

National Clean Plant Network for Grapes: What it is Doing for You?

Dr. R. Keith Striegler
Outreach Coordinator, NCPN
Keith@flintridgevinegrowingservices.com

17th Annual Nebraska Winery and Grape Growers Forum and Trade Show
Kearney, NE March 1, 2014

Acknowledgements

Sue Sim

**NPCN Grapes Coordinator / Staff Research Associate
Foundation Plant Services, University of California, Davis**

Deborah Golino

**NCPN Grapes Chair/ Director
Foundation Plant Services, University of California, Davis**

Olivia Dally

**NCPN Outreach Support Staff/Program Representative
Foundation Plant Services, University of California, Davis**

Why do we need clean
plant material?

Grapevine Virus Diseases





1. Nepoviruses



2. Leafroll Viruses



3. Rugose Wood Viruses

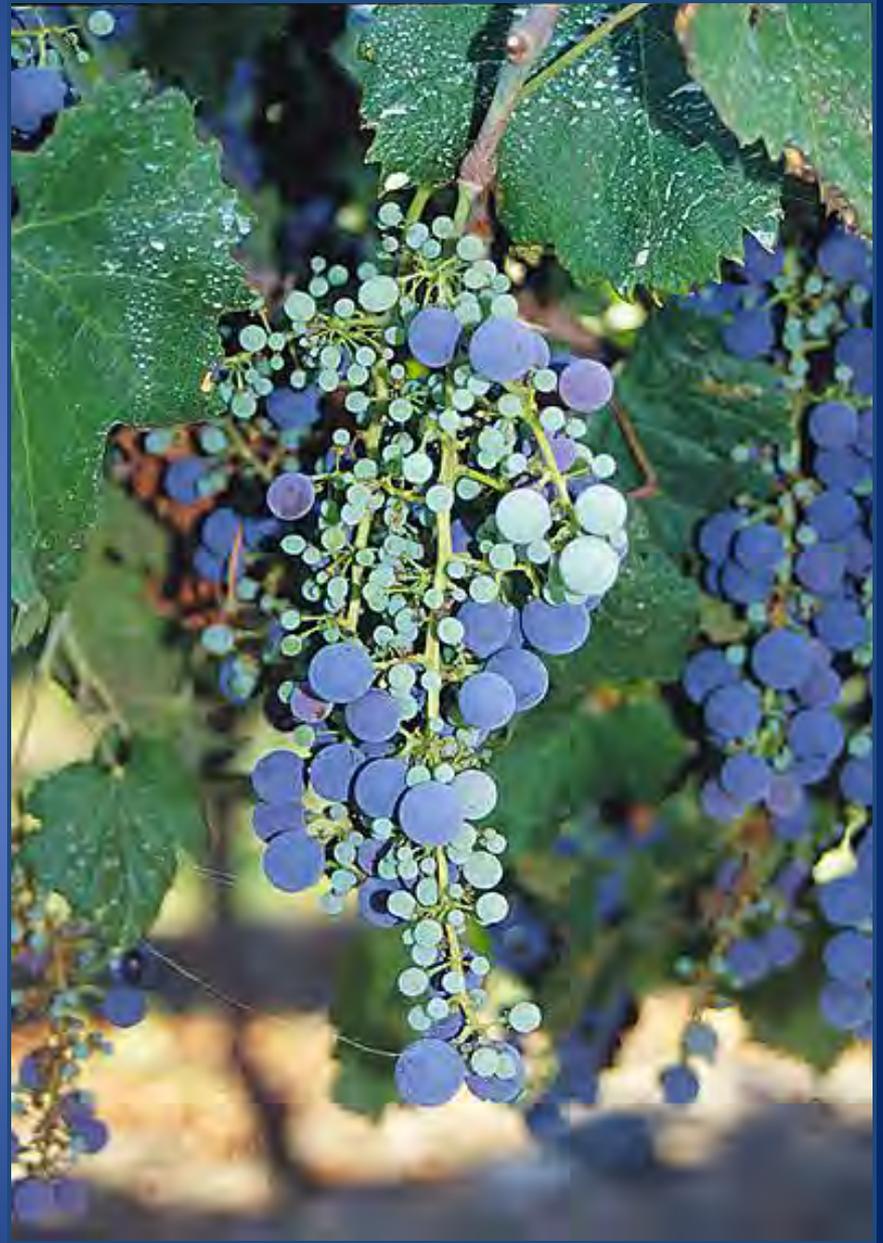
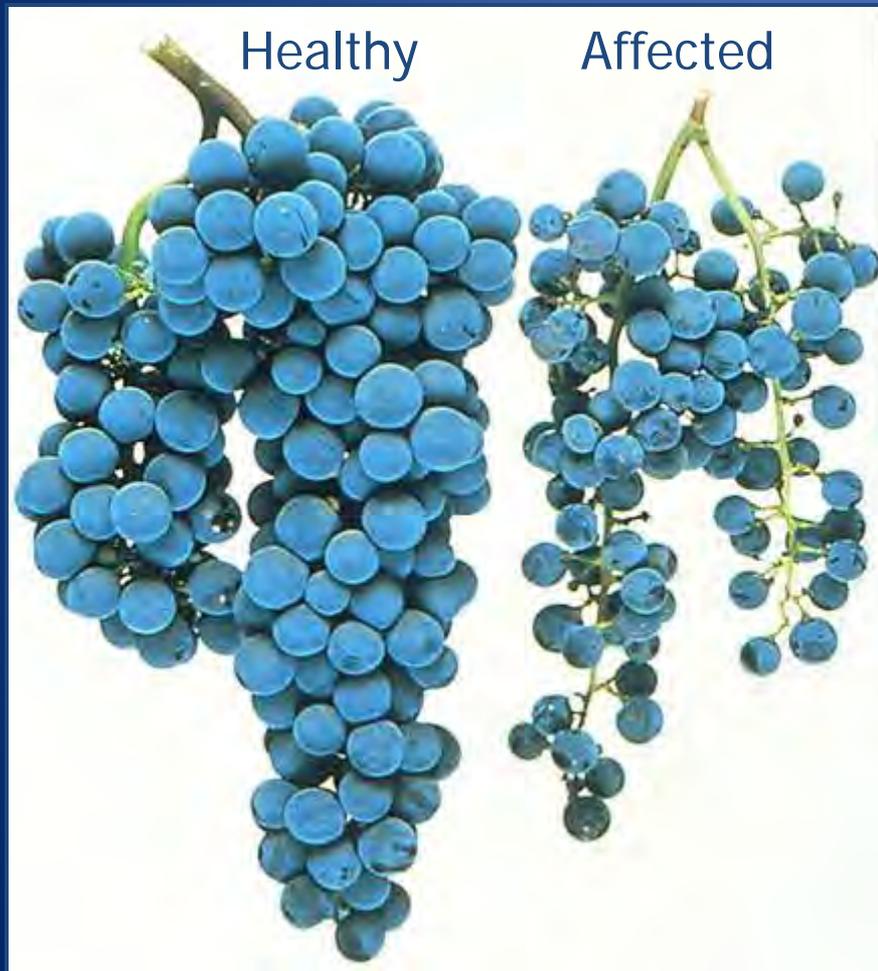


NEPOVIRUSES

“Nematode Transmitted Polyhedral
Virus”

- | | |
|-------------------------------|-------|
| ◆ Artichoke Italian latent | AILV |
| ◆ Arabis mosaic | ArMV |
| ◆ Blueberry leaf mottle | BBLMV |
| ◆ Bulgarian latent | GBLV |
| ◆ Grapevine chrome mosaic | GCMV |
| ◆ Grapevine fanleaf | GFLV |
| ◆ Grapevine Tunisian ringspot | GTRV |
| ◆ Peach rosette mosaic | PRMV |
| ◆ Raspberry ringspot | RRV |
| ◆ Tobacco ringspot | TRSV |
| ◆ Tomato ringspot | ToRSV |
| ◆ Tomato black ring | TBRV |
| ◆ Strawberry latent ringspot | SLRSV |

