# Viticultural Characteristics of the GRN Rootstocks and Field Trial Evaluations

Larry Bettiga
Viticulture Advisor
Monterey, Santa Cruz and San Benito Counties

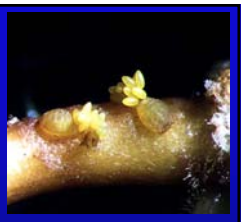
UC CE | University of California
Agriculture and Natural Resources | Cooperative Extension

| | Parentage |
|---|---|
| **GRN1** | *V. rupestris* x *V. rotundifolia* 'Cowart' |
| **GRN2** | (*V. rufotomentosa* x (Dog Ridge x Riparia Gloire)) x Riparia Gloire |
| **GRN3** | (*V. rufotomentosa* x (Dog Ridge x Riparia Gloire)) x *V. champinii* c9038 |
| **GRN4** | (*V. rufotomentosa* x (Dog Ridge x Riparia Gloire)) x *V. champinii* c9038 |
| **GRN5** | (Ramsey x Riparia Gloire) x *V. champinii* c9021 |

## Rootstock performance has varied based on:

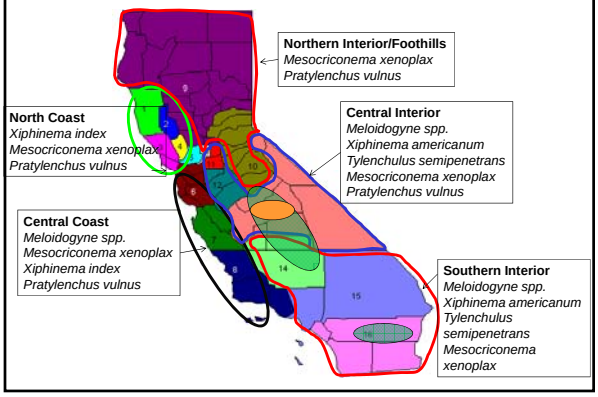
1. Soil characteristics
2. Soil pests present
3. Vineyard design/ farming practices
4. Fall/winter low temperatures
5. Pre-plant fumigation
6. Plant health and quality of propagation material

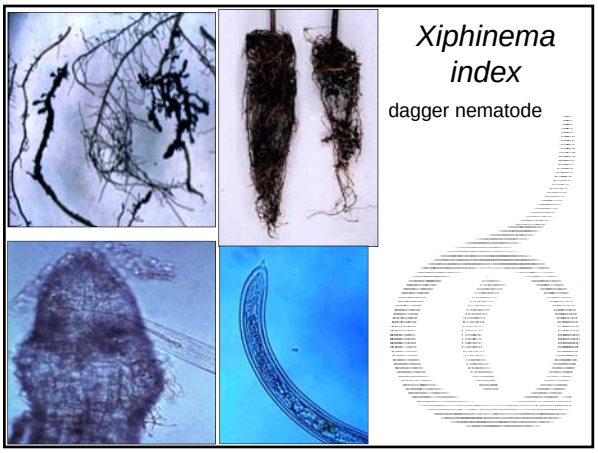
## Phylloxera



- North American insect
- Imported to France in 1850s
- Initiated rootstock breeding - most rootstocks are >100yrs old
- Phylloxera spread most readily on plant materials, and blown or move on equipment as crawlers
- Feed on leaves of rootstocks and roots of vinifera

California Grapes: Co-distribution of Nematodes



*Xiphinema index*

dagger nematode

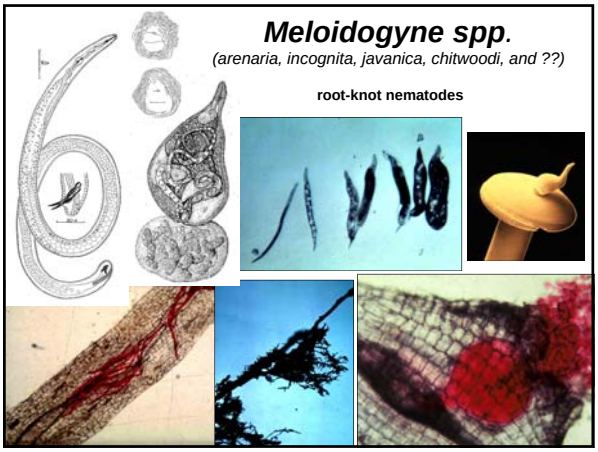
## Fanleaf Degeneration

- Disease complex caused by GFLV and vectored by the dagger nematode, *Xiphinema index*
- One rootstock alternative exists - O39-16 - *vinifera* x *rotundifolia* and *rotundifolia* is the key.
- But phylloxera, root-knot nematode and excessive vigor concerns.

