2015 LIVE Key Pest Index

Key pests are any agricultural pests that cause region-wide and significant economic damage, necessitating annual monitoring and treatment.

Region 1 refers to viticultural areas with a cooler, wetter growing season. This includes areas west of the Cascades and above the North Umpqua River in Oregon—e.g., the northern Umpqua Valley, the Willamette Valley, the western Columbia Gorge, and Puget Sound.

Region 2 refers to areas with a warmer, drier growing season. This includes areas east of the Cascades and below the North Umpqua in Oregon—e.g., the central and southern Umpqua Valley, the Rogue Valley, the Columbia Valley, and the Snake River Valley.

The **Green List** is a compilation of management options for vineyards in the Pacific Northwest, supporting integrated pest management (IPM) and compliance with LIVE standards. LIVE standards adapt IPM principles to Northwest winegrowing regions and weigh impacts to humans and the environment.

The **Yellow List** is LIVE's reference list of accepted pesticide controls, permitted only for key pest occurrences not adequately managed with Green List measures.

These documents reflect the work of university researchers and experienced vineyard managers, but each vineyard is unique and LIVE does not guarantee the efficacy of any method. Contact admin@livecertified.org with questions.

KEY PEST	REGION 1	REGION 2	GREEN LIST	YELLOW LIST
Botrytis cinerea	☁	☀	✓	✓
Powdery Mildew	☁	☀	✓	✓
Weeds	☁	☀	✓	✓
Rust Mite	☁	☀	✓	✓
Blister Mite	☁	☀	✓	✓
Bud Mite		☀	✓	
Spider Mite (Pacific, Two-spotted, Willamette)		☀	✓	✓
Cutworm		☀	✓	✓
Thrips		☀	✓	✓
Leafhopper		☀	✓	✓
Mealybug		☀	✓	✓
Lecanium Scale Insects		☀	✓	✓
Phylloxera	☁		✓	
Voles	☁	☀	✓	✓

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General Management Practices

Planning and planting vineyards

- When planting a new vineyard, the grower should prepare a written vineyard development and risk assessment plan
- Disease tolerant clones should be considered
- Existing hedges and grass strips should be retained
- A minimum of 5% (ideally greater than 15%) of the farm managed as ecological infrastructure
- Patches of native/natural trees, shrubs and grasses as appropriate for the area should be retained or planted
- A wind erosion mitigation plan must be developed and executed

Fertilization

- Fertilizer applications must based on soil and tissue analysis
- If synthetic nitrogen is applied, it is only done so between March 1st and October 30th
- Nitrogen input is reduced to 10lbs per ton of fruit harvested
- Green manure and composting should be used to improve fertility and soil humus
- The amount of phosphorus, potassium, and magnesium applied should not exceed 35lbs. of P205, 90lbs of K20, and 45lbs. of Mg per acre, unless ratios between phosphorus, potassium, magnesium and calcium are not in balance and need to be corrected

Soil, habitat, and canopy management

- Mechanical cultivation or mulching is used for in-row weed control
- Maintain a balanced open canopy with low leaf layer (1.5 leaf layer or less)
- Maintain a minimum of ten different botanical species (15+ optimum)
- Irrigation schedule is based on monitored sensor systems

Key beneficials

If a chemical control method is needed, the most selective one should be considered first, to protect populations of beneficial insects.

- **Predatory mites** (Typhlodromus pyri) - a generalist predator and the most beneficial mite in this region that seeks refuge in wild blackberry near vineyards in Western Oregon and Washington. Maintain or establish populations and restrict use of products that are toxic to predatory mites.
- **Parasitoid/Predatory Complex** - an insect whose immature stages develop on or inside a single host eventually killing that host
- **Ladybeetle** (Cryptolaemus montrouzieri) for mealybug
- **Predatory wasps** (including Anagrus spp for leafhopper) - Encourage populations with overwintering sites.
- **Lacewings** (Chrysoperla spp) for mealybug and general

REGION 1

- Phylloxera resistant rootstocks are strongly encouraged when replanting
- Total green cover in winter months
- Green cover in alleyways/restrict summer competition in vine rows
- Alternating mowing regime applied and permanent flower supply provided
- Limit number of shoot per foot (3 to 6 shoots) and maintain an open low density canopy

REGION 2

- High wind is a factor in the Columbia Valley AVA. Wind erosion is a serious concern and growers must use practices that prevent soil loss.
- Strict adherence to virus and insect quarantines is required and the use of grafted planting material (American rootstock) against Phylloxera or nematodes should be considered if the climate allows.
- Green cover of alleyways maintained in winter months. Green or dried vegetation maintained throughout rest of season
- Alternating mowing regime applied
- Mechanical cultivation or mulching for in-row weed control

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Botrytis cinerea

REGION 1 | REGION 2 | YELLOW LIST

Botrytris cinerea is a fungus that causes Botrytis bunch rot. Non-chemical control includes preventing excess vigor and maintaining an open canopy. See below detail.

This disease is common on the west side of the Cascades but a sporadic problem in the arid viticulture regions of the PNW.

Many fungal and bacterial organisms, of which Botrytis cinerea is the most important, can infect grapes and result in a bunch rot. B. cinerea has a large host range and grows and sporulates on most of them. The fungus overwinters and oversummers as black sclerotia on old cluster stems, canes, and mummified grapes. Spores spread by wind. Young, succulent shoots can be infected in spring, especially if injured by hail.

Flower parts frequently are infected and can serve as a source of the fungus within the developing bunch. Young shoots and leaves infected in spring may develop brown, water-soaked areas. These areas generally girdle the shoot, causing it to wilt and die back. The characteristic gray moldy growth may or may not be present.

Generally, rotted berries appear in late summer and autumn as small, brown spots on maturing berries. The berry skin may slip off easily when rubbed. Later, characteristic tufts of gray fungal growth appear on the surface of infected berries. Often, rotted berries are near the center of the bunch. The rot then spreads quickly and may encompass most of the bunch. Other organisms may invade the berries later, producing a large variety of colors, smells, and tastes. Occasionally, immature berries may develop a soft brown rot early in summer.

Wet weather favors infection and disease development, especially near harvest when canopies are dense and berries accumulate sugar. The fungus can quickly spread from berry to berry within ripening bunches and can develop readily on wounded or split berries.

Botrytis cinerea will infect grape berries from 53 to 86°F with as little as 4 hours of berry wetness. The number of berries infected; however, rises as hours of berry wetness increases. A forecasting program assigns a medium bunch rot risk at 60°F with 15 hours of berry wetness but a high risk if berries have been wet 17.5 hours.

Fungicides are to be applied after a medium risk during the growing season. This program has not been evaluated in the Pacific Northwest.

Cabernet Sauvignon is the least susceptible wine grape grown in Oregon. Gewurtztraminer is less susceptible than Chardonnay, Pinot Noir, and Riesling. Bunches that are more tight or compact are at higher risk of the disease.

Under certain environmental conditions, white grapes infected solely by B. cinerea may develop a special rot known as noble rot. These grapes are used to produce a very sweet wine.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Prevent excess vigor • Maintain open canopy, removing east side leaves after shatter	• Monitor temperature and hours of berry wetness to assess risk	• Reference the Yellow List for accepted fungicidal controls. • Avoid consecutive use of fungicides from the same class (except for sulfur/biorational controls). • Pyraclostrobin is scheduled to be removed from the Yellow List after 2015.

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Powdery Mildew

REGION 1 | REGION 2 | YELLOW LIST

Powdery mildew is a fungal disease. Non-chemical control includes preventing excess vigor, timely suckering, and maintaining an open canopy. Rotate controls by mode of action for resistance management. See below for detail.

Erysiphe necator (formerly Uncinula necator) is a fungal disease common to all areas of the Pacific Northwest. The disease tends to be more severe on the west side of the Cascades but is a chronic problem in arid districts where over-the-canopy irrigation is used for early-season frost protection or watering.

