Slowing the Spread of Grapevine Viruses

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Grapevine
a biological 'Cuisinart' for viruses

Spread of grapevine viruses

- All disseminated via plant material (own-rooted, grafted)

- Some spread by vectors (insects, nematodes, etc.)

Control of virus diseases

No chemicals available to cure a virus-infected grapevine or protect healthy grapevine from infection.

Management involves preventive rather than curative measures

Major virus diseases in Washington vineyards

Established
- Leafroll

Emerging
- Red blotch
- Soil-borne

All diseases are not the same

Disease	Virus	Genome	Vector
Leafroll	Several	RNA	Mealybugs & Scale insects
Red blotch	One	DNA	Leaf/treehoppers?
Fanleaf	Several	RNA	Nematodes

Available Options

- Pre-planting:
  Using virus-tested plant materials

- Post-planting:
  Reduce virus incidence by roguing and vector control
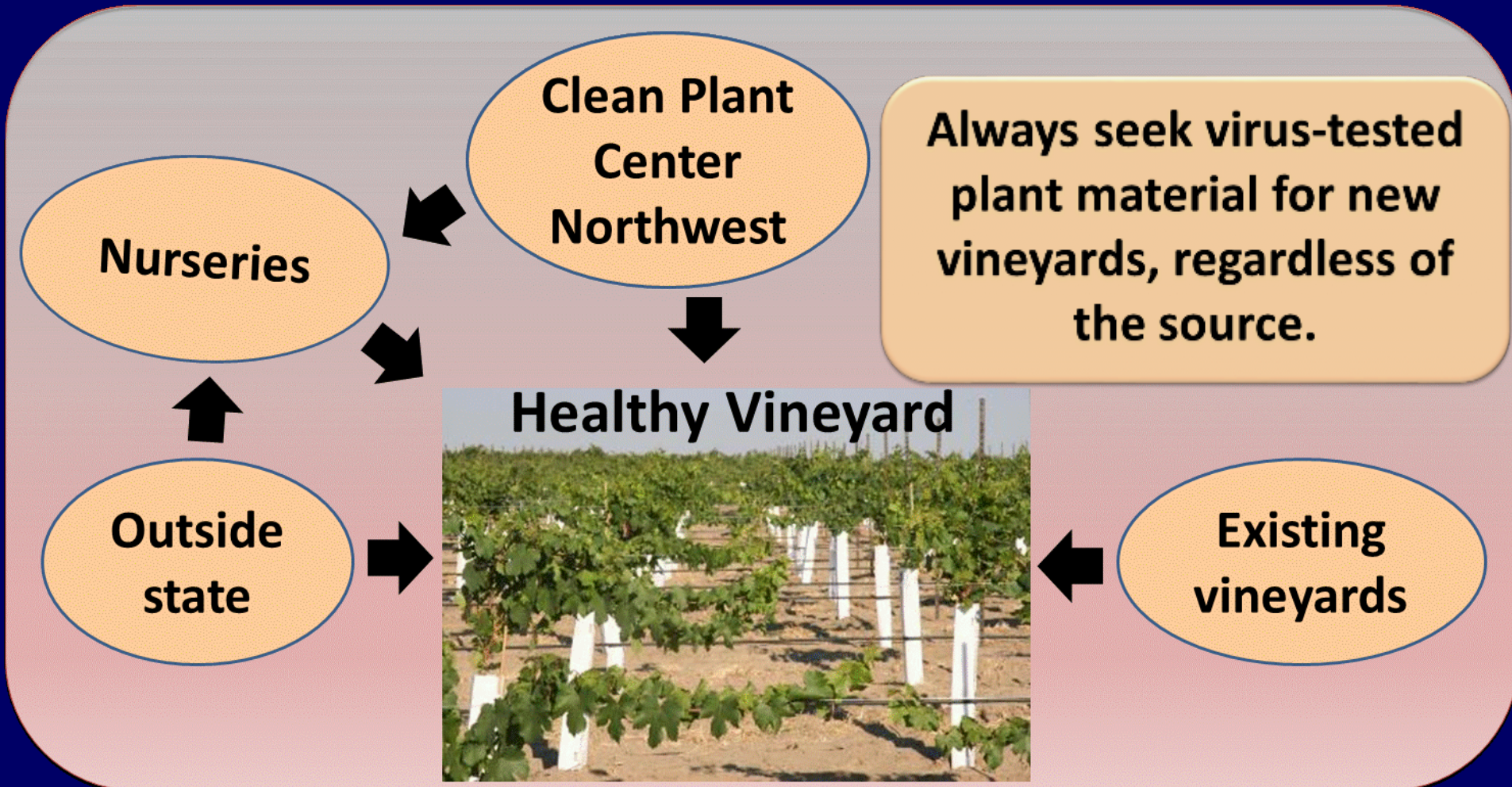
The Mantra of 'Start Clean, Stay Clean' for Healthy Vineyards
Naidu Rayapati
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Pre-planting options

