NEW ZEALAND WINE
PURE DISCOVERY

RESEARCH SUPPLEMENT

Information and Updates on NZ Winegrowers Research Programmes.
Associate Editors: Dr Simon Hooker, General Manager Research and Innovation

A regular feature at the back of each issue of WineGrower to inform industry people about research projects being undertaken for their benefit. Newly approved projects (when available) are briefly summarised in the first section 'Introducing New Projects'. Longer reports in the section headed 'Progress Reports', will describe what has been achieved so far. Scientists in charge of each project have been asked to make these reports reader-friendly rather than to follow the usual format of scientific papers. When completed, each project will be reported in full detail, with references, on the website: **http://winenf.nzwine.com/research.asp**

LIST OF PROJECTS

QUALITY WINE STYLES FOR EXISTING AND DEVELOPING MARKETS
Manipulation of methoxypyrazine (MP) levels in Sauvignon Blanc wine through leaf and rachis additions
Plant and Food Research
(Claire Grose)

Influence of juice pH on thiol production
Plant and Food Research
(Claire Grose)

Identification of natural genetic variation in grapevine contributing to pathogen resistance
Lincoln University
(Chris Winefield)

The development of a functional genomics tool for the capture and characterization of transposon mutants in Vitis Vinifera (PhD Scholarship)
Rod Bonfiglioli Scholarship Lincoln University
(Darrell Lizamore)

Investigation of perceived minerality in white wine
Lincoln University
(Wendy Parr)

Identification and quantification of chiral volatile compounds in New Zealand wines that affect aroma
Lincoln University
(Roland Harrison)

Sensory effects of defoliation timing and method on Sauvignon Blanc, Chardonnay, Merlot, and Cabernet Sauvignon
Eastern Institute of Technology (EIT)
(Mark Krasnow)

PESTS AND DISEASE
Implementation of Virus Elimination Strategy
Various
(Nick Hoskins – Project Manager)
Supported by MPI Sustainable Farming Fund

Review of New Zealand and other related trunk disease information
Plant and Food Research
(Dion Mundy)

Managing Botrytis in New Zealand Viticulture
Vino Vitis Ltd
(Ruby Andrews)

Botrytis decision support (BDS) industry training & botrytis sampling protocols
Plant and Food Research
(Rob Beresford)

Understanding causes of slip skin
Plant and Food Research
(Rob Beresford)

SUSTAINABILITY/ORGANICS
Organic Focus Vineyard Project
Organic Winegrowers New Zealand
(Rebecca Reider)
Supported by MPI Sustainable Farming Fund

Effects of undervine vegetation

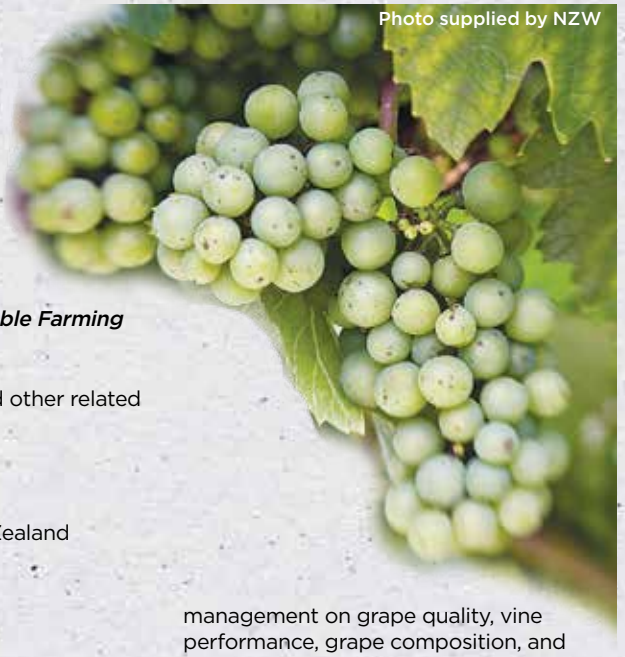
Photo supplied by NZW

management on grape quality, vine performance, grape composition, and soil properties
Eastern Institute of Technology (EIT)
(Mark Krasnow)