Powdery mildew can attack all aboveground plant parts. Colonies are more easily detected in full sunlight with the sun over your shoulder. In early stages, whitish or grayish patches are on leaves and, if severe, ultimately cover both surfaces. Later in the season, the mildew darkens and is peppered with minute black dots (chasmothecia). On fruit, the fungus at first may look grayish or whitish but later has a brownish, russeted appearance. Infected fruit cracks and drops from the cluster. Even blossoms sometimes can be infected, causing them to dry up or fail to set fruit. When green shoots and canes are infected, the affected tissues appear dark brown to black in feathery patches. Patches later appear reddish brown on the surface of dormant canes. Flag shoots are difficult to detect. Some young shoots may be covered with a large white mass of threads or mycelium. Others may have only a hint of thin threads on the shoot. Shoots generally are delayed in bud break and appear stunted and somewhat yellowed compared to healthy shoots.

Chasmothecia on the exfoliating bark release sexual spores during rainy weather above 50°F from budbreak through bloom. This weather also favors infection that results in individual powdery spots, called colonies, on the surface of leaves growing close to the bark. Many asexual spores (conidia) are produced on the surface of powdery mildew colonies. Temperatures over 85°F and/or sunlight inhibit conidia germination. Free water from rain and/or irrigation can wash conidia off of a colony, burst conidia, or result in poor or abnormal germination of the conidia.

Grape berries are highly susceptible from the time calyptras (hoods) fall off to shortly after bloom when berries are about pea size (BBCH 73 to 75). Susceptibility of the fruit drops rapidly after that time. Grapes do not get new infections on fruit after 8% Brix but can still have sporulation up to 15% Brix. Leaves and canes, however, can be infected up to and past harvest.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Prevent excess vigor.	• Monitor temperature, growth stage, and Brix to assess risk.	• Reference the Yellow List for accepted fungicidal controls.
• Maintain open canopy and practice timely suckering.		• Avoid consecutive use of fungicides from the same class and limit applications from the same chemical family to 3 per season (except for sulfur/biorationals).
		• **For sulfur in Region 1**: do not exceed 5 lb/acre per treatment of ACTIVE INGREDIENT and a total of 35 lb/acre per year for powdery mildew. **For sulfur in Region 2**: do not exceed 4 lb/acre per treatment of ACTIVE INGREDIENT and a total of 24 lb/acre per year for powdery mildew. Overuse of sulfur is harmful to beneficial mites. See mite sections for additional sulfur application restrictions.

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Weeds

REGION 1 | REGION 2 | YELLOW LIST

Non-chemical control includes planting competitive cover crop, mechanical cultivation, and in-row mulch. A weed survey is an important monitoring tool.

LIVE provides a weed survey template as a monitoring tool, and a completed survey is required for the use of pre-emergent herbicides in order to confirm that the herbicide's target weed(s) are present in the vineyard.

Some common vineyard weeds:
Bittersweet Nightshade (Solanum dulcamara)
Blue weed (Echium vulgare)
Broadleaf dock (Rumex crispus)
Canada Thistle (Cirsium arvense)
Common Evening primrose (Oenothera biennis)
Common Groundsel (Senecio vulgaris)
Common knotweed (Polygonum aviculare)
Common mallow (Malva neglecta)
Common plantain (Plantago major)
Common purslane (Portulaca oleracea)
Crab Grass (Digitaria sanguinalis)
Field Morning Glory (Convolvulus arvensis)
Field Mustard (Brassica campestris)
Green Bristlegrass (Setaria viridis)
Henbane (Hyoscyamus niger)
Himalayan Blackberry (Rubus procerus)
Kentucky Bluegrass (Poa pratensis)
Lambs Quarters (Chenopodium album)
Poison Oak (Rhus diversiloba)
Prickly Lettuce (Lactuca serriola)
Prickly Sow-thisle (Sonchus asper)
Queen Anne's Lace (Daucus carota)
Red Root, Pig weed (Amaranthus retroflexus)
Reed Canary Grass (Phalaris arundinacea)
Scotch Broom (Cytisus scoparius)
Shepherds purse (Capsella bursa-pastoris)
St John's-wort (Hypericum perforatum)
Watsons Willow-herb (Epilobium watsonii)

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Plant competitive cover crop. • Mechanical cultivation. • In-row mulch.	• Identify and document specific weeds.	• Reference the Yellow List for accepted herbicidal controls. • Prior to use of accepted pre-emergent herbicides, complete a weed survey. • Diquat, Paraquat, and herbicides with residual properties greater than one growing season are prohibited. • Use of chemical herbicides on more than 50% of the vineyard floor is prohibited.

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Rust Mite

REGION 1 | REGION 2 | YELLOW LIST

Grape rust mite and other eriophyid mites are microscopic pests that overwinter in vineyards—careful monitoring is essential, and dormant buds can be examined for mite presence. See below for detail.

Grape rust mites are tiny (0.1 to 0.2 mm long), wormlike and white, much like the bud and erineum mite. They have two pair of legs near the head end. These mites are hard to see without magnification (45X or higher under a microscope), and the damage they cause is usually the first indication of their presence.

Grape rust mites cause damage to newly growing tissues in spring. Shortly after bud break, rust mite damaged leaves are crinkled and deformed, shoots will have stunted growth, and scarring may be found on the stem tissues. During summer, rust mites are found on leaves and can cause stippling of leaves. Feeding of high populations of rust mites on leaf surfaces late in summer and early fall lead to a blackening or bronzing of leaves.

Grape rust mites overwinter as adult females under the bark of the vine, in crevices and between the outer bud scales and bud tissues, and they migrate from these areas in early spring to developing shoots. Mites may congregate and feed on young susceptible shoots, then move on to opening foliage where they continue feeding during summer. Unlike most other mite species, grape rust mites feed on the top and bottom surfaces of leaves. Feeding on epidermal tissue of leaf surfaces results in stippling of the leaf during spring and summer, and they may cause visual discoloration of leaves that begins as dark-green to black and become a bronze or brown color during later summer when leaf populations are high. Stem tissues or leaves can be collected and observed for rust mite presence in spring and summer. Scout for grape rust mite populations during summer by looking for leaf stippling (early- to mid-summer) or leaf discoloration. Scouting during the late dormant season involves collecting dormant 1-year old canes to examine buds for mite presence before pruning ensues. Also collect loose bark from the trunk of the vine.

To see images of the grape rust mite, see Grape Rust Mite on eViticulture.org: http://www.extension.org/pages/33107/grape-rust-mite.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote predatory mite populations.	• Monitor throughout the year, including the dormant season. • Confirm presence from previous growing season or dormant buds of current growing season. • Many occurrences of eriophyid mites do not constitute economic risk, or require chemical control..	• Reference the Yellow List for accepted acaracidal controls. • For sulfur, apply a maximum of 5 lbs of actual sulfur at wooly bud and 5 lbs ten days later • Lime sulfur limited to one application at 2.5 lb/acre. If applied, micronized sulfur allowance is not available.

See **Blister Mite** on next page

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Blister Mite

REGION 1 | REGION 2 | YELLOW LIST

Blister mite and other eriophyid mites are microscopic pests that overwinter in vineyards—careful monitoring is essential, and dormant buds can be examined for mite presence. See below for detail.

Grape erineum/blister mite is microscopic, wormlike, and white-yellow in color. It overwinters between outer bud scales and bud tissue and feeds on leaves during spring and summer. The upper leaf surface becomes blistered, and the lower leaf surface of the blister appears hairy and white, almost resembling fungal growth. The lower leaf surface turns from a white color early in the season and progresses to yellow or brown later in the season. In severe cases, these mites may infest clusters in early spring.

Colonies of mites live in blisters (erinea) formed by their feeding on lower leaf surfaces. The blisters are comprised of masses of enlarged leaf hairs. These blisters protect mites from natural enemies and direct contact of pesticide sprays. As the population increases, some move to new areas or other leaves and form new erinea. From mid-August until leaf drop, there is a movement from the erinea back to overwintering sites beneath the bud scales.