Source of plant material matters

Spread of viruses via compromised plant material into young vineyards
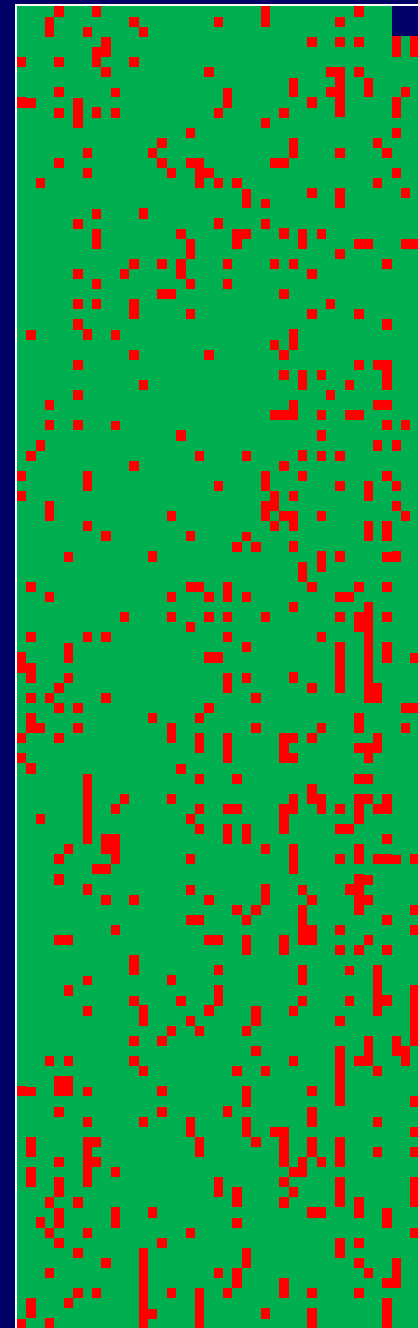

