The importance of clean grapevine plants and how to secure them

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SRJC, Santa Rosa, CA
January 31, 2025

GOALS OF QUALITY ASSURANCE in GRAPEVINE PLANT PRODUCTION

- Growers want delivery of:
  - *uniformly high quality vines*
  - *in correct amount*
  - ***on time***
  - Virus-test negative
  - Of good physical condition =
    - Low fungal and bacterial pathogen loads

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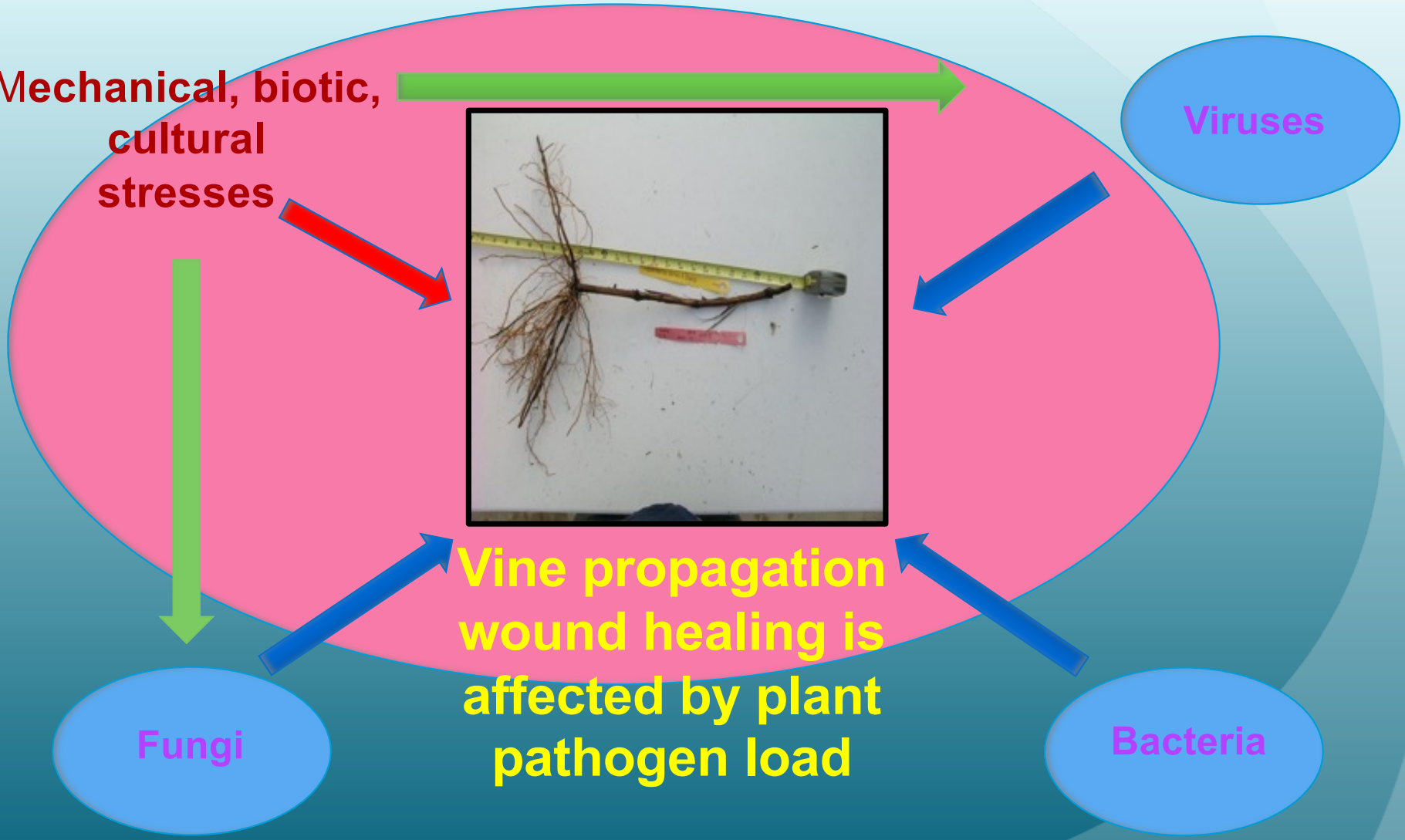
Vine Quality Assurance

- Selection of nurseries/placement of orders
- Propagation materials selection, evaluation and testing
- Monitoring: grafting, callus success, greenhouse/field growth: notify client
- Finished product grading and shipping approval
- Evaluation of pathogenic and physical status of FINISHED product

HOW TO SELECT A NURSERY

- Good communication – order status
  - Transparency/Dedicated nursery representative
- Clean, modern, sanitary facilities
- Mother blocks distant from commercial vineyards
- In-house virus test program: protocol?, viruses?
- Mealybug control and exclusion program

