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JUDGES' REPORT

WINE INDUSTRY INNOVATION

TOHU WINES – BROWN BEETLE CONTROL

INTERVIEWED	Mauricio Gonzales-Chang and Mondo Kopua
DATE	21 November and 8 December 2016
JUDGES	Tracey Marshall, Roger Kerrison and Bev Doole

INTRODUCTION

Tohu Wines started planting their vineyard on a former Awatere Valley sheep and beef farm in 2002. Of the 120 ha property, 72 ha is now in grapes and about a sixth of this (13 ha) is under organic management.

An issue for the vineyard, and many others in Marlborough, is the New Zealand brown beetle (*Costelytra zealandica*). Infestations in spring can strip the leaves and inflorescences severely affecting fruit production.

Tohu has employed PhD student Mauricio Gonzales-Chang to develop scientifically proven organic methods to control the brown beetle. They are seeking an alternative approach to the pesticide Karate, a pyrethroid chemical that can be sprayed a few times a year.



The research project has received strong backing from Tohu's parent company, the Wakatu Incorporation, and is part of their kaupapa of Land Wellness - Oranga Waiora te Whenua and their 500-year Plan Te Pae Tawhiti.

Judges were impressed by the wide scope of the research project - including beetle behaviour, soil and air conditions, vineyard plantings and mussel shell mulch; the scientific rigour in measuring and monitoring results; and the desire to make solutions easily accessible to the industry and beyond.

GENERAL INFORMATION

This project aims to find natural, sustainable ways to mitigate brown beetle damage to grape vines. The idea came from vineyard manager Mondo Kopua and organics consultant Bart Arnst, and they successfully applied for research funding from Callaghan Innovation.

Tohu joined up with Mauricio and Prof. Steve Wratten from Lincoln University's Bio-Protection Research Centre and trials began on the organic block in Tohu vineyard in 2013.



Brown beetle is a member of the scarab family. It feeds from the edge of the leaf to the centre, leaving just the veins. (Different to the bronze beetle, which are smaller and eat holes in the leaves).

The brown beetle can cause severe damage and is usually controlled by the pesticide Karate. However, Karate is not an option for the increasing number of organic vineyards and it may also have a limited future in conventional vineyards.

Problems with synthetic pesticide such as Karate include:

- Kills beneficial insects as well as pests (e.g., spiders that catch brown beetles in their web).
- The targeted insect may develop resistance to Karate over time.
- Overseas markets are rejecting the use of toxic sprays as consumers seek more environmentally friendly practices.

For a better understanding of how to control the brown beetle with natural methods, Mauricio studied its lifecycle, behaviour patterns in the vineyard, and the role of external factors such as air and soil temperature. He used an infra-red camera to film flight patterns at night, and up to six people to physically count and remove beetles from the leaves.

The female brown beetles fly in spring and eat the leaves and new shoots before releasing a pheromone to attract males. After mating they drop to the ground to lay their eggs (which become grass grub larvae) and live for another 4-6 weeks after laying their eggs.

Biological methods trialled by Mauricio include planting hedges and tall miscanthus grass to intercept the beetles; using organically approved sprays to reduce the palatability of the vine leaves; and experimenting with under-vine mulches to disrupt the breeding behaviour.

Three years of data show:

- Flight depends on air temperature (needs to reach 13C).
- Numbers increase when the soil temperature reaches 16C.

- The main flying season is October/November.
- The number of beetles and amount of damage varies from year to year, e.g. 2014 was particularly bad.
- Beetle numbers are higher at the end of rows and edges of the vineyard and decrease towards the centre.
- On the 96 plants monitored at the end of rows, counts ranged from 1000-7000 beetles a night.
- The females seem to be attracted by the vine silhouettes and could be distracted if other plants were established nearby.
- Grass grub larvae do not do so well in damp soil conditions.
- There was a significant drop in brown beetle numbers, and leaf damage, where mussel shells were used to mulch under the vines.
- Black plastic and white plastic under the rows had similar results.

Mauricio finished his PhD thesis in October 2016 and is keen to produce a brochure for growers to help them better predict brown beetle flights and combat brown beetle damage.

He is developing an app called Wingfinder which calculates the risk of beetle flight based on air temperature and soil conditions.

Being able to time the flight allows for a more targeted approach to spraying Karate, saving chemical use and fuel costs as well as reducing the negative environmental impacts.