Cabernet Sauvignon

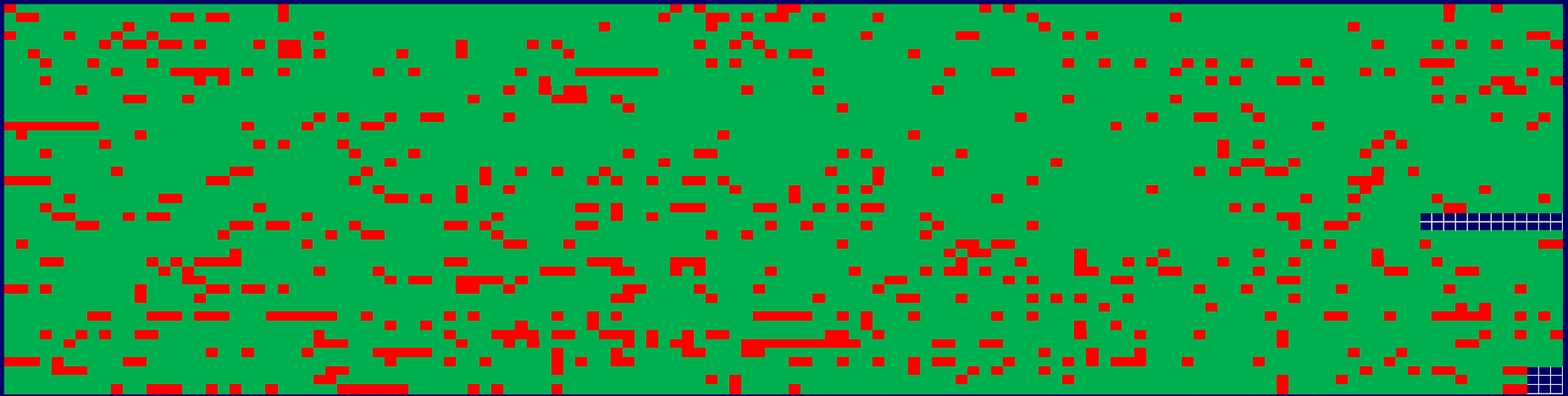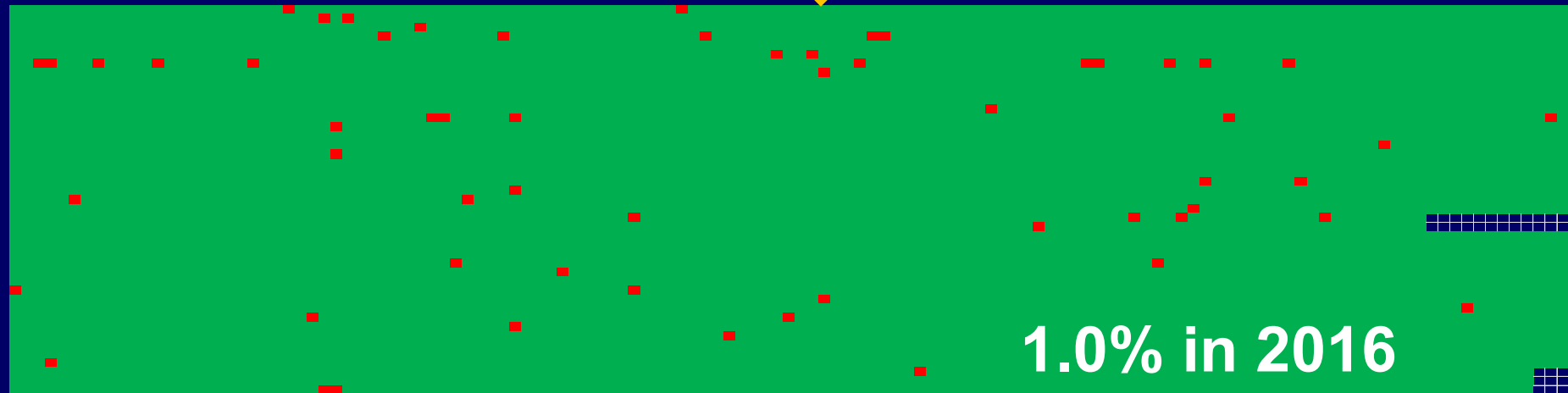5.5 acre block planted in 2015