It is common for erineum mites to be found sporadically throughout western Oregon vineyards in any given year. In recent years, there has been an increase in erineum mite presence in vineyards where there has been reduced sulfur use. This rarely leads to economic problems or crop losses.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote predatory mite and beetle populations.	• Monitor throughout the year, including the dormant season. • Confirm presence from previous growing season or dormant buds of current growing season. • Many occurrences of eriophyid mites do not constitute economic risk, or require chemical control..	• Reference the Yellow List for accepted acaracidal controls. • For sulfur, apply a maximum of 5 lbs of actual sulfur at wooly bud and 5 lbs ten days later • Lime sulfur limited to one application at 2.5 lb/acre. If applied, micronized sulfur allowance is not available.

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Bud Mite

REGION 2

Bud mite and other eriophyid mites are microscopic pests that overwinter in vineyards—careful monitoring is essential, and dormant buds can be examined for mite presence. See below for detail.

Grape bud mites are tiny (0.1 to 0.2 mm long), wormlike, and whitish yellow with two pairs of legs near the head. They can only be seen under magnification (45x or higher on a microscope), and the damage they cause is usually the first indication of their presence.

The grape bud mite resides within the bud and causes damage by feeding on the stem, leaf and flower primordia within the bud. In spring, damaged buds may be delayed and only weak shoots may grow, if any at all from damaged buds. Vines infested with bud mites may exhibit erratic budbreak, stunted shoots, malformed basal leaves and have few flower clusters that may consist of only a few berries. Stunted shoots may have arrested development and fail to grow beyond a few inches. Damage is most visible shortly after budbreak and until shoots are less than 6 inches in length. Symptoms observed from mite feeding should not be confused with symptoms of nutrient deficiency (boron or zinc), low reserve carbohydrates, herbicide damage, frost, or thrips damage. There are distinct differences between bud mite-related damage and other factors.

Grape bud mites overwinter as adults inside buds where they feed on bud tissues and may kill the overwintering bud. When buds begin to swell in spring, mites migrate to newly developing tissues where they feed and lay eggs. Eggs hatch within 5 to 10 days and develop into adults within 14 days. Bud mites move to the newly forming buds in the axils of the leaf petiole where they reside until budbreak the following year. During the next growing season, once growth commences, mites residing in the inner scales are distributed along the shoot length as the shoot develops. Those mites in the outer scales remain at the base of the shoot.

Rust mites may be found in buds, particularly at the outer bud scales while bud mites may be in the inner portion of the bud. The two mites look similar upon visual inspection. If high populations are present in dormant buds, damage may have already been done, and spring control will reduce populations of bud mites for future years.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote predatory mite and beetle populations.	• Monitor throughout the year, including the dormant season. • Confirm presence from previous growing season or dormant buds of current growing season. • Many occurrences of eriophyid mites do not constitute economic risk, or require chemical control..	• LIVE does not have chemical controls listed for this pest.

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Spider Mite

REGION 2 YELLOW LIST

Spider mites are microscopic pests that overwinter in vineyards. Non-chemical control includes promotion of vine health and predatory mites, and dust abatement. Careful monitoring is essential. ***Listed for Region 2 only****. See following description for detail.*

Adults are about 0.02 inch long. They have eight legs and an oval body. Eggs are spherical and translucent white when first laid. Newly hatched larvae are six-legged and go through two nymphal stages before reaching adulthood.

Spider mites damage grape leaves by puncturing cells and sucking out the contents. This produces small yellow-white spots on the upper leaf surface. In heavy infestations, the spots coalesce and the leaf turns yellow or reddish-bronze. In general, spider mites are not consistently a major problem on Pacific Northwest grapes. Whenever a problem does occur, it invariably can be traced to use of broad-spectrum insecticides and/or environmental conditions conducive to mite outbreaks (e.g., hot, dry, and dusty conditions).

Spider mites overwinter as fertilized females under bark or in soil debris. They move to young foliage when buds break in spring and produce many generations from spring to autumn. Females can lay up to 10 eggs per day and more than 200 during their lifetime. Egg-to-adult development can take 7 to 10 days during summer. They thrive under hot, dry conditions. Large colonies of mites produce webbing. Dispersal occurs mainly through wind transport.

Thresholds have not yet been established, but economic damage is unlikely at levels below 15 to 20 per leaf. Treatment thresholds must always consider the presence of predatory mites, which are major biological control agents.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote populations of natural enemies with low/"soft" chemical inputs.	• Many occurrences of spider mites do not constitute economic risk, or require chemical control..	• Reference the Yellow List for accepted acaracidal controls.
• Use water or vineyard floor vegetation to control dust.	• Economic damage unlikely at levels below 15-20 per leaf.	

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Cutworm

REGION 2 YELLOW LIST

Cutworms are caterpillars and identification is important. Most damage is caused by climbing cutworms. Non-chemical control includes parasitic wasps and predatory insects, and cultivation timing. ***Listed for Region 2 only****. See below for detail.*

Adults are dark gray moths about 1 inch long, and wingspan is about 1.5 inches. Caterpillars of these moths (cutworms) grow to about 1.5 inches long and are generally a dull gray-brown. Spotted cutworms have a row of dark, elongated triangular markings on each side of the upper body surface.

Cutworms injure grapes primarily in early spring at or shortly after bud break when they feed on developing buds and emerging young shoots. When primary buds/shoots are destroyed, secondary buds may emerge but fruitfulness of secondary shoots varies according to variety and is often lower than primary shoots leading to reduced yields.

The spotted cutworm overwinters in the soil or under debris as a partially grown second or third instar. Cutworms begin feeding on winter annual weeds during warm periods in February to March. By budbreak, they are nearly full grown. They remain under cover during the day (in cracks in the soil, plant debris, or under rough bark on the trunk), and climb vines at night to feed on buds and shoots. Not all cutworm species in vineyards will climb grapevines if broad-leaved weeds are available; many will stay on the vineyard floor. Recent research indicates that most damage to grapevine buds is caused by the two climbing cutworm species, Abagrotis orbis and Agrotis vetusta. Mature larvae return to the soil and pupate; the pupal stage lasts 7 to 10 days. Moths emerge from the soil in May and June. There are one or more generations per year, but only the overwintering cutworm population causes damage to grapevines.

Sampling for cutworms is difficult, and control decisions usually are based on levels of bud injury. Cutworm infestations usually are localized within vineyards and often occur in the same places each year.Commence monitoring during bud swell for the presence of bud feeding/injury by cutworms. Concentrate on areas with a history of cutworm damage. Randomly select 20 locations to sample. Check three vines within each location for buds damaged by cutworms (total of 60 vines). Treatment is justified when about 10 to 15% of buds in susceptible areas are damaged. Treatment of an entire vineyard is rarely needed as damage is often localized and limited in size. Continue monitoring until average shoot growth has reached 6 inches. If the population is not causing damage before this growth stage, foliar development will be sufficient to ensure production.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Cultivation may reduce cutworm populations. • Maintain cover crop for alternate host species.	• Monitor vineyard for cutworms feeding on buds	• Reference the Yellow List for accepted insecticidal controls. • Maintenance and monitoring of untreated control areas is required. • Pyrethroid sprays on vine canopy and strip spray are prohibited.

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Thrips

REGION 2 YELLOW LIST

Thrips are small insects present in vineyards as wingless nymphs and winged adults, with some natural predators. Not all occurrences constitute economic risk—damage can be minor and cosmetic. ***Listed for Region 2 only****. See below for detail.*

Thrips commonly found on grapes are approximately 0.04 to 0.6 inch in size. Adult thrips are winged. Nymphs are wingless and usually yellow-orange. They usually appear at bloom as they feed on pollen and tender tissues. However, thrips have been found in early spring in Oregon vineyards, much earlier than bloom.

Thrips may scar very young berries as early as fruit set. Later, the scars can restrict berry growth, producing oddly shaped or scarred berries. Occasionally, large populations of thrips may damage shoots and leaves in spring, particularly when cool conditions restrict plant growth. Damage caused by thrips during this period has been reported to be similar to that of rust and bud mites (leaf deformation and shoot scarring). High thrips populations have been observed in western Oregon vineyards and have led to strange growth patterns; however, economic damage was not reported. Damage is usually minor and cosmetic on wine and juice grapes in the Pacific Northwest. These are of cosmetic concern for table grape production. Extremely high populations that cause greater damage are usually found in vineyards located near alternative wild hosts.

