Observations from the Grapevine Nursery Industry and Recent Vineyard Plantings

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WE ARE ALL FAMILIAR with the expression, "The buck stops here," which was popularized by President Harry S. Truman, who kept a sign with that phrase on his desk in the Oval Office. It refers to the notion that the President must make the decisions and accept the ultimate responsibility for those decisions. Although not completely apropos to the winegrowing industry, the condition and performance of grapevine nursery stock are always up for discussion when problems occur in recently planted vineyards. Someone must be at fault when vines fail to perform, and the nursery is the go-to fall guy. The best way to plant a vineyard is to have a complete understanding of the physical and pathological status of vines pre-propagation, during production and at the time of delivery. Documentation of the status of propagation materials and quality control parameters, through vine production and selection of finished product, provides the grower with a record—similar to a pedigree—of parameters relating to the origin and status of the grapevine plant product.

With a biological system as complex as wine—considering all the materials, processes, skilled and manual labor, weather conditions, soil, irrigation and chemical interactions—it is essential to know that one can at least rely on the condition of the vines upon which the whole industry stands. Simply put, when things go wrong, it helps to know that the vines planted were of high quality.

How to Avoid Fall Vine Mortality in Recently Planted Vineyards

Ordering grapevine plants is time-consuming and complicated by the considerable array of options available to the grower (**TABLE 1**).

The type of product available for planting is usually determined by the length of time between order placement and desired planting time. One of the most popular products is the green potted bench graft, which takes 16 to 20 weeks from grafting to planting. Most nurseries begin grafting potted green product in mid-January to February of the delivery year, and consequently, green vines are delivered from late June through early August. Planting, after July, should be considered a late planting, and vines must be carefully managed to allow for reasonable establishment and growth before hardening off prior to winter frosts. A temperature of 21.2°F was recorded on Nov. 10, 2020 in Oakville (NE Ranch 88) following daytime temperatures in the mid-60s and in the mid- to high-80s during the previous week1.

Similar rapid falls in temperature from elevated daytime highs were experienced in 2019 and illustrate the importance of controlling fall growth on newly planted vines to prevent frost damage and concomitant vine mortality. Given the unknowns associated with climate change, it should be expected that more extreme weather is on the table.

TABLE 1. Grapevine Plant Product Selection

Best for early planting: April - June Dormant product	
Product	**Comments: pros and cons**
1 year old dormant potted vines	Root binding, vine/pathogen stress, nursery losses over winter
Bare root dormant rootstock rootings	110R, 1103P in short supply. Availability of budwood
Bare root dormant bench grafts	Order may be short. Poor quality VR 039-16 vines. 420A, Riparia Gloire shortages
Best for limited exposure to virus pressure Potted vines (no field exposure after testing)	
Product	**Comments: pros and cons**
Freshly grafted green product is preferred	May only be available late in planting season. Order may be short. VR 039-16, 420A difficult to graft. GRN-1 is hard to source
Best for replanting/interplanting	
Product	**Comments: pros and cons**
1 year old dormant potted vines	Stronger than fresh green vines
Large format 24", 36" grafted vines	Larger roots system better for in-row competition
Bare root dormant rootings and grafted vines	Stronger vines for better establishment

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FIGURE 1. Spur tissues green but no bud push on cold temperature-damaged Durif 03/1103P vine planted in July 2020 (5.6.21)

Frost-associated Vine Mortality

Problem:

- Occurs especially in late planted, green potted bench grafts
- Vineyards subject to any and/or late fall/early winter frosts
- Especially problematic with VR 039-16 grafted vines (*Vitis vinifera* cv. Almeria × *V. rotundifolia*)

Observations: Dead or Dying Vines in Early Spring

- Green potted vines planted in summer year 1 protected by carton:
  - Significant proportion of vines fail to push (i.e., are dead) in spring year 2
- Vines dying back from spurs—green spur tissues present but no bud push (FIG. 1)
- Where bud push does occur, it is often from base of spur—rather than from buds on spur (FIG. 2)
- Wound response callus developing from rootstock shaft or below/at graft union (FIG. 3)
- Examination shows vines in good condition at time of planting, i.e.,
  - Good roots—often live
  - Clean trunk—live
  - Good graft union—maybe drying out
  - Strong spurs