Symptomatic vines – 11.8%

GLRaV-3 +ve

Slowing the spread in young vineyards by roguing

cv. Cabernet Sauvignon

11.8% in 2015

Roguing

1.0% in 2016

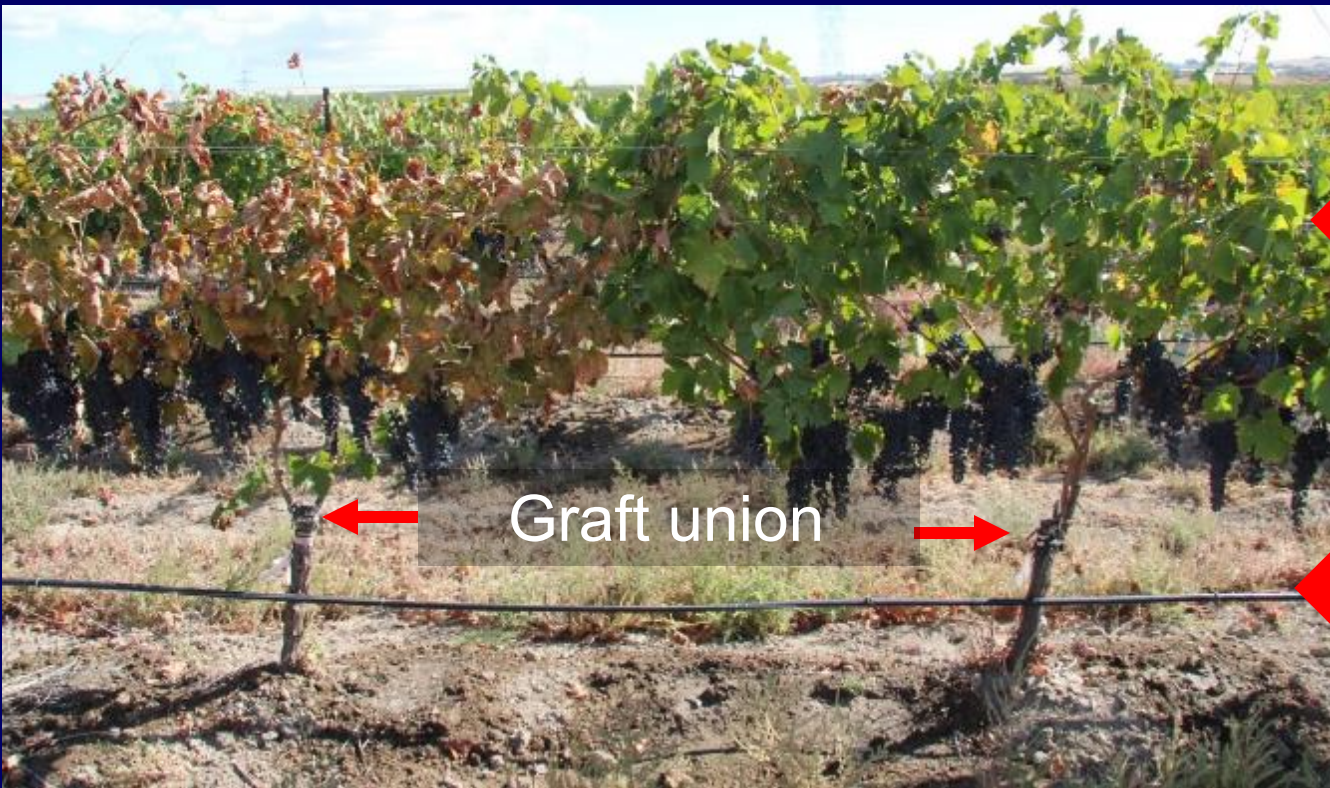# Spread of viruses via top-grafting

**Two partners:
keep them 'clean'**

➡ Scion wood from 'new' variety

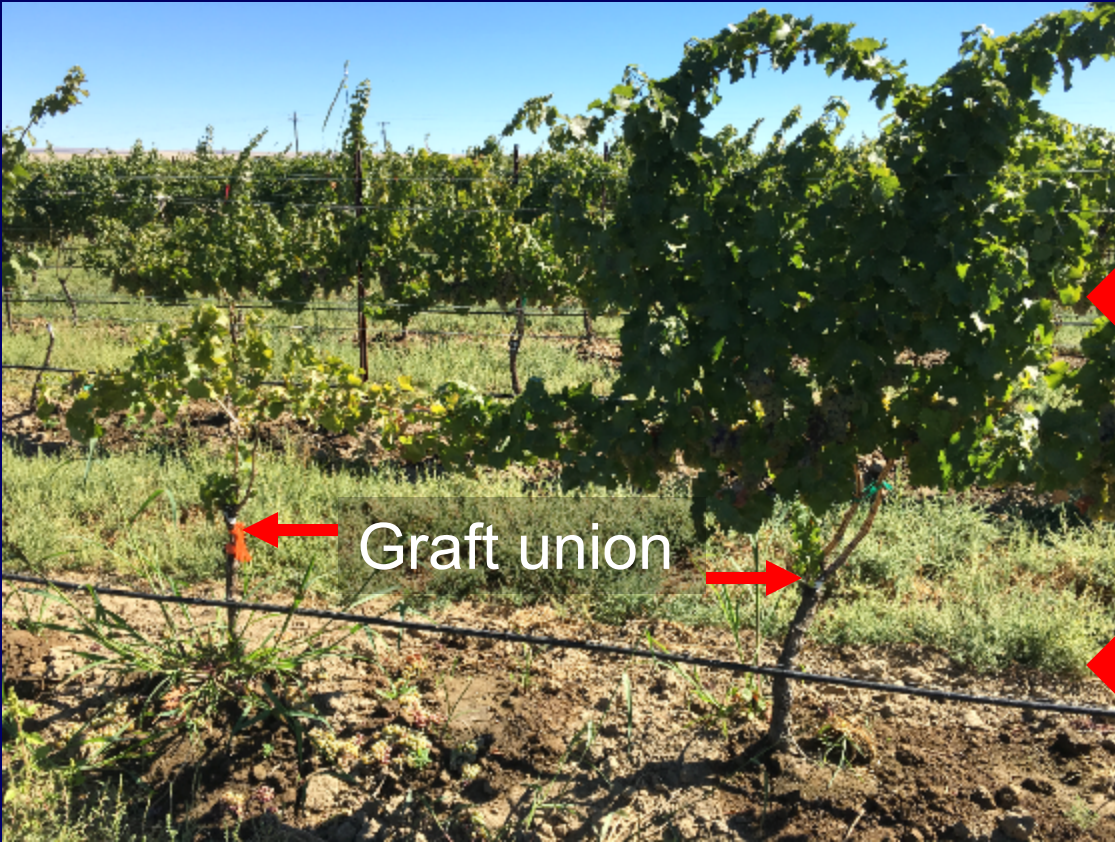➡ Existing trunk variety

Spread of viruses via top-grafting

cv. Syrah
(Scion variety)

