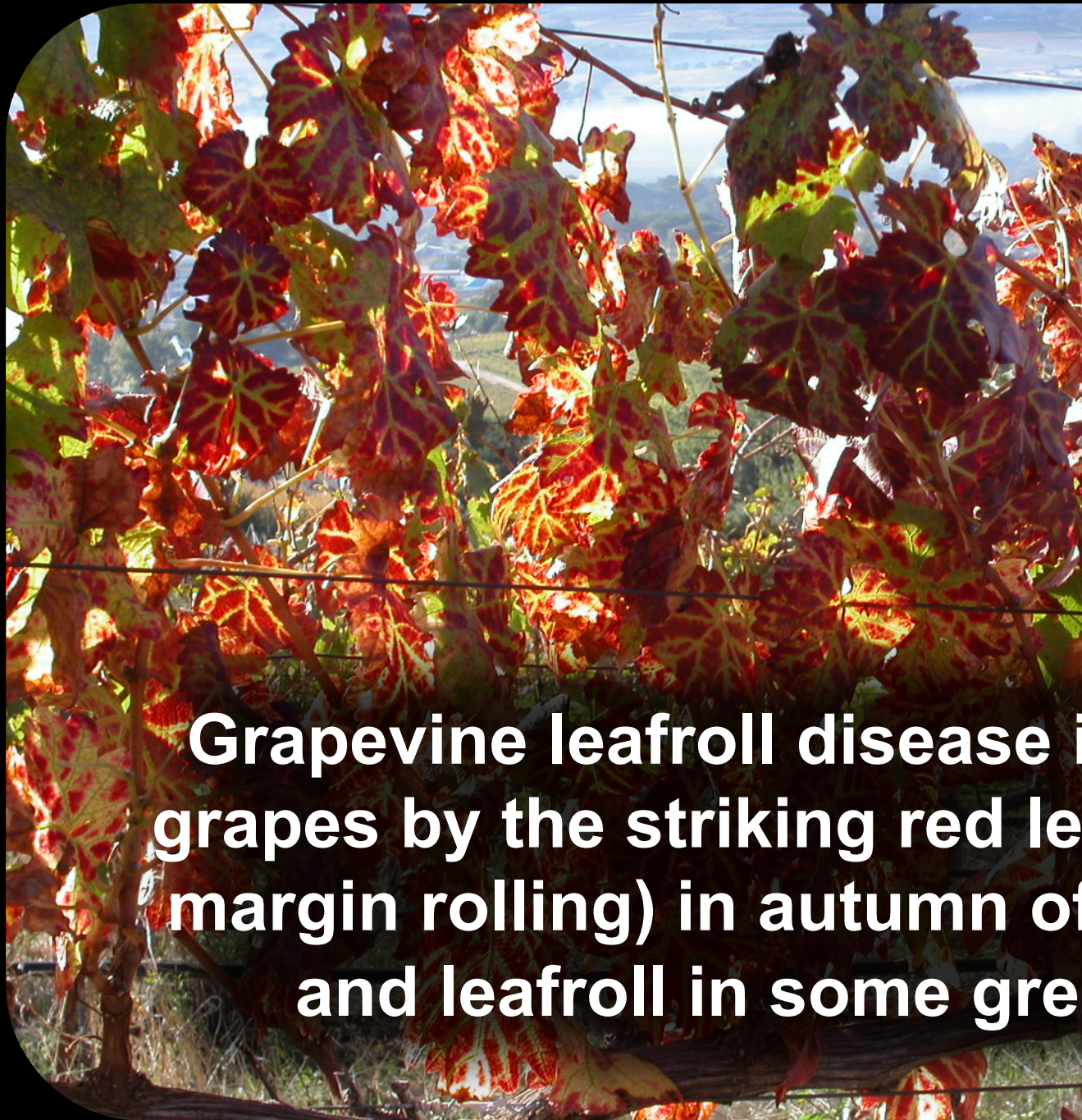


Grapevine leafroll disease, an underestimated disease in table grape production in South Africa

Gerhard Pietersen
Patho Solutions, South Africa.





Grapevine leafroll disease is characterized in wine grapes by the striking red leaves (and sometime leaf margin rolling) in autumn of black berried cultivars, and leafroll in some green-berried cultivars.



Recognized as the most important viral disease of wine grapes worldwide and also in South Africa.

Caused **primarily** by
Grapevine leafroll
associated virus
type 3 (GLRaV-3).

Spread by
mealybugs and
scale insects.

