The Organic Focus Vineyard Project

Experiences converting to organic management

A project by Organic Winegrowers New Zealand. Funded by Sustainable Farming Fund and New Zealand Winegrowers.

ORGANIC WINEGROWERS NEW ZEALAND

Ministry for Primary Industries
Manatū Ahu Matua

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Related Documents

The following related documents can be accessed at the project website: http://organicfocusvineyard.com

- *Fruition Horticulture – Annual data reports, 2012, 2013, 2014*
- *Vineyard managers' annual reports, 2012, 2013, 2014*
- *Winemakers' reports, vintage 2014*
- *Microvin production report, vintage 2014*
- *Jenkins, T.A. (2014). Soil Quality Report for the Organic Focus Vineyard project – Two year assessment*
- *Jenkins, T.A., Jenkins, V. (2014). Report on Soil and Leaf Chemical Analyses and Soil Microbiology*

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Introduction to the Organic Focus Vineyard Project

Over the past several years, New Zealand's organic viticulture industry has grown rapidly. This project arose in response to new and prospective organic winegrowers' requests for deeper information about organic growing.

New organic growers can benefit from witnessing practical examples of successful organic vineyard management, especially when it comes to helpful practices and potential challenges that can arise in converting a conventional vineyard to organic production. Vineyard and winery companies also need clear information about the potential costs and benefits of converting to organic production.

In spring 2011, Organic Winegrowers New Zealand launched this three-year education and monitoring project, with funding from the MPI Sustainable Farming Fund and New Zealand Winegrowers. The Organic Focus Vineyard project was set up to follow three conventional vineyards as they transitioned to certified organic production. Vineyard managers would document all inputs, activities and costs incurred on their vineyards; scientific technicians would monitor and report on vineyard health; and the winegrowing community would get a clear window into the organic conversion process in real time, through field days, seminars and blogs by the vineyard managers.

For purposes of comparison, each grape variety in the focus vineyards was split into two vineyard blocks. Half of each grape variety would continue being grown according to the standard conventional methods of each company. The other half would be converted to organic production.

Vineyard blocks entered organic production at the start of the 2011-12 growing season. (One exception was the Wither Hills organic Pinot Noir, which started conversion to organic production a year earlier, in the 2010-11 season.)

From the outset of the project, in 2011, the organic blocks were registered in conversion to organic production with BioGro NZ. By the end of the project's third growing season, at vintage 2014, all organic blocks in the project had achieved full BioGro organic certification.

Professional organic viticulture consultant Bart Arnst provided advice to the focus vineyard managers, helping them to design organic management plans for their vineyards. Local conventional growers were consulted as well to ensure that standard best practices were used on the conventional half of each focus vineyard.

The project included a detailed monitoring program for all three vineyards. To ensure independence and reliability of data, monitoring and data analysis were conducted by Fruition Horticulture and the Centre for Sustainable Agricultural Technologies. The monitoring team collected information annually on the following:

- soil physical, chemical and biological properties
- pest and disease levels
- plant nutritional status
- soil moisture and water use
- yield and grape maturity
- financial operating costs
- juice and wine chemical properties (wine only analysed in final year of project).

This report discusses the journey the focus vineyards have travelled during their three year conversion to organic production. It explores both management practices and the end results of those practices, including both monitored data and observations from the vineyard managers and winemakers.

IMPORTANT: PLEASE NOTE

This project involves existing commercial vineyards which were not planted specifically for the project. For some varieties, the conventional and organic blocks have different clones, rootstock and canopy and crop management practices. The Mission Estate Merlot and Syrah and the Wither Hills Sauvignon Blanc have the same rootstock and clone in their conventional and organic blocks.

This means that differences discussed between blocks may be due to factors other than conventional or organic management practices. Differences between blocks are not scientifically representative of an inherent difference between conventional and organic management systems. This project has a small sample size, and results of organic management practices will vary across different New Zealand vineyard sites.

Focus Vineyard Locations

Mission Estate Hawkes Bay

Vineyard Overview

- Our Mere Road vineyard is located on the Gimblett Gravels in Hawkes Bay.
- The vineyard is 9ha, planted in Merlot and Syrah. Planting began in the year 2000.
- The vineyard was previously growing under a conventional growing regime but was slowly shifting toward more organic practices.
- The soils have varying levels of silt over stones, which produces balanced vines of high quality fruit.
- This is our ultra-premium block for high-end products such as Huchet, Jewelstone and Reserve.
- This vineyard is very well balanced, has high cultural inputs, and has thin, low-vigour canopies with open bunch zones. This lends itself to a softer organic approach, especially for powdery and botrytis control.

Variety	System	Pruning System	Row Spacing	Vine spacing	Vines / ha	Area (ha)	Clone	Rootstock	Soil type
Merlot	Conventional	2 cane	2.5	1.8	2228	1.20	181	3309	Gravels
Merlot	Organic	2 cane	2.5	1.8	2225	4.01	181	3309	Gravels
Syrah	Conventional	2 cane	2.5	1.8	2202	0.42	MS	3309	Gravels
Syrah	Organic	2 cane	2.5	1.8	2228	1.60	MS	3309	Gravels

Mission Estate Hawkes Bay

2011

Initial thoughts before the conversion project started

Caine Thompson - Viticulturist, Mission Estate (Year 1 and 2)

Leaving as minimal impact as possible on the land is what has drawn me to organic winegrowing. As intensification of farming systems has increased, we need to balance this with further care and attention for our plants and soils. If this can be achieved under an organic system with 'softer' inputs, then this seems to be a logical direction for further growth and development.

One of my main concerns is achieving consistent mealybug control under an organic system, which I believe requires further investigation through research. I was initially concerned about organic weed control but am confident now with the technology available that we can adequately control weeds throughout the season. I'm particularly excited about the movement away from herbicides and the improvement of soil health and ultimately wine quality that will be evident in years to come.

2014

Key points of interest during conversion period

Steve Wheeler - Viticulturist, Mission Estate (Year 3)

Looking back, the transition from conventional to organic production has been relatively smooth at Mission Estate.

- Good pest and disease control relied on regular monitoring, healthy vines, an open canopy and a well set up sprayer. With this we were able to achieve excellent pest and disease control.
- Weed control was the most difficult challenge, especially in wetter seasons. Irrigation lines had to be lifted to allow mechanical weeding. There were difficulties removing weeds from around the base of the vines.
- Throughout the organic conversion period, grape quality continued to be excellent, and our yields remained the same.
- The wines produced were chemically similar. The winemaker believed the organic Syrah to be a better wine than the conventional.

Future plans

Now that the Organic Focus Vineyard project has concluded, Mission Estate intends to continue the organic/conventional split in the vineyard for one more year to monitor the differences in wine quality more closely. The intention is that the vineyard will then go all-organic in the following year.

Wither Hills Marlborough

Vineyard Overview

- The blocks involved in the project form part of our 95 hectare Taylor River Vineyard, located in the Southern Valley sub-region of Marlborough.
- Both the Pinot Noir and Sauvignon Blanc monitored in this project are of a northerly facing aspect.
- As an extension to the 40 hectares Wither Hills already had in conversion to BioGro organic certification, we began conversion of the Sauvignon Blanc focus block for this project.
- The organic portion of the Pinot Noir had been under our organic management programme for one year prior to the project beginning.
- The organic and conventional Pinot Noir focus block vines are grown on different rootstocks.
- The site consists of stony alluvial free-draining soil, largely belonging to the Renwick Series.
- Originally pasture land, this area was planted in cherry and apple orchards for 8-9 years. Subsequently grapes were planted in the mid-'90s. As this site can be prone to spring frosts, the vineyard floor was in the past always totally sprayed out in early spring to increase the radiation from the soil, reducing the possible frost effect.

Variety	System	Pruning System	Row Spacing	Vine spacing	Vines / ha	Area (ha)	Clone	Rootstock	Soil type
Pinot Noir	Organic	2 cane	2.2	1.8	2526	2.09	667	3309	Stony silt loam
Pinot Noir	Conventional	2 cane	2.2	1.8	2533	2.05	667	Schwarzmann	Stony silt loam
Sav Blanc	Organic	4 cane	2.2	1.8	2543	1.73	BDX 316	101-14, 5C, S04	Stony silt loam
Sav Blanc	Conventional	4 cane	2.2	1.8	2495	1.73	BDX 316	101-14, 5C, S04	Stony silt loam

Wither Hills Marlborough

2011

Initial thoughts before the conversion project started

Jacqueline Maclaurin - Viticultural Technician, Wither Hills

Wither Hills has been involved in organic production since 2008. We are very excited to take it a step further as part of the Organic Focus Vineyard project and show the process of converting blocks to organic management and producing wine of top quality.

The two main challenges facing us as we convert the blocks to organic production are:

1) The stony nature of the soil. During any cultivation in the vineyard interrow or undervine, rocks are brought to the surface, causing a hazard for machinery operators and staff. To try and minimise the risk we will pick up large rocks and keep the number of passes cultivating the interrow to a minimum. This also led to our decision to operate a Braun undervine weeder and not an undervine mower.

2) The vineyard team's knowledge and understanding of organic management. Helping the team to understand the benefits of organic management may take more time. We are increasing staff training in the area with activities such as making compost, so they too can see the benefits of converting to organics.