Graft union

cv. Riesling
(Trunk variety)

Spread of viruses via top-grafting

cv. Sauvignon Blanc
(Scion variety)

Graft union

cv. Riesling
(Trunk variety)

Emerging problems

Fanleaf degeneration/decline

cv. Grenache

Pears – no obvious problem
Replaced with a wine grape cultivar – serious problem
An example of species jump – pears to wine grapes

The mantra for 'start clean'

- Use virus-tested 'clean' plant material for new plantings.
- Make sure existing blocks are tested before top-grafting.
- Ensure no nematode vectors in the soil before planting new vineyards.

- Do 'clean' vineyards remain free from virus infection?

- What is the risk of virus spread from neighboring blocks ?

Post-planting strategies

Monitor young vineyards on a regular basis

Leafroll ?
Nutrient deficiency ?
Winter damage ?
Crown Gall ?

Leafroll ?
or
Red blotch ?

Is it leafroll or red blotch?
cv. Cabernet franc

Is it leafroll or red blotch?

Difficulty with symptom-based diagnosis

cv. Cabernet Sauvignon   cv. Syrah   cv. Petite Sirah

Red blotch   Red blotch   Red blotch
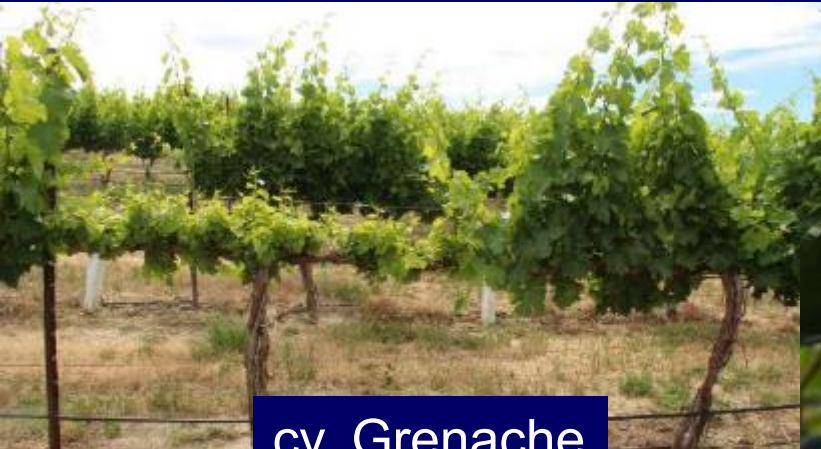
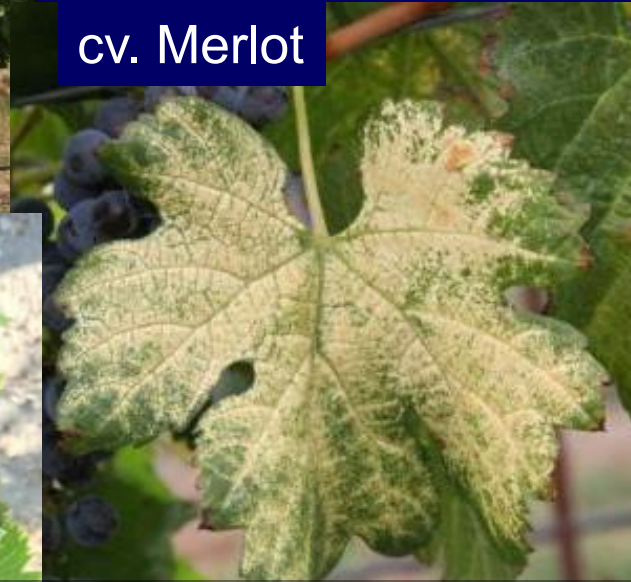Leafroll   Leafroll   Leaf roll

