

DEMYSTIFYING GROWER DECISION-MAKING:

INFLUENCES ON THE ADOPTION OF GRAPEVINE VIRUS MANAGEMENT PRACTICES

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Understanding the challenges and opportunities to the adoption of virus management practices is paramount to achieving successful disease outcomes. Using grapevine leafroll and red blotch diseases as model systems, this document summarizes data from interviews with 42 viticulture specialists in California and Washington.

Numerous factors were identified that explain why virus management practices may or may not be adopted depending on a variety of contexts. These are summarized below, accompanied by illustrative quotes from participating viticulture specialists. The factors are broadly categorized as economic, knowledge, and social-behavioral.

This data provides context for the agricultural industry, research scientists, extension educators, and other supporting partners of the financial, interpersonal, and technical issues that must be overcome to successfully manage leafroll, red blotch, and other grapevine viral diseases.

References:

1. Hobbs M, Vengco S, Moyer M, Bolton S, Bettiga L, Cooper M. (2023). Meeting the challenge of viral disease management in the wine grape industry: demystifying decision-making, fostering agricultural networks, and optimizing educational resources. *Australian Journal of Grape and Wine Research*. doi.org/10.1155/2023/7534116.
2. Hobbs M, Vengco S, Moyer M, Bolton S, Bettiga L, Cooper M. (2021). Adoption of best management practices for grapevine leafroll and red blotch diseases: A survey of west coast growers. *PhytoFrontiers*. 2: 181-191.

<https://ucanr.edu/county/napa-county-ucce/pest-and-disease-identification-and-management>

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ECONOMIC FACTORS

Influences of practice costs, grape yields, and salability of fruit or wine.

1

Adoption of virus management practices is costly. Practices cost money in materials and labor. Growers must possess the financial resources to be able to adopt a practice. The huge cost of redeveloping whole vineyard blocks is a universal barrier to removing infected vines and other practices are measured against their ability to avoid or delay that scenario.

"The longevity of those vineyards is more important than a few costly virus tests...we've done the expensive replanting and we don't want to do it ever again".

"What does it cost to scout vines, mark them, rogue them, replant them, have a crew come through and do training passes on all those replanted vines, the cost of irrigation stuck in by those young vines? There are a lot of dollar signs in these practices, and I think people just get overwhelmed and say that is too expensive or I don't have the time and labor".

"I know people who have done it organically and I know they've released predators [of vine mealybug] which is so costly, but they don't have any organic pesticide...they were also lucky that they had that huge pool of money that they could spend on it".

"[after roguing] if your vineyard isn't set up with separate irrigation valves to be able to water old and young vines in the same row, that's hard...It takes more time in a vineyard of mixed ages to train it. It's a separate task to go train up those vines, fertilize them separately...that is an economic challenge for sure".

Specific vineyard contexts influence the expense of practices. For example: (1)

where disease spread is rapid practices must be deployed on a greater scale; (2) organic management practices can be more expensive than conventional practices; (3) rogued vineyard blocks consist of mixed-age vines that are more expensive to farm.

2

3

Reduced yields and fruit quality due to virus motivate the adoption of practices.

Management practices are implemented to maintain financially viable production and quality standards. Growers may be reluctant to remove infected vines when production and quality standards are met. Ultimately, decisions regarding quality are heavily influenced by the perceptions of the winemakers using the fruit, even if other decision makers have concerns about disease incidence and spread.

"...we always hope to keep these vineyards in as long as we can...30 years is what we aim for and it seems like with these virused [sic] vineyards, we are getting maybe 20 at best...that's really where the expense comes in...\$30,000 to \$40,000 to replant an acre and you don't get production for three years...it's basically an economic issue with losing a percentage of production".

"The winemakers absolutely love three or four of these old cab [Cabernet Sauvignon] blocks that are just full of leafroll, and so winemaking won't let the company put in the capital plan to yank those blocks".

"You have to take into consideration what price per ton you are actually selling it. [There is] an economic threshold. Does it even make sense to rogue or remove a whole block, or just keep producing?"