Mussel shell mulch has benefits for weed control, moisture retention, reflecting light up into the canopy to ripen the grapes as well as inhibiting the brown beetles. It is a natural product and readily available in Marlborough as a waste product, however more research is needed into the time it takes to decay and any long-term effects on soil pH.

Over the course of the research project NZ Winegrowers and Wither Hills have added their support with the Wither Hills vineyard near Blenheim providing different growing conditions to add to the data.

Tohu has taken a pro-active approach to mitigate future risk from brown beetle damage, which is an important move as NZ Winegrowers work to achieve their aim of 20% of vineyards being organic by 2020. The results are also relevant for other horticulture industries including avocado, kiwifruit, strawberry and orange producers.

Mauricio has seen the effects of intensive land and chemical use in his home country of Chile. His desire to use his knowledge to reduce the use of chemicals and take a more natural approach to looking after the land and crops is an excellent fit with the values of Tohu and the Wakatu Corporation.

PROBLEMS AND HOW THEY HAVE BEEN TACKLED

- **Miscanthus grass:** This tall grass can grow up to 4 metres and was planted along the roadside to see if the tall silhouettes would intercept or distract brown beetles. It did not grow as quickly as expected. Taking a wait-and-see approach.
- **Pushed for time:** brown beetles fly for just a couple of hours a night, usually 9.00 pm-11.00pm. This compresses the time for on-site observation and leaf count. Mauricio brought in Lincoln students and Tohu workers to help gather the information.

- **Dynamic research:** As the research progressed more variables arose, for example trying to determine why the mussel shell mulch was an effective deterrent – was it light reflection? Or coverage of bare earth? Or the nature of the material? Each discovery raises new avenues to explore. Mauricio's response is to stick to the scientific method and not jump to conclusions.
- **Keeping the Board on board:** With the shift to organics in the Tohu vineyard there was some concern about impact on yields and finances. However, it is a good fit with the company's cultural values of kaitiakitanga (guardianship and protection) and whanaungatanga (relationships between people and connections to nature). The Board has backed the brown beetle research as part of the company's belief in innovation and doing the science to sustainably manage their operations. There is an understanding that commercial sustainability goes hand in hand with cultural and environmental values.
- **Ongoing funding:** The Callaghan Institute funding for the brown beetle project has come to an end. However, other organisations are now on board with Tohu, including NZ Winegrowers and Organic Winegrowers. The new Research Institute of Viticulture and Oenology is another possibility for continuing the research.

SUMMARY

The data gathered by Mauricio and his team is a significant step in understanding the behaviour of the brown beetle and developing organic and sustainable methods of control.

Brown beetle damage is not confined to vineyards – it also affects other horticulture. The judges were impressed at the combination of scientific rigour and practical knowledge that has emerged from this project and can be used by growers.

It shows that ideas can turn into reality if the right individuals and organisations are involved. Tohu were not the experts but they knew where to look for them, and how to find external funding. With the backing of the Whakatu Corporation board they found the way to make the research happen.

Their knowledge partnership with Callaghan Innovation, Lincoln University, Auckland University, Marlborough Research Centre and Plant & Food show the value of a multi-prong approach and provides a model for other companies and industries to consider.

It is hoped that funding will be found to keep Mauricio engaged in next steps for the research and dissemination of the information.

The judges congratulate Tohu on their willingness to look beyond “business as usual”. The company's practices are always under review as they strive to improve soil quality, minimise use of chemicals and leave the land in a better state than when they started.



SUGGESTIONS

- With the data and experience gathered for Mauricio's thesis, please follow through with developing a brochure for growers in layman's language.
- Arrange a Grape Day workshop to explain the research and how it could apply to growers.
- Engage with the new Research Institute of Viticulture and Oenology to be established in Marlborough for funding and progressing the project. For example, the correlation between brown beetle risk and grape variety.
- Broaden the research out to other regions to gain understanding of seasonality and get more data for predictive modeling to forecast severe brown beetle years. Research Institute of Viticulture and Oenology would be a good partner for this.
- Look for native alternatives for end-of-row interceptor plantings, e.g. flax rather than miscanthus. This enhances vineyard biodiversity while integrating with pest management.
- Share your values and practices with your contract growers by passing on information about organic control of brown beetles and encouraging grower participation.