2014

Key points of interest during conversion period

Ben Burridge – Viticultural Technician, Wither Hills

- The organic Sauvignon Blanc maintained a financially viable yield throughout the conversion period.
- The organic Sauvignon Blanc showed a significant shift in vigour. This was most noticeable in the last season, requiring less trimming, with less leaf development.
- The organic Sauvignon Blanc wine had strong green bean aromatics with a rich palate and tight acidity. In contrast, the conventional wine adheres more typically to the fruitier style of Sauvignon, with fresh citrus notes and a green apple finish.
- The organic Pinot Noir struggled through the conversion, with reduced vigour, and yields below desired levels, although some recovery was apparent in Year 3. After many viticultural interventions to increase the vigour and quality of fruit, including interrow cultivation, ripping, and nitrogen-rich cover crops, the organic phenological development in Year 3 finally was on par with the conventional; however yields were still low.
- The organic Pinot Noir wine had a line of fruit purity and favourable textural qualities, an elegant wine. The conventional wine had strong ripe fruit characters and a well-integrated fruit palate, overall a bigger style of wine.

Future plans

For the 2015 vintage these blocks will retain their current status, split between organic and conventional, with Wither Hills continuing to monitor vineyard yield and performance. Ultimately, we need to increase the yield of the organic Pinot Noir to above its current average of 4 t/ha to make it viable. However I'm sure we can achieve this with the leaps and bounds it has made this past season.

Gibbston Valley Wines Central Otago

Vineyard Overview

- Altitude between 300m to 400m in the sub-region of Bendigo, Central Otago
- Majority of vineyard runs north-south, tending west, with 0.7 Ha Pinot Gris running east-west.
- Soils are a light sandy loess over glacial washed schist.
- Long ripening season with a greater diurnal temperature variation. Low rainfall, high UV light and wind exposure
- Single fruiting wire at 1m with 2.5 pairs of foliage wires
- Pinot Noir yields are managed to a maximum of 6t/Ha; Pinot Gris yields between 7-9t/Ha
- The wines from our School House Vineyard have been amongst our very best. This vineyard provides grapes that are destined for our premium, single vineyard and ultra-premium wines. We view this vineyard as the largest and most important source of our fine wine production.

Variety	System	Pruning system	Row spacing	Vine spacing	Vines / ha	Area (ha)	Clone	Rootstock	Soil type
Pinot Noir	Organic	2 cane	2.4	1.2	3472	3.24	6, 667, 777	3309	Loess on schist gravels
Pinot Noir	Conventional	2 cane	2.4	1.2	3471	3.83	115, 114, 5	3309	Loess on schist gravels
Pinot Gris	Organic	2 cane	2.4	1.2	3472	2.18	2/15	3309	Loess on schist gravels
Pinot Gris	Conventional	2 cane	2.4	1.2	3411	1.70	2/21	3309	Loess on schist gravels

Gibbston Valley Wines Central Otago

2011

Initial thoughts before the conversion project started

Max Marriott
Assistant Vineyard Manager, Vinewise Viticulture – contractor for Gibbston Valley Wines

For Gibbston Valley Wines, converting to organic winegrowing will allow us to monitor changes in vineyard health, as well as see how organic growing is expressed in our wines.

Our respect for this amazing vineyard site, our School House Vineyard, means we are keen to implement a programme that lowers inputs in order to see improvements in biodiversity and soil fertility, as well as water and energy conservation. We want to discover if organic farming allows the grapes to show more varietal character, intensity, and a truer sense of place. It is a beautiful vineyard that simply warrants excellence.

Challenges going organic

1. Weed control. The vineyard is exposed to wind and naturally low in vigour. We do not want weed competition.
2. Vine nutrition. Access to and cost of organic products. Sorting out which products will work best in our situation.
3. Financial. There will be setup costs in making the organic section of the vineyard compatible with undervine weeding, with further costs hiring equipment for the duration of the project.

2014

Key points of interest during conversion period

Grant Rolston
Vineyard Manager, Vinewise Viticulture – contractor for Gibbston Valley Wines

- Weeding was probably the biggest challenge of the conversion and required the first major financial input. The weeding itself went pretty well, but we did have more weed competition than we would have liked.
- Nutrition was the other major issue. Looking back, we could have given the vines more from the start. We definitely saw some vigour issues, particularly in year two, but vines recovered in year three.
- Erosion was reduced in the organic blocks. The undervine weeding area seemed to soak up the rain and meant we had little to no runoff.
- Canopy management labour was reduced in the organic blocks in some instances, due to the lower vigour, giving a positive financial spinoff. Caution needs to prevail with regard to having sufficient canopy to successfully ripen the fruit.
- Interrow cultivation was practised in every tenth row, with the goal of growing buckwheat and *Phacelia*. We always had some success with seed strike, just not as prolific as we would like.

Future plans

Following on from this trial, Gibbston Valley Wines has decided to keep the focus vineyard organic blocks under organic production, and to convert the conventional blocks to organic management as well. The winery will also begin converting another of its Pinot Noir vineyards to organic management.

Lessons and tips for future organic growers

This section discusses

- **Tips and advice from vineyard managers about the organic conversion process**

Tips on setting up an organic block

New organic growers often speak of the importance of networking and knowledge-sharing in organic growing.

In that spirit, just after completing the three year organic conversion process, the focus vineyard managers offered the following suggestions for new entrants.

Ten things to consider when starting an organic conversion process.

1. Discuss the blocks to be targeted for organic management with your winery. Involve the General Manager/CEO, winemaker and viticulturist. It is important to inform the purchasers of your fruit that a change of management is going to occur. Winemakers will be able to give an indication of block size needed for a particular ferment, and General Managers/CEOs will be able to start thinking about product placement, potentially under an organic label, in three years' time once full organic certification is reached. These aspects can have large influences over varietal choice for conversions; it's not just about the part of vineyard to convert, but just as importantly, the appetite for organically produced fruit.

2. Decide on what type of weeding option you will use. Most organic growers choose one of two options: undervine mowing (cutting the weeds off at ground level), or undervine cultivation (disturbing or cutting the roots of the weeds to limit growth). Both of these options have a place in weed management for different situations in vineyards. Where available, it can be wise to use a contractor to perform this task when first starting out, before you commit to a particular machine.

3. Lift irrigation lines and cover and stake around valves and risers to protect these from potential cultivation damage.

4. Posts – Due to the new prohibition on using treated timber posts as replacement posts under USDA and Canadian organic rules from 1 July 2010, many alternatives to treated posts have arisen. It is well worth researching the options available and pairing the alternatives to your site, plant canopy growth and likely harvest method.

5. Stake young vines to prepare them for undervine weeding.

6. Register your block/vineyard for organic certification with your preferred certification company and get a full set of guidelines for direction throughout the season.

7. Determine what products will be used throughout the season. Most agrichemical suppliers now have organic spray programs and representatives who can assist in putting a program together. It is important that your suppliers know you are transitioning to organics so that they are aware of the need to only supply you with organically certified inputs.

8. Establish a full set of operating procedures for organically managed blocks, from cleaning hand tools and machinery operation through to harvest procedures.

9. Label all organic blocks with obvious signage to remind the team they are entering an organically managed block.

10. Staff training – Provide training to the viticulture team on the organic procedures. Make sure that they are aware of buffer zones when canopy and weed spraying and harvesting, and that they use dedicated equipment such as the organic canopy sprayer for these blocks.

BioGro Audits – A Manager's Perspective

Caine Thompson, Viticulturist - Mission Estate

I was expecting a tough, problematic torrid time of it, however this was really not the case.

The BioGro auditor was very helpful, knowledgeable and understanding. I was very impressed with his knowledge of viticulture and what is actually involved in viticulture systems and practical applications.

I had been given a list pre-audit of everything that he required for the audit, which included:

1. Accurate site maps of organic and conventional blocks
2. Soil tests
3. Multi-residue soil tests
4. Spray diary records from the previous season
5. Letter of notification to neighbours and contractors whom I needed to notify about organic growing
6. Affidavit stating the last non-organic agrichemicals applied
7. Cleaning between organic and conventional blocks procedure and confirmation
8. Proof of separate agrichemical storage of organic and non-organic products
9. Detailed management strategy to avoid spray drift from neighbours

Knowing what was required was very helpful, as I had everything available to go through step by step. The process was straightforward and very logical. The audit took about six hours.

Once we provided all the documents, we were signed off officially as being in our first year of organic growing under BioGro.

The process was thorough and detailed, but providing you keep good records, it is common sense and fairly straightforward. In comparison to other audits I have been through, I found it no more or less difficult to SWNZ audits.

Mission Estate

General

Looking back, the transition from conventional to organic production has been relatively smooth at Mission Estate.

Weed control was the biggest challenge. Irrigation lines had to be lifted to allow mechanical weeding, and there were difficulties removing weeds from around the base of the vines.

Good pest and disease control relied on regular monitoring, healthy vines, an open canopy and a well set up sprayer. With this we were able to achieve excellent pest and disease control.

Where to from here?

The intention is to continue with the organic regime, as both blocks are now BioGro certified. The conventional areas of the organic focus vineyard will be converted over to organics in the future, due to the organic blocks performing so well over the last three years.

What has been the biggest challenge in the overall conversion process?

Weed control is still the most difficult challenge, especially in wetter seasons.

What has been the biggest success in the overall conversion process?

The quality continues to be excellent. It is also great that the yields in our organic block have remained the same as those in the conventional blocks. Also, the organic spray programme has worked extremely well. Using sulphur for powdery control has surprised us with how effective it is.

Are there any skills involved in managing an organic vineyard that are different to conventional?

Skills required for organic production are similar to conventional, however there is more emphasis on:

- Soil management (fertilisers, weed control, water management)
- Monitoring and observation
- Vine balance and canopy management
- Organic sprays

Do you have any recommendations for others converting about upskilling in any particular area?

Upskilling in vineyard soil management and general organic growing could be an advantage.

Working closely with staff, involving them in every aspect of the transition to organics, has led to a high level of buy-in.

What has been the most noticeable change in the vineyard since its conversion to organic?

The vineyard hasn't changed a lot since converting, though it looks a bit weedier than the conventional block.

Has being involved in the conversion process changed your thinking or vineyard practices for the future?