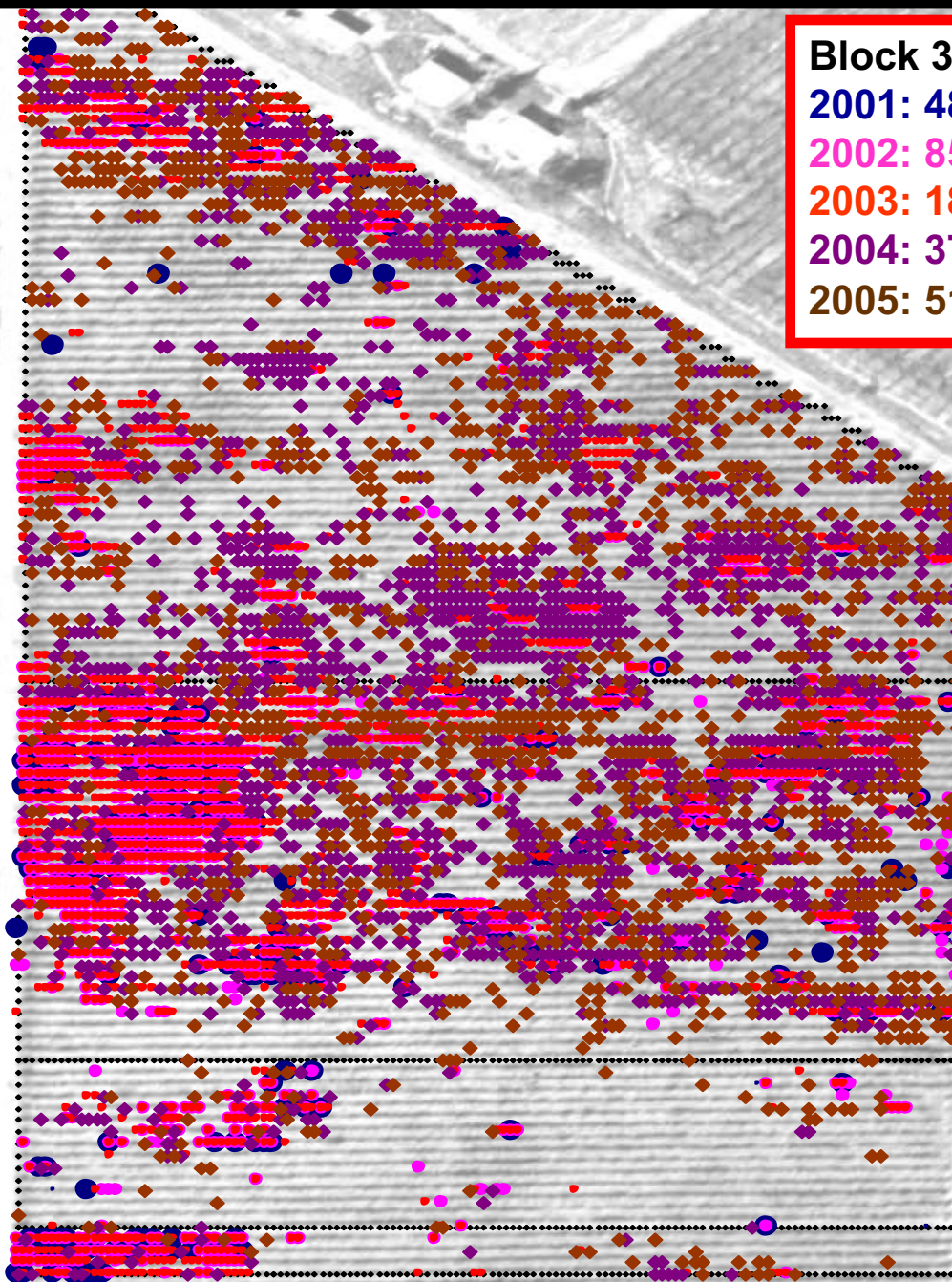
Background Photo: K. Kasdorf



Problem:

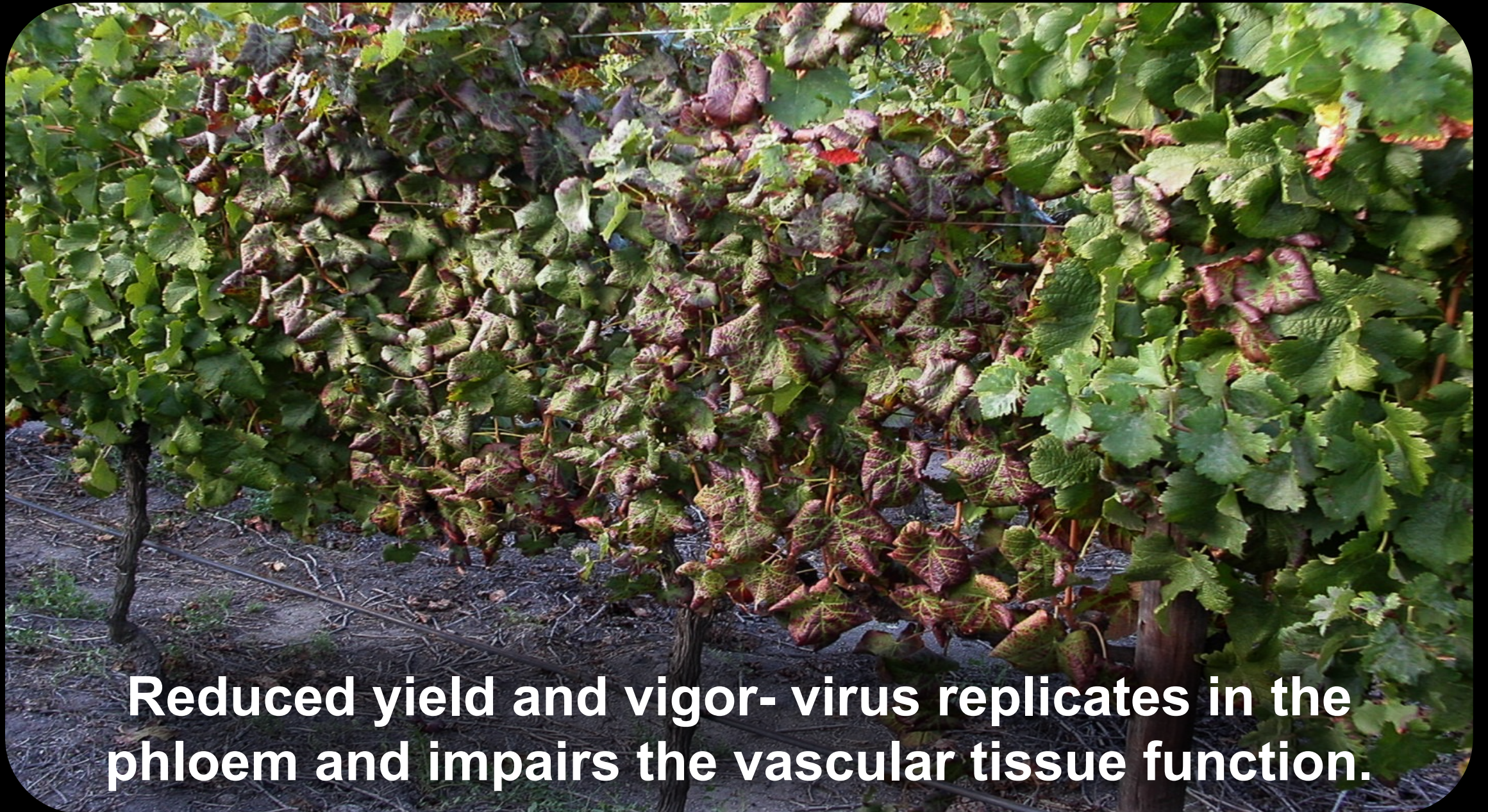
**High prevalence
in grape
production areas.**