Fanleaf degeneration/decline

cv. Merlot

cv. Grenache

cv. Grenache

Grapevine fanleaf virus or Tobacco ringspot virus

cv. Grenache

cv. Cab franc

cv. Merlot

Reliable identification for slowing the spread

Virus	Vector	WA
Grapevine fanleaf virus	*Xiphinema index*	**No**
Tobacco ringspot virus	*X. rivesi*	**Yes**

Grapevine fanleaf virus:
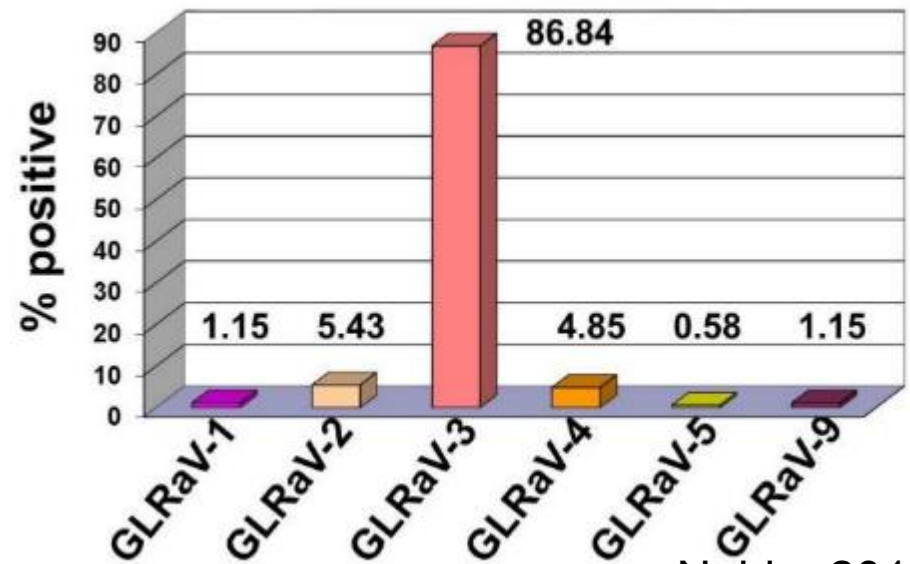Rouging, then replanting with virus-tested cuttings

Tobacco ringspot virus:
Roguing, then replanting with virus-tested cuttings
Nematode vector management

Post-planting strategies

Accurate diagnosis is critical for slowing the spread of virus diseases

Grapevine leafroll disease

Naidu, 2011

Virus	Cuttings	Mealybugs	Soft scales
GLRaV-1	Yes	Yes	Yes
GLRaV-2	Yes	**No**	**No**
GLRaV-3	Yes	Yes	Yes
GLRaV-4	Yes	Yes	Yes
GLRaV-7	Yes	**No**	**No**

Naidu et al., 2014. Plant Disease 98:1172-1185.