It has reinforced the importance of good vine balance and good canopy management.
Regular checking of your sprayer setup is essential. Thorough calibration and spray deposition tests must be carried out.

If you could give one piece of advice to others considering converting to organics, what would it be?

Talk to as many organic growers as possible before converting in order to understand the requirements, then start with a small area and convert areas as you build confidence in the process.

Mission Estate – Syrah, 10th February 2014

Organic

Conventional

Wither Hills

Where to from here?

For the 2015 vintage, these blocks will retain their current status, split between organic and conventional, with Wither Hills continuing to monitor yield and performance. Ultimately we need to increase the yield of the organic Pinot Noir to above its current average of 4 t/ha to make it viable. However I'm sure we can achieve this with the leaps and bounds it has made this past season.

What has been the biggest challenge in the overall conversion process?

The biggest challenge in the overall conversion process has been trying to achieve economic feasibility in the organic Pinot Noir. Yield has been below desired levels, and there was a significant lag phase before quality fruit started to come from this block. In comparison, the organic Sauvignon Blanc has maintained a financially sustainable yield throughout the conversion.

What has been the biggest success in the overall conversion process?

The greatest success over the conversion process has been the ability of the team to develop management strategies for underperforming blocks. Pruning weights done this winter show that vigour has increased significantly in the organic Pinot Noir and that these vines have a greater fruit-bearing capacity for the 2014-15 season. Over the course of the conversion process, we have gained a better understanding of the vineyard, and we look forward to seeing how these blocks progress.

The spray program based around sulphur, Protector and a small amount of copper has also worked well. Even though powdery mildew pressure was at unprecedented levels, the organic blocks were not sprayed more than usual and did not succumb to disease pressure.

What has been the most noticeable change in the vineyard since its conversion to organic?

The most noticeable change in the vineyard has been the restoration of a healthier ecosystem. The vineyard floor is now a habitat of diverse fungi and bacteria, which are essential for resource recycling and soil health. Furthermore, beneficial insects are more common, reducing the need for insecticides.

Are there any skills involved in managing an organic vineyard that are different to conventional?

The best task to master in an organic vineyard is undervine weeding. Operators need to be well trained, as incorrect use can destroy vines and vine roots.

The manager should also have a clear direction for the block and be prepared to try different strategies to achieve this. Being observant and proactive throughout the season is critical to the success of the season.

Do you have any recommendations for others converting about upskilling in any particular area?

Taruna College offer a fantastic Certificate in Applied Organics and Biodynamics. This course not only gives insight into organic land and soil management but helps people connect with other organic managers. One thing I've found is that people in organics are always willing to lend a helping hand and share their knowledge.

Has being involved in the conversion process changed your thinking or vineyard practices for the future?

Being involved in the conversion process has helped us understand how critical it is to produce healthy vines for organic grape growing. Vine health is often masked by the plethora of chemicals and fertilisers available. Once these are taken from the equation, the viticulturist has to better examine what is happening below the ground and outside of the confines of conventional practice.

If you could give one piece of advice to others considering converting to organics, what would it be?

Start small so you can gain knowledge about what processes are required to run an organic vineyard. The Organic Focus Vineyard Project has demonstrated that organic blocks are managed quite differently depending on location, variety and philosophy. Observation during the conversion process can unlock a wealth of knowledge which will allow you to confidently proceed with organic development.

Wither Hills – Sauvignon Blanc, 27th February 2013

Organic

Conventional

Gibbston Valley Wines

Where to from here?

We will be converting the conventional regions of the School House focus vineyard to organic management. We are also changing the Pinot Noir in our China Terrace, Bendigo vineyard to organic as well.

What has been the biggest challenge in the overall conversion process?

Weed control. The Braun undervine system has done a good job across 80% of the area. However, the vines had too much weed competition in some areas.

What has been the biggest success in the overall conversion process?

Simply knowing that we are managing the vineyard with minimal intervention. This is resulting in quietly improving soils, improving soil biology and general vine health. Also knowing that the system we are using has little impact environmentally and therefore is more sustainable than conventional systems. We strongly believe that all of this will give a better reflection of the site through the wines we produce from it.

Having a better understanding of the block has resulted in us addressing some problem areas with regard to pruning, nutrition and water requirements. Pruning to vigour and especially pruning quite hard in some of the very bony spots.

What has been the most noticeable change in the vineyard since its conversion to organic?

Increased soil biological activity resulted in reduced erosion, along with the other benefits that biological activity brings to the vines.

Are there any skills involved in managing an organic vineyard that are different to conventional?

I definitely think the management approach needs to be more proactive, and certainly one needs to be more observant and in tune not only with the vineyard but also with what the weather may challenge you with.

Do you have any recommendations for others converting about upskilling in any particular area?

Talk to others who are doing it already, or take paid advice from people specialising in organic production. A lot of mistakes can be avoided in this way, as others will generally have overcome many of the issues that you may face. Remember though that your block will have its own peculiarities, and you may have to find your own remedies for certain situations.

Has being involved in the conversion process changed your thinking or vineyard practices for the future?

It has really just cemented the fact that it is reasonably simple to convert to organic production here in Central Otago, provided one has the desire to do so, along with the required financial resources for the change. I personally think that as long as the owner's/company's philosophy toward organics is strong, then as in all farming, "Providing the desire to aspire lies with those holding the purse strings, the people on the ground will make it happen."

If you could give one piece of advice to others considering converting to organics, what would it be?

"Don't be afraid of taking a step back so that you may be allowed to go forward."

Pest and Disease Control

This section discusses

- **How to manage pests and diseases organically**
- **How effective were organic methods?**
- **How much did organic pest and disease control cost?**

Pest and Disease Control Summary

- Overall, pest and disease levels were relatively low for all vineyards, varieties and growing regimes throughout the three year project.
- All vineyards used sulphur at 10-14 day intervals as the basis of their spray programmes.
- All vineyard managers considered their organic pest and disease control programmes to be greatly successful.
- Pest and disease control costs for each vineyard were determined by seasonal variations in disease pressure.

Key points for managing pests and disease in an organic system

Bart Arnst – Viticultural Consultant

- Consider historical pressures. Be aware of which areas in the block have a history of disease issues, and pay attention to these.
- Weather monitoring is important. Understand the environmental conditions which encourage pest and disease development, and adjust your actions accordingly. For example, if weather patterns are consistent with powdery mildew infection, then closely monitor for any sign of the disease, and be prepared to tighten your spray program.
- Keep a tight spray program especially over rapid growth phases.
- Encourage vineyard plant diversity. You can create a more balanced ecosystem by enhancing insect habitat.
- Reduce canopy density to facilitate air flow through the canopy and better spray penetration.
- Make sure your water rate gives good coverage; a good rate is 400-500 L/ha at full canopy.

Mission Estate

How did we manage pests and disease?

- At Mission Estate, regular sulphur and occasional copper formed the basis of the spray programme.
- Good pest and disease control relied on regular monitoring, healthy vines, an open canopy and a well set up sprayer. With this we were able to achieve excellent pest and disease control.
- Below is a typical Mission Estate organic canopy spray programme (similar for both grape varieties).

Organic			Conventional		
	Product Trade Name	Active Ingredient		Product Trade Name	Active Ingredient
7 Oct	Kumulus Blue Shield	*sulphur* *copper hydroxide*	7 Oct	Kumulus Blue Shield	*sulphur* *copper hydroxide*
24 Oct	Kumulus Blue Shield	*sulphur* *copper hydroxide*	24 Oct	Kumulus Blue Shield	*sulphur* *copper hydroxide*
18 Nov	Kumulus Blue Shield	*sulphur* *copper hydroxide*	18 Nov	Kumulus Blue Shield	*sulphur* *copper hydroxide*
3 Dec	Kumulus Blue Shield Protector	*sulphur* *copper hydroxide* *fatty acid – fungicide*	3 Dec	Kumulus Blue Shield Protector Switch	*sulphur* *copper hydroxide* *fatty acid – fungicide* *fludioxonil & cyprodinil*
10 Jan	Kumulus Blue Shield	*sulphur* *copper hydroxide*	10 Jan	Kumulus Systhane Switch	*sulphur* *myclobutanil* *fludioxonil & cyprodinil*
17 Jan	Kumulus	*sulphur*	17 Jan	Kumulus Prostar	*sulphur* *myclobutanil*
24 Jan	Kumulus	*sulphur*	24 Jan	Kumulus	*sulphur*

How effective was the pest and disease programme?