COST REDUCTION/INCREASED PROFITABILITY
New opportunities for sustainable grape thinning
Plant and Food Research
(Mike Trought)
Supported by MPI Sustainable Farming Fund

Reduced berry size and Botrytis tolerance through trauma to the vine
Plant and Food Research
(Mike Trought)

Evaluating pruning wound treatments for management of eutypa dieback in grapevines

Mark Sosnowski - South Australian Research & Development Institute and Dion Mundy - The New Zealand Institute for Plant & Food Research Limited

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Introduction

Eutypa dieback is emerging as a major disease of grapevines, along with botryosphaeria dieback, in New Zealand and threatens the sustainability of the wine industry. The disease occurs worldwide, causing significant economic losses to wine industries in other countries. It is caused by the fungus Eutypa lata, which infects vines through pruning wounds, colonises wood tissue and causes dieback of cordons, stunting of green shoots, leaf distortion and eventually kills vines (Figure 1 and 2).

In a project funded by New Zealand Winegrowers which concluded recently, a pilot evaluation of pruning wound treatments for the control of eutypa dieback was conducted in Hawke's Bay and Marlborough. The aim of the project was to generate preliminary efficacy data and to develop a proposal for further research to develop management strategies for eutypa and botryosphaeria dieback in New Zealand.

Methods

A field trial was conducted on Sauvignon blanc vines planted in 2003 at the Paritua Vineyard in Hawke's Bay to evaluate the efficacy of five fungicides as pruning wound protectants against E. lata (Table 1), using methods developed in Australia. Treatments were selected based on results in trials from Australia and with industry advice in New Zealand.

In July 2011, 1-year-old canes were pruned to two-buds (Figure 4) and treated with Folicur® (0.3, 0.6 & 1.5 ml of formulated product/L distilled water), Proline® (0.5, 1 & 2.5 ml/L), Comet® (0.5, 1 & 2.5 ml/L), Nando® (1, 2 & 5 ml/L) and Systhane™ (0.06, 0.12 & 0.3 ml/L) or distilled water as a control (Table 1, pg68). Treatments were applied liberally, with a paintbrush, to wounds within 2 hours of pruning (Figure 5). Each wound was inoculated twice with 500 E. lata spores, 1 and 3 days after treatment (Figure 6). A non-inoculated control was included to determine the incidence of natural infection.

One year later, in July 2012, canes were harvested from vines and returned to the laboratory at the Marlborough Research Centre where they were tested for the presence of viable E. lata. Bark was removed from each cane and the exposed wood was surface sterilised

Figure 1. Dieback symptoms on spur-pruned Sauvignon blanc vines.

Figure 2. Foliar symptoms of eutypa dieback on Sauvignon blanc.

Table 1: Fungicides evaluated in the grapevine pruning wound trial.

Product	Active Ingredient	Activity Group	Manufacturer
Folicur®	Tebucanozole (430 g/L)	Demethylation inhibitor (DMI)	Bayer CropScience, Auckland, NZ
Proline®	Prothioconazole (250 g/L)	DMI	Bayer CropScience, Auckland, NZ
Comet®	Pyraclostrobin (200 g/L)	Qinone outside inhibitor (QoL)	BASF, Auckland, NZ
Nando®	Fluazinam (500 g/L)	2, 6-dinitro-analine	Nufarm Ltd, Auckland NZ
Systhane®	Myclobtanil (400 g/L)	DMI	Dow Agrosciences, New Plymouth, NZ

Figure 3. Pruning Sauvignon blanc vines in Hawke's Bay.

Figure 4. Applying treatment to pruning wound with a paint brush.

in bleach for 10 minutes and rinsed in sterile water. Canes were cut into small chips taken from each side of the margin between live and dead wood tissue. Wood chips were placed on agar and incubated on the laboratory bench for 7 days and then assessed for presence or absence of E. lata cultures (Figure 7).

Efficacy was based on the mean percent recovery (MPR) of E. lata from the treated canes by isolation on agar and presented as mean percent disease control, which was calculated as the reduction in MPR as a proportion of the inoculated control.