"Our fruit costs are really relatively low to our bottle prices [so] we have the ability to do more things than most people do. Like pulling out vineyard blocks just because it's qualitatively a problem".

Market prices for fruit and wine determine the financial resources available.

Low grape and wine prices limit growers' financial resources; high prices allow a greater commitment of resources.

4

5

High demand for fruit lessens the incentive to adopt practices.

High demand makes it easier to sell infected and low-quality fruit. It can also result in risky shortcuts to boost production, such as planting uncertified plant material. Oversupply of grapes can lead to winery demands for higher quality.

"Because Washington was in such a boom for so many years there wasn't nearly enough fruit and...ultimately people compromise[d] on the health and quality of planting stock, so I think some bad decisions were made because of urgency in trying to fulfill winery needs".

"...people say we don't want red blotch fruit [but] there's just literally not enough supply of fruit down here for people to say that they absolutely won't take red blotch fruit".

"Locally I think it's taken a glut of grapes and wineries demanding clean vines and saying your contract's up if they're out in your vineyard and notice a bunch of leafroll...ultimately it takes something like that to force any change".

"I'm concerned where we're planting 3rd generation vineyards in the past 3 to 4 years, that if these brand-new ones succumb to red blotch that they won't be vineyards anymore".

"The red blotch hasn't seemed to spread in that block, so we have not done any roguing or anything in that block. We've known about it for 7 or 8 years and we've almost taken a hands-off approach".

Risk assessments of disease impacts are an important component of decision-making.

In California red blotch is viewed as high risk due to declines in fruit yield. Conversely, the absence of a vector and overall lower incidence of red blotch in Washington leads growers to focus on sourcing virus-screened plant material as their principal mitigation strategy.

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Cultivar differences have a big influence on the economics of adopting practices.

White and red grapes differ widely in value. White wine grapes are easier to sell regardless of infection status, whereas it is harder to achieve and maintain quality standards for red wine grapes.

"[leafroll] delays fruit ripening in white varieties. We don't care because we pick those earlier and there isn't a ripening problem as much. It is mostly the red varieties that we care about".

"In white grapes...the price per ton is so low that no one cares or does anything...Chardonnay is \$2,600 to \$2,800 a ton...Napa Cab \$8,000 a ton...Almost all the Chardonnay I have worked with or seen has leafroll".

KNOWLEDGE FACTORS

The role of scientific knowledge and its dissemination

"I've heard that they're still working on finding other potential vectors [for red blotch]...that research is crucial because the nice thing is we know mealybugs are vectors of leafroll-3...that gives people some hope...they can be proactive, they have a chance of beating it [leafroll]"

"With red blotch you tell a client you have to replant, and they say: 'great how do we not get that again?'. [So] it's hard to convince people of the economic outlays when it's not clearly defined what you're fighting"

Scientific studies convince growers to adopt practices. Understanding transmission biology is critical. Evidence that mealybugs transmit leafroll expanded management options and boosted the confidence of that the disease can be controlled. Uncertainty surrounding the transmission of red blotch, limited vector identification, and the few management options has created pessimism amongst California growers. **Growers identified several perceived knowledge gaps they wanted addressed.**

1

Perceived knowledge Gaps

- Availability of mealybug resistant rootstocks.
- More control options for organic growers.
- Region-specific studies of disease management.
- Evidence for the effectiveness of new strategies.
- Understanding of red blotch vectors.
- "Digestible" economic models and digital calculators.
- Mitigation of mealybug insecticide resistance.
- New tools for detecting viruses.

2

Growers must acquire knowledge of disease ecology and develop relevant skills. Knowledge increases adoption and proper implementation. Low knowledge leads to improper implementation and lost confidence in recognized management responses. The ability to identify and quantify disease and vector incidence is especially important.