**Relatively rapid
spread.**



Block 37 (Total 11939):
2001: 487 (4.08%)
2002: 855 (7.17%)
2003: 1847 (15.55%)
2004: 3735 (31.44%)
2005: 5115 (43.09%)





Reduced yield and vigor- virus replicates in the phloem and impairs the vascular tissue function.

Leafroll infected

Healthy

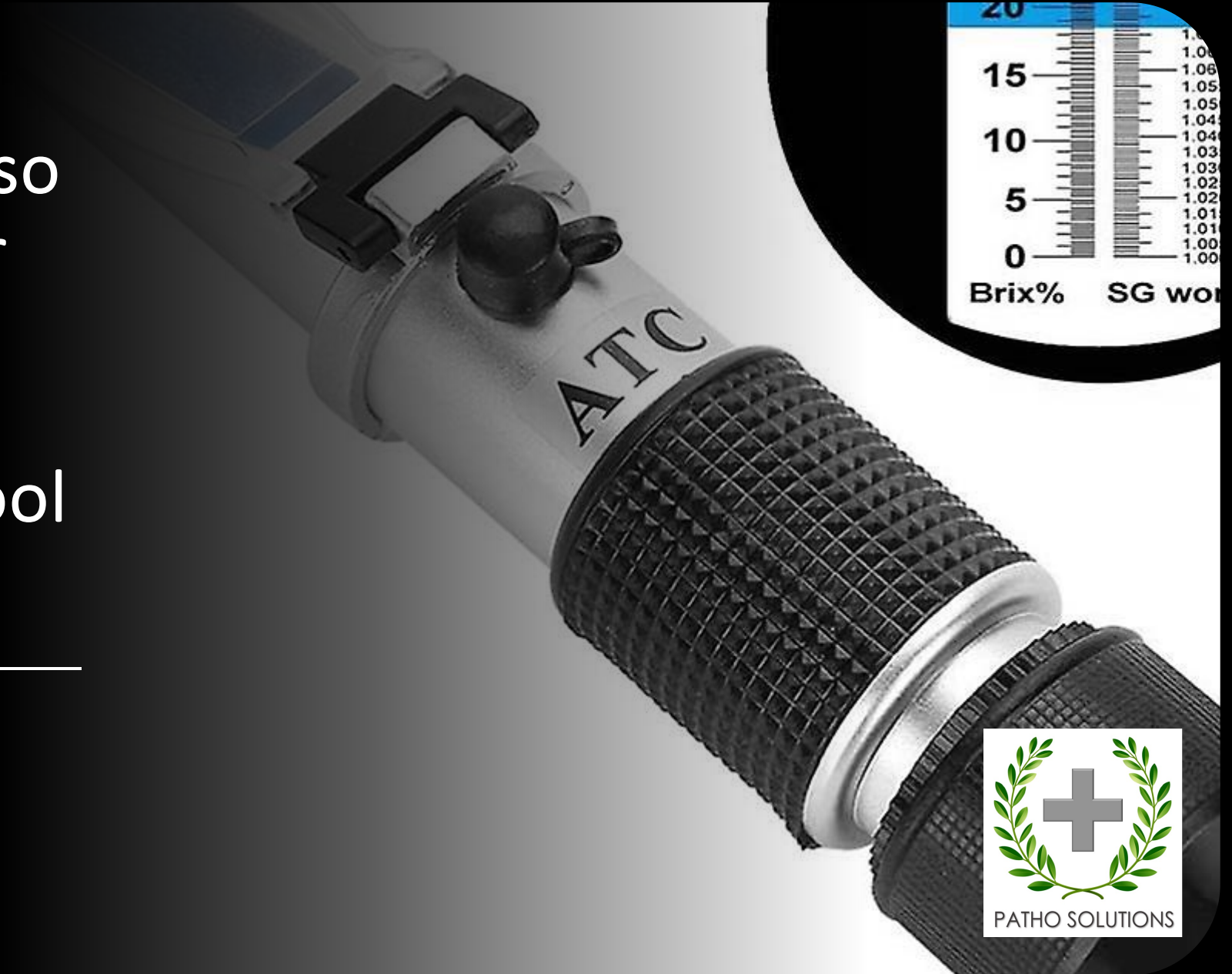


Diseased vines display uneven ripening of berries/bunches and a delayed/lack of colour formation

Image: R.A. Naidu



Diseased vines also have a delayed or reduced sugar development (especially in a cool season)?





*This results in the replacement of vineyards
(red-wine cultivars **AND** white wine cultivars)
every 15-25 years because of
reduced yields and quality*



Control of grapevine leafroll disease by:

1. Planting of certified (GLRaV-3 negative) material
2. Remove infected vines
3. Control the vector (mealybugs) numbers
4. Control vector dispersal from external GLRaV-3 sources

The detail of this can be found in a series of leafroll fact sheets, available at:

<http://igws.co.za/content/fact-sheets/leafroll>



**When applied
area/estate- wide, the
virus can be very
efficiently controlled
to near-elimination
level.**

**The image is of a red
cultivar at Tokara,
April, 2020.**



Most high-end wine estates are applying leafroll control with success.

Image: Vergelegen red wine cultivar, Autumn 2015



Results in harvests of high yields of early and evenly ripening berries with good colouring and flavour profiles.