Results

E. lata was recovered from 68% of untreated and inoculated control wounds, with only 5% recovery from naturally infected controls. Folicur and Proline were the most effective treatments, providing around 50% control of eutypa dieback when applied at 1.5 ml/L compared with untreated and inoculated wounds (Figure 7). Comet, provided 25-31% control when applied at 1-2.5 ml/L. Nando provided 25% control when applied at 5 ml/L. All other application rates of these fungicides did not provide significant control of E. lata infection. Systhane did not control E. lata infection at any of the rates evaluated.

Conclusion

Folicur and Proline were the most effective pruning wound treatments in the Hawke's Bay field trial. Both products contain the Demethylation Inhibitor (DMI) fungicides tebuconazole and priothioconazole, respectively.

They were most effective when applied at five times the rate registered for foliar application on grapes in Australia (1.5 ml/L). In recent South Australian trials, Folicur and Prosaro (tebuconazole + prothioconazole) provided effective control of eutypa dieback at 0.6 and 1.5 ml/L. Variation in results is common with field trials where conditions can vary greatly between seasons and locations. Based on past experience with field trials, double inoculation with a total of 1000 spores per wound will ensure sufficient recovery in controls so that the efficacy of treatments can be determined with statistical confidence. In the vineyard, natural infection was only 5% in the current study and, based on Australian field trials, can range up to 15%.

Therefore 68% recovery of E. lata from inoculated controls in the field trial represents extremely high disease pressure and the degree of control under conditions of natural infection could be expected to be much greater. In early work on E. lata in apricots, it was suggested that wounds were more likely to be exposed to approximately 10 spores under natural condi-

Figure 5. Inoculating treated wounds with spores of Eutypa lata using a pipette

Figure 6. Cultures of Eutypa lata growing on agar from wood chips cut from treated canes.

tions. Research in Australia is currently being conducted to determine the relative efficacy of treatments at lower inoculation concentrations, using a detached cane assay in the greenhouse.

Comet (pyraclostrobin) and Nando (fluazinam) provided some control of eutypa dieback at the higher rates in the current study, but less than that of Folicur and Proline.

In South Australian trials, these fungicides provided varying degrees of control and it is likely that the relative efficacy under natural disease pressure will be much greater. Systhane (myclobutanil) was not effective at any of the rates tested, which confirms results in Australia, therefore this product will not be included in further New Zealand evaluation trials.

Funding is currently being sought from New Zealand Winegrowers and the Ministry for Primary Industries to expand this research and develop strategies to reduce the impact of trunk diseases.

The new project proposes to deliver recommendations for practical application of pruning wound treatments using tractor-driven sprayers, along with advice on optimal timing of application and a range of effective treatments to provide chemical and non-chemical alternatives for growers. Economic analysis will provide decision support for growers and encourage adoption of practices for the benefit of the wine industry.

The project will build scientific and technical capability in New Zealand for grapevine trunk disease management.

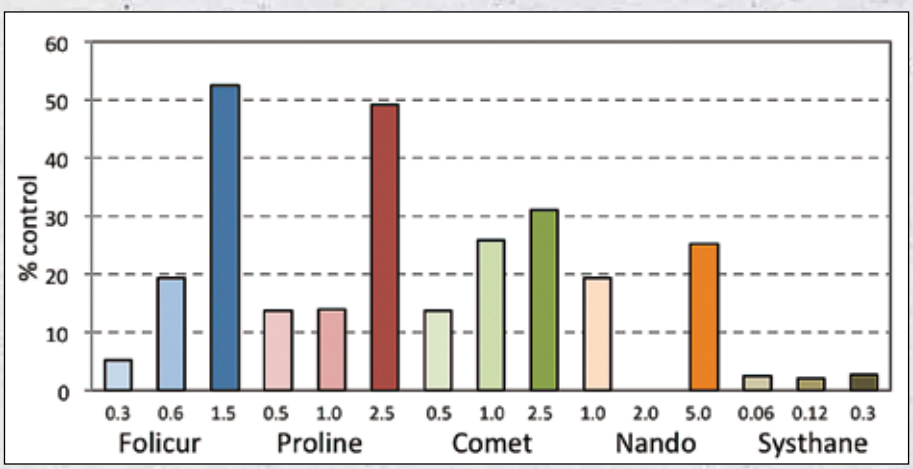

Figure 7. Mean percent control of eutypa dieback on Sauvignon blanc vines inoculated with 1000 Eutypa lata spores per wound, following application with fungicides at different rates (ml/L) to pruning wounds in the Hawke's Bay field trial. Folicur® (tebuconazole), Proline® (priothioconazole), Comet® (pyraclostrobin), Nando® (fluazinam) and Systhane™ (myclobutanil).