Western flower thrips appear to be the most important species on grapes in the Pacific Northwest. This species has up to five or six generations per year. Populations usually peak during spring, which may be a result of migration into vineyards from surrounding host plants that are beginning to senesce. Thrips overwinter as adults or nymphs.

Reproduction may be sexual or asexual. The minute eggs are laid in soft tissue, particularly in flowers. Each female lays about 20 eggs that hatch in about 5 days. Nymphs feed on the host through two nymphal stages lasting 7 to 12 days. Pupation occurs is in soil debris. Adult thrips feed on pollen as well as plant tissues. Scarring has been observed on stem, leaf and berry tissue in Oregon.

Grape thrips overwinter as virgin females in the soil, and populations peak in midsummer. This species may be mostly responsible for young leaf and new growth damage during summer.

Thrips populations can be determined by counting nymphs and adults that have been knocked out of flowers or fruit clusters onto a board or into a container. Reliable thresholds have not been developed, although numbers in the range of 5 to 30 thrips per cluster are unlikely to be damaging. Populations on leaves can be identified using leaf washes in spring and summer using the alcohol wash method.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote beneficial insect populations. • Maintain cover crop. • Alternate row mowing.	• After budbreak, observe first few leaves for presence of thrips and thrips damage • At bloom, observe flower clusters. More than 30 thrips per cluster may require direct control.	• Reference the Yellow List for accepted insecticidal controls.

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Leafhopper

REGION 2 YELLOW LIST

Leafhoppers are insect pests that can damage leaves. Identifying the species and corresponding lifecycle is critical. Non-chemical control includes parasitic wasps, particularly Anagrus. ***Listed for Region 2 only****. See below for detail.*

Adult western grape leafhoppers (WGLH) and Virginia creeper leafhoppers (VCLH) are about 0.12 inch long and are pale yellow with reddish and dark brown markings. VCLH can be distinguished from WGLH by red spots on the back behind the eyes. The eggs of both species are bean-shaped, 0.03 inch long, and laid mostly on the undersides of leaves, just under the epidermis. The eggs of WGLH are laid singly, but eggs of VCLH more often are laid in rows of two to nine. Newly hatched nymphs of both species are white. After 1 day, red spots appear on the back of VCLH nymphs.

Leafhopper adults and nymphs pierce leaf cells and suck out the contents. Each feeding puncture leaves a white spot. As injury increases, photosynthetic activity declines; heavily damaged leaves turn yellow and brown and fall off the vine in severe cases.

Grape leafhoppers overwinter as non-breeding adults in plant debris and leaf litter in protected locations. Adults emerge from overwintering sites in March and feed on annual weeds on the vineyard floor. They move on to grape foliage after budburst, and females begin laying eggs usually in late April. Egg-laying continues for about 6 weeks.

The first generation of nymphs feeds primarily on basal leaves from May to June and produces new generation adults in July. The second generation of nymphs appears later in the month (feeding on outer canopy leaves) and produces the second adult generation in the latter half of August and September. These adults form the overwintering population.

The relationship between leafhopper populations and economic damage to wine and juice grapes is not well understood in the Pacific Northwest, but it is clear that vines can tolerate quite large populations before suffering economic loss. This is particularly true for spring populations of overwintered adults and first generation nymphs, which confine their feeding activity to the basal six to eight leaves.

The second generation of nymphs moves on to outer canopy leaves. Their numbers should be assessed using leaf counts. An average of more than 20 nymphs per leaf on outer canopy leaves, with no evidence of egg parasitism, is likely to require treatment.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Promote beneficial insect populations, particularly Anagrus.	• The threshold for direct control is 20 nymphs/leaf on average, depending on vine health and canopy size.	• Reference the Yellow List for accepted insecticidal controls.
• Alternate row mowing	• Consider thresholds/strategy based on risk, with early ripening varieties at lower risk.	• Thiamethoxam, dinotefuran applied via drip irrigation.
• Leaf removal and suckering once eggs are laid.		• Thiamethoxam and dinotefuran cannot be applied when bees are present or if flowering plants are within the drip zone.

2015 LIVE Green List

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Mealybug

REGION 2 YELLOW LIST

Mealybugs are insect pests that can be a vector for leafroll virus. Source clean plant material. Natural parasites and predators can provide control, including a lady beetle called the "mealybug destroyer." ***Listed for Region 2 only****. See below for detail.*

The grape mealybug has a soft, oval, flattened, distinctly segmented body. The adult female is 0.25 to 0.5 inch long, pink to dark purple, and with a white, mealy, wax secretion. Long caudal filaments along the lateral margin of the body become progressively shorter toward the head. Eggs are yellow to orange and laid in cottony egg sacs. Crawlers that hatch from them are tiny (0.06 to 0.12 inch long), yellow to brown.

Males and females are similar in early instar stages. Males pass through three nymphal instars, then form a cottony cocoon about 0.12 inch long in which the pupa is formed. All stages of the female are similar, varying in size only. The crawler stage of this pest is most mobile. Grape mealybug contaminates fruit with cottony egg clusters, eggs, immature stages, adults, and honeydew. A black fungus (sooty mold) may grow on the honeydew. The grape mealybug is a vector of grapevine leafroll virus and can lead to significant spread of the virus within and across vineyards when both the pest and virus are present.

Grape mealybugs overwinter on the cordon section of vines, under the loose bark, in all life stages and these are the preferred feeding sites, making them inconspicuous to growers. When populations are large enough preventing establishment in before mentioned preferred feeding sites all stage, but especially crawlers, move to new growth to feed. Eggs can be laid on all plant parts during the season.

One to two generations of mealybugs can develop in vineyards in the Pacific Northwest. Generations may overlap during the latter part of the season making control more difficult. As populations build, migrating mealybug populations may move to clusters during July and August, causing direct crop damage. Some females maturing in mid to late August lay their eggs on fruit and leaves, while most return to old wood to overwinter and lay eggs that will survive to the next season.

Control thresholds have not been defined. Early spring populations are usually small and inconspicuous. The number of late season migrating mealybugs increase the likelihood of contamination with vine leafroll virus and warrant control.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Purchase insect and virus-free, clean, certified (if available) plants	• Determine leafroll virus status in vineyard by scouting followed by lab verification.	• Reference the Yellow List for accepted insecticidal controls.
• Crew and equipment movement should be managed to prevent disease migration. Begin work in a non-infested block and work toward infested blocks.	• Scout vineyard for mealybug and scale.	• Thiamethoxam, dinotefuran applied via drip irrigation.
• Manage canopy density for coverage.		• Thiamethoxam and dinotefuran cannot be applied when bees are present or if flowering plants are within the drip zone.
• Remove virus-infected vines. If removal of vines is not an option, the grower must present a quarantine and re-planting plan to the inspector.		

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Lecanium Scale Insects

REGION 2

YELLOW LIST

Lecanium scale insects are generally found on 1-3 year old wood. Control measures may not be necessary if infestation is limited to parts of the vine removed during pruning. Parasitic wasps are a natural enemy. ***Listed for Region 2 only****. See below for detail.*

This scale assumes many sizes, shapes, and colors. The typical form is almost hemispherical, shiny brown, smooth, and approximately 0.12 to 0.19 inch long. Eggs are oval and pearly white. The young vary from yellow to pale brown.

Adult females may be found on leaves or bunches but mostly on shoots of current growth or on 1- to 3-year-old wood. Males have not been observed. Females lay eggs under their bodies. As the female dies, the body shrinks and an egg-filled pocket is formed. As more eggs are laid, the walls of the scale's body becomes hard and, after death, brittle. Young overwinter in a juvenile state on 1- to 3-year-old wood. They mature in late spring, when eggs are produced in great abundance. Hatching continues during early to midsummer. There is one brood per year.