(Image M. van Rensburg, Vergelegen, 2019).





However, in the South African table grape industry leafroll disease is not regarded with the same seriousness

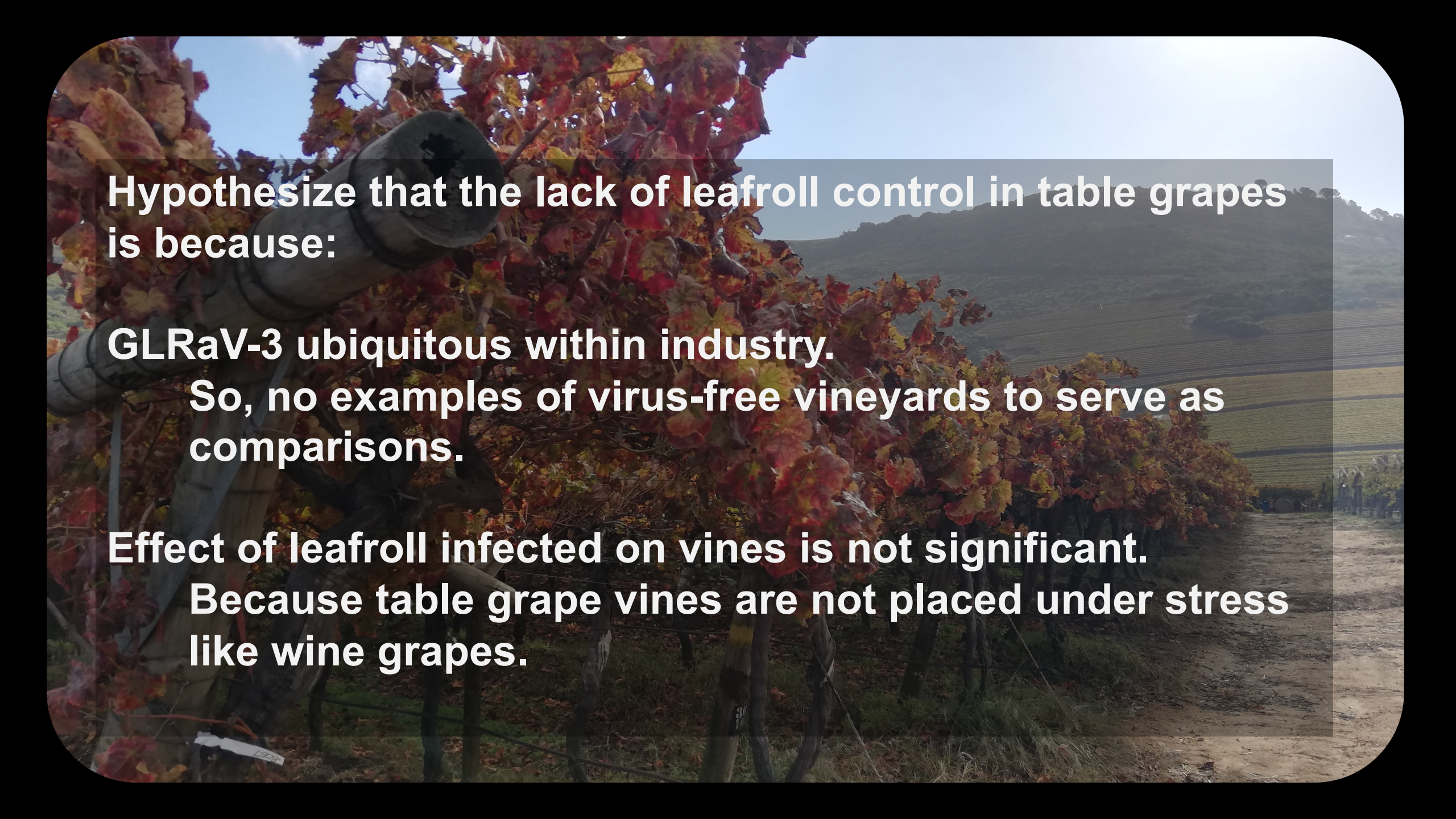


A photograph of a vineyard during autumn. In the foreground, a large wooden barrel is partially visible, surrounded by grapevines with leaves in shades of red, orange, and yellow. The background shows a rolling hill under a clear sky.

Very little specific control of grapevine leafroll within table grape industry.

We are not aware of any grower applying the leafroll control strategy.





Hypothesize that the lack of leafroll control in table grapes is because:

GLRaV-3 ubiquitous within industry.

So, no examples of virus-free vineyards to serve as comparisons.

Effect of leafroll infected on vines is not significant.

Because table grape vines are not placed under stress like wine grapes.

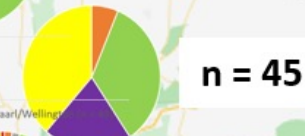
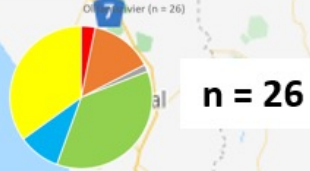
Project: Survey for viruses of table grapes (2017-2020) **(E. Gagliano)**



145 vines from 25 vineyards in five major production areas collected.

Tested for a theoretical 41 known viruses of grapevine (including GLRaV-1, -2, -3 and 4).

Results:



- Tombusviruses
- Maculaviruses
- Marafiviruses
- Geminivirus
- Reoviruses
- GLRaV-3
- GLRaV-1
- GLRaV-2
- Nepoviruses (clade B)
- Vitiviruses and Foveaviruses

GLRaV-3 occurred in every vineyard sampled (n = 25).

114 of 145 samples positive for GLRaV-3.

46 of 145 samples positive for GLRaV-2 (often in mixed infections with GLRaV-3).

5 of 145 samples positive for GLRaV-1 (four were mixed infections of GLRaV-1, 2 and 3).