Acknowledgements

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Tools for manipulating Sauvignon Blanc wine flavour and aroma: harvest and processing of grapes

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The classic Marlborough Sauvignon Blanc wine is a combination of tropical-passionfruit aromas and green-herbaceous characters. The varietal thiols, 3MH and 3MHA, are significant contributors to the tropical aromas, whereas methoxypyrazines, IBMP and IPMP contribute to the green characters in the wine.

Thiols – tropical, passionfruit

Methoxypyrazines – herbaceous, green capsicum

The balance between thiols and methoxypyrazines helps to define the unique style of New Zealand Sauvignon Blanc and the typicality of a Marlborough Sauvignon Blanc with the wines exhibiting more intense flavours of green capsicum, tropical and passionfruit than Sauvignon Blanc wines produced in other countries. The balance between these green and fruity flavours is essential to the concept of a typical Marlborough Sauvignon Blanc wine.

Grape harvesting and processing methods can both have substantial influences on Sauvignon Blanc wine aroma and flavour. Our research carried out during the 2011 vintage has shown that thiol concentrations were affected by harvest processing and pressing. This trend continues in the 2012 New Zealand Winegrower funded harvest and processing research. Grape processing methods can elevate or reduce the intensity of thiol and methoxypyrazine-related flavours in the finished wine and can be used to manipulate the thiol:methoxypyrazine ratio to produce a desired wine style.

This current New Zealand Winegrowers-funded, Harvest Processes trial aims to determine the extent to which harvest and grape processing technologies affect the sensory profiles, overall complexity and the typicality as Marlborough Sauvignon Blanc of the final wines produced. Using an additional vineyard site to build on existing harvest technologies research carried out in 2011 will speed up these investigations. The additional vineyard site, which was chosen as a contrast to that used in 2011, has increased the volume of data collected for the 2012 vintage period, providing robustness and verifying results from previous SBII Harvest Technologies trials. Our goal is faster delivery of information and new tools to aid winemakers to select the appropriate grape processing method to achieve a desired wine style.

In a second series of experiments, the effects of juice oxidation during harvest and processing on the thiol concentration of Sauvignon Blanc grapes were investigated. These experiments tested the protective oxidative properties of sulphur and ascorbic acid additions to harvested grapes, and the subsequent effects on wine chemistry and aromas.

Sauvignon Blanc grapes were sourced from two vineyards sites in Marlborough. A site predicted to deliver high thiols (Dillons Point, located in Lower Wairau) was used in 2011 and 2012. A potentially low thiol site (Benmorven, located in the Southern Valleys) was included in 2012. Two winemaking trials were undertaken in collaboration with St Clair Family Estate.

Trial 1: Influence of harvesting and processing of grapes on chemical and sensory properties of Sauvignon Blanc

Five grape processing methods were investigated. Grapes were either (1) hand harvested-whole bunch pressed, (2) hand harvested-crushed and destemmed and given three hours of skin contact time, or (3) machine harvested. These three treatments were pressed in a small-scale 8-hL commercial airbag press. The fourth treatment, using the Marlborough Wine Research Centre (MWRC) standard processing protocol, was pressed in a 200-L hydro press. For the fifth treatment, grapes were commercially processed and a juice sample taken from St Clair Family Estate winery tank after pressing and cold settling. Juice was returned to the research winery for fermentation.

8-hL airbag press


200-L hydro press

Wine was fermented in triplicate batches using the MWRC's standard Sauvignon Blanc winemaking protocol. Wines have been chemically analysed, and sensory evaluation was undertaken by a panel of wine industry professionals from Marlborough in December 2012.