Factors affecting grapevine performance and longevity



VINE CERTIFICATION: CDFA and FPS

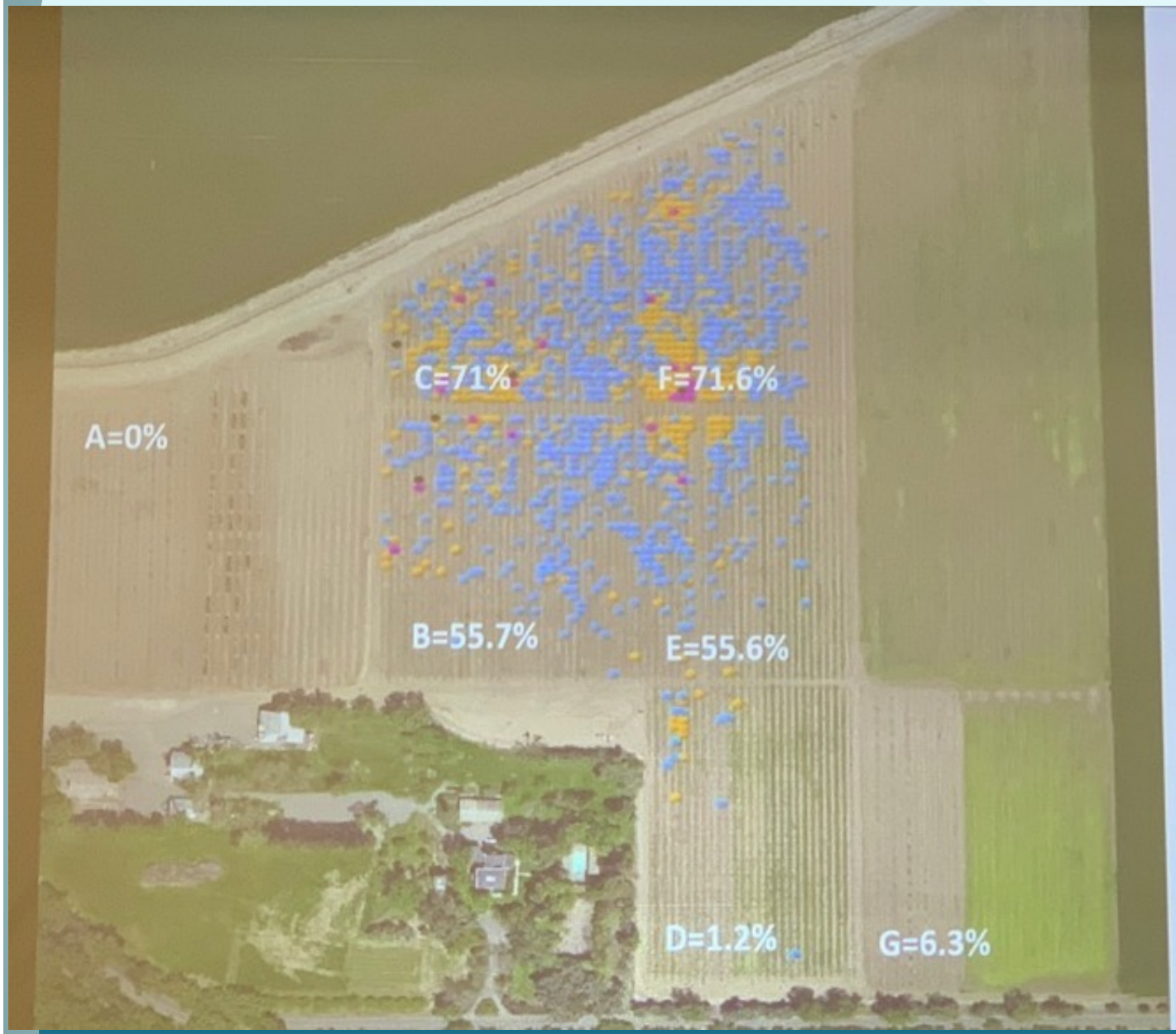
- **CDFA provides vine material product guidelines: Grapevine Nursery Certification Program**
- FPS cleans, identifies and establishes Foundation Block vineyard: 2 vines per selection – in SCREENHOUSES
- FPS propagates FB material for Increase Block establishment at Certified nurseries
- Nurseries propagate, graft and distribute vines derived from IB cuttings
- Protocol 2010 vs. Classic certified

CDFA Certification

- Voluntary
- Virus status regulated by CDFA
- Fungal/bacterial pathogens are not
- Rootstock production
  - most produced under CDFA guidelines
- Scion production – reasonable proportion not produced under CDFA guidelines
- Field evaluation/testing: FB, IB & nursery row vines

2010 Protocol: the new standard

- Grape material must be generated via micro shoot-tip TC virus elimination therapy
- Foundation grapevines must test free of all known grapevine viruses
- Planted in Russell Ranch Foundation Vineyard between Davis and Winters
- **RRFV CURRENTLY BEING REPLACED BY SCREENHOUSE VINES**



2021 Estimated GRBV Incidence

Year	Percent Positive
2017	0.1%
2018	0.5%
2019	7.1%
2020	18%
2021	51.6%*

*Estimated

Abandoned 2021

Pathogens found in nursery stock

- GLRaV-3: mealybugs
- GRBV: tree hoppers – TCAH *Spissistilus festinus*
- LR4, LR5, LR9: mealybugs
- GVA, GVB (Rugose wood disease/vascular tissues)
- Grapevine Pinot Gris Virus (Erineum mite)
- **Combinations of viruses: top working**
- **GFLV (not found in certified stock to-date)**
- *Agrobacterium vitis* (Crown gall): very common
- Opportunistic fungal pathogens

Historical incidence of virus in CDFA certified Increase Blocks

26% of 68 certified rootstock increase blocks were positive for LR2 or LR3 or GVB or combinations (Stamp 2001-2010)

Table 4. Testing of RS and scion increase blocks. Nov. 2012-May 2014

Material	Source	GRBaV	LR2	LR3	LR9
101-14MG	CDFA CERT	POS			
420A -1*	CDFA CERT	POS			
420A -2*	CDFA CERT	POS			
5C	CDFA CERT	POS			
VR 039-16	CDFA CERT	POS			
CH FPS 4	CDFA CERT	POS			
CS ENTAV 15 -1	CDFA CERT	POS			
CS ENTAV 15 -2	CDFA CERT	POS			
CS ENTAV 169 -1	CDFA CERT			POS	
CS ENTAV 169 -2	CDFA CERT	POS			
CS ENTAV 338	CDFA CERT	POS			
CS ENTAV 412	CDFA CERT	POS			
CS FPS 4	CDFA CERT	POS			
CS FPS 6	CDFA CERT			POS	
CS FPS 7 -1	CDFA CERT			POS	
CS FPS 7 -2	CDFA CERT	POS			
CS FPS 7	Field selection	POS			
CS FPS 31	CDFA CERT			POS	
CS FPS 33 (191)	CDFA CERT	POS			
CS FPS 47 (337) -1	CDFA CERT			POS	
CS FPS 47 (337) -2	CDFA CERT			POS	
MB FPS 9 -1	CDFA CERT	POS			
MB FPS 9 -2	CDFA CERT	POS			
ME ENTAV 181	CDFA CERT	POS			
PN ENTAV 943	CDFA CERT			POS	
PN FPS 90 Calera	CDFA CERT			POS	
PN Calera	Field selection 1		POS	POS	
PN Calera	Field selection 2	POS		POS	
PV FPS 2	CDFA CERT	POS			
SB FPS 1	WA STATE CERT			POS	
SB FPS 1 -1	CDFA CERT			POS	
SB FPS 1 -2	CDFA CERT				POS
SB FPS 1	Field selection	POS			

*-1, *-2: different increase block sources
POS: positive for virus

Grapevine Red Blotch associated Virus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Red Blotch Disease

- Grapevine red blotch virus is causal agent
- GRBV is graft-transmissible
- GRBV is not mechanically transmitted
- Vectored by Three Cornered Alfalfa Hopper – YES – easy to find - but difficult to trap
- Plant only virus tested, clean vines
- Manage by removal of infected vine – rogueing

Feeding damage 3C Alfalfa Hopper

Spissistilus festinus

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Two treehopper species in California
Family Membracidae

Treehoppers are identified by the enlarged and elongated first thorax segment (pronotum) which projects above the head and extends back over the abdomen. Key characteristics distinguishing these two species are: a) size and b) where lateral ridges join.