**Confirms
widespread
occurrence of
GLRaV-3 in
table grape
vineyards
tested and
probably in
industry.**





Project: Do viruses play a role in the berry colour problem of Crimson seedless table grapes



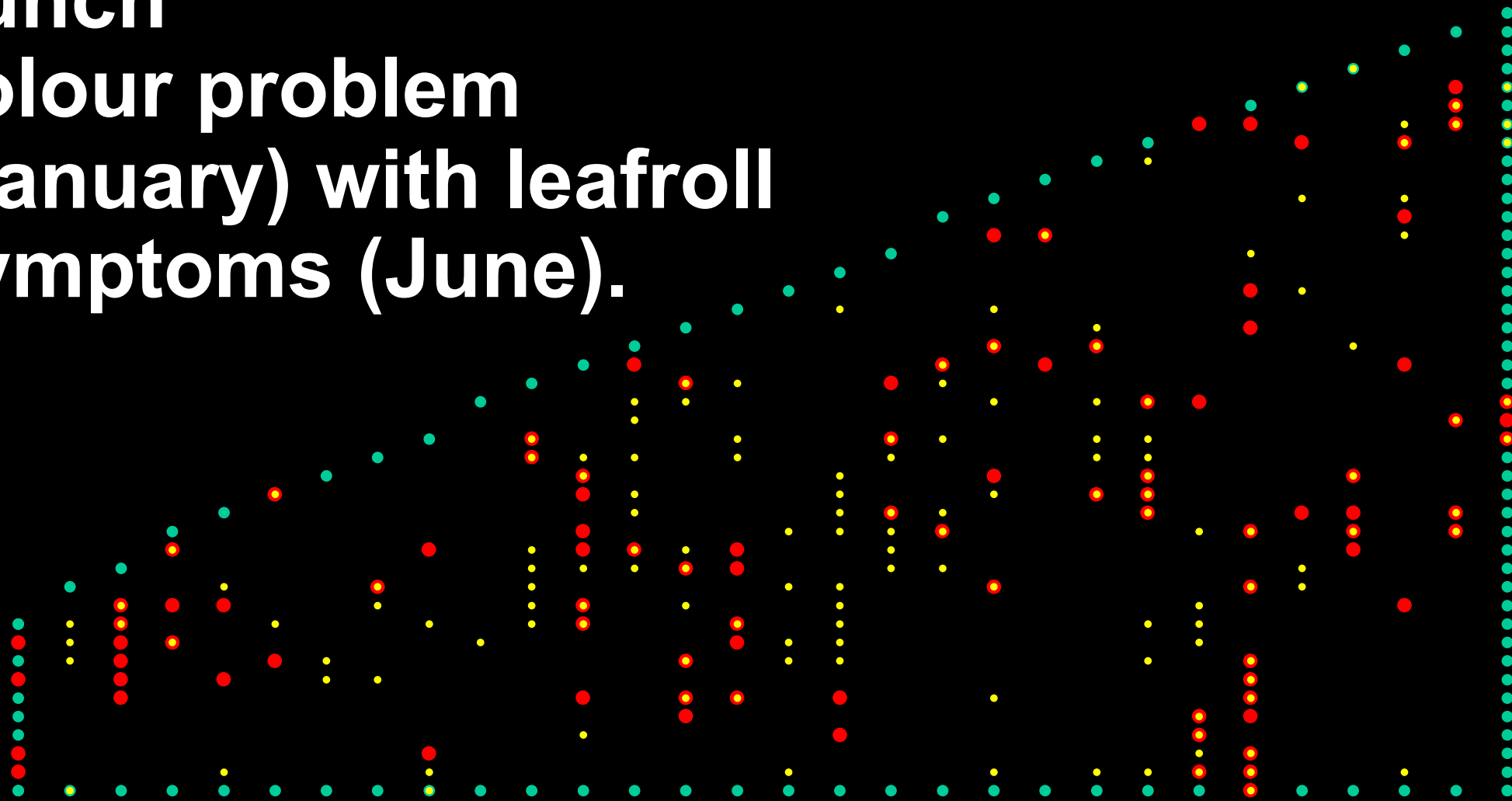
Record spatio-temporal dynamics of the bunch color problem in seven CSS vineyards over a three-year period.



Crimson seedless bunch coloring problem spread is similar to that of leafroll disease



Spatial correlation of bunch colour problem (January) with leafroll symptoms (June).