## *Meloidogyne spp.*

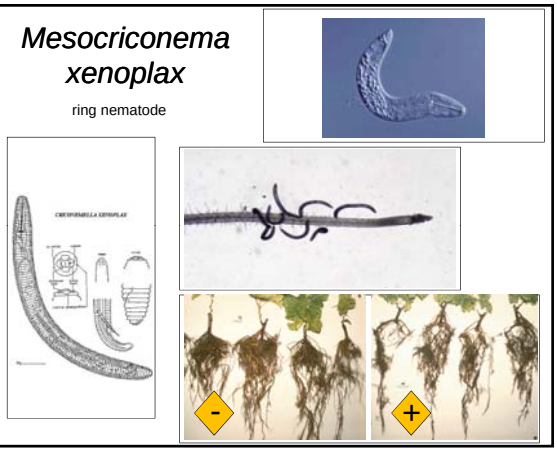
*(arenaria, incognita, javanica, chitwoodi, and ??)*

**root-knot nematodes**



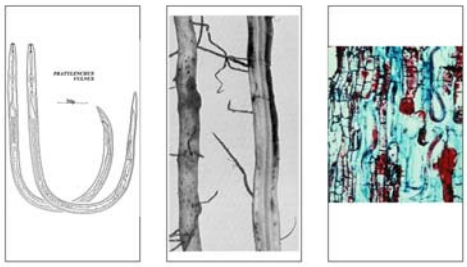
## *Mesocriconema xenoplax*

ring nematode

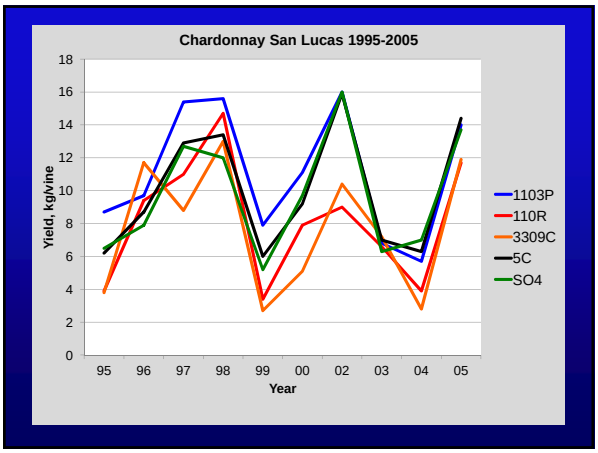


## *Pratylenchus vulnus*

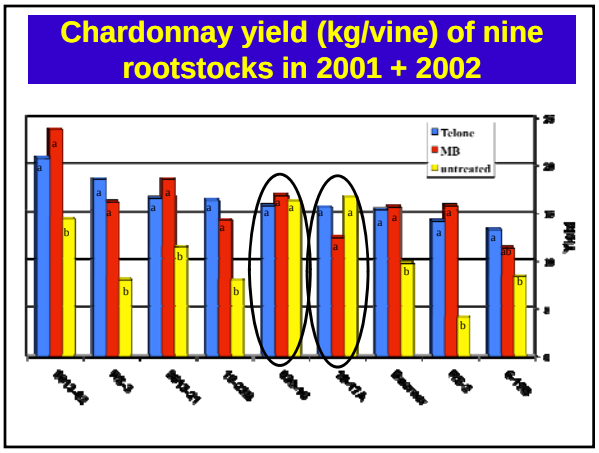
root lesion nematode

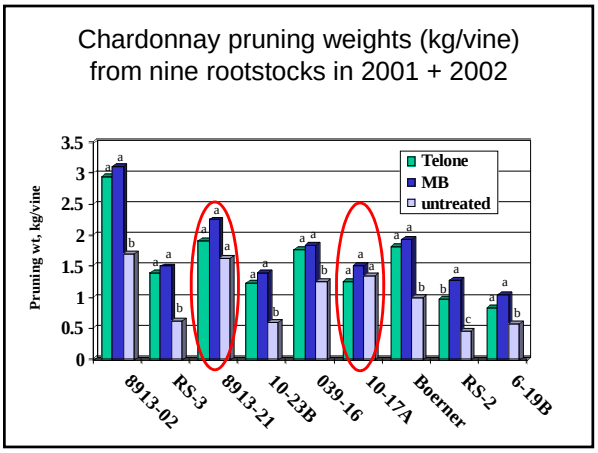


## Weather-Related Disorders: Winter Cold Injury


## Do we need effective fumigants?



## Rootstock Selection

✓ Best suited rootstock can vary dramatically based on site conditions

There is often no best choice, but for some sites there can be wrong choices that will result in poor vine performance