Methoxypyrazine concentrations in the finished wine varied between the 2011 and 2012 vintages. In 2011, methoxypyrazine concentrations were low at the Dillons Point site (Table 1). Methoxypyrazine concentrations were low around the Marlborough district as a whole in 2011 and this trend was seen in other experimental work conducted across the district. In 2011 when methoxypyrazine concentrations were low, grape processing had a greater influence on wine methoxypyrazine concentrations. The trend was for harvest processes that generated more extensive maceration of the grapes (in the case of the machine harvest and tank treatments), or longer skin contact, to have higher methoxypyrazine concentrations. In contrast, when concentrations were higher in 2012, the mode of grape processing had little effect on methoxypyrazine concentrations in the finished wine.

Thiol concentrations for the Dillons Point site were similar in both the 2011 and 2012 vintages. In 2012 there were differences in thiol concentrations between the Dillons Point and Benmorven sites, with Benmorven wines having lower thiol concentrations. This result was consistent with the Benmorven site being identified as having low thiol potential. Wines made from whole-bunch pressed grapes, irrespective of site, had low thiol concentrations. Increas-▸

Table 1: The effects of grape processing on thiol and methoxypyrazine concentrations for Dillons Point 2011, 2012 and Benmorven 2012

Variable	Treatment	Year	Whole Bunch	Crush-> Destem	Machine Harvest	Tank Sample	MWRC Protocol
Thiol 3MH (ng/L)	Dillons Point	2011	349.7	2873.7	3257.7	5846.3	4119.3
		2012	569.3	4790.7	3513.0	5835.3	3933.3
	Benmorven	2012	280.3	1042.3	883.0	1814.7	1805.7
Thiol 3MHA (ng/L)	Dillons Point	2011	103.0	1569.0	1652.3	2868.7	2113.0
		2012	280.0	2798.3	2301.0	3419.3	2177.7
	Benmorven	2012	69.0	503.7	405.7	696.3	715.0
Thiol concentration (nM/L)	Dillons Point	2011	3.2	30.3	35.7	59.8	42.7
		2012	5.8	51.6	39.2	62.9	41.7
	Benmorven	2012	2.5	10.6	8.9	17.5	17.5
Methoxypyrazine IBMP (ng/L)	Dillons Point	2011	0.9	1.4	2.7	2.8	2.0
		2012	15.9	17.4	16.4	17.6	17.7
	Benmorven	2012	13.3	11.8	11.4	15.7	13.2

3MH = 3 mercaptohexanol, 3MHA = 3-mercaptohexyl acetate, IBMP = 3-isobutyl-2-methoxypyrazine, MWRC = Marlborough Wine Centre

Table 2: Wine analysis for 18-L oxidation ferments.

Treatment	Rep #	pH	Titratable acidity (g/L)	3MH (ng/L)	3MHA (ng/L)	Thiol concentration
25 ppm sulphur 100 ppm ascorbic acid	1	3.31	10.68	5887	3008	60.92
	2	3.31	10.61	6508	3276	67.07
	3	3.30	10.51	6521	3261	67.08
65 ppm sulphur	1	3.29	10.63	2605	1292	26.74
	2	3.29	10.62	2462	1253	25.45
	3	3.29	10.53	2566	1332	26.67
Tank sample	1	3.18	11.56	6075	3502	65.12
	2	3.18	11.62	5558	3279	60.01
	3	3.18	11.53	5873	3477	63.48

3MH = 3-mercaptohexanol, 3MHA = 3-mercaptohexyl acetate.

ing grapes maceration and skin contact time during harvest and grape processing increased wine thiol concentrations.

Preliminary results from the Harvest Technologies trial, where press fractions were fermented in 700-ml volumes, showed that juice collected from different press fractions (free run, heavy press and combined press samples) resulted in differing thiol concentrations in the finished wines. Thiol concentration was highest in the free run press fraction when grapes had been crushed or machine harvested before pressing. Where grapes had been whole-bunch pressed, thiol concentration was greater in the mid to heavy pressed fraction.