Threecornered alfalfa hopper, *Spissistilus festinus*

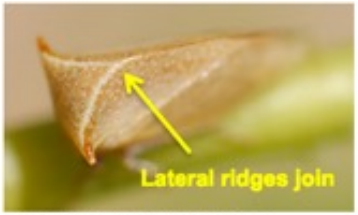
Nymph has 12 pairs of hairy spines and a protruding "tail" at the end of the abdomen.
Photo: Charles Lewallen

Adult ~¼ inch (6mm) long and green in color. Pronotum gradually curves backwards with lateral ridges joining midway to ¾ the length of the body. No lateral horns.

Tortistilus albidosparsus

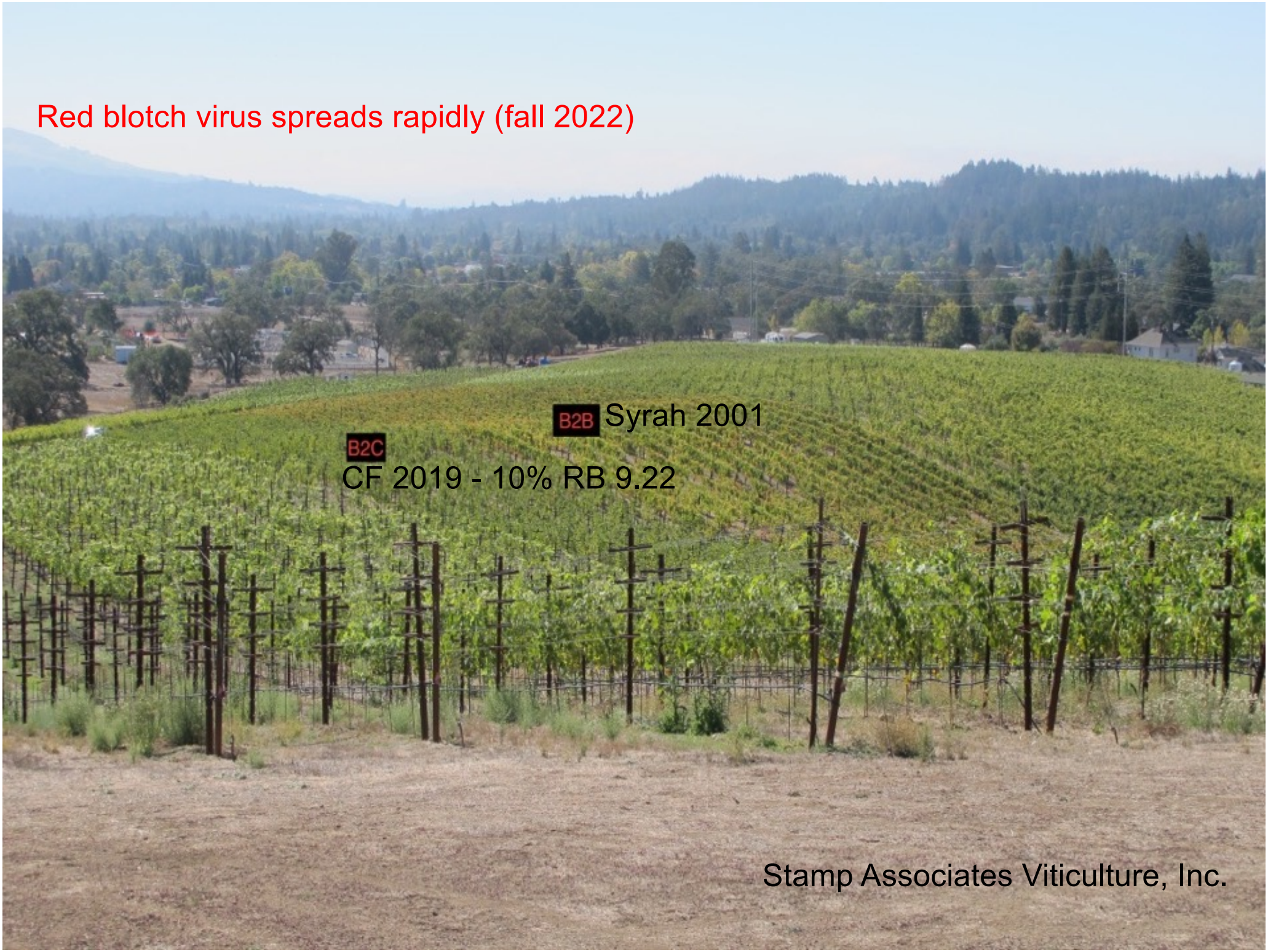
Adult ~1/3 inch (8mm) long; brown or green in color. The pronotum rises vertically above the head with the lateral ridges joining over the thorax. Polymorphic (many forms) species; some hornless, others with pronotal lateral cone-like horns of various sizes.

Photo: Cindy Preto



Above and center photos: specimen with red-tipped lateral pronotal horns.

Above photo: green hornless specimen (left); brown with pronotal horns (right).


Red blotch virus spreads rapidly (fall 2022)
B2B Syrah 2001
B2C
CF 2019 - 10% RB 9.22
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Red blotch virus spreads rapidly: FPS Russel Ranch

- Sentinel vines

CF: Planted May 2020

- GRBV inoculum

UCDAVIS
Foundation Plant Services

October 2022

Red blotch virus spreads rapidly: FPS P2010 Russel Ranch

CF sentinel vines: Planted May 2020

Time point	GRBV+ Vines	Incidence
May	21	1.0
August	4	0.08 – 1.0
October	2	0.17 - 0.67
Total	28/284	10%

UCDAVIS
Foundation Plant Services

Red Blotch disease impacts

- Reduced sugar in fruit juice
- Reduced fruit yield
- Higher pH in fruit juice
- Higher titratable acidity in fruit juice
- Lower anthocyanins & tannins in berry skin
- Reduced vine growth
- Sauvignon Blanc - less symptomatic

TABLE 3 The bottom line: The effect of Red Blotch on wine value at a Napa Valley winery

Red Blotch	Wine category	Harvest sugar	Seed components	Tons/acre	Cases/ton	Gal/ton	$/gal	$/case	FOB Gross wine revenue/acr
NEG	Reserve	28° Brix	Complete ripening	3	50			$600	$90,000
POS	Bulk	25° Brix	Impaired ripening*	2		150	$25		$7,500

*immature pigment and phenolic components

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Managing RED BLOTCH and LR3 infections

- Determine incidence in a given area of vineyard as soon as symptoms noticed
- Rogue infected vines if disease incidence is less than 30%
- A full vineyard replacement should be considered if disease incidence is above 30%
- Rough guidelines depending on many other factors: area, management, tolerance etc.