	Powdery mildew	Mealybug		Leafroller		Crop loss to botrytis
	Feb	Feb	Pre-harvest	Feb	Pre-harvest	Pre-harvest
Year 1	Low incidence in bunches and leaves for all blocks (0.0 – 1.3%) Low severity for all (<1.0%), except Conv Merlot (5.6%)	Low incidence Conv only (1.0%)	Low incidence Conv Merlot only (0.3%)	None	Low incidence Org only (0.3 - 0.8%)	Some loss in all blocks (0.6 - 3.2%)
Year 2	None	None	None	None	None	None
Year 3	Bunches - high incidence but low severity in all blocks Merlot Org: Incidence 10.8%, Severity 5.0% Merlot Conv: Incidence 4.5%, Severity 1.3% Syrah Org: Incidence 6.8%, Severity 1.6% Syrah Conv: Incidence 3.8%, Severity 1.5%	Low incidence Org only (0.8 – 1.0%)	Incidence Merlot Org 2.8% Merlot Conv 1.8% Syrah Org 2.0% Syrah Conv 4.0%	None	Low incidence in all blocks (0.3 – 0.5%)	None

Definition: Incidence (%) — *The percentage of bunches with any presence of disease or pest*
Severity — *Average percentage of the sample affected by disease or pest*
Crop loss — *Incidence x severity to give the percentage of the total crop affected*

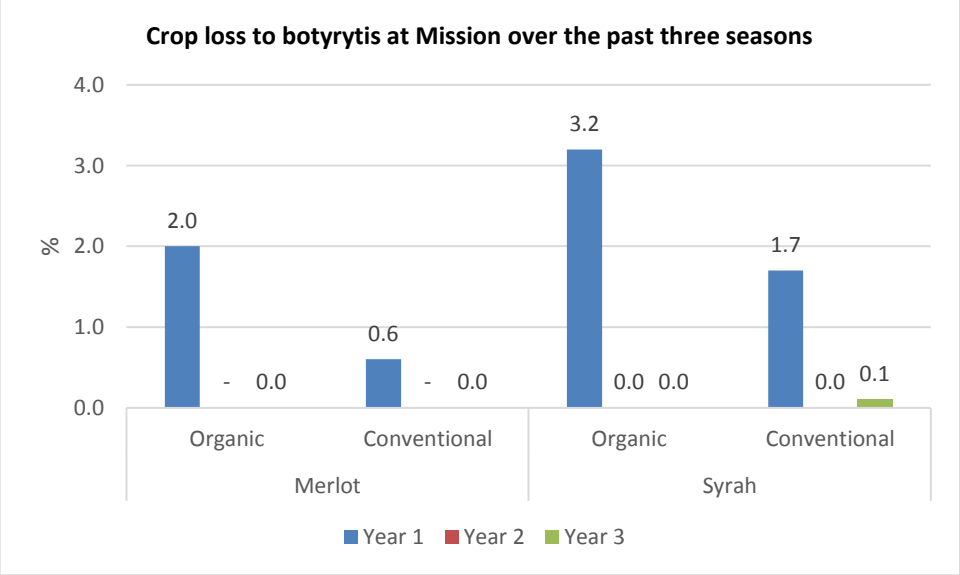
Mission Estate

Vineyard managers' comments

Year 1 - A challenging season put significant pressure on both organic and conventional regimes in terms of powdery mildew, downy mildew and botrytis. Botrytis at harvest was a significant issue. The organic block showed slightly higher levels of botrytis at harvest, although both the organic and conventional were under 1.5% incidence, which was a good outcome. We achieved good control of powdery and downy mildew under both systems using different approaches and products, which was very encouraging in a high-pressure season.

Year 2 - Disease pressure from powdery mildew was high, but pressure was low for downy mildew and botrytis for all blocks. The organic spray program has worked extremely well. The use of sulphur for powdery control has surprised me with how effective it continues to be against this disease.

Year 3 - We had one of the highest numbers of powdery mildew infection periods on record this season. Vineyard practices such as bunch exposure, spray timing and spray selection had to be executed perfectly. More sprays were used for powdery mildew control, and rates were increased. Other sprays used were normal. The organic blocks performed really well this season despite the high disease pressure. Low botrytis and downy mildew pressure.



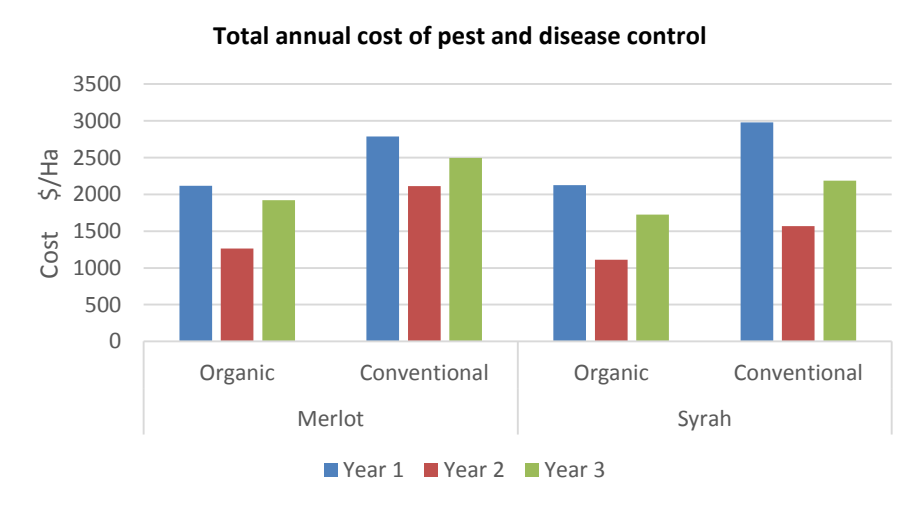
Note: Data rounded to nearest 0.1%. 0.0 means value is less than 0.05 but greater than zero. – equals 0.

Mission Estate

What were the costs of pest and disease programmes?

At Mission Estate, pest and disease management costs were consistently lower for the organic blocks. The higher costs for conventional blocks were due to additional sprays being used in the conventional blocks. Additionally, some conventional sprays cost more than organic products.

	Merlot organic $/Ha			Merlot conventional $/Ha			Syrah organic $/Ha			Syrah conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Bird netting	444	333	600	444	333	600	444	333	600	444	333	600
Canopy spray	1674	932	1321	2343	1778	1894	1680	779	1127	2536	1234	1586
Total	**2118**	**1265**	**1921**	**2787**	**2111**	**2494**	**2124**	**1112**	**1727**	**2980**	**1567**	**2186**



Wither Hills

How did we manage pests and disease?

- Spray intervals were normally 10-14 days, however were reduced to 7-10 days in high pressure situations.
- The organic blocks had more spray passes than the conventional blocks, due to the shorter protective window that sulphur offers.
- Buckwheat (35 kg/ha) and *Phacelia* (3 kg/ha) were sown in every 10th row of the organic blocks to attract beneficial insects to predate on insect pests.
- Below is a typical sample Wither Hills canopy spray programme.

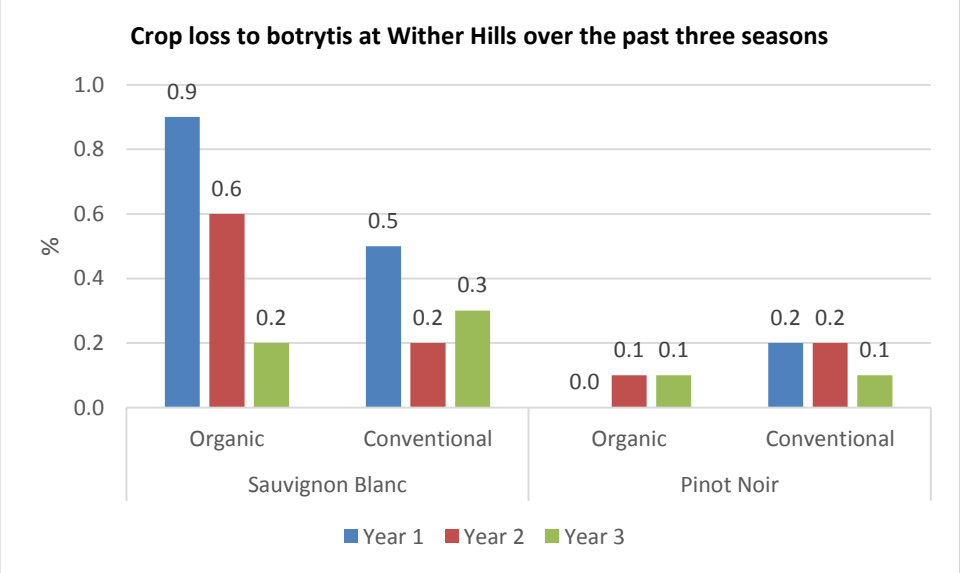
Organic			**Conventional**		
	Product trade name	Active Ingredient		Product trade name	Active Ingredient
10 Oct	JMS Stylet Oil	*mineral oil*	7 Oct	JMS Stylet Oil	*mineral oil*
22 Oct	Kumulus	*sulphur*		Kocide Opti	*copper*
	Blueshield	*copper hydroxide*	17 Oct	Dithane	*mancozeb*
	Protector	*fatty acid – fungicide*		JMS Stylet Oil	*mineral oil*
29 Oct	Kumulus	*sulphur*	29 Oct	Dithane	*mancozeb*
	Protector	*fatty acid – fungicide*		Kumulus	*sulphur*
12 Nov	Kumulus	*sulphur*	13 Nov	Dithane	*mancozeb*
	Protector	*fatty acid – fungicide*		Kumulus	*sulphur*
25 Nov	Kumulus	*sulphur*		Ovation	*buprofezin*
	Protector	*fatty acid – fungicide*	25 Nov	Dithane	*mancozeb*
4 Dec	Serenade Max	*Bacillus subtilis*		Systhane	*myclobutanil*
13 Dec	Kumulus	*sulphur*		Movento	*spirotetramat*
	Protector	*fatty acid – fungicide*	3 Dec	Pristine	*boscalid & pyraclostrobin*
30 Dec	Serenade Max	*Bacillus subtilis*		Success	*spinosad*
4 Jan	Kumulus	*sulphur*		Duwett	*trisiloxane ethoxylate*
	Protector	*fatty acid – fungicide*	15 Dec	Talendo	*proquinazid*
	Champ	*copper hydroxide*	31 Dec	Switch	*fludioxonil & cyprodinil*
15 Jan	Kumulus	*sulphur*		Duwett	*trisiloxane ethoxylate*
	Protector	*fatty acid – fungicide*	7 Jan	Quintec	*quinoxyfen*
27 Jan	Kumulus	*sulphur*	28 Jan	Gem	*fluazinam*
	Protector	*fatty acid – fungicide*		Sulgran	*sulphur*

Wither Hills

How effective were the pest and disease programmes?