Trial 2: Influence of juice oxidation on sensory and chemical properties of Sauvignon Blanc

Two vineyard sites were used: Dillons Point (high thiol), and Benmorven (potentially low thiol) site. Grapes were harvested and two additions, either potassium metabisulphide only (65 ppm) or sulphur and ascorbic acid (25 ppm and 100 ppm respectively) were made to the gondolas after machine harvesting. Grapes were then transported to the winery in 10-T trucks, where the grapes were commercially pressed. Samples of free run and pressed fraction juices were collected during the press cycle, along with a combined free run and press sample. Three replicates, each of 700 ml of juice, were fermented using the MWRC standard winemaking protocol.

Larger volume (18 L) wines were made from the combined press fraction (free run/press) from the Dillons Point site, along with a standard commercially grapes processed sample (tank sample).

Preliminary results from the Oxidation 18-L ferments (Table 2) suggest that sulphur and sulphur/ascorbic acid treatments may produce wines of differing thiol concentrations. An addition of low sulphur (25 ppm) and high ascorbic acid (100 ppm) to harvested grapes appeared to increase thiol concentrations in the wine and produced similar thiol concentrations to those in the commercial tank sample. For the commercial tank sample, St Clair Family Estate standard sulphur and ascorbic acid additions were added. High sulphur additions (65 ppm) added to harvested grapes produced wines of lower thiol concentrations. Sensory analysis of wines by the Marlborough industry winemaker panel was carried out in December 2012, and results are currently being analysed.

18-L fermentation vessels

700-ml fermentation vessels

The project demonstrates collaboration with commercial wineries such as St Clair Family Estate, extending opportunities for future commercial research winemaking.

Grape harvesting and processing methods can both have a substantial influence on Sauvignon blanc wine aroma and flavour. Decisions on harvest methods and grape processing protocols represent some important tools that the industry can use for manipulating the thiol:methoxypyrazine ratio, and thus the flavour of Sauvignon Blanc wine, to produce a desired wine style that meets product specifications and brand needs.

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New Zealand Winegrowers for providing industry research funding

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Marlborough industry winemaker sensory panel.■

Grapevine leafroll disease a serious problem for winemakers

Nick Hoskins

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On the international scene, New Zealand is a small producer of wine, accounting for less than 2% of world production. Because of our relatively high costs, cool climate, and distance from markets, our production is aimed at quality high-end wine. While the "New Zealand" brand is synonymous with Sauvignon Blanc, our red wine production of Pinot Noir, Syrah, and Bordeaux blends has gained considerable recognition on the world stage.

Anything that has the potential to jeopardise wine quality is a serious threat to the industry, and Grapevine Leafroll Disease has this potential. One virus in the Leafroll group is particularly debilitating to red grape varieties: Grapevine Leafroll-associated Virus Three (GLRaV-3) causes significant reductions in yield, impedes sugar accumulation, and affects colour and tannins in red wine. Worse, GLRaV-3 is rapidly spread by mealybug, and New Zealand has two known species of the vector: Pseudococcus citrophilus and P Longispinus.

New Zealand Winegrowers (NZW), the national industry body, has funded research into GLRaV-3 for the better part of a decade. Recognising the need to control the spread of this virus in premium red-wine-growing areas, NZW applied for and received a grant from Ministry Of Primary Industries (MPI) in 2009 to establish the "Virus Elimination Project" The project combines development of practical management tools, "current best practice" that growers can implement today, a district-wide mapping component to monitor the spread/success of the interventions, and a science component to research and develop new "best practice".

Thanks to New Zealand Winegrowers and NZIHAS I travelled to California in June 2011 to attended the American Society for Enology and Viticulture "Grapevine Leafroll and Vitivirus Disease" workshop. Following the successful 2009 -2012 "virus elimination project" a new project NZW/MPI funded project "Sustainable virus free vineyard, replants and beyond" commenced in June 2012, this new project enabled be to travel to University of California Davis (UCD) in October 2012 to attend the 17th Congress of the International Council for the Study of Virus and Virus like diseases of the Grapevine (ICVG). Below are some of the more relevant notes from these conferences and field trips.