"Last year there was an issue because it was hard to tell the difference between potassium deficiency and red blotch or leafroll"

"I have to rein my managers in from what I call the 'active no management' [strategy] that makes them feel good just because they did something but it's not going to fix the problem"

Poor knowledge leads to...

- ❖ Poor decision-making.
- ❖ Inability to detect vectors and disease.
- ❖ Inefficient roguing protocols.
- ❖ Confusion over certified plant material.
- ❖ Inappropriate use of chemicals.

The challenge of identification

- ❖ Difficulty detecting vectors hampers vector management.
- ❖ Diagnostic assays are used to overcome the challenge of visual symptom identification.
- ❖ Inability to visually assess or assay every vine hinders roguing.

“We went ahead and committed to a full-blown roguing program...we went from [removing] 1000 to removing...150 the next year to removing 30 the next year to removing 20 last year and this year...I think we’ll remove 10”.

“...when you go around and pull out leafroll you see it decline from season to season...whereas red blotch disease it seems like you can pull it out and you will see the same exact amount or maybe even more the next year...maybe pulling out vines is the wrong answer?”

Experience using practices influences adoption.

Positive experiences and successful prior outcomes encourage growers to maintain implementation of practices. Previous experience managing leafroll was beneficial in convincing growers to respond to red blotch.

3

4

Extension educators are an important and influential source of knowledge. Agricultural knowledge-sharing networks that include extension educators, local industry groups, crop consultants, and growers can be particularly effective. There are concerns when the number of educators is insufficient, and they are overstretched.

“It’s essential to have some kind of public researcher in each county”.

“[One UC advisor has] got two counties...[They’ve] not only grapes to deal with [they’ve] got row crops...and nursery crops...[their] attention span for all intents and purposes is way, way, over stretched”.

“There is a lot of good information out there, but I think it needs a lot of condensing and processing to be more accessible for folks”.

“There is a lot of mixed messaging...[extension] are doing great work but at the end of the day right now talking to you, you ask me to list the top 3 concerns of red blotch [and] I don’t have a really good go to thing to say...I don’t know what I would do in the same way as I can with leafroll”.

Extension educators should reflect on their activities to maintain high quality outreach programs.

There is continued demand for user-friendly, practical resources to distill the volume of information into more accessible formats. Messaging could be improved on specific issues such as economic models of leafroll, the impact of red blotch on wine quality, and red blotch transmission biology.

5

SOCIAL-BEHAVIORAL FACTORS

Organizational processes within companies, regional cooperation, public policy

1

Team processes within vineyard companies strongly influence knowledge acquisition, adoption, and implementation.

Management teams. High level vineyard decisions are typically made by multi-disciplinary teams that include viticulturists, winemakers, financial officers, and owners. Viticulturists view themselves as educators and advocates within these teams, responsible for raising awareness of viral disease issues and management solutions. Healthy working relationships, good communication, and trust between team members result in better quality decisions and effective implementation of virus management. Dysfunctional processes hinder implementation or lead to inappropriate practices.

“Upper management are pretty involved being out in the vineyard seeing what’s going on. You know, listening to me [viticulturist] for twenty years we all know where we are at and what we are trying to accomplish”.

“The wine-makers might not even know which vineyards have red blotch...they just see the grapes come in a truck and they crush everything and make wine”.

Vineyard team. Once the management teams decide to adopt certain tactics, the responsibility shifts to the farming team to implement those practices effectively. High value is placed on training for scouts and field crews. Specifically, trained workers who pay careful attention to detail are needed to scout for and identify vectors and visual disease symptoms.

“I’ve heard a vineyard manager say ‘I don’t know what’s wrong, I pulled out all my red vines’, but it’s like did you actually walk through after the crew pulled them out? Because I’ve worked other places where they leave half of them”.

“We’ve found it very effective for any host of problems...to make sure our entire team is as educated as they can be on signs, symptoms and bugs. We’ve built a culture where they can share that information and action is taken on that. If we’ve got educated, empowered employees, all of a sudden, it’s not myself and 3 viticultural staff looking at everything, we’ve got 30 people looking at the plants all the time”.