Spread of GLRaV-3 into young vineyards
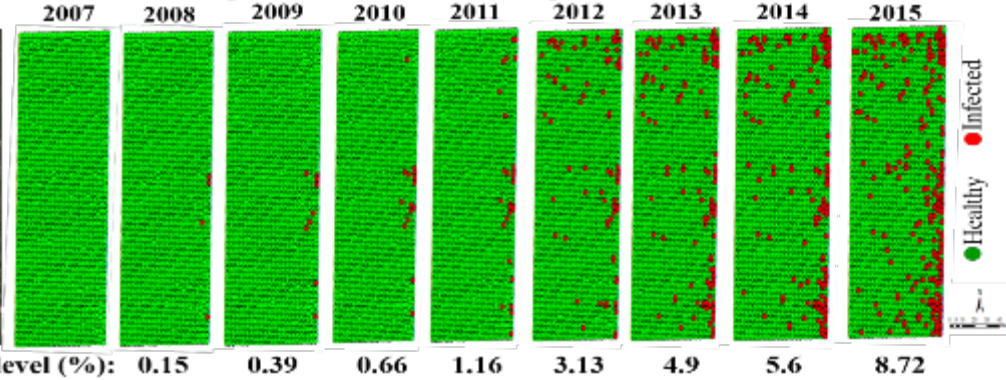
One side with leafroll block
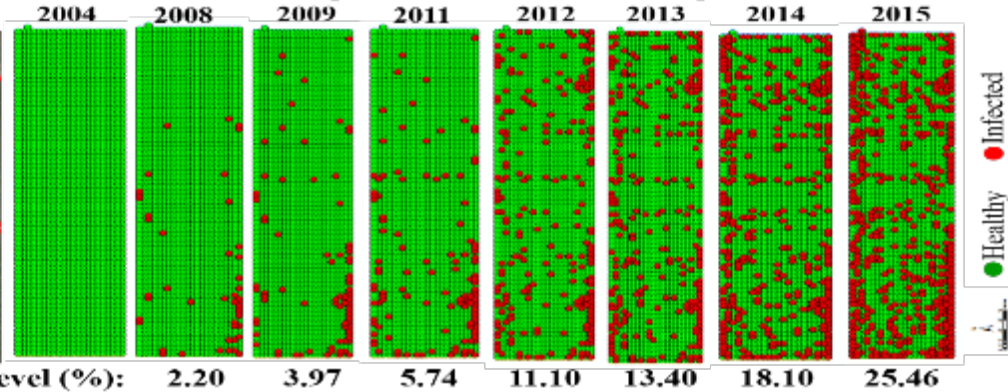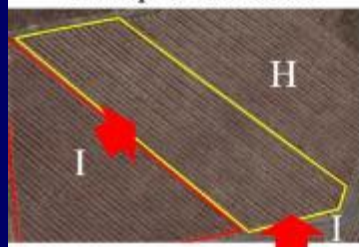
Thee sides with leafroll blocks
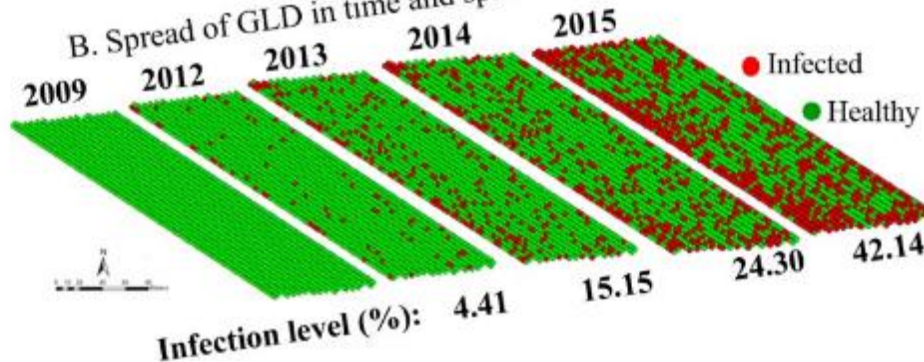
Two sides with leafroll blocks & windy site

Summary points

Multi-year field studies on the spread of leafroll in three wine grape cultivars have provided convincing evidence that:

- Young vineyards planted with 'clean' virus-tested plant material can become infected with GLRaV-3.

- Rate of spread may depend on site-specific influences (viz. proximity to infected blocks, vectors, climatic factors, etc.).