	Powdery mildew on leaves	Mealybug		Leafroller		Crop loss to botrytis
	Feb	Pre-harvest	Feb	Pre-harvest		Pre-harvest
Year 1	Low incidence and severity (<1.0%) in bunches and leaves for Conv and Org S. Blanc	None	None	None	None	Below 1% for all blocks
Year 2	None					
Year 3	None on leaves Present in Org bunches only Incidence 0.3 – 3.5% Severity 1.0 – 1.4%				Low incidence Org only (0.8 – 1.5%)	

Definition: Incidence (%) — *The percentage of bunches with any presence of disease or pest*
Severity — *Average percentage of the sample affected by disease or pest*
Crop loss — *Incidence x severity to give the percentage of the total crop affected*



Note: Data rounded to nearest 0.1%. 0.0 means value is less than 0.05 but greater than zero. – equals 0.

Focus Vineyard 2

Wither Hills

Vineyard managers' comments

Year 1 - A high pressure year for diseases such as powdery mildew prior to Christmas, and downy mildew late in the season. These diseases showed up in the Pinot Noir as high incidence but low severity. Sprays were applied in response to the results from fortnightly monitoring. There was little botrytis pressure this season. We applied more canopy sprays than in a "normal" low disease pressure season.

Year 2 - A high disease pressure season for powdery mildew. Spray intervals were reduced from 14 days to 7-10 days. There was little botrytis pressure. A spray program using sulphur, seaweed and biological products worked well for us; in fact it has proven to be just as effective as synthetic chemical use in the conventional blocks.

Buckwheat and *Phacelia* were sown in the organic blocks to achieve flowering in December. This was sown at a rate of 35 kg/ha for buckwheat and 3 kg/ha for *Phacelia.* Once it was flowering, we topped every fourth bay to encourage a longer flowering for the duration of the summer.

Year 3 - Powdery mildew was seen on an unprecedented scale throughout the district, with many growers struggling to control the disease. A spray program of sulphur, Protector and a small amount of copper worked well. Both our organic and conventional spray regimes were effective at preventing any significant outbreaks.
.
Botrytis incidence was much higher in the Sauvignon Blanc bunches this season; however, crop losses were below 1% for both the organic and conventional regimes. The organic blocks had more spray passes than the conventional due to the shorter protective window that sulphur offers.

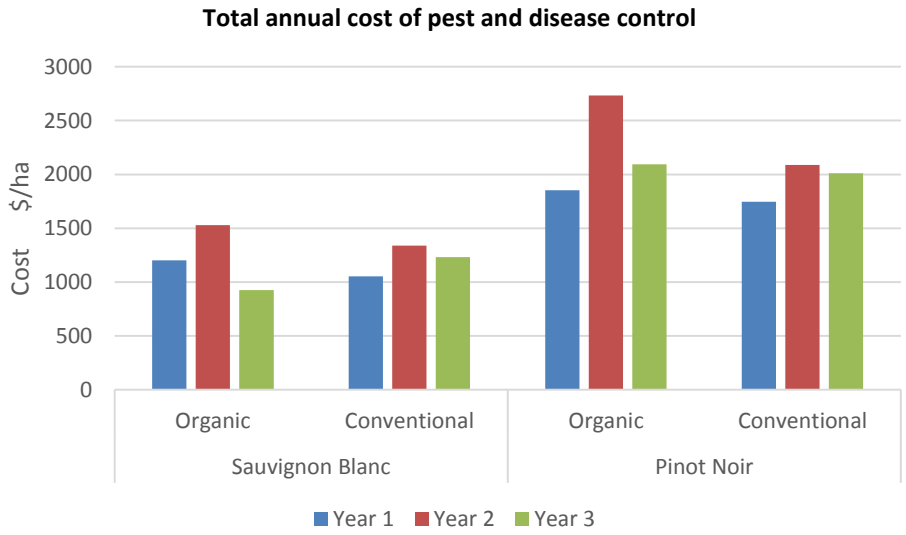
Botrytis was more prevalent throughout the conventional focus vineyard blocks this season, perhaps due to the bigger crops and denser canopies that they had in comparison to the organic.

There has been little sign of light brown apple moth, suggesting that our plantings of buckwheat and *Phacelia* have supported a multitude of beneficial insects to prey on the caterpillars.

Wither Hills

What were the costs of pest and disease programmes?

	Sauvignon Blanc organic $/Ha			Sauvignon Blanc conventional $/Ha			Pinot Noir organic $/Ha			Pinot Noir conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Bird netting							409	572	783	361	455	794
Canopy spray	1110	1249	886	1052	1337	1230	1382	1815	1254	1384	1633	1308
Planting to attract beneficial insects		72	13					132	13			
Seed drilling and rolling	92	208	26				63	215	43			
Totals	**1202**	**1529**	**925**	**1052**	**1337**	**1230**	**1854**	**2734**	**2093**	**1745**	**2088**	**2102**



Gibbston Valley Wines

How did we manage pest and disease?

- We used a 10-14 day sulphur and seaweed spray regime for the duration of the season until nets (consistent with a normal growing season).
- *Phacelia* and buckwheat cover crops were sown in every tenth row to attract beneficial insects to predate on pests.
- Below is a typical Gibbston Valley canopy spray programme (same for both grape varieties).

	Organic		**Conventional**	
	Product trade name	Active ingredient	Product trade name	Active ingredient
12 Oct	Kumulus	*sulphur*	Kumulus	*sulphur*
30 Oct	Kumulus	*sulphur*	Kumulus	*sulphur*
6 Nov	Kumulus	*sulphur*	Kumulus	*sulphur*
22 Nov	Kumulus	*sulphur*	Kumulus	*sulphur*
4 Dec	Kumulus	*sulphur*	Kumulus	*sulphur*
19 Dec	Kumulus	*sulphur*	Kumulus	*sulphur*
20 Dec			*Switch*	*fludioxonil & cyprodinil*
			DuWett	*trisiloxane ethoxylate*
6 Jan	Kumulus	*sulphur*	Kumulus	*sulphur*
14 Jan	Kumulus	*sulphur*	Kumulus	*sulphur*
30 Jan	Kumulus	*sulphur*	Kumulus	*sulphur*
8 Feb	Kumulus	*sulphur*	Kumulus	*sulphur*

How effective was the pest and disease programme?

	Powdery mildew		**Mealybug**		**Leafroller**		**Crop loss to botrytis**
	Feb	**Pre-harvest**	**Feb**	**Pre-harvest**	**Feb**	**Pre-harvest**	**Pre-harvest**
2012	None	None	None	None	Low incidence in all blocks (1.8 – 2.3%)	Low incidence P.Gris Org 0.5% Conv 2.5% P.Noir Org 0.3% Conv 1.3%	High P.Gris Conv 20.4% Org 7.0 % P. Noir Conv 3.8% Org 1.3%
2013					None	None	Low – P.Gris only (<1.0%)
2014						Low incidence in all blocks (1.3 – 2.5%)	Very low in all blocks (<0.2%)

Definition: Incidence (%) *The percentage of bunches with any presence of disease or pest*
Crop loss *Incidence x severity to give the percentage of the total crop affected*

Gibbston Valley Wines

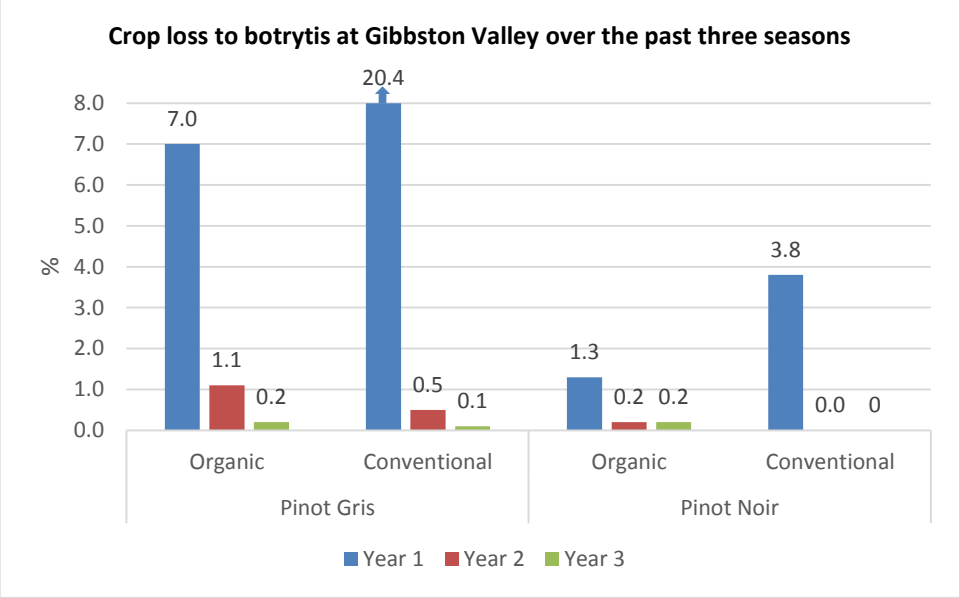
Vineyard managers' comments

Year 1 - Due to the influx of rain received post-veraison, Pinot Gris bunches swelled and botrytis was an issue. The conventional block of Pinot Gris had a substantially higher incidence and severity of botrytis. We think there are two reasons for this. The undervine area is flat and uniform, making it easier for spores to spread, compared to the more uneven and complex undervine area of the organic blocks. Secondly, the undervine area in the organic blocks has a higher degree of weed competition and reduced water uptake, which in turn may lead to poorer fruit set and more open bunches.

Year 2 - There was no powdery mildew or downy mildew. Some botrytis was present in isolated patches, particularly the organic Pinot Gris again this year – though markedly lower incidence and severity than last year. The buckwheat strike was excellent, whereas the *Phacelia* was less successful. There appear to be different and more diverse interrow species emerging in the organic blocks. Visually, it's been interesting to note a reduced incidence of leafroller caterpillar.