2

Regional cooperation is critical but

challenging. Local spread of virus is a major concern. Cooperation among neighbors involves sharing information about disease and vector incidence, coordinating practices, and sharing costs. Regional peer knowledge-sharing groups foster cooperation.

“it’s a hard thing to go over to your neighbor and tell them to pull their vineyard up, or that I think that you should manage your vineyard this way or that way”.

“We’re lucky to get our stuff replanted, let alone time it with our neighbors. I’m not gonna move my block replant up 10 years because my neighbor wants to line up with me”.

“I’ve got a really good relationship with my neighbor. They caught a couple mealybugs and applied some insecticides, and he asked if I would be willing to apply insecticides if they paid for the products, and I completely understood his investment. We try and be good neighbors and I felt fine about it”.

Challenges to neighborhood collaboration

- ❖ Coordinating logistics to align practices such as pesticide applications, mating disruption, replants.
- ❖ Different financial resources of neighbors that need to collaborate.
- ❖ Multiple neighbors and/or neighbors with different farming philosophies.
- ❖ Reluctance to share ‘propriety information’ or admit presences of virus.
- ❖ Sensitive nature of conversations about viral diseases.

Peer Knowledge Sharing Groups

- ❖ Facilitate conversations about disease problems.
- ❖ Allow sharing of information.
- ❖ Provide networking opportunities for neighbors to collaborate independent of group.
- ❖ Voluntary participation can be hard to initiate and sustain.

“These groups are great, because it opens up a conversation. It’s like pulling nails to get growers to start talking. It was good for them to sit down at one of those meetings and say ‘oh, we can coordinate when we replant and that will be much more effective”.

3

Public policy instruments can effectively support adoption of practices. Salient issues for growers are (a) nursery standards and regulations, (b) pesticide regulation, and (c) government assistance programs.

A

“The TAP program is very difficult to negotiate and could be improved. That is a great incentive for removing a vineyard. They pay up to 70% of the cost of replanting; we tried it, but it’s really difficult to jump through their hoops.”

Where I worked previously, we actually went through the County and got some Anagyrus [vine mealybug parasitoid] bottles brought up to distribute. It was really awesome that was available”.

Government assistance programs. Federal programs have helped cover the costs of vine removal and replanting for some growers. Others found these programs inaccessible or hard to navigate. Local County monitoring and management programs are popular. Some growers feel local government should mandate certain technologies or promote adoption with incentives. However, others are worried about government interference and overreach.

Pesticide Regulation. Growers are challenged by regulations restricting certain pesticides which are not always quickly replaced with alternatives. Limits on the timing or total applied amounts allowed can force growers to choose between using them for vectors of virus or other insects. These regulations can extend beyond US borders for growers targeting other countries for export.

“The government is knocking out a lot of chemistries that work for mealybugs and other pests...And we are not being really quick to get new chemistries on the market”.

“...last year the EU decided that Applaud [buprofezin; insect growth regulator] was not acceptable and so this year if we wanted to export product into those countries, we can’t have that residue on our product”.

B

Nursery standards and regulation. Many growers are sympathetic to the challenge nurseries face in supplying clean plant material. Others are frustrated and blame poor regulatory standards for viral issues. Growers are divided as to whether solutions should be punitive or collaborative. Nursery owners worry that stronger regulation can be counterproductive to their efforts to produce virus-free plant material. Lack of confidence in certified plant material is leading some growers to adopt riskier practices such as propagating their own material

“Nurseries are obviously really concerned about leafroll too. I think we’ve done a great job as an industry getting plant material cleaned up”.

“We’re going away from buying nursery stocks. We’re using all of our own budwood now because we feel like we can control it better”.

“I would like a certification program with teeth: with penalties, fines, license revocations”.

“I don’t know if there could be much more put in place from a regulatory perspective. Every nursery takes a little different approach that caters towards their pressures. Some common sense has to be applied; we are going to deliver the cleanest plants that way to our growers”.

C