CULTURAL AND BIOLOGICAL CONTROL MEASURES

- Promote beneficial insect populations, particularly parasitic wasps.
- Affected plant material may be removed at pruning if infestation has not reached main framework of vine.

MONITORING AND DECISION-MAKING

- Determine leafroll virus status in vineyard by scouting followed by lab verification.
- Scout vineyard for mealybug and scale.

RESTRICTED AND PROHIBITED PRACTICES

- Reference the Yellow List for accepted insecticidal controls.

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Phylloxera

REGION 1

Phylloxera is an insect pest that damages vines. Resistant rootstock is available. Listed for Region 1 only. See follow description for detail.

A small, aphid-like insect that feeds on grapevine roots of grapevines causing stunted growth, reduced vigor, and vine death of own-rooted Vitis vinifera. Depending on the vineyard location and climate, death can occur within 3-10 years with mortality being quicker in drier climates where vines experience more nutrient and water stress. Phylloxera has been confirmed in all winegrape-growing regions of Oregon with the exception of the Milton-Freewater area of eastern Oregon. Washington has had only limited areas of confirmed phylloxera. Regular sampling is encouraged to determine presence in areas thought to be phylloxera-free.

Most adults are wingless females, generally oval; egg layers are more pear-shaped. They vary from 0.03 to 0.04 inch long. Adults vary in color according to food supply: on fresh, vigorous roots they are yellow, yellowish green, olive green, or light brown; on weakened roots, they are brown or orange.

Sampling for phylloxera should be conducted during late summer and early fall when populations are at their highest. Dig 12-18" below the soil surface about 12" away from the vine trunk. Sample both soil and roots. Use a stereoscope to view the roots and search for root swellings (nodosites and tuberosites), adults and eggs. If you do not have adequate magnification, contact your local Extension agent or crop consultant for assistance in identifying the insect. Only one phylloxera is needed to create a problem in the vineyard; populations can increase and spread over time and attack grapevine roots.

CULTURAL AND BIOLOGICAL CONTROL MEASURES	MONITORING AND DECISION-MAKING	RESTRICTED AND PROHIBITED PRACTICES
• Plant on Phylloxera resistance rootstock where conditions are appropriate. • Practice good sanitation when moving equipment in an out of infested area. • Enhance fertility in infested area to encourage root re-growth and prolonged vine life. • Replant when economically feasible.	• Monitor for symptoms and or movement of pest annually	• LIVE does not have chemical controls listed for this pest. • Vineyards may request variance to use spirotetramat on vines planted prior to 2015.

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Voles

REGION 1 | REGION 2 | YELLOW LIST

Voles are rodents that have population spikes on a 4-7 year cycle. Non-chemical control includes disrupting burrows with cultivation and promoting habitat for owls and kestrels. Vineyards may tolerate low to moderate vole damage. See below for detail.

Voles are mouse-like rodents with compact, heavy bodies, short legs, short-furred tails, small eyes, and partially hidden ears. The long, coarse fur is grayish to blackish brown. When fully grown they can measure five to eight inches long, including the tail. Voles differ from house mice in that they are larger and have shorter tails and smaller ears.

Voles spend most of their time below ground in their burrow system but establish above-ground runways that connect burrow openings. These runways are usually hidden beneath a protective layer of grass or other ground cover. There are multiple burrow openings about 1-1/2 to 2 inches in diameter that lead to a tunnel system just below the ground surface that is used for feeding on plant roots. A deeper set of burrows, typically six to eight inches deep, are used for food storage, nesting, and rearing young. Voles can begin breeding after only three weeks of age and produce four to six offspring per litter, with as many as ten litters per season. Species of voles that live at higher elevations have shorter breeding seasons. The gestation period is three weeks. Their life span is two to sixteen months. Voles are active day and night, year-round.

Several adults and young may occupy a burrow system. Their home range is usually a few hundred square feet. Voles feed on a variety of grasses, herbaceous plants, bulbs, and tubers. They will also eat bark and tree roots, especially in fall or winter. Voles store seeds and other plant matter in underground chambers.

Voles cause damage by their feeding, especially when numbers are high. Damage to tree trunks normally occurs in the area just above or below the ground surface, sometimes causing girdling that can kill trees. Where snow cover is present, damage to trees may extend a foot or more up the trunk,and may escape notice until it is too late. The distinctive on-the-surface runways, which may be partially hidden by grasses and weeds, and the small numerous burrow openings are the main signs of voles. On trees, gnaw marks about 1/8 inch wide and 3/8 inch long found in irregular patches may be found. Remember to check for below-ground damage by pulling soil away from tree trunks. In areas with winter snow, voles can do serious damage to tree trunks hidden under the snow pack.

CULTURAL AND BIOLOGICAL CONTROL MEASURES

- Install owl boxes and kestrel perches, and/or bring a falconer to vineyard. Work with neighbors to encourage habitat on their property as well - birds of prey may forage miles from their home. If possible encourage mated pairs, as families of owls will consume many more rodents.
- Leave a wide swath of bare ground around affected areas. Voles will not travel long distances over bare ground.
- Disrupt burrows by cultivation.

MONITORING AND DECISION-MAKING

- Document vole damage and severity of burrow network. Voles populations spike on a four to seven year cycle, and therefore direct control may not be necessary every year. Low to moderate vole damage may be acceptable to avoid chemical control.

RESTRICTED AND PROHIBITED PRACTICES

- Reference the Yellow List for accepted acaracidal controls.
- Use of zinc phosphide must be discontinued immediately if any non-target organisms are affected. Especially vulnerable are Canadian geese, dogs, and deer.

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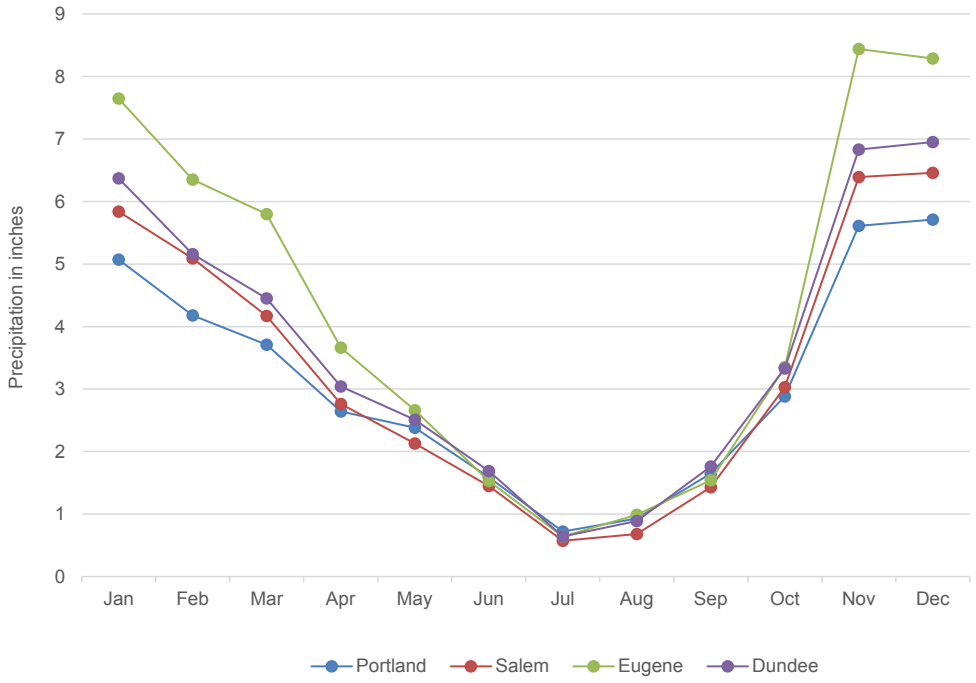
REGION 1

Precipitation Data



Region 1 refers to viticultural areas with a cooler, wetter growing season. This includes areas west of the Cascades and above the North Umpqua River in Oregon—e.g., the northern Umpqua Valley, the Willamette Valley, the western Columbia Gorge, and Puget Sound.