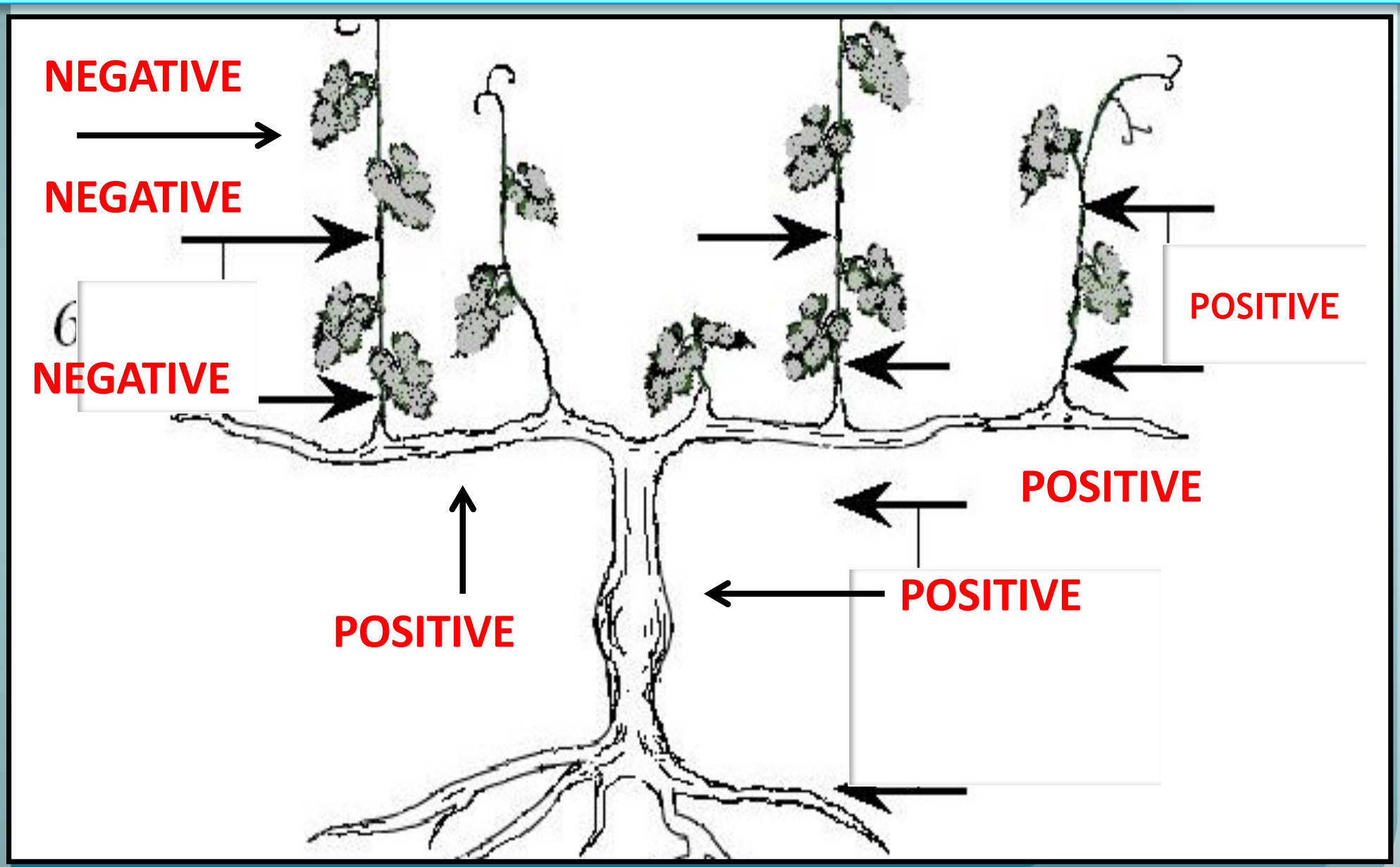
Red Blotch disease observations:

- Can take up to 16 months after infection before symptoms develop
- TCAH moves into vyds when surrounding vegetation dries out – vyds not 1st choice for feeding
- A gemini virus – TCAH has to be found in salivary glands
- Girdled vines not necessarily infected.
- Not known if roots are good for testing