Year 3 - There was a little powdery mildew pressure during the season. Ten applications for the season was at the high end for us, but explainable by the early spring and cool summer. The number of applications and tight spray interval program worked well. Botrytis pressure was low, but there was some. The organic blocks had no botrytis sprays, and showed a little disease, however it was a very low percentage.

About growing buckwheat and *Phacelia*: We either plant early while we have moisture to get a strike, but then risk frost to the buckwheat in particular; or risk planting later. The issue with planting later is that typically the vineyard gets very dry and then we don't get a strike anyway. We tried both early and late but neither did very well.

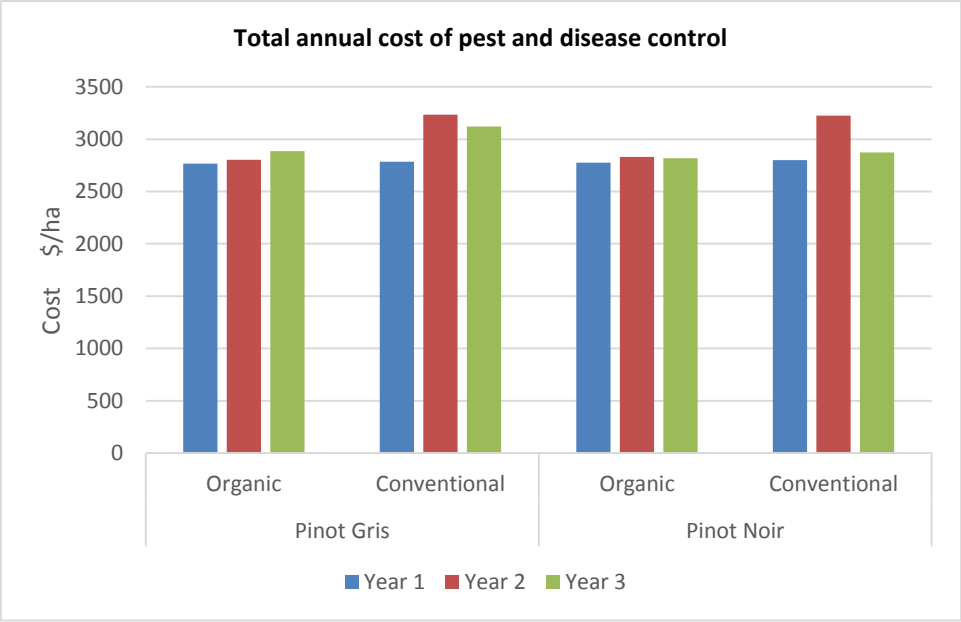


Note: Data rounded to nearest 0.1%. 0.0 means value is less than 0.05 but greater than zero. – equals 0.

Gibbston Valley Wines

What were the costs of pest and disease programmes?

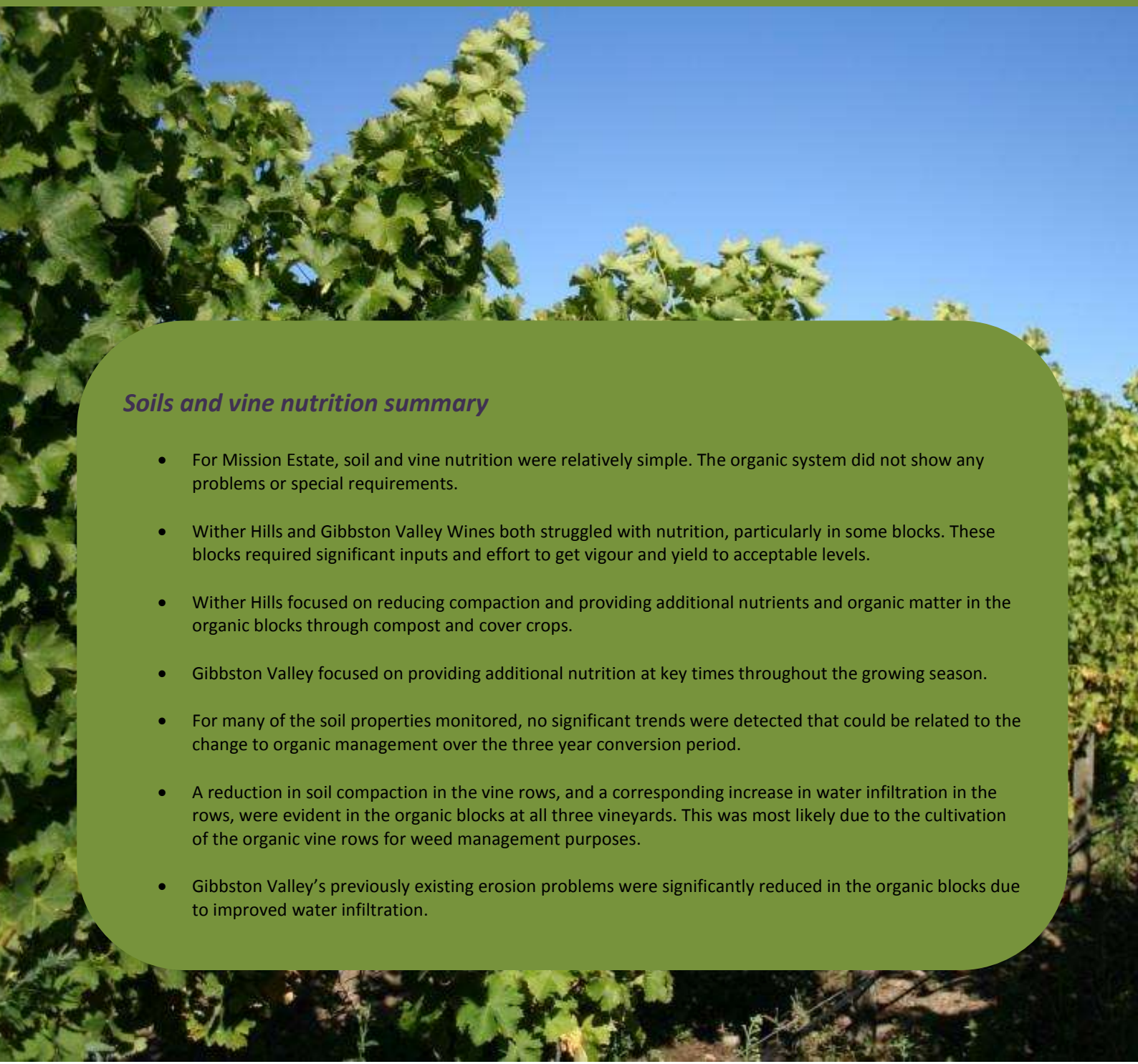
	Pinot Gris organic $ /Ha			Pinot Gris conventional $/Ha			Pinot Noir organic $/Ha			Pinot Noir conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Bird netting	1461	1185	921	1426	1217	1046	1463	1185	820	1427	1217	816
Canopy spray	1195	1542	1545	1270	1981	2042	1205	1559	1586	1283	1973	2024
Planting to attract beneficial insects		39	61					51	62			
Interrow cultivation	17		323				17		317			
Rabbit control	89	36	34	89	36	34	89	36	34	89	36	34
Totals	**2762**	**2802**	**2884**	**2785**	**3234**	**3122**	**2774**	**2831**	**2819**	**2799**	**3226**	**2874**



Soils and vine nutrition

This section discusses:

- **How to manage vine nutrition organically**
- **How did organic management affect soil properties?**



Soils and vine nutrition summary

- For Mission Estate, soil and vine nutrition were relatively simple. The organic system did not show any problems or special requirements.
- Wither Hills and Gibbston Valley Wines both struggled with nutrition, particularly in some blocks. These blocks required significant inputs and effort to get vigour and yield to acceptable levels.
- Wither Hills focused on reducing compaction and providing additional nutrients and organic matter in the organic blocks through compost and cover crops.
- Gibbston Valley focused on providing additional nutrition at key times throughout the growing season.
- For many of the soil properties monitored, no significant trends were detected that could be related to the change to organic management over the three year conversion period.
- A reduction in soil compaction in the vine rows, and a corresponding increase in water infiltration in the rows, were evident in the organic blocks at all three vineyards. This was most likely due to the cultivation of the organic vine rows for weed management purposes.
- Gibbston Valley's previously existing erosion problems were significantly reduced in the organic blocks due to improved water infiltration.

Soil physical and biological quality monitoring

- Soil physical and biological properties were measured at each focus vineyard. Baseline information was gathered in October 2011, and monitoring was repeated in November 2012 and August/December 2013.
- In each vineyard, soil samples were taken in three randomly selected rows from one conventional and one organic block. The locations in each block were close to the other block, on similar slope, aspect and soil type. The soil samples taken were not necessarily representative of the block as a whole.
- Samples were also taken from various positions within a row: under the vine, under the wheel tracks between rows, and between rows but not under wheel tracks.
- Soil bulk density and soil moisture levels were calculated from 75mm soil cores that were weighed on site and further tested in the laboratory.
- Infiltration rates were measured in situ using a 90mm column driven 25mm into the ground.
- Compaction was measured using a penetrometer at 75mm, 150mm, 300mm, 450mm and 600mm.
- Earthworm data was collected from a 20cm x 20cm area. Sample areas were interrow. Three samples were taken per block.

Soil chemical and microbiology monitoring

- Soil chemical and microbiological testing were carried out in May, 2011 – 2014.
- Petiole testing was carried out in December, 2011 – 2013.
- Leaf blade testing was carried out in February, 2012 – 2014.
- The Mission Estate Syrah, Wither Hills Sauvignon Blanc and Gibbston Valley Wines Pinot Noir blocks were monitored.
- Samples were collected from both the organic blocks and conventional blocks.
- Soil tests were taken from 20 set sites for each of the organic and conventional blocks for each vineyard.
- 150 mm deep samples were collected and analysed by Hill Laboratories, Hamilton.
- Mycorrhizal sampling was based on feeder root samples from a vine at each block.
- Microbiological analysis was conducted by the Soil Foodweb Institute New Zealand.