Fanleaf Virus Fruit Symptoms



Leafroll Viruses



Cabernet franc infected with GLRaV-3



Chardonnay, Healthy vs. leafroll – infected

Effects of Grapevine leafroll virus



Healthy Emperor



LR infected
'White' Emperor

- Sugar reduced 1-4° Brix
- Color reduced
- Yield reduced
- Ripening delayed
- TA increased
- Graft incompatibility
- Disease severity depends on variety, clone, rootstock, site, year, leafroll type/strain



Leafroll virus infection in Cabernet Sauvignon

Healthy (L) vs. Leafroll (R)

Sauvignon blanc/ Freedom with severe leafroll symptoms 1st year up the stake, no symptoms in budwood source on AXR

Infected with Leafroll-2, -3, and Grapevine Virus A , B



Grapevine DNA Viruses

- Grapevine Red Blotch associated Virus
- Grapevine Vein Clearing Virus

Grapevine Red Blotch

1. Investigations into what appeared to be a new disease began in 2008.
2. Red blotch was identified in independent studies in New York and California in 2012.
3. It reduces sugar accumulation by up to 5 Brix.
4. It is widespread geographically and has been identified in many varieties.
5. All vines at the new Russell Ranch Foundation Vineyard have been tested; **none are infected.**



Red blotch has flat margins.

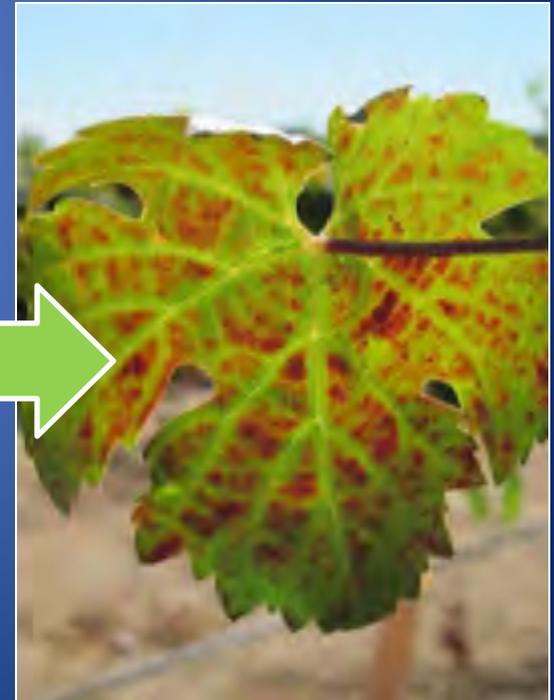


Leafroll has leaf margins that roll downward.



Red blotch has pink veins .

Leafroll has green veins.





Grapevine red blotch on Cabernet Franc

Courtesy of Dr. M.R. Sudarshana



Grapevine red blotch
on Cabernet Sauvignon
St. Helena, Fall 2012.



Grapevine Vein Clearing

1. First noticed in regional vineyards 30 years ago; investigation began in 2004
2. Deformed young leaves, edges may split and crinkle
3. Translucent veins in affected leaves
4. Berries have irregular shape, exhibit light brownish color, and become stone-like
5. Vine mortality increases with virus severity



Translucent vein clearing on young leaves



Deformed shape and hardening of berries on severely affected Vidal Blanc



Decline of vine vigor and thin canopy in severely affected Vidal Blanc

Courtesy of Wenping Qiu

**What can we do to prevent
grapevine virus problems?**

Control virus problems

- Plant with virus-tested vines
- Control virus vectors
- Use sufficient fallow period before replanting
- Reduce alternative host plants within 300 ft of vineyard



What is the National Clean Plant Network (NCPN)?