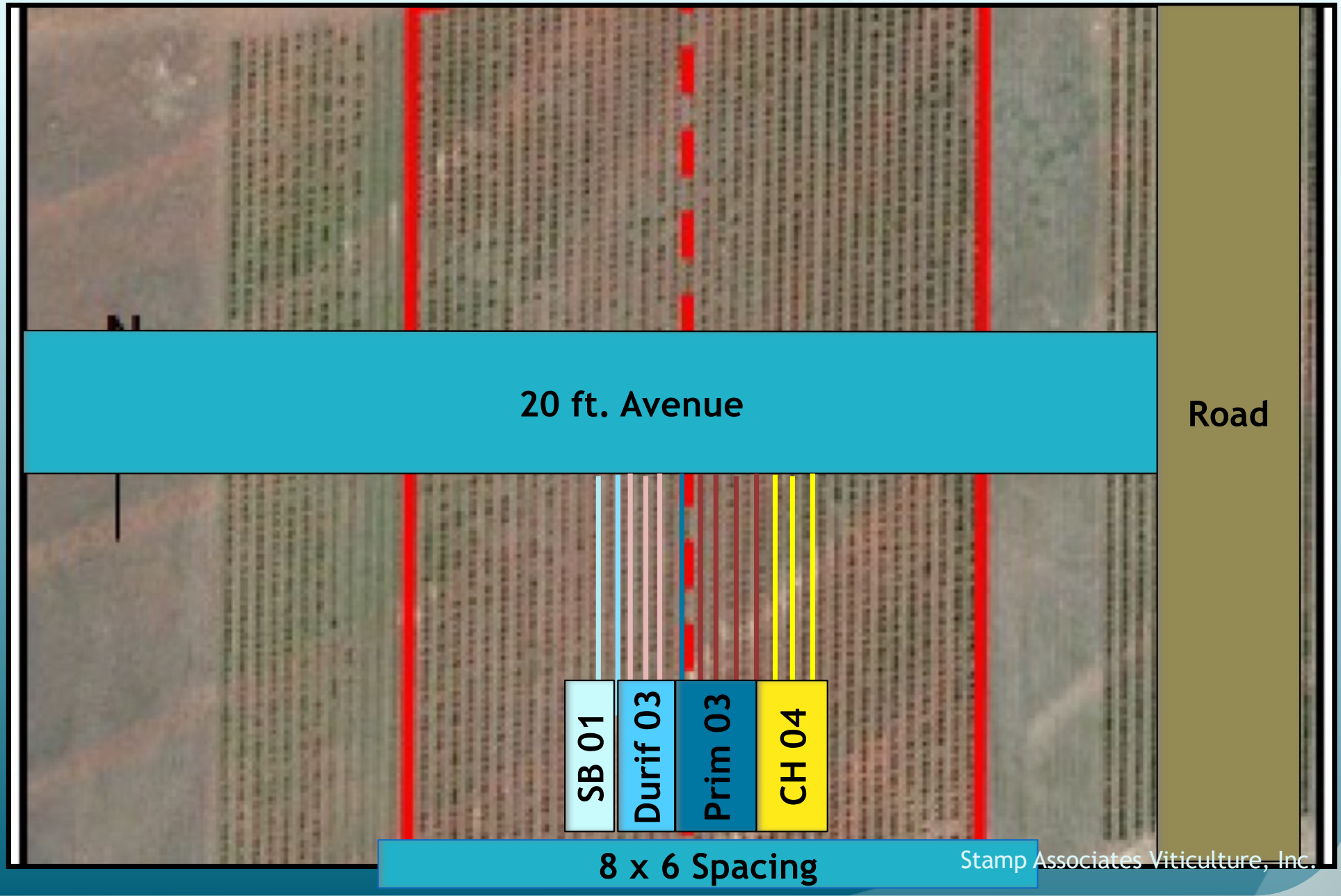
Sampling strategies: Pre-grafting

- Visually evaluate, test and tag every IB vine as late as possible while leaves attached: October
- Walk both sides of rows
- Select contiguous healthy vines, rows, blocks
- Woody canes close to head: virus titer variability
- Pre-screen for: *Agrobacterium vitis* (crown gall)-
  - and/or GRBV, LR3, GPGV

Virus distribution in grapevine: uneven



What is an increase block? Source of propagation materials for grafting



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Sampling Increase Blocks


CHARDONNAY
© INSPECTED BY
JAMES A. STAMP, PH.D.
Row# Block# Code Rootstock FPS
291 4 SG-CH0004*IN*-C 5BB FV G R9 V6
Row# Block# Code
291 4.00 SG-CH0004*IN*-C
CHARDONNAY 04
Origin: Olmo

When to sample – as late as possible before leaves fall

Sampling Increase Blocks

CH Montrachet 10.20.23

CH Montrachet 11.7.23:

- red blotch positive

Red blotch CH04 12.4.14

CS412. 9.24.12

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CS412 11.6.12

Cost to test mother vines to produce 10,000 benchgrafts by grafting 17,000

	# Vines	Composite samples @ 2 cuttings per vine, 5 vines per sample	Test 100%, LR3, GRBaV + 12 additional viruses @$15/test	Per vine cost 10,000 vines
RS (@100c/v)	170	34		
Scion (@200 b/v)	85	17		
		51	$10,710	$1.07

Sampling strategies: Post-grafting: finishing/finished product

- Examine vines in nursery row in fall for health status
  - Pre-screen for GRBV, LR3
- Use statistically significant methods to sample finished product for full virus panel
- Determine physical condition of finished product

Fall field evaluation: Malbec 09/420A production: GRBaV +ve

Fungal pathogens are STILL important

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Fungal and Bacterial pathogens of greatest concern in nursery stock

- Petri Disease/Esca/Young Vine Decline pathogens include:
  - *Phaeomoniella spp. (Togninia minima)*
  - *Phaeoacremonium spp.*
- Black Foot Disease
  - *Cylindrocarpon*

Opportunistic pathogens: problematic only under situations of stress

Pathogens prevent propagation wound healing in nursery stock

- ***Standard propagation methods mean that most new vines may be contaminated with opportunistic fungal pathogens***
- These affect graft union and propagation wound healing and root development. And can cause the development of lesions at the graft union and rootstock base
- Consequently, the 'stronger' the vine, the lower the likely pathogen load
- Plants' response also includes blocking of xylem tissues - reducing vascular function

How to identify low pathogen- load, healthy vines by physical evaluation

- Percent take in the greenhouse or field: If low take, surviving vines may be inferior
- Careful external and internal examination of product essential
- Dormant vines should withstand moderate flexing in two planes at 90^0 to each other – detects weak graft unions and rootstock lesions
- Complete root systems (no RS lesions)

Evidence of fungal pathogens in bare-root vines

Evidence of fungal pathogens in dormant vines: trunk lesions

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Fungal pathogens in dormant potted vines

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Crown gall or Callus?

Crown gall	Callus
Tend to be spherical in structure	Do not tend to be spherical
Smooth, uniform surface, amorphous	Knobby, pitted, convoluted surface, resembles redwood burl
Tissue is soft and wet—easy to squeeze moisture from, easy to squeeze out of shape	Tissue is hard and dry. Not easily deformable. May have woody interior
Red varieties tend to have red streaked interior	No red streaking observed
Frequently found at soil line	Rarely found at soil line

Crown gall at soil surface of CS685.1/VR O39-16.1 green vine (20 weeks old)

Surface of callus at disbudding site on rootstock shaft of CS412.1/O39-16.1 green vine (20 weeks old)

Internal structure of crown gall shown above

Internal tissue structure of callus shown above

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CS7.1/110R.1 (28%)

CS30.1/VR 039-16.1 (12%)

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Vine evaluation: dormant

- Root system: complete, milky white in section
- Rootstock: wound healing, internal condition, lesions, translucent white section
- Graft union: strong, completely healed
- Vine withstands flexing
- Spur development: emerald green in section
- No rootstock suckers
- No crown gall

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Vine evaluation: green potted

- Stability in soil: root development
- Root ball remains intact when vine removed
- Graft union: firmly established
- Top growth: spur caliper, length and lignification
- Age

Greens vs Dormant bench grafts

Greens

- Order year prior to delivery
- Plant when ready for best root architecture: 16-20 wks.
- Cleaner production
- Better for 420A, O39-16, Riparia Gloire:
  - reduced testing costs
  - more likely to fill order
- Late delivery: multiple plant dates?

Dormants

- Order two years prior
- Better root architecture
- Contamination in nursery row?
- On time early season delivery likely – but field losses may occur
- Dormant rootings
  - Budwood source?
  - Field grafting - weather

Green vine deliveries: May - July, 2015

Mounding for frost protection

CURRENT STATUS/THE FUTURE?

