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# Grapevine Leafroll Virus and Mealybug Prevention and Management in Oregon Vineyards

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**G**rapevine Leafroll associated Viruses (GLRaVs) cause disease in grapevines worldwide. In some regions, the viruses have reached epidemic levels. Recently, they have been identified in vineyards in Oregon, which has led to concern. The disease is caused by a complex of ten species of viruses that may produce a wide variety of symptoms including: leaf chlorosis and discoloration; downward rolling of leaves; fruit yield reductions of up to 40%; and lower berry quality from a lack of ripening, reduced sugar content and poor pigmentation. The viruses have also been associated with poor graft union development and young vine failure.

Mealybugs (Homoptera: *Pseudococcidae*) are known transmitters, or “vectors,” of GLRaVs. Virus-infected vines often mirror patterns of mealybug infestations in a vineyard. Prominent examples of mealybugs found in Oregon include grape mealybug (*Pseudococcus maritimus*), obscure mealybug (*Pseudococcus viburni*) and longtailed mealybug (*Pseudococcus longispinus*). Grape mealybug is the only mealybug found in vineyards in the state. Vine mealybug (*Planococcus ficus*), an invasive species, is also believed to be a vector of viruses in California. It has not been reported in Oregon to date.

Viruses and their insect vectors, including mealybugs, can be mitigated by implementing safe practices, first by prevention and second by management. Prevention measures should be used to keep insect vectors and viruses out of vineyards. Management of GLRaVs and quarantine of mealybug vectors are required to prevent further spread if a vineyard site is already infected.



Figure 1: Honeydew, ants and sooty mold are often found on grape clusters infested with mealybugs.

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## 5 Keys to Prevention

**1. Closely monitor your vineyard.** Look for the presence of virus-like symptoms on leaves, as well as mealybugs, honeydew, ants and sooty mold (see Figure 1). Your vineyard could be at risk if you purchased plants or received harvested grapes from vineyards or areas with known mealybug and virus infestations. Flag infected vines and monitor spread over time. (For more information, refer to Skinkis et al. 2009.)

**2. Prevent movement.** Avoid moving mealybug-infested nursery stock or virus-infected plant materials. Purchase certified plant materials, such as vines free from GLRaVs, from reputable commercial nurseries where mealybugs and other insect pests are eliminated prior to shipment into Oregon. Discuss control practices including hot water dips and insecticide usage with nurseries before obtaining vines. Not all cultivars and clones are certified. Once a vine is infected with a virus, there is no cure. ***Do not assume virus-free status based on visual symptoms.*** Grapevines may not display symptoms (Figure 2) immediately after planting or for the first few years. Symptoms vary depending on grape cultivar, clone, vineyard management practices and vine health and age. Presently, nurseries outside Oregon must abide by the current grape quarantine, which restricts movement of plants into the state. Nurseries in Oregon are not under quarantine restrictions. Check with them to ensure plant materials are free from pests and disease.

**3. Test for viruses.** Perform virus testing on cuttings from existing vineyards used to establish a clean new vineyard or for use as budwood in grafting over an older vineyard. Testing for viruses should be done by a reputable plant virus testing facility. Test rootstock vines for virus status before grafting over a vineyard to a new cultivar.

**4. Use proper sanitation.** Implement proper sanitation practices to reduce mealybug spread in and around vineyards (Figures 3 and 4). Mealybugs can be spread physically on equipment, field crews and tools, and by natural dispersion by birds, animals and wind-blown infested leaves. The sticky honeydew produced by mealybugs facilitates spread. Adults, nymphs and eggs can easily stick to equipment and laborers who come in close contact with vines and fruit. Tractors, bins, picking



Figure 2: Infected plants may not display visual symptoms of grapevine leafroll associated viruses (GLRaVs).



Figure 3: Use hot water and soap to sanitize workers' clothes and shoes on site to prevent mealybug spread.



Figure 4: Using proper sanitation measures, harvest “high-risk” blocks by hand.

containers, worker clothing and gloves can transport the pests to other locations. Sanitize workers’ clothes and shoes, vineyard equipment, trailers and harvesting bins with hot water and soap on site, to help prevent spread. Machine harvesters also pose a significant risk of spreading mealybugs because they have contact with fruit and foliage, and are moved between vineyard locations.

**5. Properly compost pomace.** Waste from processed grape clusters harvested from mealybug-infested vineyards should be composted properly. This will prevent survival and movement of mealybugs, which can lead to further spread (see *Tips for Composting Pomace* below).