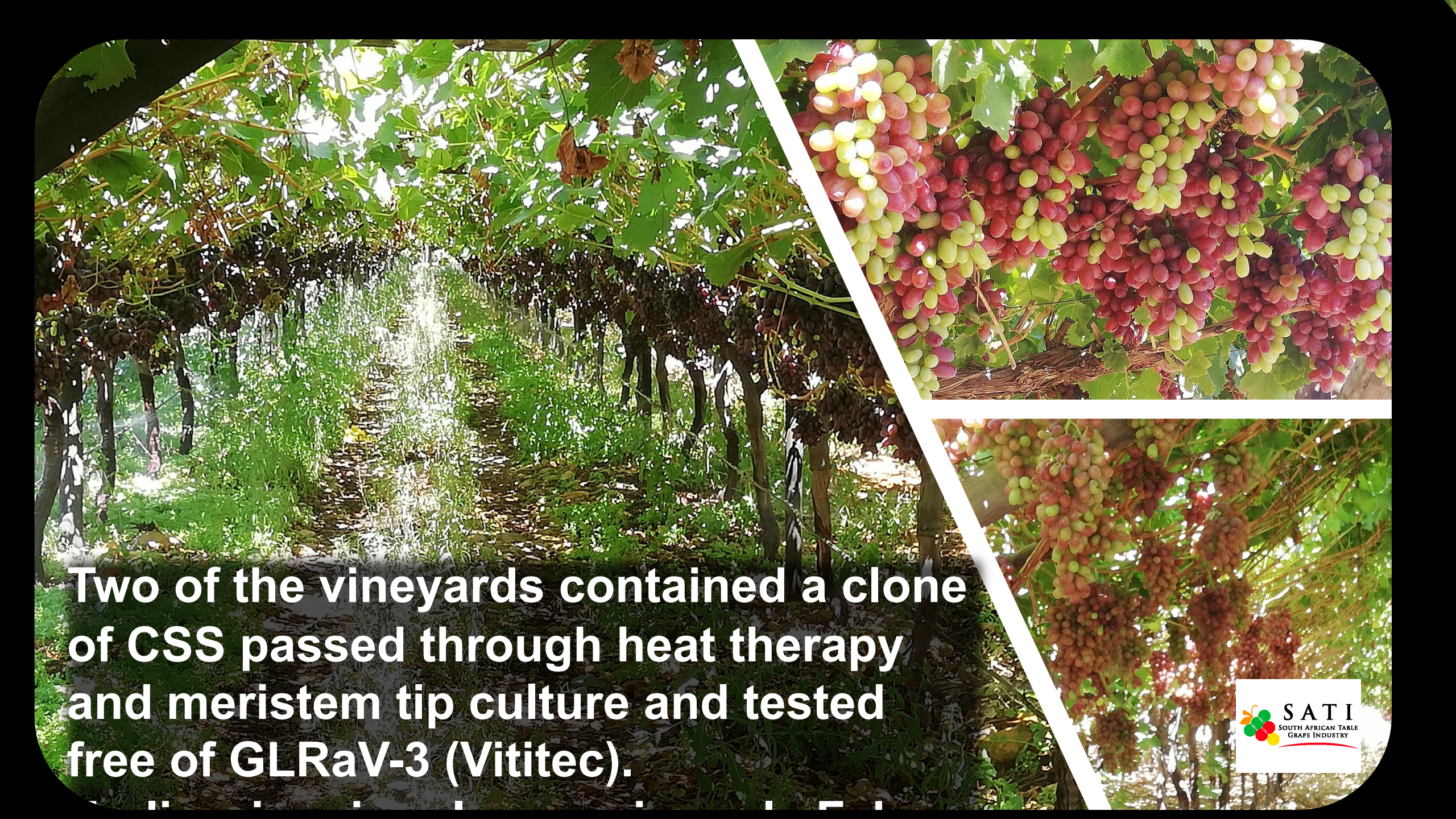


• Border

• Non colouring phenotype 9/3/2020

• Leafroll symptoms 29/6/2020





Two of the vineyards contained a clone of CSS passed through heat therapy and meristem tip culture and tested free of GLRaV-3 (Vititec).





Row	Berry colour delay				
	1	2	3	4	5
64					
63					
62					
61					
60					
59					
58					
57					
56					
55					
54					
53					
52					