- Grapevine propagation has remained unchanged for generations
- Consider how important our grapevine plants are
  - Net per vine ***fruit value*** 20 years Napa CS @ 10.56 lb/v: $572
  - Net per vine ***wine value*** 20 years Napa CS @ $51/bottle: $3,233
- We need to invest in the development of improved production methods
- Going forward, the only real solution is the application of gene editing technologies for LR3 and GRBaV resistance
- We need to engage consumers in a conversation about genetically improved vines

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Acknowledgements

Stamp Associates Viticulture Clients,

Nursery and Laboratory partners

Associates

- Pablo Covarrubias
- Benjamin Falk
- Ziru Mo
- Michaella Patt

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Crown gall vs. callus

Crown gall	Callus
Tend to be spherical in structure	Do not tend to be spherical
Smooth, uniform surface, amorphous	Knobbly, pitted, convoluted surface. Resembles redwood burl
Tissue is soft and wet – easy to squeeze moisture from. Easy to squeeze out of shape	Tissue is hard and dry. Not easily deformable. May have wood interior

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

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.

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

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Bare root dormant rootings and grafted vines	Stronger vines for better establishment

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Dr. James Stamp, PhD, owner of Stamp Associates Viticulture, has announced the expansion of his forensic viticultural services to include the diagnosis of under performing and non-performing vineyards.
"The nurseries have done a good job in providing clients with trouble free planting material but we still continue to receive calls post-planting for under performing vineyards," said Dr. Stamp.
"These problems have been as basic as winter kill or more complex involving fungal pathogens and trunk disease or vineyards compromised by poor planting techniques," said Dr. Stamp
"During this current planting boom many companies have been handicapped by a shortage of professionally trained labor and supervision as well as a certain amount of "sticker shock" when the true cost of vineyard redevelopment becomes apparent. People try to save money at planting time but that is absolutely the wrong time to cut corners," said Dr. Stamp.

PROPAGATION QUALITY ASSURANCE

- Evaluate all steps of the propagation process
  - IB block selection, testing and tagging in late fall
    - Walk both sides of all rows
    - Only test contiguous rows/stands of “healthy” vines
  - Oversight of harvest of IB propagation materials
  - Grafting oversight
  - Callusing success: is re-grafting required? Alternatives?
  - Production cycle observations: greenhouse and field (poor takes?)
  - Selection, grading and testing of finished product
    - Evaluation of physical condition

Critical steps in choosing grapevine nurseries

- Open to frequent visits: excellent communication
- Modern, clean sanitized operation facilities
- Increase blocks far removed from commercial vineyards
- Frequency that nursery tests IB's for viruses?
- Protocol 2010 materials available?

CLEAN FACILITIES = CLEANER VINES

Choosing a vine product

- Dormant benchgrafts
  - Nursery row contamination
  - Adjacent crops – MB?
- Rootings: is budwood available?
- Potted vines
  - Cleaner than dormants?

The importance of proper vine establishment before application of stress

- Time of planting: especially green vines
- Proper planting practice
- Irrigation
- Establishment of strong root system
- Young vine decline: fungal pathogens

Timing is everything…..

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Root Binding

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Historical incidence of virus in CDFA certified stock

- 26% of 68 certified rootstock increase blocks were positive for LR2 or LR3 or GVB (Stamp 2001-2010)
- LR3 found frequently in scion blocks in 2012-present
- GRBaV found frequently in scion blocks and less often in rootstock blocks in 2012-present

Historical incidence of virus in CDFA certified Increase Blocks

- 26% of 68 certified rootstock increase blocks were positive for LR2 or LR3 or GVB (Stamp 2001-2010)
- LR3 found frequently in scion and rootstock increase blocks since 2012
- GRBaV found frequently in scion blocks and less often in rootstock blocks since 2012

CH04 11.4.14

CS4/1103P and CS7/1103P: 17,000 dormant vines in each lot (Feb. ’15)

Scion	Rootstock	% Samples Positive	
		GRBaV	LR3
Cabernet Sauvignon 04	1103P	0%	63%
Cabernet Sauvignon 07*	1103P	10%	10%

*Different samples tested POS for GRBaV and LR3

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- How we got started
  - Ph.D. Plant propagation
  - Post doc UC Davis
  - Founder of Novavine
  - Mid 90's unhealthy vines
    - "Black goo"
    - Young vine decline/Esca
    - Failure of recently planted vineyards

(4) Primary and secondary increase blocks shall be tested by the Department for *Grapevine fanleaf virus*, *Tomato ringspot virus*, *Grapevine leafroll-associated viruses*, and *Grapevine red blotch-associated virus* at least once every five years.

(5) Certified nursery plantings may be tested for *Grapevine fanleaf virus*, *Tomato ringspot virus*, *Grapevine leafroll-associated viruses*, and *Grapevine red blotch-associated virus* by the Department.

(1) In a foundation block, at least two visual disease inspections of each vine shall be made by FPS each growing season.

(2) In primary and secondary increase blocks, one visual inspection of each vine shall be made by the Department each growing season.

(3) In a nursery planting, one visual inspection shall be made by the Department each growing season. In addition, nursery stock shall be inspected at the time of digging.

CDFA Grapevine Registration and Certification Program

- Regulations revised in 2010
- Voluntary: 31 CA participants in 2016
- Participants pay fees for regular inspection/testing of blocks:
  - **$140,000/annum CA**
  - **$150,000 IAB funds**

CDFA Certification

- Voluntary
- Virus status regulated by CDFA
- Fungal/bacterial pathogens are not
- Rootstock production
  - most produced under CDFA guidelines
- Scion production
- Field evaluation/testing: FB, IB & nursery row vines

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Virus in CDFA scion: Most contaminated clones 2010-2018

- Cabernet Sauvignon ENTAV, FPS 4, 7
- Sauvignon blanc 01
- Primitivo 03
- Cabernet franc ENTAV 214 (11), ENTAV 327 (12)
- Merlot 181 ENTAV
- Non P2010 ENTAV blocks

Historical incidence of virus in CDFA certified Increase Blocks

- 26% of 68 certified rootstock increase blocks were positive for LR2, LR3, LR5 or GVB (Stamp 2001-2010)
- LR2: 15% of blocks positive
- LR5, GVB: 6% of blocks positive
- LR2 & LR5: 4% of blocks positive
- LR2 & GVB: 3% of blocks positive