Soil chemical and microbiology results

Note: **For most of the soil properties monitored, no consistent or statistically significant trends could be related to organic management over the three year monitoring period. It is important to note that a three year period is a relatively short time in which to see changes in soil chemistry and microbiology.**

Soil nutrient status	Organic matter	No statistically significant difference between organic and conventional.
	Soil pH	No statistically significant trends
	Phosphorus availability	No statistically significant trends
	Base cations (K, Ca, Mg, Na)	No statistically significant trends
	Trace elements	Small increase in cobalt in organic blocks. No other statistically significant trends.
Petiole and leaf blade tests		Observed nutrient levels were generally similar across the organic and conventional management regimes.
Soil microbiology	Numbers of organisms present	No significant trends in numbers of organisms recorded in Soil Foodweb lab assessments.
	Fungi: bacteria ratios	There was an increase in the ratio of active fungi to active bacteria in the organically managed soils at Mission Estate and Gibbston Valley School House.

Nitrogen and organic matter in organically managed soils

(The following results did not show statistical significance during the monitoring, but may be of interest in future work.)

Nitrogen availability

Nitrogen management in organic vineyards has been highlighted as a potential challenge due to its effect on vine vigour and productivity. The methods used by the focus vineyard managers to manage nitrogen included compost applications, cover crops, foliar sprays such as Wuxal Amino, and other inputs such as dried blood and bone.

Trends for total nitrogen take longer to show up on soil tests than for available nitrogen. This is because much of the total nitrogen is from slowly available organic matter and vineyards do not generally have high annual losses of nitrogen. No trend in total nitrogen levels was observed over the three focus vineyards.

Cultivation and active organic matter

At Wither Hills, the organic block's soil tests showed a dramatic temporary increase in available nutrients one year after conversion to organic management. This was likely to be related to cultivation of every second interow for cover crop establishment. Cultivation may have caused accelerated decomposition from active organic matter sources, resulting in release or mineralisation of minerals. A year later, this effect was no longer apparent.

Although cultivation can provide a temporary boost in nutrient availability, there can be long term negative impacts on organic matter levels and soil biology from excessive repeated cultivation. Continued monitoring could be useful to check the ongoing impact of cultivation on vineyard soils.

Mission Estate

How did we manage soils and vine nutrition?

Leaf condition and growth were fairly similar for organic and conventional treatments throughout all growing seasons.

Year 1

BioAg Soil and Seed was applied to soil through fertigation to both the conventional and organic blocks throughout the growing season. Moana Natural was also applied to foliage.

Year 2

BioAg Roots and Shoots was applied to foliage throughout the growing season, and one application of BioAg Flowers and Fruit was applied to foliage in February.

Year 3

	Organic and Conventional	Nutrient /ha	Target
30 Sep	BioAg Soil and Seed	8 l/ha	Ground drench
	Boron	2 kg/ha	Ground drench
	Moana Natural	30 l/ha	Ground drench
24 Oct	BioAg Roots and Shoots	1.5 l/ha	300mm shoots
18 Nov	BioAg Roots and Shoots	1 l/ha	750mm shoots
	Natura Kelp	1 l/ha	750mm shoots
27 Nov	BioAg Soil and Seed	2.5 kg/ha	Fertigation
	Moana Natural	20 l/ha	Fertigation
	Magnesium sulphate	8 kg/ha	Fertigation
3 Dec	Natura Kelp	1 l/ha	Full canopy
	Potassium bicarbonate	3 kg/ha	Full canopy
10 Jan	Natura Kelp	1 l/ha	Full canopy
	Potassium bicarbonate	3 kg/ha	Full canopy
24 Jan	BioAg Roots and Shoots	1 l/ha	Full canopy
	Natura Kelp	1 l/ha	Full canopy

Mission Estate

Soil monitoring results

- A reduction in vine row compaction levels at the surface was noticed in the organic blocks. This was most likely due to the cultivation of the organic vine rows.
- Water infiltration was generally faster in the row areas of the organic blocks. This was most likely due to undervine cultivation.
- The majority of soil physical properties showed no clear trend in the three years as a result of the change to organic management.

Soil Type: Typic Fluvial Recent Soil of Omahu "Gimblett Gravels" stony sand to sandy loam

Merlot

Soils were light and stony		Organic			Conventional		
		2011	**2012**	**2013**	**2011**	**2012**	**2013**
Earthworm numbers *(per m^2)*		25	113	58	17	158	33
Earthworm weights *(kg/ha)*		340	680	205	67	799	147
Compaction *(mPa)*	Vine row	2.07	2.7	0.86	2.07	3.1	1.61
	Interrow	2.07	3.22	1.72	2.07	4.36	1.38
	Track row	3.96	3.62	2.12	3.56	4.94	2.35
Soil bulk density *(kg/l)*	Interrow	-	0.96	1.06	-	0.96	0.95
Water infiltration *(mm/hr)*	Vine row	10.1	20.2	17.7	7.0	3.1	2.3
	Track row	8.0	6.5	2.4	2.8	3.9	3.1

Syrah

More loam, less stone		Organic			Conventional		
		2011	**2012**	**2013**	**2011**	**2012**	**2013**
Earthworm numbers *(per m^2)*		150	450	125	75	25	25
Earthworm weights *(kg/ha)*		650	1921	794	452.5	120	208
Compaction *(mPa or mega Pascal)*	Vine row	2.07	1.32	0.52	2.07	2.07	1.55
	Interrow	1.49	2.87	1.21	1.72	2.41	1.03
	Track row	2.07	4.36	2.24	2.07	2.07	2.41
Soil bulk density *(kg/l)*	Interrow	-	1.0	1.09	-	0.9	1.09
Water infiltration *(mm/hr)*	Vine row	4.0	12.6	0.6	0.3	7.9	0.8
	Track row	2.0	0.5	0.2	0.3	0.4	0.9

Wither Hills

How did we manage soil and vine nutrition?

- An old spray unit was mounted on the back of the tractor used for undervine weeding. Through this we sprayed a mixture of seaweed, Effective Microorganisms (EM) and molasses onto the soil every time we did a pass with the weeder. This brew is a great food source of sugars for the microorganisms in the soil.

- Compost was made in December 2011 by the viticulture team and was made from hay, cow manure and wood chips that were sourced from outside our property, and shredded paper, green waste and grape marc from our own property. The compost had a high carbon content, so some of the matter took time to break down.

- In Year 2, we continued spraying a soil drench undervine and interrow each time weeding was done. Fertiliser was also spread on all blocks – a mixture of RPR and boron on all blocks, plus compost undervine on the organic Pinot Noir.

- Due to light canopy, poor fruit quality and lack of ripening of the organic Pinot Noir in Year 1, in Year 2 we increased our inputs of nitrogen with the aim of improving canopy growth and crop load. We used Wuxal Amino, as it has one of the highest percentages of nitrogen (9.2% total nitrogen) in a product permitted for use under BioGro certification.

- Some of the products chosen were not compatible to spray together, increasing the total number of spray rounds.

- A winter cover crop was sown (May 2013) of lupin (50 kg/ha) and black oats (50 kg/ha) in every second row in the organic blocks, in an effort to continue to build soil fertility and increase nitrogen and organic matter. The cover crops reached significant heights and were then mulched and disked into the soil in late September to provide plenty of nutrition for spring growth, whilst reducing our early season frost risk.

- By Year 3, the extra work put into the organic Pinot Noir had paid off, with the canopy looking healthy and the growth stages similar to the conventional Pinot Noir. Petiole tests showed a slight improvement in nitrogen.

- Soil remediation through ripping, composting and cover crops allowed us to significantly reduce the inputs for foliar nutrition in the organic blocks.

- The greatest challenge in Year 3 was sowing the winter cover crop early enough in autumn to get good growth for disking in spring. Since resources are committed to harvest over this period, labour tends to be scarce and cover crops tend to go in too late to reap maximum benefit.

Wither Hills

Nutrition programme

Organic							
Year 1		**Year 2**			**Year 3**		
Foliar nutrient applications							
SM6	1.5 l/ha	1 Nov	Wuxal Amino		21 Oct	SM6	1.5 l/ha
Biomin Ca		14 Nov	Natura Kelp	3.5 l/ha	29 Oct	SM6	1.5 l/ha
Biomin Booster V		29 Nov	Natura Kelp	3.5 l/ha	12 Nov	SM6	1.5 l/ha
			Wuxal Amino		23 Nov	SM6	1.5 l/ha
		10 Dec	Wuxal Amino			Biomin Booster V	1.5 kg/ha
			Organic Mag Super	7 kg/ha	29 Nov	Biomin Ca	1.5 kg/ha
		27 Dec	Wuxal Amino		13 Dec	SM6	1.5 l/ha
			Biomin Ca	3 kg/ha	4 Jan	SM6	1.5 l/ha
		8 Jan	Wuxal Amino	*Season Total 15.5 l/ha PN 13.5 l/ha SB*			
			Natura Kelp	3.5 l/ha			
			Biomin Ca	3 kg/ha			
Soil nutrient applications							
RPR		May	RPR	250 kg/ha		RPR and sulphur	200 kg/ha
Boron		May	OrganiBor	25 kg/ha		Blood and bone (Pinot Noir)	150 kg/ha
		21 Jan	Viaphos MSK	5 kg		Compost (Pinot Noir)	15 t/ha
			Compost (Pinot Noir)	15 t/ha			

Conventional							
Year 1		**Year 2**			**Year 3**		
Foliar nutrient applications							
Unknown		14 Nov	Bortrac		Unknown		
			Zinctrac				
		28 Nov	Natura Kelp	1 l/ha			
			Bortrac	*Season Total 1.5 l/ha PN 1 l/ha SB*			
			Zinctrac	*Season Total 1 l/ha*			
		17 Dec	Natura kelp	1 l/ha			
			Stopit				
		8 Jan	Stopit				
		28 Jan	Stopit	*Season Total PN 19 l/ha SB 13 l/ha*			
Soil nutrient applications							
RPR			RPR	250 kg/ha		RPR and sulphur	200 kg/ha
Boron			Boron	25 kg/ha		Dolomite (Conv PN)	750 kg/ha

Wither Hills

Managing soil compaction

After Year 1 of the project, soil compaction was thought to be contributing to poor canopy growth and lack of root growth in the Pinot Noir. Reducing soil compaction would allow the roots to access more water and nutrients, and help fertiliser work down through the soil instead of remaining in the surface layers. To do this a para plough deep ripped down the middle of the interrow on both the organic and conventional Pinot Noir blocks. The Sauvignon Blanc blocks were not done, to avoid bringing up more rocks.