Slowing the spread in young vineyards by roguing

**Remove infected vines
within the first few years after planting**
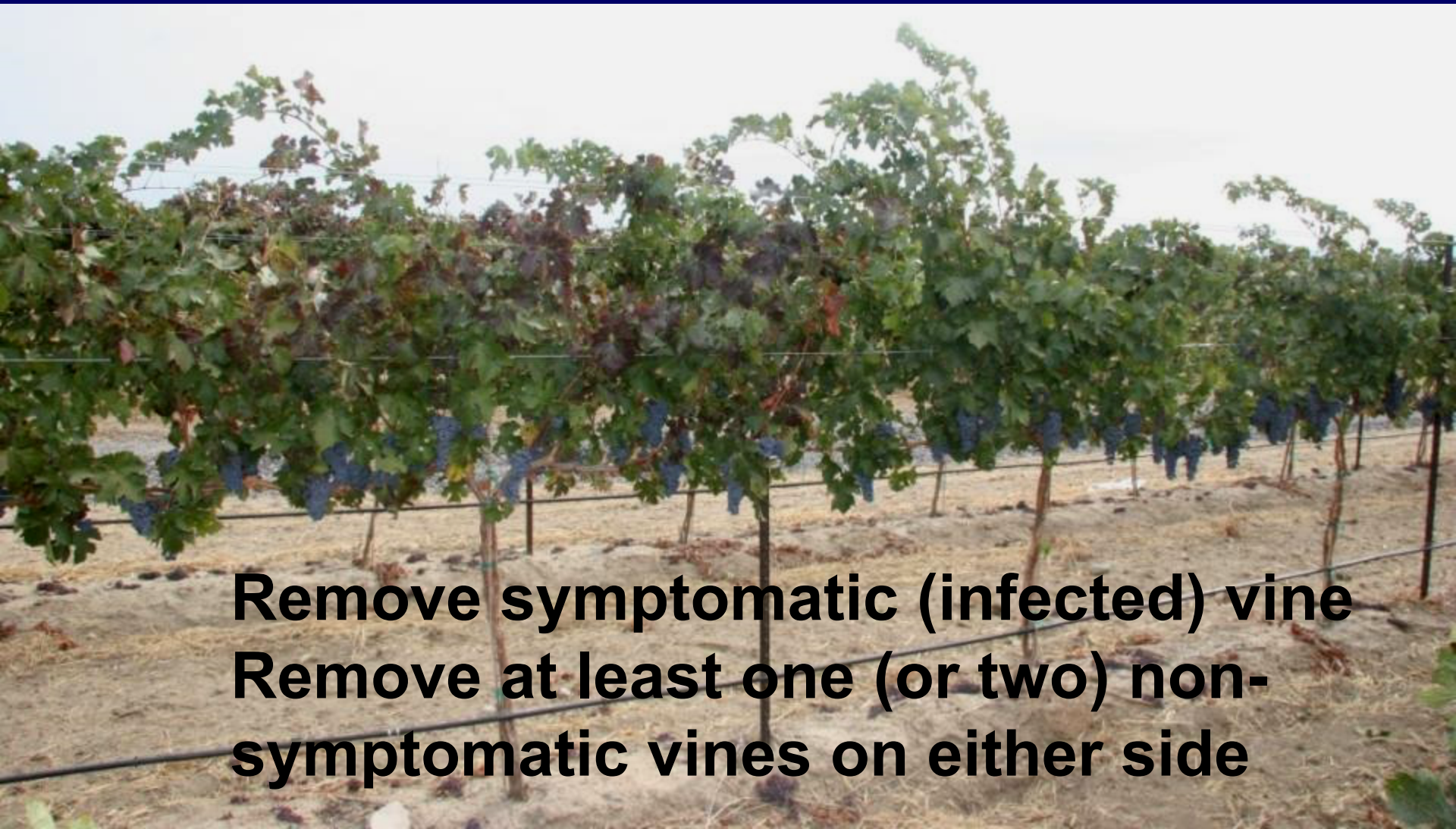
**Remove symptomatic (infected) vine
Remove at least one (or two) non-symptomatic vines on either side**

Roguing as one of the post-planting strategy

Rouging, then replanting with 'clean' cuttings as a key component of management strategy for reducing virus spread in young vineyards

Slowing the spread by controlling vectors

- Grape mealybugs (*Pseudococcus maritimus*) as vectors
- Soft scale insects (*Parthenolecanium corni*) as vectors

Community-based initiatives for successful implementation of area-wide strategies for slowing virus spread and disease management

Best practices for slowing virus spread
Scouting vineyards

- Cultivar-specific differences in symptoms
  - Red grape varieties:
    symptom-based followed by testing
  - White grape varieties:
    no symptoms, only by testing
  - Climate-driven influences

- Scouting in early ripening cultivars first
  (e.g. Chardonnay, Pinot noir, Cab franc,
  Merlot, Syrah,……..Cabernet Sauvignon, etc.)

- Scouting before harvest and <u>NOT</u> after harvest

- Sampling strategies
  - Pooled sampling strategies for economy
  - Leaf samples during the season
  - Cane samples during dormant season

Best practices for slowing virus spread

- Sanitation to prevent spread
  - visit clean blocks first
  - clean machinery
  - worker sanitation
  - education

- Vector control plan
  - chemigation, foliar applications, fumigation

- Vineyard replacement
  - clean plants (and fumigation?)
  - regular monitoring and testing
  - roguing
  - education

Best practices for decision making

- Use reliable diagnostic assays
  - ELISA
  - PCR
  - High-throughput sequencing

- 'Smart' decisions
  - Cultivar-specific differences in virus titer
  - Delayed expression of symptoms in new plantings
  - Age of the vine and virus titer
  - Review test results for risk tolerance
  - A sample that is negative for one virus may be positive for other virus(s)
  - Seek guidance from WSU - contact
  Naidu Rayapati (naidu.rayapati@wsu.edu)

Industry 🤝 University
partnerships

healthy vineyards

Acknowledgements

Thank You