Table 2: 2018 GRBV Positive Vines Testing and Distribution History

Plant ID	Cultivar	Date Planted	Location	Disease Status						Distribution History
				2013	2014	2015	2016	2017	2018	
36117	Teroldego 6.2	8/11/2014	B 35 33		Planted			NEG	POS	No sales records for this plant
50838	Chardonnay 28.1	7/31/2013	C 21 8	Planted			NEG	NEG	POS	2014, 2015, 2017
51426	Cabernet Sauvignon 49.1	7/16/2011	B 2 17	NEG		NEG		NEG	POS	2013, 2016, 2017, 2018
51616	Pinot noir 82.1	7/13/2011	B 5 25	NEG		NEG		NEG	POS	No sales records for this plant
51741	Zinfandel 17.1	7/14/2011	C 8 2	NEG		NEG		NEG	POS	2013, 2014, 2015
51742	Zinfandel 18.1	7/13/2011	C 8 3	NEG		NEG		NEG	POS	2013, 2014, 2015
53740	Riesling 49.1	5/28/2012	B 12 34	NEG		NEG		NEG	POS	2013, 2016
53953	Sangiovese 15.1	5/28/2012	B 17 32	NEG		NEG		NEG	POS	No sales records for this plant
53958	Sweet Scarlet 1.1	5/28/2012	C 17 3	NEG		NEG		NEG	POS	2013, 2014, 2016, 2017
54033	Chardonnay 96.1	7/30/2012	C 10 14	NEG		NEG		NEG	POS	2013, 2016, 2017, 2018
54057	Clairette blanche 4.1	7/30/2012	C 14 16	NEG		NEG		NEG	POS	2013, 2014, 2018
54934	Valley Pearl 1.1	8/11/2014	C 35 14		Planted			NEG	POS	2015, 2016, 2017, 2018
60512	Pinot noir 123.1	8/11/2014	C 38 1		Planted			NEG	POS	2016, 2017, 2018
60516	Pinot noir 123.1	8/11/2014	C 28 5		Planted			NEG	POS	2017
60537	Primitivo 6.1	8/11/2014	C 38 26		Planted			NEG	POS	2015
60569	Shiraz 6.1	8/11/2014	B 39 26		Planted			NEG	POS	No sales records for this plant
60578	Syrah 6.1	8/11/2014	C 39 1		Planted			NEG	POS	No sales records for this plant
60639	Thompson Seedless 02A.1	8/11/2014	C 40 1		Planted			NEG	POS	2015
60640	Thompson Seedless 02A.1	8/11/2014	C 40 2		Planted			NEG	POS	2015
60641	Thompson Seedless 02A.1	8/11/2014	C 40 3		Planted			NEG	POS	No sales records for this plant
60643	Thompson Seedless 02A.1	8/11/2014	C 40 5		Planted			NEG	POS	No sales records for this plant

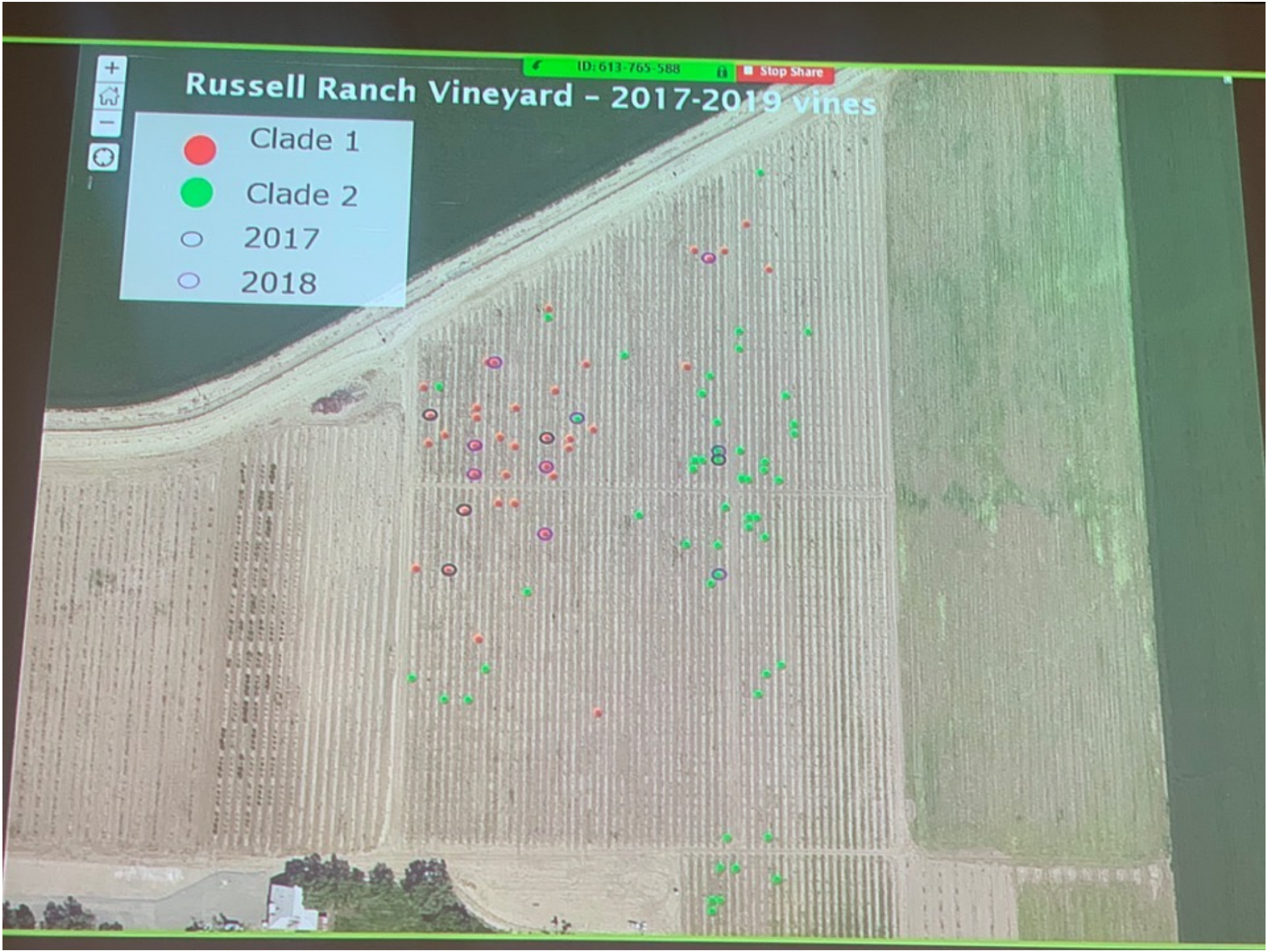
Russell Ranch Vineyard

Block	Planting Date
A	2011-2014
B	2011-2014
C	2011-2014
D	2015-2019
E	2015-2019
F	2015-2019
G	2016-2019

# Vines	# Selections	Acreage
4,761	2,052	29.50

Red Blotch at Russell Ranch

- Classic block (at UCD): RB at 0% - 0.21% since 2013
- *Russell Ranch P2010 Vineyard:*
  - *0.1% in 2017 (5 of 4,132)*
  - *0.5% (24/4,406) in 2018*
  - *7.1% (339/4,761) in 2019*
  - *18.0% (788/4,367) in 2020*