### Top Management Tips

If your vineyard has a mealybug and/or virus infestation, follow the management practices below to restrict spread within vineyards, to new vineyard blocks and to other vineyards. Please note the effectiveness and feasibility of some of these practices have not been validated with research data.

**Use care with all loads.** Consider taking sanitation measures for all loads received at the winery, not just for loads known to have come from mealybug-infested vineyards. Also, work to prevent intermingling of bins.

**Put high-risk plots last.** Address mealybug- and virus- infested, or “high-risk,” blocks of vineyards at the end of a work schedule. This could help to avoid spread to other areas.

**Keep it clean.** Thoroughly pressure wash equipment and tools including the harvester, tractor, trucks, sprayers, bins, clippers and hedgers prior to entering or leaving a vineyard. All plant debris and leaves must be removed from equipment and tools. Pressure washing on site with hot water and soap is ideal. If this is not possible, hose down equipment on site then move it to a nearby location where it can be thoroughly washed before entering another vineyard. Do not blast debris into vineyards while washing; set up safely secluded wash areas that will minimize such contamination.

**Throw it out.** Wear disposable protective clothing in vineyards with known mealybug presence. If field crews cannot wear such clothing, vigorously brush off work clothes to remove mealybugs and plant debris that could contain crawlers. Doing so will reduce the risk of moving mealybugs.

**Clean up.** Wash hands, arms and footwear with soap and hot water before entering or leaving a vineyard. Clean-up should be complete before leaving a vineyard.

**Remove and compost.** Remove and compost all mealybug-infested vegetative materials resulting from cultural practices (vine prunings, leaves, green fruit droppings and dormant pruning wood, for example) to minimize mealybug movement.

**Eradicate vines.** Remove virus-infected vines. The level of infection and age of a vineyard may determine when vines should be pulled. Replacing vines in a young vineyard with low levels of infection is more economical than replacing vines in heavily infected older vineyards. During removal, dig out the vine and remove as much of the root system as possible. Remove one to two vines surrounding the infected plants to reduce the likelihood of secondary spread from the original source. Remove all suckers growing from residual roots in the soil.

## Practices for Managing Mealybug and Grapevine Leafroll Virus in Oregon Vineyards

### Pre-harvest

- Scout vineyards regularly. This will help identify mealybug and virus infestations early on.
- Treat mealybug-infested vines. Use a short-residual insecticide well in advance of harvest to reduce harvest population levels. Consider life stage when selecting a suitable pesticide.
- If practical, pick mealybug-infested clusters prior to harvest and place them in plastic bags. Dispose of such clusters in a place that is not in close contact with the vineyard, off site.
- Notify wineries that receive fruit from infested vineyards. This will ensure a delivery schedule and protocols are in place before shipment.

### Harvest

- Schedule mealybug-infested, or high risk sites toward the end of the harvest cycle.
- At the crush facility, direct loaded trucks from infested vineyards to the front of the line for processing. This will limit waiting time and infestation risk.
- Harvest infested and high-risk blocks by hand.
- Limit the amount of non-fruit plant material (leaves and shoots) in pails and harvest bins.
- Before transport, cover all crop and pomace loads. Use a tarpaulin made from heavy poly plastic sheeting, or enclose loads in a trailer or truck.

- Pressure-wash the outside and inside surfaces of trucks, trailers, bins and tarps to remove all plant debris. Do this before a load leaves the vineyard and before refilling with harvested fruit.
- Inform the compost facility of mealybug infestation in pomace and waste so it can be sanitized.
- Immediately cover infected pomace waste in clear plastic and store away from the vineyard until it is properly composted. Composting kills most mealybug adults, eggs and nymphs.

### Tips for Composting Pomace

Pomace should be composted away from vineyards to prevent movement of insects. When you compost:

1. Select an isolated waste pile area away from vineyard blocks to avoid leachate and mealybug contamination.
2. Cover pile with heavy poly plastic sheeting when waste is deposited, to help heat build up.
3. Aerate and moisten waste. Increase temperature in pile to >130°F for at least 7 days, optimally for one month, to kill mealybugs that survive the winery's crusher/destemmer. Ensure correct pile depth and turn material frequently to adequately heat and decompose materials.
4. Find out if your local commercial composting operation can properly compost waste material at low or no cost to your production unit.

## Conclusions

This document suggests practices believed to mitigate the spread of disease and virus. Growers should determine practices feasible for their own operations. For technical information about proper composting of grapevine pomace, see Smith and Varela (2008). For more information on mealybug management, see UC IPM (2008).

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