## New Rootstock Summary

| | Root-lesion Nematode | Citrus Nematode | Ring Nematode | Phylloxera Nodosities | Rooting Depth |
|---|---|---|---|---|---|
| GRN-1 | MR | R | R | HR | D |
| GRN-2 | MR | MS | S | HR | S |
| GRN-3 | MR | R | S | R | M |
| GRN-4 | MR | R | MS | R | M |
| GRN-5 | MR | R | MR | MS | D |

The above all resist root-knot and X. index

## GRN Rootstock Trials

- Gallo/Livingston with Chardonnay – (Sunridge) Freedom, 101-14 and 3309C as controls (2009)
- Bakersfield with Autumn King – UCCE (Sunridge) Freedom, 5C, 1103P as controls (2010)
- Franzia/Dunnigan with Pinot gris (Sunridge) (2009)
- J&L Farms, San Lucas / Cab. Sauv. (2009, GRN-1 2010)
- Cloverdale (Chard.) and Santa Rosa (PN) (2010)
- Lodi Fanleaf and RKN – Stanton Lange & Gallo (2011)
- Constellation trials (Madera, Central Coast, Sonoma and Napa)

## Current Rootstock Trials

| Area | Established | Rootstocks | Scion | Soil Pests |
|---|---|---|---|---|
| San Lucas | 2009 | 10 | Cabernet Sauvignon | P, (cold) |
| Soledad | 2011 | 12 | Chardonnay | P, (RK, RN) |

P = Phylloxera; RK = Root Knot Nematode; RN = Ring Nematode

## GRN Series Rootstock Evaluation

**Site:** Pinnacles Vineyards, Soledad
**Planted:** 2011 (Chardonnay 4)
**Soil:** Chualar loam
**Spacing:** 5 x 6.33 ft
**Trellis:** Vertical shoot positioned
**Training:** Head trained, cane pruned
**Design:** RCB, 8 replications of 12 selections using 5 vine plots
**Evaluated:** 2014 -

## Rootstocks

1. GRN1
2. GRN2
3. GRN3
4. GRN4
5. GRN5
6. RS-3
7. RS-9
8. O39-16
9. 1103P
10. SO4
11. 101-14
12. St. George

## RS-3 & RS-9 (Ramsey x Schwarzmann)

- Bred by D. Ramming, selected by M. McKenry; released in 2003
- RS-3 is more vigorous than RS-9
- Good nematode resistance to RKN, *P. vulnus* and *X. index*
- Designed to have better nematode and phylloxera resistance than Freedom/Harmony, but less vigor than Ramsey/Dogridge

| Genotype | *M. incognita* Race 3 | *M. javanica* | *Meloidogyne arthrolyes* Harmony AGC | *M. chitwoodi* | *X. index* | *M. xenoplax* | *P. vulnus* | *T. semipenetrans* | *X. americanum* | *Para. hamatus* |
|---|---|---|---|---|---|---|---|---|---|---|
| 101-14Mgt | | | R | | S | S | MR | | | S |
| 1103Paulsen | | | S | | S | S | MS | | | S |
| RS-3 | R | R | MR | MR | S | S | MR | | | S |
| RS-9 | R | R | R | R | S | S | MS | | | S |
| St. George | S | | S | | S | S | MS | | | MS |
| Teleki 5C | MS | MR | S | | MR | MS | S | S | S | MS |
| VR O39-16 | S | S | S | | R | R | MR | S | MR | MR |
| UCD GRN1 | R | | R | | R | R | MR | R | | MR |
| UCD GRN2 | R | | R | | R | MS | MR | MS | | MR |
| UCD GRN3 | R | | R | | R | MR | MR | MR | | MR |
| UCD GRN4 | R | | R | | R | MR | MR | MR | | MS |
| UCD GRN5 | R | | R | | R | R | MR | MR | | MR |

From: Ferris, H., Zheng, L. and Walker, M.A. 2012. Resistance of grape rootstocks to plant-parasitic nematodes. Journal of Nematology 44:385-394.

Table 3. The effect of rootstock on the average canopy length of Chardonnay grapevines, Pinnacles Vineyard, 2014.

| Rootstock | Average canopy length, inches | |
|---|---|---|
| 1103P | 56 | a |
| St. George | 54 | ab |
| SO4 | 52 | ab |
| 101-14 | 50 | ab |
| GRN4 | 50 | ab |
| RS9 | 49 | b |
| GRN2 | 49 | b |
| RS3 | 42 | c |
| GRN5 | 42 | c |
| GRN3 | 40 | cd |
| GRN1 | 37 | cd |
| O39-16 | 36 | d |

Duncan's multiple range test, 5% level.