Characteristic reddening and leaf rolling symptoms GLRaV-3.

Overview of grapevine viruses, their characterisation and symptoms: Professor Giovanni Martelli (University of Bari, Italy)

There are two major infectious virus diseases of grapevines: the aforementioned Leafroll Disease and Rugose Wood. A third disease is emerging and concerns Graft Incompatibility.

The Leafroll diseases GLRaV-1, GLRaV-3, GLRaV-4, GLRaV-5, GLRaV-6, GLRaV-7, GLRaV-8 and GLRaV-9 all belong to the genus Ampelovirus, and all are characterised by leafrolling symptoms and reddening or yellowing of leaves.

The ampeloviruses are all transmitted by mealybug species and soft scale insects. There is still some question regarding the taxonomy of GLRaV-7 and GLRaV-8, but the rest demonstrate the characteristics of true ampeloviruses. In the future, GLRaV-4 may include the relatively similar viruses GLRaV-5, 6, and 9, leaving us with three ampeloviruses GLRaV-1, GLRaV-3, and GLRaV-4.

Grapevine Rugose Wood Complex is a "disease of combination", and wood symptoms (pitting and grooving) develop only after grafting. The viruses involved in this complex comprise two genera: (1) Vitivirus – Grapevine Virus A (GVA), Grapevine Virus B (GVB), and Grapevine Virus D (GVD), and (2) Foveauvirus – Grapevine Rupestris Stem Pitting-associated Virus (GRSPaV).

The Vitiviruses GVA, GVB, and GVD can be transmitted by insect vectors. The Foveauvirus GRSPaV does not have a recognised vector.

Four syndromes within the Rugose Wood Complex have been categorised on the basis of their differential responses: (1) Kober stem grooving (KSG), (2) Corky bark (CB), (3) Rupestris stem pitting (GRSPaV), and (4) LN33 stem grooving (LNSG).

Graft Incompatibility (an emerging disease) involves GLRaV-2, a species in the genus Closterovirus. GLRaV-2 is not transmitted by insect vectors. It induces mild leafroll symptoms with associated graft incompatibility symptoms; its severity depends largely on the rootstock and scion combination. Rugose Wood is also an agent of graft incompatibility.

Graft incompatibility Symptoms in vines infected with GLRaV-2, In New Zealand.

Leafroll transmission and field spread in the Napa valley: Rodrigo Almeida (University of California, Berkley.)

Mealybug transmission of Grapevine Leafroll-associated Viruses

In the Napa Valley, transmission of GLRaVs is by *Planococcus ficus* (vine mealybug) and Pseudococcus longispinus (longtailed mealybug). Almeida reported that GLRaV-4 and 9 (for which no vector transmission evidence had previously been available) are mealybug transmitted. He also reported there appeared to be no vector virus specificity in mealybug transmission or GLRaVs. In other words, different mealybug species could transmit GLRaV-3 and one species Planaococcus ficus transmitted five GLRaVs. Further comparative transmission work needs to be done to

establish the efficiency with which the various GLRaVs are transmitted and to establish the vectors for GLRaV-2 and GLRaV-7.

Transmission of GLRAV-3 by vine mealybug

This study indicated that vine mealybug transmits GLRaV-3 in a semi-persistent manner, with first instars proving to be more efficient vectors than adults. Virus acquisition occurred with a one-hour inoculation access period, and vine mealybugs lost infectivity four days after acquisition. Virus was not transmitted by infected females to their progeny.

Diversity of GLRaV-3 in the Napa Valley

Fifty symptomatic plants from the Napa Valley were DNA sequenced and amplified. The study identified four strains of GLRaV-3 and concluded that there is little evidence to suggest that strains are increasing and that these four have likely been present in the Napa valley for several decades.

GLRaV-3 infected vine showing unripe (light coloured) fruit on symptomatic portion of the vine.