- A national network of clean plant centers, scientists, regulators and educators
- Focused on providing healthy planting stock of vegetatively propagated specialty crops to nurseries and growers



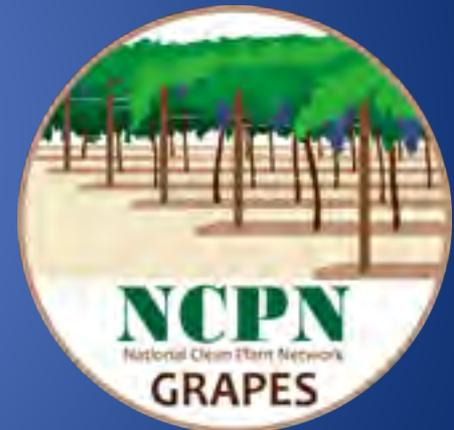
Participating Crops:

1. Fruit Trees
2. Grapes
3. Berries
4. Hops
5. Citrus

Others interested in joining



Activities funded by the National Clean Plant Network since 2009



Farm Bill 2008



NCPN -Section 10202:

- pathogen diagnosis and elimination
- existing federal/state clean plant centers
- clean plant material for industry
- consult with state DOAs and universities
- funding - \$5 million/year x 4 years (\$20m total)

Farm Bill 2014

- Funds NCPN for 2014 – 2018, and every year thereafter
- Language guarantees at least \$5 million per year for NCPN
- Merged sections 10201 and 10202 from 2008 Farm Bill

NCPN Goals

- High quality (disease tested) plants for industry
- Coordinated outreach effort to nurseries/growers on the benefits of clean plant material
- Sustained source of funding to university clean plant centers (CPC) to develop foundation materials
- Standardized procedures and protocols for all CPCs
- Harmonized model regulations for state certification programs

NCPN Grape Network Objectives

- Cooperation among clean plant centers
- Upgrade of centers' facilities and equipment
- Shared standard operating procedures
- Implementation of new, rigorous standard for foundation grapevine material
- Harmonization of grape regulations

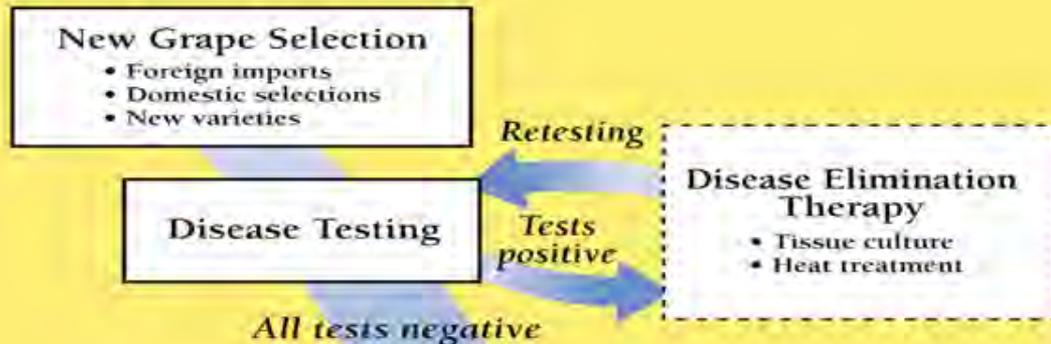
NCPN Grapes Clean Plant Centers



National Clean Plant Network for Grapes Headquarters at FPS, UC Davis



Grape Process at FPS



Pathogen Diagnosis

1. Woody indexing:	
St. George	Fanleaf, Rupestris Stem Pitting Virus, Fleck Virus
Cabernet franc	Leafroll viruses
LN-33	Corky Bark, Stem Grooving
Kober 5BB	Rugose Wood Viruses
2. Herbaceous Host indexing:	
<i>Chenopodium quinoa</i> <i>C. amaranticolor</i> <i>Cucumis sativus</i> <i>Nicotiana clevelandii</i>	Nepoviruses
3. Lab Tests: RT-PCR/ qRT-PCR ELISA	GLRaV-1, -2, -3, -4, -5, -6, -7, -9 –Car, GFLV, GRSPaV, GFkV, GVA, GVB, GVD, ArMV, ToRSV, TRSV