ID: 613-765-588
Stop Share
Russell Ranch Vineyard – 2017-2019 vines
Clade 1
Clade 2
2017
2018

CURRENT STATUS

- Today we are discussing fixes (band aids) for a propagation system that has remained unchanged for generations
- Perhaps, instead we should be focusing on development of permanent solutions?
- Given the multibillion dollar value of our industry, surely there is an appetite - and need – to invest in the development of new and improved, predictable and sanitary production methods?
- Consider how important our grapevine plants are
  - Net per vine ***fruit value*** 20 years Napa CS @ 10.56 lb/v: $572
  - Net per vine ***wine value*** 20 years Napa CS @ $51/bottle: $3,233

THE FUTURE

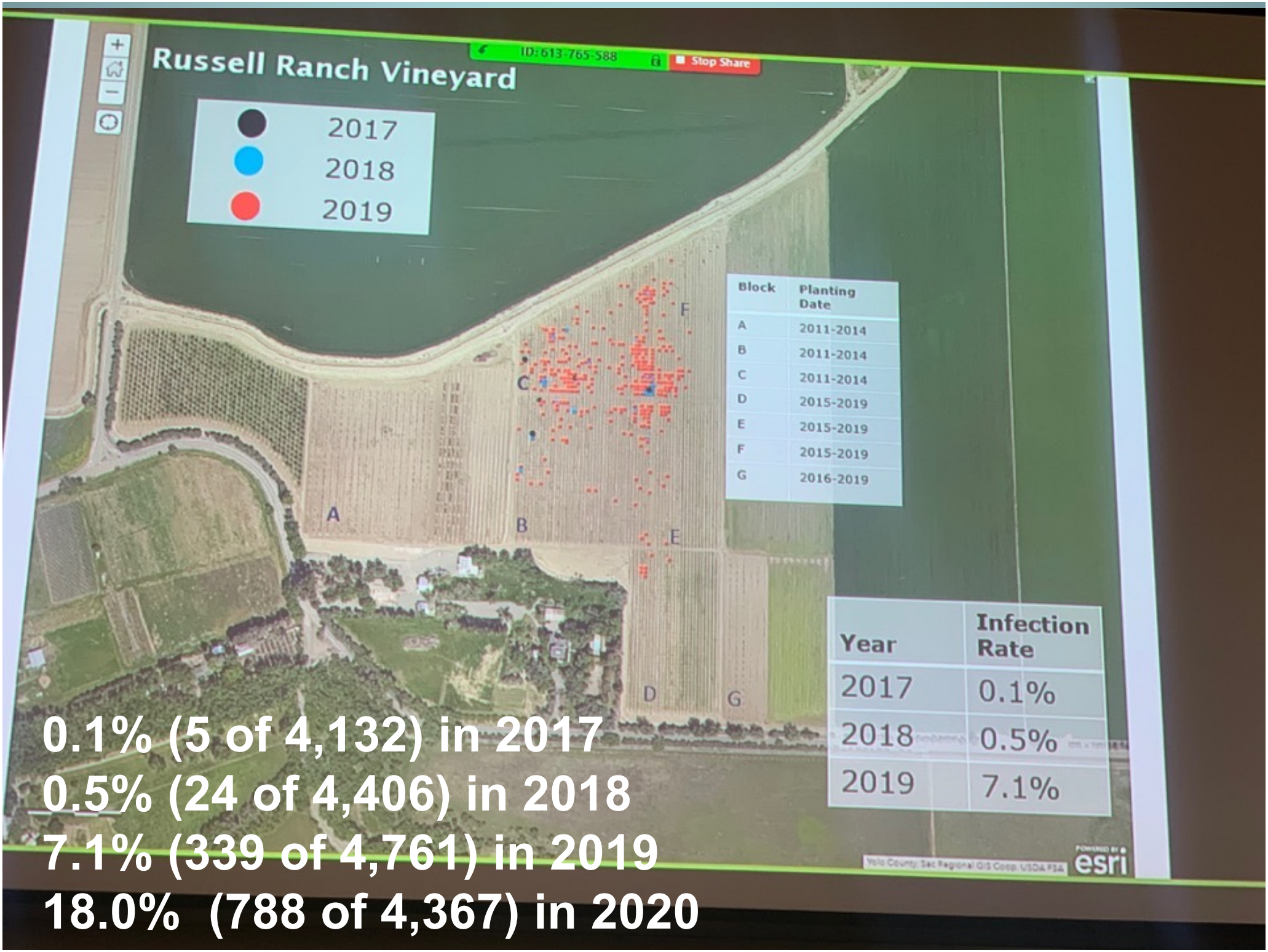
- Is FPS stretched too thin? Should there be a CA institution dedicated to grapevine propagation and improvement alone?
- CDFA funds are insufficient for the job of policing our grapevine nursery stock program
- We should invest in the development of improved propagation technology
- Going forward, the only real solution is the development of *gene editing technologies* for LR3 and GRBaV resistance
- We need to engage consumers in a conversation about genetically improved vines

TABLE 2. Most commonly found economically important pathogens in certified materials: 2015-2017

Virus/pathogen	Frequency of detection
GLRaV-9	Most frequent
GRBaV	
GLRaV-3	
GLRaV-5	
Xylella fastidiosa (bacterium)*	
GLRaV-2	Least frequent

*causes Pierce's Disease

Source: Stamp Associates Viticulture, Inc.


Russell Ranch Vineyard
ID: 613-765-588
Stop Share
2017
2018
2019
Block
Planting Date
A 2011-2014
B 2011-2014
C 2011-2014
D 2015-2019
E 2015-2019
F 2015-2019
G 2016-2019
A
B
C
D
E
F
G
Year
Infection Rate
2017 0.1%
2018 0.5%
2019 7.1%
esri
0.1% (5 of 4,132) in 2017
0.5% (24 of 4,406) in 2018
7.1% (339 of 4,761) in 2019
18.0% (788 of 4,367) in 2020

Sidebar 2. Relationship between GRBaV DNA copy number and severity of symptoms in CS7/VR039-16 vines (Samples collected on same date October 2012)

Sample #1
Green foliage
No gel band was seen by conventional PCR. No copy number identified by quantitative real-time PCR analysis (qRT-PCR).

Positive: RSP and RSP-SY

qRT-PCR copy #: 0

Sample #2
Blotchy red foliage
Weak-to-intermediate gel band was observed with conventional PCR.

Positive: GRBaV

qRT-PCR copy #: 200+/-

Sample #3
Complete red foliage
Strong gel band was observed on conventional PCR

Positive: GRBaV

qRT-PCR copy #: 80,000+/-

CH04 12.4.14

Stamp Associates Viticulture, Inc.