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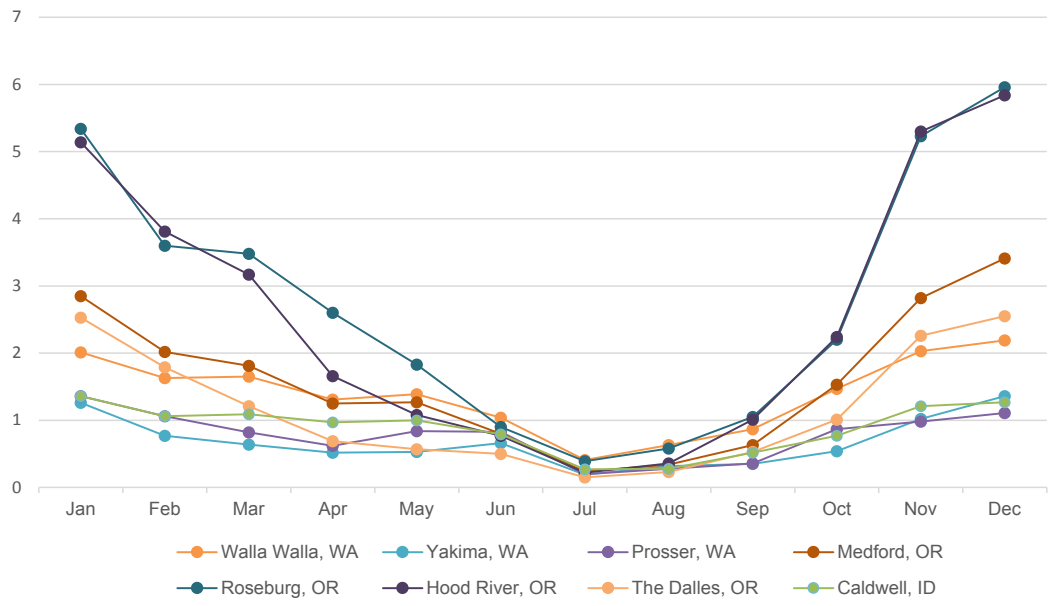
REGION 2

Precipitation Data



Region 2 refers to areas with a warmer, drier growing season. This includes areas east of the Cascades and below the North Umpqua in Oregon—e.g., the central and southern Umpqua Valley, the Rogue Valley, the Columbia Valley, and the Snake River Valley.

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How LIVE and Salmon-Safe Work Together

Salmon-Safe is dedicated to protecting watersheds and aquatic life from the impacts of agriculture and urban development. In 2001, LIVE partnered with Salmon-Safe to develop and certify to whole-farm standards. For those members who have additional crops, landscaping, or other managed land beyond the borders of the vineyard, our inspectors will verify that Salmon-Safe standards are being met. For the most current Salmon-Safe standards, visit www.salmonsafe.org.

The Salmon-Safe List of High Hazard Pesticides (right) is used to flag management practices that could potentially harm aquatic life and/or leach to groundwater. Chemical controls that appear on the LIVE Yellow List of Approved Pesticides have been examined through the lens of this list, and application restrictions have been written where appropriate.

A farm using any of the pesticides indicated as "High Hazard" may be certified only if written documentation is provided that demonstrates a clear need for use of the pesticide, that no safer alternatives exist and that the method of application (such as timing, location and amount used) represents a negligible hazard to water quality and fish habitat. Any variance must be approved in advance by Salmon-Safe. For information about the variance process, or to request a variance form, please contact info@salmonsafe.org.

APPENDIX C: SALMON-SAFE'S LIST OF HIGH HAZARD PESTICIDES

Salmon-Safe's High Hazard Pesticide List

Certain pesticides are a serious threat to salmon and other aquatic life. In addition, pesticide formulations can contain other ingredients that are potentially more toxic than the active ingredients, such as non-ionic surfactant nonylphenols, their parent compounds or nonylphenol polyethoxylates found in the spreader R-11. In addition to killing fish, certain pesticides at sublethal concentrations can stress juveniles, alter swimming ability, interrupt schooling behavior, cause salmon to seek suboptimal water temperatures, inhibit seaward migration and delay spawning. All of these behavioral changes ultimately affect survival rates.

The following table lists many of the pesticides known to cause problems for salmon and other aquatic life. The list includes chemicals that could be used for site management purposes that are listed with the U.S. Environmental Protection Agency (EPA) in various hazard categories. Use this list to identify pesticides that require special consideration. Please note that this table lists only some of the currently available and commonly used pesticides.

AGRICULTURAL PESTICIDES THAT POSE HAZARD TO SALMON AND AQUATIC LIFE			
1,3-dichloropropene	Diazinon	Imidacloprid	Pendimenthalin
2,4-D	Dicamba	Iprodione	Permethrin
Abamectin	Dichlobenil	Linuron	Phorate
Acephate	Diflubenzuron	Malathion	Phosmet
Alachlor	Dimethoate	Mancozeb/Penncozeb	Prometryn
Atrazine	Disulfoton	Methamidophos	Propargite
Azinphos-methyl	Diuron	Methidathion	Propiconazole
Bensulide	Emamectin Benzoate	Methomyl	Pyraclostrobin
Bifenthrin	Endosulfan Sulfate	Methyl Parathion	Quintozene
Bromoxynil	Esfenvalerate	Metolachlor	Simazine
Carbaryl	Ethalfluralin	Metribuzin	Tebuthiuron
Carbofuran	Ethoprop	Naled	Terbufos
Chloropicrin	Extoxazole	Norflurazon	Thiophanate-methyl
Chlorothalonil	Fenamiphos	Nuvaluron	Thiram
Chlorpyrifos	Fenbutatin-Oxide	Oryzalin	Triallate
Copper Sulfate*	Fenpropathrin	Oxyfluorfen	Triclopyr
Cyhalothrin	Fenpyroximate	Parathion	Trifluralin
Cypermethrin	Flumioxazin	Pebulate	

*Salmon-Safe limited use restrictions apply to any copper-containing pesticide including copper hydroxide, copper ammonium hydroxide, copper carbonate, copper oxide and others.

This list is based on EPA hazard levels for fish and fish habitat. It is revised as pesticide registrations are updated and as more environmental data becomes available.

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Ecological Infrastructures

Ecological infrastructures are areas of the farm that are either left wild or managed for the express purpose of promoting biodiversity, wildlife corridors, landscape level continuity, and/or habitat for beneficial fauna.

Cover crop as ecological infrastructure

It is frequently asked if cover crop can be used as ecological infrastructure. The answer to this depends on how it is managed. Permanently flowering or native cover may be used. Alternate mowing at long intervals is allowed to manage competition with crop. However tilling under is not allowed for this area to qualify as infrastructure. Spading every other row every fourth year is allowed – this will result in four distinct age groups of flora within the ecological infrastructure, thus maximizing its ecological quality.

Mowing heights and mower types

Mulching mowers cause the most damage to beneficial fauna and should not be used in ecological infrastructures. Traditional horizontal mowers are relatively harmless. If bee activity is expected, mowing before 7am or after 6pm will mitigate damages to their populations. Fauna can escape if mower is set to higher than 4-5 inches. Alternate mowing/leaving patterns of wildflower patches is necessary to maintain food sources for beneficial fauna.

Distances

Crawling, flying, or windborne beneficial insects have a limited operational distance of 30-150 feet. Although as of yet unproven, there is a hypothesis that planting pollen and nectar sources such as open faced roses as 'stepping stones' between infrastructures may help these insects to extend their predation range.

Buffer zones and pesticide drift

To reduce drift, please observe the following recommendations:

- No pesticide application if wind speed exceeds 10mph.
- If possible no application if temperature exceeds 77°Fand relative humidity is below 50% (ideally <70%)
- Avoid droplet sizes that are too small
- Nozzles as close to target as possible
- Near ecological infrastructure: do not treat the field edge or sensitive off-crop areas (minimum distance of 10ft) and if possible reduce delivery pressure and sprayer speed

Stinging nettle

Stinging nettle, while commonly seen as a weed/nuisance, can host more than 100 insect species, including many beneficials. Butterfly and aphid species are attracted to nettle, as are the egg parasitoids of grape leafhopper. Colonization of nettle patches by beneficials occurs extremely rapidly (within 3 years).