Solutions:

Pre-plant solutions:

- Plant as early as possible in year 1

Post-plant solutions:

- Remove fertigation by mid-September of year 1 at the latest to harden-off vines
- Remove cartons before first fall frost
- Mound vines with native soil to cover at least 3 inches above graft union
  - Mound by hand—or if no cover crop sown and soil easily workable, plow with tractor
- Soil provides much better insulation and heat retention when mounded than:
  - Adding soil to cartons
  - Adding wood shavings to cartons
  - Adding grass to cartons
- Remove mound at time of two-bud pruning in spring year 2 and re-install cartons

FIGURE 2. Bud push from base of two-bud spur on cold temperature-damaged vine (5.25.21)

FIGURE 3. Wound response callus from rootstock shaft below graft union

Vineyard Observations Spring 2021: Pinot Leaf Curl

Some recently planted and established Pinot Noir vineyards in Sonoma County exhibited significantly stunted growth this spring—with some vines showing very little shoot development around bloom time. This is especially worrying in first leaf vineyards where the establishment of good vine growth in the spring is critical. This is defined as Pinot Leaf Curl (PLC).

What is Pinot Leaf Curl?

- Related to changeable cold/hot weather, unstable temperatures and also the similar condition known as "Spring Fever"
- Low temperatures in early spring cause stunting of new shoots—observed in mid-April 2021 in the Forestville/Trenton Road area of Sonoma County (FIG. 4)
- In some instances, shoot foliage is severely stunted, and only clusters develop
- Visual appearance of vines is especially worrying in large new plantings
- Development of symptoms correlates with prolonged periods of low temperatures at the beginning of the growing season through bloom[2].

FIGURE 4. Stunted growth associated with Pinot Leaf Curl, April 20, 2021

Biology of Pinot Leaf Curl and Treatment Options

- PLC shows similarities to the nitrogen-related disorder "Spring Fever"
- Spring fever symptoms correlated with elevated Putrescine levels
- There is no strict correlation between PLC and putrescine—the cause of PLC is unknown
- This can result in significant crop loss because of flower loss before or during bloom
- PLC may be confused with frost damage

What to Do

- Don't panic
- Make sure to plant only high quality, physically sound vines so that defective vines can be ruled out as the cause of the problem—and that vines affected by PLC are suitably robust to pull through this challenge
- Vines will usually revert to normal growth after the cold spell has passed and temperatures increase

TABLE 2. Budwood Selection Options

Field budding	When?	Purpose	Wood source	# buds to vines	Pros	Cons
Spring field budding	May - June	Grafting varietal to rootstock rooting	Dormant canes collected previous winter	150%	Budwood fairly readily available	Buds need to be stored for several months. Buds need to be properly prepared for cold storage. Buds need to be properly handled prior to grafting.
Spring top working	April	Changing varietal of established vines	Dormant canes collected previous winter	300%	as above	as above
Fall field budding	August	Grafting varietal to rootstock rooting	Lignified canes collected direct from source vines	150%	Faster development of scion due to earlier grafting. No budwood storage required.	Difficult to locate budwood - best if non-nursery source of buds available. Limited number of buds available from mother vines.

Budwood for Field Grafting

A significant proportion of growers with sufficient time to enjoy the luxury of delayed scion clonal selection prefer to plant dormant bare-root rootings in the spring followed by field grafting (usually) in the spring of the following year. Planting dormant rootings allows for establishment of a strong root system and trunk during the first year, which will support the development of rapid and unform shoot growth after grafting the following year. The downside to this method of vineyard establishment is the requirement to secure high quality budwood for field grafting. Due to the varied quality of available budwood, it is usually wise to order 1.5 times as many buds as vines to graft for spring field budding and three times as many for topworking new varietals (TABLE 2).

Rootstock Selections for *Xiphinema index*/Fanleaf Virus-infected Sites

VR 039-16 is the workhorse rootstock planted to tens of thousands of acres in Napa and Sonoma counties. First released in 1991 and bred by HP Olmo at UC Davis, the rootstock supports excellent fruit and wine production and represents a monoculture where no other rootstock variety has a proven record of resistance to *Xiphinema index* and fanleaf virus. Two other fanleaf-resistant rootstocks are available, however, and are worth discussing as possible alternatives to VR 039-16: GRN-1 and RS3.