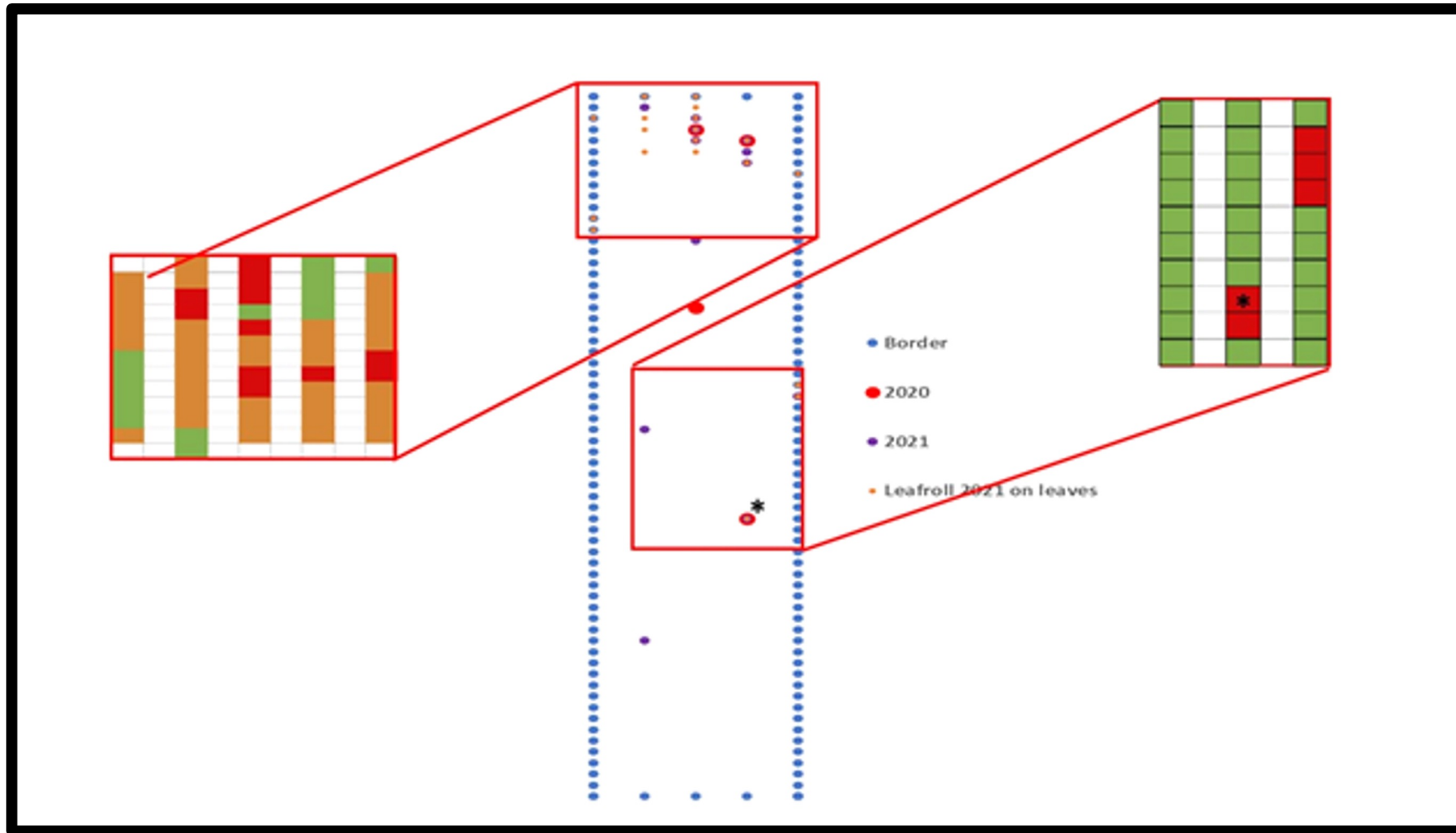
Berry colour delay
March, 2022

Some problems in achieving full colour berries
Earlier ripening: Images in early Feb. 2022



**Also, some
vines with no
berry colouring
by mid-March**





Vines with severe lack of bunch colour-up (CSSBD) in 2019, 2020, 2021, vines with leaf symptoms of grapevine leafroll in 2021, and a section of the vineyard with the GLRaV-3 ELISA results (red = clearly positive vines, orange = low absorbance vines (weakly positive) and green = healthy vines).

**GLRaV-3 and viroids found in vines of Crimson
seedless bunch coloring problem and neighbours,
GLRaV-3 not elsewhere**



**Presence of
often mild
leafroll
symptoms in
Mid-May, in
vines with
CSSBD or
testing positive
for GLRaV-3
earlier that
season.**

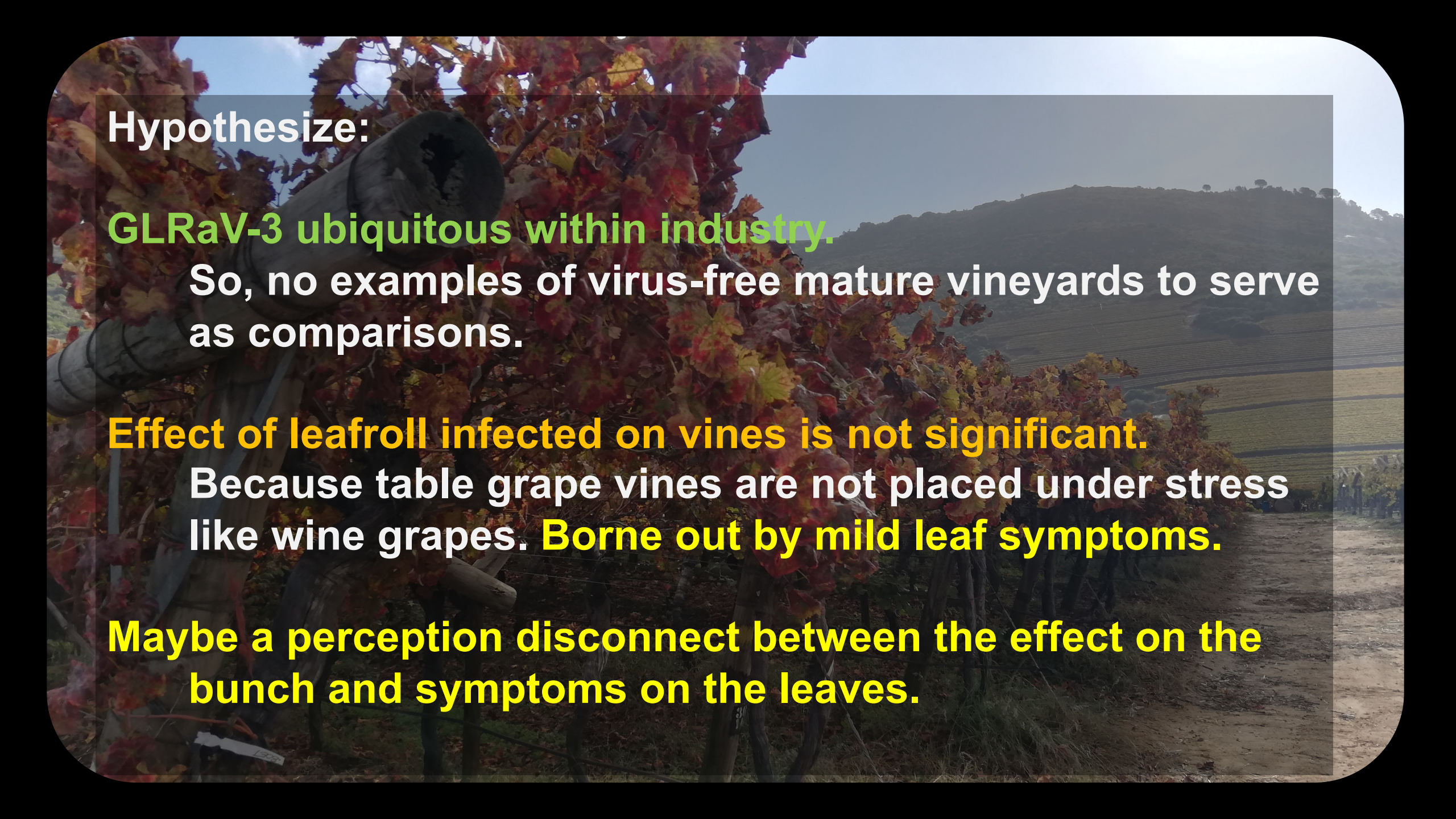


The image is a composite of three photographs. The largest, on the left, shows a perspective view of a vineyard with rows of grapevines. Many leaves show signs of leafroll, appearing distorted and yellowed. The ground is covered in green grass and fallen leaves. Two smaller, rounded-corner photographs are on the right. The top one is a close-up of several bunches of grapes hanging from a vine; the grapes are a mix of red and green, indicating uneven ripening. The bottom one is another close-up of grape bunches, showing similar mixed coloring. A white diagonal line separates the two smaller photos.