Further recommendations

Please see the next page for ideas of ecological infrastructure types and management practices.

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Ecological Infrastructures (continued)

FOR VINEYARDS

Low intensity grassland	No fertilizer or pesticides except spot treatment of problem weeds with LIVE-approved herbicide. High mowing once per year allowed
Wetlands	No fertilizers or pesticides. High mowing once per year to once per three years allowed.
Conservation headland	No fertilizer or pesticides except spot treatment of problem weeds with LIVE-approved herbicide. No mowing allowed.
Wildflower strips	No fertilizer, pesticides, or mowing
Rotational fallows	No fertilizer, pesticides, or mowing
Unmanaged hedges and woodland patches	May be trimmed every 2-3 years (low hedges) every 5-10 years (tall hedges/trees) or thinned (woodland patches). Grass strips of at least 3m wide that transition from hedge to cropped area receives no fertilizer or pesticides, and may be mowed once per year, high and late, if at all. Grass strips cannot be double counted as buffer area and ECA.
Non-agricultural high-stem fruit trees/orchard	No fertilizer or pesticides. Old trees with dead branches and cavities are left alone. Minimum 30 trees, ideally 300+ trees. May be pruned periodically (every 2-5 years)
Low intensity pasture or pasture land	No fertilizer or pesticides
Ditches and ponds	Ponds are not used for irrigation
Stone heaps, embankments and stone	
Unpaved farm trails	No fertilizer or pesticides
Wildlife corridors	No fertilizer or pesticides

FOR FRUIT FARMS

Botanically rich alleyways	Alternate mowing regime allowed
Intertree-strips with cover plants	No residual herbicides allowed
Wildflower strips	No fertilizer or pesticides. Ideally 10% + of orchard surface. Superficial hoeing allowed to reduce competitive grasses and to enhance annual broadleaf plants.
Low intensity grassland	No fertilizer or pesticides. Maximum of two cuts per year, the first occurring after plants bloomed and seeded.
Pioneer plants in wild areas	No fertilizer or pesticides. May be high-mowed every 2-3 years. Stone heaps should be piled up periodically and growing shrubs removed
Hedges and woodland patches	See vineyard section
Single trees and non-agricultural high	See vineyard section

Livestock Unit Conversion Chart

Dairy Cow	1
Dry medium beef	1
Medium beef cow	1
Bull	1
Horse	0.8
Sheep	0.15
Goat	0.1
Llama	1
Pig	0.25

To calculate your total Livestock Units (LU), multiply the quantity of each animal by the LU for that animal and then add them up.

Example: You have 5 sheep, 2 pigs and 3 horses
(5 sheep x .15 LU) + (2 pigs x .25 LU) + (3 horses x .80 LU) = 3.65 Livestock Units

References

All inset plant disease descriptions in this document were selectively sourced from the Pacific Northwest Plant Disease Management Handbook.
Pscheidt, J.W., and Ocamb, C.M., senior editors. 2013. Pacific Northwest Plant Disease Management Handbook [online]. Corvallis, OR: Oregon State University. http://pnwhandbooks.org/plantdisease/grass-seed-rusts (accessed 21 Jan 2014).

All inset pest descriptions in this document were selectively sourced from the Pacific Northwest Insect Management Handbook.
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Vole inset description taken from Journal of Pesticide Reform.
Stein, Dan. (2006) Controlling Voles (Meadow Mice) Journal of Pesticide Reform. Winter 2006 • VOL. 26, NO. 4, P.8.

2015 LIVE Yellow List

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Controls for **Botrytis cinerea**

Botrytris cinerea is a fungus that causes Botrytis bunch rot. Non-chemical control includes preventing excess vigor and maintaining an open canopy. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Fenhexamid	Elevate	Labeled for botrytis with suppression effects for powdery mildew.	4	0	17	Hydroxyanilide
Cyprodinil	Vangard		12	7	9	Anilinopyrimidine
Pyrimethanil	Scala		12	7	9	Anilinopyrimidine
Difenoconazole/Cyprodinil	Inspire Super	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	3, 9	Triazole and anilinopyrimidine
Bacillus subtilis	Serenade, Serenade MAX		4	0	Biofungicide	Biological
Reynoutria spp	Regalia	For powdery mildew, limit of 3 applications from this chemical family per season.	4	0	P5	Plant Host Inducers
Iprodione	Rovral	Cannot be used within 100 feet of a waterway (toxic to aquatic invertebrates).	12	7	E3	Dicarboximide
Azoxystrobin	Abound	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	11	Strobilurines
Trifloxystrobin	Flint	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	11	Strobilurines
Boscalid	Endura	For controls containing boscalid, limit of 1 application per season for powdery mildew and 1 for Botrytis. For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	7	SDHI
Boscalid/Pyraclostrobin	Pristine	Pyraclostrobin scheduled to be removed from the Yellow List after 2015. For products bundling pyraclostrobin with boscalid, reference additional boscalid restrictions. For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	7, 11	QoI/SDHI
Streptomyces	Actinovate		1	0	Biofungicide	Biological

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Controls for **Powdery Mildew**

Powdery mildew is a fungal disease. Non-chemical control includes preventing excess vigor, timely suckering, and maintaining an open canopy. Rotate controls by mode of action for resistance management. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Reynoutria spp	Regalia	For powdery mildew, limit of 3 applications from this chemical family per season.	4	0	P5	Plant Host Inducers
Metrafenone	Vivando	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	U8	Benzophenone
Cyflufenamid	Torino	For powdery mildew, limit of 3 applications from this chemical family per season.	4	3	U6	Phenyl-acetamide
Tebuconazole	Tebucon	For powdery mildew, limit of 3 applications from this chemical family per season.	12	7	3	DMI
Triflumizol	Procure	For powdery mildew, limit of 3 applications from this chemical family per season.	24	7	3	DMI
Myclobutanil	Rally	For powdery mildew, limit of 3 applications from this chemical family per season.	24	14	3	DMI
Fenarimol	Vintage	For powdery mildew, limit of 3 applications from this chemical family per season.	12	21	3	Pyrimidine
Difenoconazole/Cyprodinil	Inspire Super	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	3, 9	Triazole and anilinopyrimidine
Kresoxim-methyl	Sovran	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	11	Strobilurines
Azoxystrobin	Abound	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	11	Strobilurines
Trifloxystrobin	Flint	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	11	Strobilurines
Boscalid/Pyraclostrobin	Pristine	Pyraclostrobin scheduled to be removed from the Yellow List after 2015. For products bundling pyraclostrobin with boscalid, reference additional boscalid restrictions. For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	7, 11	QoI/SDHI

2015 LIVE Yellow List

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Controls for **Powdery Mildew** (continued)

Powdery mildew is a fungal disease. Non-chemical control includes preventing excess vigor, timely suckering, and maintaining an open canopy. Rotate controls by mode of action for resistance management. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Quinoxyfen	Quintec	For powdery mildew, limit of 3 applications from this chemical family per season.	12	14	13	Quinoline
Streptomyces	Actinovate		1	0	Biofungicide	Biological
Bacillus pumilus	Sonata		4	0	Biofungicide	Biological
Potassium salts of fatty acids	M-Pede		12	0	Biofungicide	Soap
Paraffinic Oil; Mineral Oil	JMS Stylet Oil; Pure Spray Green		4	0	Biofungicide	Oils
Potassium Bicarbonate	Armicarb, Kaligreen		4	1	Biofungicide	Bicarbonates
Bacillus subtilis	Serenade, Serenade MAX		4	0	Biofungicide	Biological
Micronized Sulfur	Multiple Names	Region 1: limit 5 lb/acre per treatment of ACTIVE INGREDIENT and a total of 35 lb/acre per year for powdery mildew. Region 2: limit 4 lb/acre per treatment of ACTIVE INGREDIENT and a total of 24 lb/acre per year for powdery mildew. It is strongly discouraged to approach the annual limit except in years with severe mildew conditions. Overuse of sulfur is harmful to beneficial mites. See mite sections for mite application restrictions.	24	0	M (Multi-site)	Inorganic