What Leafroll viruses are spreading in the Napa Valley

Two hundred and sixteen samples were tested for GLRaV-1, 2, 3, 4, 5, and 9. Of them, 80% were infected with GLRaV-3, followed by 11% with GLRaV-2, while the remaining 9% were mixed infections of GLRaV-3 and GLRaV-1, 4, or 9. A further 468 samples were tested for genetic variants: of the 65% positive for GLRaV-3, seven variants were found, three of which represented 71% of the positives. The work did not support an epidemic-like spread of any novel GLRaV-3 species or variant in the Napa valley.

Economics of Leafroll Disease: Shadi Atallah (Cornell University)

Atallah presented an economic survey of 10 vineyards in the Finger Lakes region of New York with a history of Grapevine Leafroll Disease (GLD). Respondents provided information about perceived ranges of GLD prevalence, magnitudes of yield reduction due to the disease, control measures adopted and penalties incurred for fruit quality. Various scenarios reflected the impact on cash flow of one acre of vineyard over a 25-year lifespan.

The scenarios included: (1) no GLD, (2) no disease control, (3) GLD prevention through vineyard establishment with certified vines, (4) roguing scenarios, (5) vineyard replacement, (6) late vector-mediated GLD infection.

Atallah's key findings were in line with a New Zealand study conducted by Nimmo Bell in 2006 and Sutton McCarthy in 2011 (funded by New Zealand Winegrowers).

Losses ranged from $25,000 per ha over the 25 year lifespan of a vineyard (for 30% yield reduction and no quality penalty) to $42,500 per ha (for a 50% yield reduction and 10% penalty for poor quality fruit).

Growers would benefit from paying a 25% premium to purchase certified vines (free from GLRaV-3) at planting as this had the potential to limit losses to $1,850 per ha over the 25 year lifespan of the vineyard (assuming no new infection from neighbouring vineyards).

Removing infected vines from vineyards with GLD incidence lower than 25% reduced financial losses to a range of $3,250 to $25,000 per ha over the 25 year lifespan of the vineyard.

It was more cost effective to replant vineyards that were greater than 25% infected.

The use of a 10% quality penalty suggests that wineries are underestimating the impact of virus.

The Role of Mealybug Vectors: Kent Daane (University of California, Berkley)

Daane summarised research on in leafroll spread and showed some very good distribution maps and data on the introduction of the vine mealybug (Planococcus ficus) to California. Discovered in 1994 in table grapes in Coachella Valley, vine mealybug had spread to 17 counties in California by March 2004. The rest of the USA has the more benign grape mealybug (Pseudococcus maritimus). The vine mealy bug, however, is much more virulent than other species and is a very good vector for GLRaVs: 700 eggs per female and an ability to overwinter underground. Vine mealybug is not present in New Zealand, a very good reason to ensure suitable border controls are effective.

National Clean Plant Network: Deborah Golino (University of California, Davis)

Golino outlined the work of the (NCPN), established in 2008 with federal funding. The NCPN provides vine propagation material free from known viruses. It also provides an extremely good diagnostic service and maintains a clean foundation collection, Foundation Plant Services (FPS). Clean material is an important factor in eliminating the spread of virus and the cornerstone for many of the state vine certification programmes. In contrast, New Zealand nurseries maintain their own collections (and, in some cases, their own diagnostics) of "clean" propagation material, a growing number are now complying with the voluntary "New Zealand Grafted Grape Vine Standard".

Foundation Plant Services: Field trip

Susan Sim walked us through the process of eliminating virus through tissue culture, producing laboratory plants produced from the apical meristem tissue that is free of the virus. These test tube plants are then grown in temperature and humidity controlled cabinets until they are ready to move to a green houses. Peter Cousins guided us through the United states Department of Agriculture germplasm repository and multiplication blocks where much of the clean stock is grown to supply the industry. Interestingly 25 million vines planted in California 2011 of which only about half were clean stock.

Most of these plantings are field grown rootstock rootlings that are planted then grafted in the field. There was no data on how many of these rootling were grafted using clean stock scion material.

New Zealand's work on dealing with Grapevine Leafroll Disease and its spread is up to date and possibly further ahead at the vineyard or grower level than is the case with our American counterparts. This is largely due to the efforts of New Zealand Winegrowers, the late Dr Rod Bonfiglioli and the scientists at Plant & Food Research. ■