GRAPEVINE LEAFROLL DISEASE AND THE EFFECT ON SAUVIGNON BLANC

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Basic Wine

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Grapevine leafroll disease (GLD) is one of the **major diseases** affecting the grapevine and occurs in all vine-growing regions of the world. Grapevine leafroll-associated virus 3 (GLRaV-3) is the main virus mostly associated with GLD. The impact of GLD on vine health, crop yield, and quality are **difficult to assess due to a high number of variables** (such as cultivar, clone, rootstock genotype, vine age, and environmental conditions), but **significant economic losses** are consistently reported over the lifespan of a vineyard if intervention strategies are not implemented.

SYMPTOMS

Symptoms of GLD can **vary greatly** with the season, grape cultivar, and climatic conditions[1].

- In spring, **bud break and shoot development are often delayed** in GLD affected vines. This usually only lasts a few weeks.

- **Leaf symptoms** first become apparent in early to mid-summer, often appearing earlier on **water-stressed vines**. These symptoms increase in number and severity until late autumn.

- In most red cultivars, GLD causes reddening of the interveinal areas while the primary and secondary veins remain green. Leaves of some red cultivars, particularly those with deeply pigmented fruit, develop uniform red colour without green veins. In **white cultivars, the interveinal area may become chlorotic**. This symptom is often subtle and may not be recognizable.

- In late autumn, the **leaf margins roll downward and become brittle** however, the extent of leaf-rolling varies considerably among cultivars. As the growing season progresses, more and more leaves display GLD symptoms, progressing from the base of the shoot to the tip.

- Some varieties can be completely **symptomless**, like some rootstocks and certain white cultivars, which can serve as a reservoir from where GLD can be transmitted. White cultivars, like Chardonnay, show pronounced leaf-rolling by harvest time, while Thompson Seedless and **Sauvignon Blanc, show little or no leaf-rolling** at all. In these white cultivars, **GLD is nearly impossible to detect visually**. The **absence of distinct symptoms, renders the diagnosis of virus infection based on visual inspection of vineyards difficult therefore hindering disease diagnosis, timely insect vector control and effective removal of infected vines**[2]**.**

VIRUS EFFECTS

Grapevine leafroll disease can lead to[1,3]

- drastic **reduction in leaf photosynthesis** during post-véraison
- **alteration of the berry maturation** process, in particular of genes involved in the anthocyanin biosynthesis and sugar metabolism
- **stressed vines and reduction in vine productivity**

Other than the **vector spreading the disease**, the **virus titre (load/amount)** and **duration of infection** are the principle variables affecting the infection process. Other factors such as cultivar, rootstock and age of the vine may also affect the infection severity[4].

Although plenty of work has been done on the effect of the virus on red grape varieties, studies involving the effect of the **virus on white varieties are less abundant**. A recent study investigated the effect of the virus on the physiological variables of Sauvignon Blanc vines and the chemical profile of the juice and wine in a study titled,

Effects of grapevine leafroll associated virus 3 (GLRaV-3) and duration of infection on fruit composition and wine chemical profile of Vitis Vinifera L. Cv. Sauvignon Blanc[3]

MATERIALS AND METHODS

Healthy and infected vines from a commercial vineyard at Rapaura area along the northern edge of the Wairau Valley, Marlborough region, New Zealand were selected for the study (performed in 2014). Seven replicate vines of three treatments reflecting the spread of the virus were used:

- **Healthy, non-infected vines**
- **Vines infected by GLRaV-3 after 2008**
- **Vines infected by GLRaV-3 before 2008**

The virus status of the vines was confirmed by multiplex reverse transcription PCR[5]. Ripening was monitored and the **fruit was harvested as soon as the soluble solid content reached 20.4°B**. The

grapes were processed and the juice inoculated with EC1118 at 15°C. The soluble solids content and fermentation temperature were monitored daily.

RESULTS

VINE PHYSIOLOGY

- When compared to the healthy vines, the presence of the GLRaV-3 virus imposed
  - **reduction in the net photosynthesis**
  - **21% reduction on the CO_2 assimilation rate**
  - **24% reduction in stomatal conductance**
  - **reduction in chlorophyll concentration**
  - **reduction in transpiration** (vines infected before 2008)

- The harvest dates of the three treatments were as follows (harvested at 20.4°B)
  - **Healthy, non-infected plants → 26 March 2014**
  - **Plants infected by GLRaV-3 after 2008 → 2 April 2014**
  - **Plants infected by GLRaV-3 before 2008 → 4 April 2014**

- Yield, clusters per vine, cluster weight, berries per cluster, berry weight, seeds per berry and seed weight did not vary between the treatments

JUICE COMPOSITION

- The only significant difference in the general juice composition between the treatments was the **acidity**. The **titratable acidity was higher in the juice obtained from grapes grown from healthy, uninfected vines**. This was also reflected in the **tartaric acid and malic acid** measurements with higher concentrations observed in grapes harvested from healthy vines. The citric acid content was slightly higher in the juice obtained from plants infected after 2008.

- The presence of GLRaV-3 **did not affect the ammonia, total primary amino acids or YAN concentration**. However, differences in individual amino acids were observed and could have an effect on the volatile composition of the finished wine. Unfortunately, aromatic assessment and sensory evaluation were not done in this study.

- The **total phenolic content** (mg GAE/ L) was very **similar** between the three treatments. However, a slightly higher value was observed from juice obtained from grapes infected after 2008 compared to before 2008.

- The **yellow colour intensity** (measured at 420 nm) was the **lowest in the juice from healthy vines** and increased according to the infection duration.

WINE COMPOSITION

- There were **no significant differences between the wine parameters: alcohol, pH, phenolic content and wine colour.**

- The only significant difference was observed for **titratable acidity** which was **lower in the wines produced from vines infected before 2008**. Tartaric acid and malic acid results mirrored this observation but showed a difference between the wines made from healthy vines compared to wines made from infected vines (irrespective of how long the infection has been present). The fact that the grapes from infected vines had to be harvested later than the healthy vines could explain the difference in acidity, however, this **highlights the imbalance that starts to occur when assessing the sugar:acid ratio of infected vines**.

- Unfortunately, sensory evaluation and aroma assessment and were not performed. These results might have delivered interesting and very relevant findings.

CONCLUSION

The present study confirms the **effect of the GLRaV-3 virus on the grape maturity and additionally shows the impact of the duration of the virus infection on the vine health and grape composition**. This would suggest that there is a compounding/accumulating effect of the virus on the vine function. The organic acid results from this study would also suggest that the **GLRaV-3 virus affects Sauvignon Blanc berry development**, particularly at the later berry ripening phase. However, other studies, performed on various grape varieties, have reported opposite results[1,6].

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