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Controls for **Weeds**

Non-chemical control includes planting competitive cover crop, mechanical cultivation, and in-row mulch. A weed survey is an important monitoring tool. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Glyphosate	Roundup		12	14	9	Aliphatic Acid
Glufosinate	Rely		12	14	10	Aliphatic Acid
Pelargonic Acid	Scythe		12	1	N/A	Botanical/Fatty Acid
Carfentrazone-ethyl	AIM	Application must be made in a targeted manner for sucker control only. Applications are prohibited within 300 feet of streams or drainages.	24	7	14	Triazolinone
Rimsulfuron	Matrix	This material may only be used in conjunction with a completed weed survey.	4	14	1	Sulfonylurea
Flumioxazin	Chateau	This material may only be used in conjunction with a completed weed survey. Please note pre-harvest interval (PHI).	12	60	14	N-phenylphthalimide

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Controls for **Rust Mite** and **Blister Mite**

Grape rust mite, blister/Erineum mite, and other eriophyid mites are microscopic pests that overwinter in vineyards—careful monitoring is essential, and dormant buds can be examined for mite presence. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Sulfur	Multiple names	5 lb at wooly bud, 5 lb ten days later. Not allowed if lime sulfur is used.	24	0	M (Multi-site)	Inorganic
Spirodiclofen	Envidor	May not be used within 100 feet of open streams or ditches. For rust mite, available ONLY to vineyards in Oregon under 2(ee) recommendation.	12	14	23	Tetronic/Tetramic Acid
Paraffinic Oil; Mineral Oil	JMS Stylet Oil; Pure Spray Green		4	0	Biofungicide	Oils
Calcium polysulfides	Lime Sulfur	Limit one (1) application per season timed at pre-budbreak dormancy. If applied, micronized sulfur allowance for mites is not available. Apply a 2-3% solution at 50-60 gal per acre. Lime sulfur product must be registered for mealybugs on grapes for the state in which the application is being made (satisfies FIFRA 2(ee) labeling requirement). Recommended that applicator applies to every row. Must have confirmed presence of rust mites or damage from previous year.	48	0		Inorganic
Chromobacterium subtsugae	Grandevo	May not be used within 75 feet of aquatic habitats.	4	0	Unknown	Biological

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Controls for **Spider Mite** (Pacific, Two-spotted, Willamette)

Spider mites are microscopic pests that overwinter in vineyards. Non-chemical control includes promotion of vine health and predatory mites, and dust abatement. Careful monitoring is essential. ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST REGION 2 ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Chromobacterium subtsugae	Grandevo	May not be used within 75 feet of aquatic habitats.	4	0	Unknown	Biological
Spirodiclofen	Envidor	May not be used within 100 feet of open streams or ditches. For rust mite, available ONLY to vineyards in Oregon under 2(ee) recommendation.	12	14	23	Tetronic/Tetramic Acid
Bifenazate	Acramite		12	14	25	Hydrazine carboxylate
Etoxazole	Zeal	May not be used within 100 feet of open streams or ditches.	12	14	10B	Diphenyl oxazoline

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Controls for **Cutworm**

Cutworms are caterpillars and identification is important. Most damage is caused by climbing cutworms. Non-chemical control includes parasitic wasps and predatory insects, and cultivation timing. ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Spinosad	Success	Maximum of 1 application per season.	4	7	5	Microbial
Bacillus thuringiensis (BT)	Javelin		4	0	11B2	Biological
Bifenthrin	Bifenture; Brigade	Maximum of 1 application per season. Pyrethroid sprays on vine canopy and strip spray are prohibited. Spot treat to trunk base only. May not be used within 100 feet of a waterway.	12	30	3	Pyrethrin

Controls for **Thrips**

Thrips are small insects present in vineyards as wingless nymphs and winged adults, with some natural predators. Not all occurrences constitute economic risk—damage can be minor and cosmetic. ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Spinosad	Success	Maximum of 1 application per season.	4	7	5	Microbial

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Controls for **Leafhopper**

Leafhoppers are insect pests that can damage leaves. Identifying the species and corresponding lifecycle is critical. Non-chemical control includes parasitic wasps, particularly Anagrus. ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST REGION 2 ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Buprofezin	Applaud		12	7	16	Insect Growth Regulator
Potassium salts of fatty acids	M-Pede		12	1	Biofungicide	Soap
Kaolin	Surround		4	1	Unknown	Inorganic Solid Silicate
Paraffinic Oil; Mineral Oil	JMS Stylet Oil; Pure Spray Green		4	0	Biofungicide	Oils
Thiamethoxam	Platinum	Must not be used when bees are present and/or if flowering plants are within the drip zone. All LIVE Green List activities must be performed and documented prior to application. Chemistry may then be applied through drip irrigation. See LIVE Green List for details.	12	60	4A	Neonicotinoid
Dinotefuran	Venom	Must not be used when bees are present and/or if flowering plants are within the drip zone. All LIVE Green List activities must be performed and documented prior to application. Chemistry may then be applied through drip irrigation. See LIVE Green List for details.	12	SL	4A	Neonicotinoid

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Controls for **Mealybug**

Mealybugs are insect pests that can be a vector for leafroll virus. Source clean plant material. Natural parasites and predators can provide control, including a lady beetle called the "mealybug destroyer." ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST REGION 2 ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Spirotetramat	Movento		24	7	23	Tetrocic/Tetramic Acid
Buprofezin	Applaud		12	7	16	Insect Growth Regulator
Thiamethoxam	Platinum	Must not be used when bees are present and/or if flowering plants are within the drip zone. All LIVE Green List activities must be performed and documented prior to application. Chemistry may then be applied through drip irrigation. See LIVE Green List for details.	12	60	4A	Neonicotinoid
Dinotefuran	Venom	Must not be used when bees are present and/or if flowering plants are within the drip zone. All LIVE Green List activities must be performed and documented prior to application. Chemistry may then be applied through drip irrigation. See LIVE Green List for details.	12	SL	4A	Neonicotinoid

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Controls for **Lecanium Scale Insects**

Lecanium scale insects are generally found on 1-3 year old wood. Control measures may not be necessary if infestation is limited to parts of the vine removed during pruning. Parasitic wasps are a natural enemy. ***Listed for Region 2 only****. See Green List for detail.*

GREEN LIST | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Petroleum Oil, Paraffin Base	Omni Supreme and others	Apply at 50% and again at 90% egg hatch. Vines must be well watered. Must not be applied ten days before and after a sulfur application to avoid phytotoxicity. Good coverage is essential.	4	0		Narrow Range Horticultural Oil
Spirotetramat	Movento		24	7	23	Tetrocic/Tetramic Acid

Controls for **Voles**

Voles are rodents that have population spikes on a 4-7 year cycle. Non-chemical control includes disrupting burrows with cultivation and promoting habitat for owls and kestrels. Vineyards may tolerate low to moderate vole damage. See Green List for detail.

GREEN LIST | REGION 1 | REGION 2 | ADDITIONAL DATA

ACTIVE INGREDIENT	COMMON TRADE NAMES	RESTRICTIONS	REI (hours)	PHI (days)	MOA CODE	CHEMICAL FAMILY
Zinc Phosphide (ZP)	Multiple Names	May only be applied after all Green List cultural controls have been exhausted and damage is documented. ZP is a restricted use chemical and must be applied by a licensed pesticide applicator. ZP is a non-selective poison. Use of ZP must be discontinued immediately if any non-target organisms are affected. Especially vulnerable are Canadian geese, dogs, and deer. Baiting and/or trapping may not be legal depending on your state's laws and the label of the product you are using. Follow the label and the law.	0	0		Inorganic-Zinc