Pathogen Elimination

Meristem shoot tip culture



10.0 mm



Cut to < 0.5 mm



7 months



New Russell Ranch Foundation Vineyard

established 2010, Davis California



October, 2012

Qualification of Russell Ranch Foundation Vines – Grapevine Disease Testing Protocol 2010

- 1) Microshoot tip tissue culture therapy
- 2) Negative test results - long list of pathogens
- index, herbaceous, ELISA and PCR tests
- 3) *Rupestris stem pitting* virus is on list

Grape Cultivars of Interest to Midwestern and Eastern Growers in the Pipeline

- Aurore
- Baco Noir
- Barbera
- Bluebell
- Bon Noir
- Brianna
- Casetta
- Cayuga White 01
- Chambourcin
- Chancellor
- Chardonel 01
- Chelois
- Concord
- Corot Noir 01
- Couderc 241-123
- Dechaunac
- Delaware

Grape Cultivars of Interest to Midwestern and Eastern Growers in the Pipeline (Cont.)

- Dornfelder
- Dornfelder 01
- Edelweiss
- Elvira
- Emir
- Etoile I
- Excelsior Guilly
- Feteasca Alba S1
- Florilush
- Fredonia
- Frontenac
- Frontenac Blanc
- Gamaret
- Garanoir
- Garonnet
- Grüner Veltliner
- Harslevelu

Grape Cultivars of Interest to Midwestern and Eastern Growers in the Pipeline (Cont.)

- Ives
- Kadarka
- Korona
- Kozma 55
- Laurot
- Leon Milot
- Lomanto
- Marechal Foch 01
- Marzemino
- Merlot
- Muller Thurgau
- Muscat Ottonel
- Nebbiolo
- Noiret 01
- Norton
- NY76.0844.24 01

Grape Cultivars of Interest to Midwestern and Eastern Growers in the Pipeline (Cont.)

- Arandell 01
(NY95.0301.01)
- Pignolo
- Pinot Noir
- Pinot Precoce
- Regent 01
- Rossiola
- Rubin Tairovskii
- Schiava Grossa
- Grillo
- St. Croix
- St. Pepin
- Steuben
- Sunbelt
- Swenson Red
- Vespolina

For Additional Information:



www.nationalcleanplantnetwork.org

<http://ncpngrapes.org>

General Viticulture Information

Integrated Viticulture <http://iv.ucdavis.edu>

National Grape Registry <http://ngr.ucdavis.edu>

Eviticulture <http://eviticulture.org>

Thank you for your kind attention





Extra slides

Table 1: LIST OF AVAILABLE TESTS FOR PROTOCOL 2010 (revised 4/2011)