VR 039-16. *Vitis vinifera* cv. Almeria × *V. rotundifolia* Male No. 1

VR 039-16 was developed at UC Davis. It has very strong resistance to *Xiphinema index*, the dagger nematode vector of grapevine fanleaf virus (GFLV). Although this rootstock resists *X. index* feeding, it allows movement of GFLV into scions, but the severe decline in fruit set typical of GFLV infection does not occur.

- VR 039-16 is the go-to rootstock for sites with X. index and fanleaf virus with proven performance in multiple sites and locations with a broad range of varietals
- VR 039-16 is moderately to highly vigorous but produces high quality fruit when grafted to Cabernet, Sauvignon Blanc, Merlot and Chardonnay clones and other varieties in many areas of Napa and Sonoma counties, including Rutherford, St Helena, Oakville, Healdsburg and Geyserville
- Resistance to X. index and fanleaf virus is robust
- It is fairly easy to propagate as green potted vines that require two times overage grafting
- Root systems of dormant bare-root vines collapse rapidly in extended cold storage after field harvest

GRN-1. *Vitis rupestris* x *Muscadinia rotundifolia*

This selection is one of five nematode-resistant rootstocks released by Andy Walker and UC Davis in 2008. This selection is one of the rare sources of resistance to ring nematode that exhibit extremely strong and broad nematode resistance. VR 039-16 is currently being tested for its ability to induce fanleaf tolerance[3].

- It is resistant to a broad array of grapevine viruses, including a tolerance of fanleaf virus
- The longevity of resistance to fanleaf is unknown
- GRN-1 is difficult to propagate as mother vines realize only approximately 25 percent of cuttings compared with other rootstocks
- Consequently, it is expensive to test for pathogens prior to propagation—and grafted vines are costly
- There is only limited availability

RS3. Ramsey x Schwarzmann. Interspecific hybrid (*V. champinii*; *V. riparia*; *V. rupestris*)

David Ramming and Michael McKenry released this interspecific hybrid rootstock in 2003 from the USDA-ARS (Fresno, CA) and UC Riverside.

- This rootstock features broad-spectrum resistance to nematodes with a moderate vigor level that is most suitable for coarse to fine sandy loam soils and displays resistance to all known aggressive populations of root knot nematodes, X. index, the citrus nematode and root lesion4
- RS3 has moderate vigor and has proven to have good resistance to X. index and fanleaf virus in large scale plantings in vineyards north of Healdsburg, Sonoma County
- It is an interesting rootstock as it is fairly easy to propagate, appears to have good fanleaf resistance and offers an alternative to the mono culture of VR 039-16 in many premium grape regions
- Consider this rootstock for a block trial comparison with GRN-1 and VR 039-16

Pierce's Disease-Resistant Winegrapes

Five Pierce's Disease-resistant winegrape varieties were released from UC Davis in 2019, resulting from the breeding program of Dr. Andy Walker. These varietals are all 94 to 97 percent *Vitis vinifera* combined with wild *Vitis* grapevine germplasm. Three red and two white varieties are available. The red varietals are Camminare Noir, Paseante Noir and Errante Noir, which were bred from various combinations of Cabernet Sauvignon, Petite Sirah, Zinfandel, Sylvaner, Carignane and Chardonnay. The white varietals are Ambulo Blanc and Caminante Blanc, which were bred from Cabernet Sauvignon, Carignane and Chardonnay. Growers are considering using these varietals as buffers to shelter standard varietals in high PD pressure sites.

Grafted vines of these five new varietals have been promised from grapevine nurseries for delivery in 2022.

Virus Status of Grapevine Plant Materials

Grapevine Red Blotch and Leafroll 3 continue to be the most economically significant viruses found in certified classic and Protocol 2010 grapevine nursery stock. LR3 is transmitted by mealybugs while the vector for GRBV is still unknown. GRBV spreads quickly, and it has been questioned whether the virus may remain latent and undetectable for several years.