**The effect of rootstock on the yield components of Chardonnay grapevines, Pinnacles Vineyard, Soledad, 2014-16.**

| Rootstock | Yield kg/vine | Cluster number | Cluster weight, g | Berry weight, g | Berries per cluster |
|---|---|---|---|---|---|
| St. George | 7.91 a | 43 a | 183 a | 1.40 ab | 130 ab |
| 1103P | 7.63 a | 42 ab | 183 a | 1.39 ab | 137 a |
| RS9 | 7.53 ab | 43 a | 176 ab | 1.35 bcd | 130 ab |
| SO4 | 7.31 ab | 40 abc | 185 a | 1.43 a | 129 ab |
| 101-14 | 6.72 bc | 40 abc | 171 bc | 1.39 ab | 122 bc |
| GRN2 | 6.72 bc | 38 bcd | 175 ab | 1.37 abc | 128 abc |
| RS3 | 6.23 cd | 37 cd | 167 bcd | 1.30 d | 128 abc |
| GRN3 | 5.72 de | 37 cd | 157 d | 1.38 abc | 114 c |
| GRN5 | 5.64 de | 35 de | 161 cd | 1.38 abc | 117 c |
| GRN4 | 5.62 de | 35 de | 159 cd | 1.32 cd | 120 bc |
| O39-16 | 5.22 e | 32 e | 165 bcd | 1.42 ab | 116 c |
| GRN1 | 5.10 e | 32 e | 158 d | 1.32 cd | 120 bc |

Mean separation by Duncan's multiple range test, 5% level.

**The effect of rootstock on the fruit composition of Chardonnay grapevines, Pinnacles Vineyard, Soledad, 2014-16.**

| Rootstock | Brix | pH | Titratable acidity, g/L |
|---|---|---|---|
| St. George | 23.1 abc | 3.30 a | 7.6 b |
| 1103P | 23.0 abc | 3.40 a | 7.9 a |
| RS9 | 22.4 bc | 3.40 a | 7.5 bc |
| SO4 | 23.2 abc | 3.39 a | 7.5 bc |
| 101-14 | 23.5 ab | 3.43 a | 7.3 cd |
| GRN2 | 23.3 abc | 3.41 a | 7.5 bc |
| RS3 | 23.4 abc | 3.44 a | 6.8 f |
| GRN3 | 23.5 ab | 3.41 a | 7.1 de |
| GRN5 | 24.0 a | 3.44 a | 7.2 de |
| GRN4 | 24.1 a | 3.44 a | 7.0 ef |
| O39-16 | 22.2 c | 3.20 a | 7.2 de |
| GRN1 | 23.3 abc | 3.40 a | 6.9 ef |

Mean separation by Duncan's multiple range test, 5% level.

**The effect of rootstock on the growth components of Chardonnay grapevines, Pinnacles Vineyard, Soledad, 2014-16.**

| Rootstock | Buds per vine | Shoots per vine | Pruning weight, kg | Shoot weight, g | Fruit: pruning weight |
|---|---|---|---|---|---|
| St. George | 30 a | 22 ab | 0.85 b | 40 ab | 9.6 ef |
| 1103P | 26 a | 23 a | 1.02 a | 45 a | 8.3 f |
| RS9 | 28 a | 23 a | 0.76 bc | 33 cd | 10.3 de |
| SO4 | 27 a | 20 cd | 0.65 cd | 33 cd | 11.6 cd |
| 101-14 | 26 a | 20 cd | 0.83 b | 41 a | 8.5 ef |
| GRN2 | 26 a | 21 bc | 0.76 bc | 36 bc | 9.4 ef |
| RS3 | 27 a | 20 cd | 0.52 ef | 26 ef | 12.6 bc |
| GRN3 | 28 a | 18 de | 0.43 fg | 24 efg | 14.3 ab |
| GRN5 | 28 a | 20 cd | 0.48 ef | 25 efg | 11.9 cd |
| GRN4 | 26 a | 21 bc | 0.60 de | 29 de | 9.7 ef |
| O39-16 | 25 a | 17 e | 0.35 g | 21 fg | 15.2 a |
| GRN1 | 26 a | 18 de | 0.34 g | 19 g | 15.6 a |

Mean separation by Duncan's multiple range test, 5% level.