Group	Pathogen	Symbols	ELISA	qPCR	PCR	Herb. Index	Woody Index
Nepoviruses	Grapevine fanleaf virus	GFLV	√	√	√	√	St. George
	Tomato ringspot virus	ToRSV	√	√	√	√	
	Tobacco ringspot virus	TRSV		√	√	√	
	Arabis mosaic virus	ArMV	√		√	√	
	Strawberry latent ringspot virus	SLRSV			√	√	
	Blueberry leaf mottle virus	BLMV			√	√	
	Raspberry ringspot virus	RpRSV			√	√	
	Tomato black ring virus	TBRV			√	√	
	Grapevine deformation virus	GDefV			√	√	
	Artichoke Italian latent virus	AILV			√	√	
	Closteroviruses	Grapevine leafroll associated virus 1	GLRaV-1	√	√	√	
Grapevine leafroll associated virus 2		GLRaV-2	√	√	√		Cab. Franc
Grapevine leafroll associated virus 2RG		GLRaV-2RG		√	√		
Grapevine leafroll associated virus 3		GLRaV-3	√	√	√		Cab. Franc
Grapevine leafroll associated virus 4		GLRaV-4	√ gen.	√	√		Cab. Franc
Grapevine leafroll associated virus 5		GLRaV-5	√ gen.	√	√		Cab. Franc
Grapevine leafroll associated virus 6		GLRaV-6	√ gen.	√	√		Cab. Franc
Grapevine leafroll associated virus 7		GLRaV-7		√	√		Cab. Franc
Grapevine leafroll associated virus 9		GLRaV-9	√ gen.	√	√		Cab. Franc
Grapevine leafroll associated virus 10		GLRaV-10		√	√		Cab. Franc
Grapevine leafroll associated virus 11		GLRaV-11			√		Cab. Franc
Grapevine leafroll associated virus Car.	GLRaCV	√ gen.	√	√		Cab. Franc	

Table 1: LIST OF AVAILABLE TESTS FOR PROTOCOL 2010 (revised 4/2011)

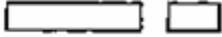
Group	Pathogen	Symbols	ELISA	qPCR	PCR	Herb. Index	Woody Index
Vitiviruses	Grapevine virus A	GVA		√	√		Kober 5BB
	Grapevine virus B	GVB		√	√		LN33
	Grapevine virus D	GVD		√	√		
	Grapevine virus E	GVE		√			
Foveavirus	Grapevine rupestris stem-pitting associated virus (all strains)	GRSPaV		√	√		St. George
Maculavirus	Grapevine fleck virus	GFkV	√	√	√		St. George
	Grapevine redglobe virus	GRGV			√		
Marafiviruses	Grapevine syrah virus-1	GSyV-1		√	√		
	Grapevine vein feathering virus	GVFV			√		
	Grapevine asteroid mosaic virus	GAMV			√		
Phytoplasma	Universal detection	Phyto			√		
Pierce's Disease	<i>Xylella fastidiosa</i>	PD		√	√		

Key: √= test is available; √ gen.= ELISA using generic antibody which detects GLRaVs-4, 5, 6, 9 and Car in a single test; qPCR= quantitative PCR= real time RT-PCR with TaqMan probe; PCR= will include RT-PCR for RNA viruses.

(+) ssRNA



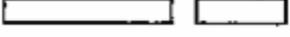
Tobamovirus



Tobravirus



Hordeivirus



Furovirus



Potexvirus



Capillovirus, Trichovirus



Carlavirus



Potyviridae



Closterovirus



Sesquiviridae

Tombusviridae

Dianthovirus

Luteovirus

Machlomovirus

Marafivirus

Necrovirus

Sobemovirus

Tymovirus



Comoviridae



Enamovirus

Idaeovirus



Bromoviridae

Cucumovirus

Bromovirus

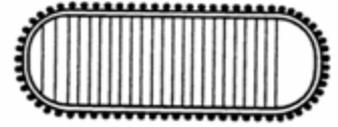


Ilarvirus



Alfamovirus

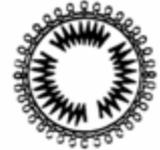
(-) ssRNA



Rhabdoviridae

Cytorhabdovirus

Nucleorhabdovirus



Bunyaviridae

Tospovirus



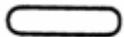
Tenuivirus

Types of Plant Viruses

dsDNA



Caulimovirus



Badnavirus

ssDNA



Geminiviridae

Geminivirus



Subgroup I, II



Subgroup III



Isometric
Banana bunchy top
virus group

dsRNA



Reoviridae

Phytoreovirus

Fijivirus

Oryzavirus



Partitiviridae

Alphacryptovirus

Betacryptovirus