Grapevine Pinot Gris virus (GPGV) has been found in certified Protocol 2010 rootstock increase blocks. To date, the only variant found in California is the asymptomatic or latent clade that does not appear to be detrimental to crop quality or yield. However, this clade was found in two rootstock varietals in 2021 versus one in 2020. GPGV is vectored by the *Erineum* mite—found broadly throughout northern California vineyards. (Please review Golino et al. 2020 for more details of the biology and distribution of GPGV in California.)

California nurseries rely on Foundation Plant Services at UC Davis for the release of clean,"pathogen-free" rootstock and scion clones for the propagation of grafted vines and the development of clean vineyards. Protocol 2010 CDFA-certified stock is maintained exclusively at the Russell Ranch Foundation block located between Davis and Winters.

1. Ongoing annual screening of this block has identified, since 2017 a rapidly expanding number of vines infected with Red Blotch virus (**TABLE 3**).
2. The rapid annual increase in the number of infected vines is especially concerning because contaminated and adjacent vines are removed each season after they have been identified.
3. Furthermore, the method of transmission of this virus is unknown.
4. Interestingly, the original Classic Foundation blocks located close to U.C. Davis have not become contaminated with Red blotch.
5. Excerpted from "Red Blotch Testing, Research, and Plans for the Future (10.14.20. FPS)": Foundation Plant Services (FPS) has been testing grapevines in its foundation vineyards for Grapevine Red Blotch Virus (GRBV) since 2013. Red blotch infection rates have remained extremely low in the Classic Foundation Vineyard, ranging from 0 to 0.21 percent since 2013. None of the 4,270 vines was infected in 2020. Russell Ranch Vineyard (RRV) remained unaffected, until 2017, when five of 4,132 vines, only 0.1 percent, were infected with GRBV. Since then, despite significant efforts to prevent the occurrence of the disease, the infection rate in the vineyard has increased to 0.5 percent (24 of 4,406) in 2018, 7.1 percent (339 of 4,761) in 2019 and 18 percent (788 of 4,367) in 20205. **WBM**

TABLE 3

Foundation Testing for Red Blotch, 2013-2020

	RUSSELL RANCH FOUNDATION				CLASSIC FOUNDATION			
Year	Vines Tested	Total Vines	Positive Vines	Infection Rate	Vines Tested	Total Vines	Positive Vines	Infection Rate
2013	1,106	1,142	0	0%	3,428	4,284	9	0.21%
2014	2	1,807	0	0%	1,010	4,081	6	0.15%
2015	1,002	2,616	0	0%	636	4,169	0	0%
2016	584	3,290	0	0%	2,276	4,163	0	0%
2017	6,761*	4,132	5	0.1%	3,604	4,088	1	0.02%
2018	6,013*	4,406	24	0.5%	4,127*	4,075	0	0%
2019	5,442*	4,761	339	7.1%	4,167*	4,075	1	0.02%
2020	4,455*	4,367	788	18%	4,301*	4,270	0	0%

*Some vines tested multiple times

References

1 westernweathergroup.com; *https://bit.ly/3g38pR3*

2 Adams et al., 2015, *http://cesonoma.ucanr.edu/files/218499.pdf*

3 *fps.ucdavis.edu/fgrdetails.cfm?varietyid=2641*

4 *fps.ucdavis.edu/fgrdetails.cfm?varietyid=2114*

5 *fps.ucdavis.edu/newsarticle.cfm?newsid=75*

6 Rhonda J. Smith, Larry J. Bettiga and Douglas O. Adams. Pinot Leaf Curl. CAPCA Adviser August 2015. *http://cesonoma.ucanr.edu/files/218499.pdf*

7 Maher Al Rwahnih,1 Alfredo Diaz-Lara,1 Kari Arnold,2 Monica L. Cooper,3 4 Rhonda J. Smith,4 George Zhuang,5 Mark C. Battany,6 Larry J. Bettiga,7 Adib Rowhani,1 5 and Deborah Golino. Incidence and Genetic Diversity of Grapevine Pinot Gris 2 Virus in California 3. AJEV Papers in Press. Published online December 29, 2020. *American Journal of Enology and Viticulture* (AJEV). doi: 10.5344/ajev.2020.20044