooks.org/weed/>

**Note:** All chemicals marked with (O) in the Pacific Northwest Plant Disease Management Handbook are allowed products listed by the Organic Materials Review Institute (OMRI) and/or the USDA Organic Program. The listed cultural and biological management tactics are also organically acceptable.

#### 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>

**How to Reduce Bee Poisoning From Pesticides, Pacific Northwest Extension Publication PNW 591:**

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20772/pnw591.pdf>

**Natural Enemies Handbook: An Illustrated Guide to Biological Pest Control, ANR Publication 3386:**

[http://www.ipm.ucdavis.edu/IPMPROJECT/ADS/manual\\_naturalenemies.html](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 the following online databases for information. Product labels can also be downloaded on many of the following sites:

**Oregon Department of Agriculture, Pesticide Division**

<http://www.oregon.gov/ODA/PEST/>

**Search for pesticides registered in Oregon**

[http://oda.state.or.us/dbs/pest\\_productsL2K/search.lasso](http://oda.state.or.us/dbs/pest_productsL2K/search.lasso)

**PICOL—Pesticide Information Center Online**

<http://picol.cahe.wsu.edu/LabelTolerance.html>

**CDMS—Crop Data Management Systems**

<http://www.cdms.net/LabelsMsds/LMDefault.aspx>

**Agrian Label Look Up**

<http://www.agrian.com/>

## Organic, Sustainable, and Integrated Production Resources

### Demeter Association

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

**Mailing address**

Demeter Association, Inc.  
P.O. Box 1390  
Philomath, OR 97370

**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. However, certain practices are unique to biodynamic agriculture. For technical guidelines and standards visit: <http://demeter-usa.org/files/DemeterFarmStandardsm1.pdf>

### Food Alliance

**Web:** <http://www.foodalliance.org>

**E-mail:** [info@foodalliance.org](mailto:info@foodalliance.org)

**Mailing address:**

Food Alliance  
1829 NE Alberta, Suite 5  
Portland, OR 97211

**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 (IOBC)

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

**E-mail:** Check website for officer contact information.

**Mailing address:** Check website for contact information.

**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 (LIVE)

**Web:** <http://liveinc.org>

**E-mail:** [info@liveinc.org](mailto:info@liveinc.org)

**Phone:** 503-584-7274

**Mailing address:**

LIVE  
P.O. Box 5185  
Salem, OR 97304

**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.

### Grape production

**OSU Viticulture & Enology Program**  
<http://wine.oregonstate.edu>

**Northwest Berry & Grape Information Network**  
<http://berrygrape.org>



**Oregon Viticulture** serves as a good introduction to vineyard production in Oregon. This book can be purchased from the Oregon State University Bookstore at <http://osubeaverstore.com/GeneralBooks.asp>

**eViticulture** is an online resource developed by the national Viticulture Extension Working Group. It provides scientifically based articles for all aspects of vineyard production: <http://www.extension.org/grapes>

## National Organic Program (NOP)

### Online standards:

<http://www.ams.usda.gov/nop/indexIE.htm>

Go to Subpart G Administrative, page 246, The National List of Allowed and Prohibitive Substances <http://www.ams.usda.gov/nop/NOP/standards/ListReg.html> "Description of Regulations"

**E-mail:** [NOPAQSS@usda.gov](mailto:NOPAQSS@usda.gov)

### Mailing address:

National Organic Program  
Room 4008-South Building  
1400 Independence Avenue, SW  
Washington, DC 20250-0020

**Purpose:** Subpart G contains criteria for determining which substances and ingredients are allowed or prohibited in products to be sold, labeled, or represented as "organic" or "made with organic (specified ingredients or food group(s))."

**Evaluation criteria:** The National List identifies specific substances that may or may not be used in organic production and handling operations. 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 (NOSB).

## Oregon Tilth

**Web:** <http://www.tilth.org>

**E-mail:** [organic@tilth.org](mailto:organic@tilth.org)

### Mailing address:

Oregon Tilth, Main Office  
260 SW Madison Ave, Ste 106  
Corvallis, OR 97333  
Phone: 503.378.0690  
Fax: 541-753-4924

**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:** OTCO 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 (NOP) final rule and Organic Production Act of 1990.

## Organic Material Review Institute (OMRI)

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

To view organic materials list online, go to "OMRI Products List". The list can be purchased or viewed online. For direct access to the online searchable list, go to: [http://omri.org/OMRI\\_datatable.php](http://omri.org/OMRI_datatable.php)

**E-mail:** [info@omri.org](mailto:info@omri.org)

### Mailing address:

OMRI  
P.O. Box 11558  
Eugene, OR 97440

**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:** <http://www.salmonsafe.org>

**E-mail:** [info@salmonsafe.org](mailto:info@salmonsafe.org)

### Mailing address:

Salmon-Safe, Inc.  
805 S.E. 32nd Ave.  
Portland, OR 97214

**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.

## Basic Elements of Safe Pesticide Use

- **Always read the 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 strict attention to warnings and cautions printed 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 applying 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 3 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 he or she 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.

**Oregon Poison Center**  
The Oregon Health and  
Science University  
Room CB 550  
3181 S.W. Sam Jackson Park Road  
Portland, OR 97201  
**Phone:** 503-494-8600  
**Call Toll Free:** 800-222-1222

**If a person has  
collapsed or has  
stopped breathing,  
Dial 911**

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