**Crimson seedless bunch colouring (CSSBD)
problem appears to be associated with leafroll
symptoms on the leaves and at least the
presence of GLRaV-3 infection.**

Conclusion: Crimson Seedless Bunch Coloring Disease is another manifestation of grapevine leafroll disease.

Illustrates negative effect of leafroll on at least CSS grapes, also ubiquitous nature in this cultivar preventing it from being recognized as a virus-induced problem.

A photograph of a vineyard during autumn. In the foreground, there are grapevines with leaves in shades of red, orange, and yellow. A large wooden barrel is partially visible on the left. In the background, there are rolling hills under a clear sky.

Hypothesize:

GLRaV-3 ubiquitous within industry.

So, no examples of virus-free mature vineyards to serve as comparisons.

Effect of leafroll infected on vines is not significant.

Because table grape vines are not placed under stress like wine grapes. **Borne out by mild leaf symptoms.**

Maybe a perception disconnect between the effect on the bunch and symptoms on the leaves.



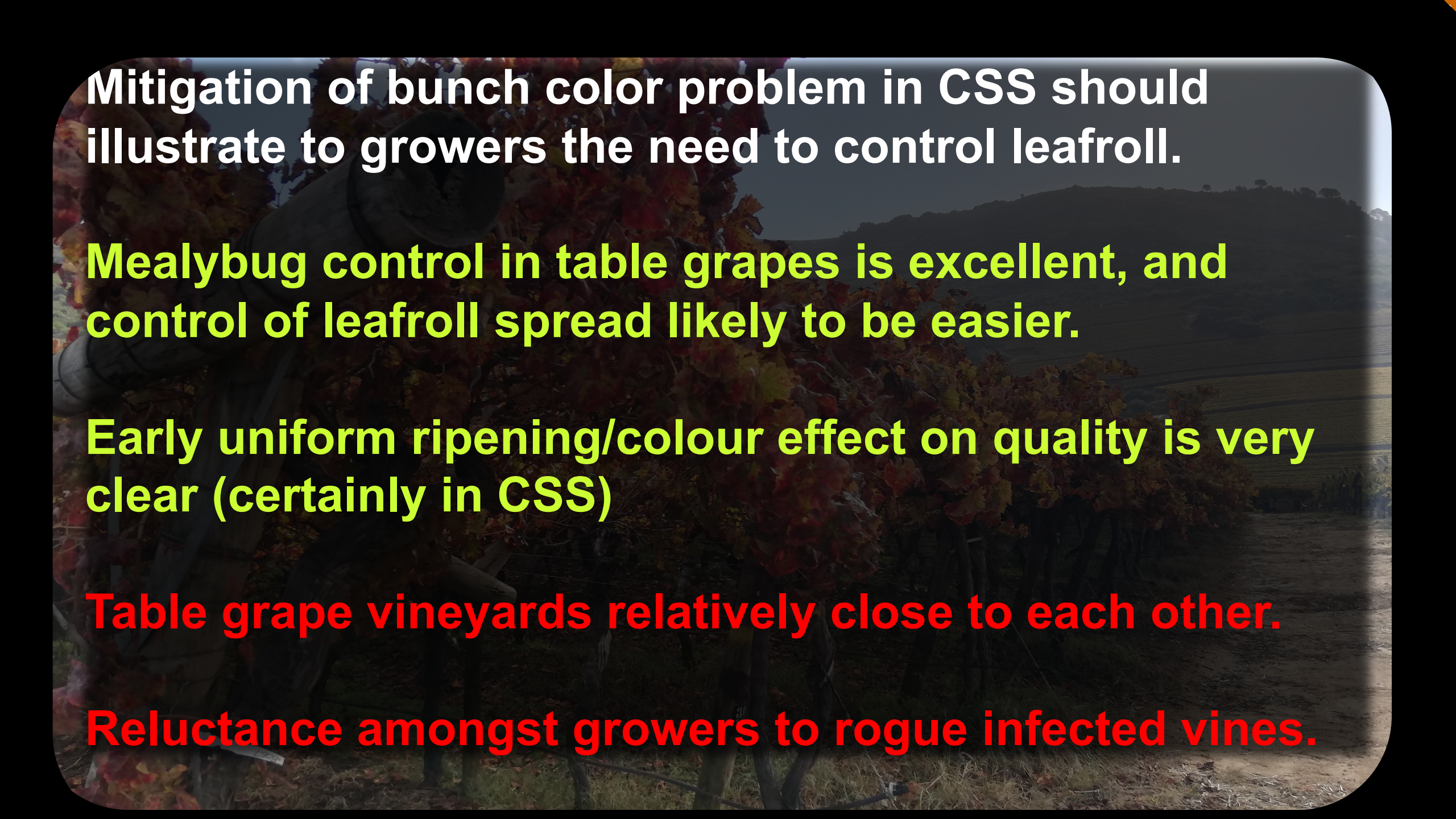
Control of grapevine leafroll disease is clearly warranted (at least in Crimson Seedless).

Recent inclusion of table grape varieties within the Vine Improvement Association (VIA) certification scheme .

Some adjustments made to scheme to accommodate the difficulties with rapid cultivar changes within Table grapes.

Project: Identify and establish GLRaV-3 immune and susceptible Ramsey (*Vitis champini*) individuals.





Mitigation of bunch color problem in CSS should illustrate to growers the need to control leafroll.

Mealybug control in table grapes is excellent, and control of leafroll spread likely to be easier.

Early uniform ripening/colour effect on quality is very clear (certainly in CSS)

Table grape vineyards relatively close to each other.

Reluctance amongst growers to rogue infected vines.

Thank you for your attention.



WINETECH