Alternate rows were ploughed, as doing every row could have disturbed the root system too much on young vines that were already underperforming. The plough was put down at a depth of about 500mm. The wheel tracks were too compacted, and the plough was not able to get into the ground there.

The ploughing caused a shatter effect on the soil in the conventional block as it broke through the 'crust,' but in the organic block the soil was held together by the sward roots. A light roller was put over the ploughed rows, just heavy enough to put the topsoil back to ground level.

In the spring of Year 3, the midrow wheel tracks were ripped to further reduce compaction in the organic Pinot Noir block. Ripping was not conducted in the conventional block due to its excessive vigour.

Soil monitoring results

Soil Type: Immature orthic Brown Soil Renwick (Eyre-Paparua) shallow stony silt loam

		Organic			Conventional		
		2011	2012	2013	2011	2012	2013
Earthworm numbers *(per m^2)*		0	16.7	208.3	29.2	58.3	233.3
Earthworm weights *(kg/ha)*		0	19.2	1375	191.7	234.2	1060
Compaction	Vine row	2.18	5.51	1.38	2.18	4.82	1.95
	Track row	3.79	5.86	3.56	3.33	5.74	2.76
(mPa or mega Pascal)	Interrow	2.12	5.74	2.35	2.24	5.51	2.35
Soil bulk density *(kg/l)*	Vine row	0.99	1.02	-	1.02	1.01	-
	Track row	1.11	1.10	-	1.11	1.10	-
	Interrow	-	1.02	1.18	-	0.97	1.17
Water infiltration *(mm/hr)*	Vine row	0.8	35.4	29.8	11.8	15.7	15.7
	Track row	1.0	6.7	9.3	24.6	3.9	13.2
	Interrow	51.4	2.3	9.9	7.3	26.9	6.6

- The majority of soil physical properties showed no clear trend in the three years as a result of the change to organic management.

- Soil compaction figures were high in Year 2 due to dry conditions. Compaction figures were high even in the vine rows. Compaction was highest in the wheel tracks.

Gibbston Valley Wines

How did we manage soil and vine nutrition?

Compost was made from our 2010 grape marc; we added rye corn straw, rotting hay and cow manure. This was turned four times, and the resulting compost was of good consistency to spread. We decided to spread this under the row in the organic blocks and then immediately mound over with the Braun mounding discs. We felt this method of incorporation into the soil allowed the best use of the compost. The microbial boost in the undervine area (previously herbicide strip) should be beneficial in biologically regenerating that soil. Ideally the compost should be spread in autumn.

The organic blocks in Year 1 and 2 showed a light green-yellowish colour. We suspected there were some nitrogen deficiencies, so we added additional Wuxal Amino to boost nitrogen levels.

Timing of foliar nutrition at the right physiological stage is important. Depending on the product used, one can take into consideration the spring and autumn root flushes, and the post-reserve push in mid-late spring, pre- and post-flowering. The decision was made in Year 3 to frequently apply small amounts of microbial and nutrient boosters such as dried blood, compost tea, fish, seaweed, humates and Wuxal Amino, instead of one-off biennial compost applications. We also planted a cover crop of oats and lupins.

When looking back to the start of the organic conversion, we could have given the vines more from the start. We definitely saw some vigour issues, particularly in Year 2. We probably need to give nutrition both through foliar applications and via the soil, as well as fertigation, certainly in the initial years. We believe that once the vine roots explore further away from their previous nutritional source (the drippers), then they will find most of what they require if it is actually available in the soil.

Organic						
Year 1		**Year 2**		**Year 3**		
Foliar nutrient applications						
Nov	AgriSea	30 Nov	AgriSea	6 Nov	AgriSea	2.5 l/ha
Dec	AgriSea	13 Dec	AgriSea	22 Nov	AgriSea	2.5 l/ha
	Biomin Booster V		Biomin Booster V		Biomin Booster V	
	Biomin Boron		Biomin Boron		Biomin Boron	
Dec	AgriSea	24 Dec	AgriSea	4 Dec	AgriSea	2.5 l/ha
Jan	AgriSea	Jan	Wuxal Amino		Wuxal Amino	3 l/ha
Jan	AgriSea	10 Jan	AgriSea	19 Dec	AgriSea	2.5 l/ha
Feb	AgriSea	21 Jan	AgriSea	6 Jan	AgriSea	2.5 l/ha
Feb	AgriSea	1 Feb	AgriSea	14 Jan	AgriSea	2.1 l/ha
		21 Feb	AgriSea	30 Jan	AgriSea	2.1 l/ha
				8 Feb	AgriSea	2.1 l/ha
Soil nutrient applications						
Compost applied to three quarters of organic area.		Compost		Dried blood, compost tea, fish, seaweed, humates.		
		GibMag				
		Ulexite				
		Vitaphos				
		Durasul sulphur and dunite				
		Liquid compost				

Conventional					
Year 1	**Year 2**		**Year 3**		
Foliar Nutrient applications					
AgriSea - Fortnightly	30 Nov	AgriSea	7 Nov	AgriSea	2.5 l/ha
		Budbuilder	22 Nov	AgriSea	2.5 l/ha
	13 Dec	AgriSea		Biomin Booster V	0.5 kg/ha
		Budbuilder		Biomin Boron	0.5 kg/ha
	24 Dec	AgriSea	4 Dec	AgriSea	2.5 l/ha
	10 Jan	AgriSea	19 Dec	AgriSea	2.5 l/ha
	21 Jan	AgriSea	6 Jan	AgriSea	2.5 l/ha
	1 Feb	AgriSea	15 Jan	AgriSea	2.1 l/ha
	21 Feb	AgriSea	30 Jan	AgriSea	2.1 l/ha
			8 Feb	AgriSea	2.1 l/ha
Soil nutrient applications					
Calcium Nitrate (x1) Kristalon Orange (x1)	Not recorded		January	Kristalon White	2.5 g/plant

Gibbston Valley Wines

How did we manage the soils?

A big downside of the conventional regime on our hilly site is erosion. The soil of the undervine weed strip is hard and compact, with a lack of organic material and nothing to retain moisture. As a result, water runs off, making little rivulets which head to the midrow and compacted tractor marks. Once there, the rivulets join up, making larger waterways rushing down the hill and eroding away fragile topsoil.

Whilst initially concerned about organic management making the erosion issue worse, we have found the opposite has been the case. In the organic blocks, the undervine cultivation and increased ground cover have been responsible for greater water retention and greater water penetration into the subsoil profile, resulting in much less erosion.

This was a little at odds with people's perception of the gutters that tend to be created from the undervine mounding, however the blading essentially fills these in, and as long as the cultivation doesn't occur prior to a rain event, the effects are negligible.

Soil monitoring results

Soil Type: Typic Argillic Semiarid Conroy (Hill Type) sandy loam

Pinot Noir		**Organic**			**Conventional**		
		2011	**2012**	**2013**	**2011**	**2012**	**2013**
Earthworm numbers *(per m^2)*		58.3	66.7	250	45	16.7	195.8
Earthworm Weights *(kg/ha)*		649.2	268.3	1370.8	85	57.5	736.7
Compaction	Vine row	0.69	1.44	0.75	1.03	1.38	1.49
(mPa or mega Pascal)	Interrow	1.09	3.04	0.86	1.09	3.9	1.26
	Track	2.35	6.9	1.38	2.18	5.17	1.95
Soil Bulk Density *(kg/l)*	Interrow	1.25	1.33	1.52	1.39	1.39	1.6
Soil Moisture *(%)*	Interrow	15.5	10		14.3	8.0	
Water Infiltration *(mm/hr)*	Row	12.9	26.5	53	0.4	0.7	0
	Track	0.2	0.2	0	0.4	0.3	0.2
	Interrow	2	0.3	0.1	0.8	1.1	0.1

Pinot Gris		**Organic**			**Conventional**		
		2011	**2012**	**2013**	**2011**	**2012**	**2013**
Earthworm numbers *(per m^2)*		79.2	187.5	137.5	45.8	12.5	154.2
Earthworm Weights *(kg/ha)*		548.3	596.7	660.8	345	26.7	668.3
Compaction *(mPa)*	Vine row	1.15	1.55	1.26	1.38	1.44	1.15
	Interrow	1.15	2.01	1.21	1.49	2.7	1.55
	Track	3.10	5.0	2.12	2.76	5.4	1.84
Soil Bulk Density *(kg/l)*	Interrow	1.26	1.31	1.68	1.37	1.38	1.67
Soil Moisture *(%)*	Interrow	13.5	11.9		9.1	7.9	
Water Infiltration *(mm/hr)*	Row	8.8	8.0	0.4	0.5	2.0	0.1
	Track	0.1	0.1	0	0.4	0.1	0
	Interrow	1.1	0.7	0.1	4.4	0.8	0

- Water infiltration rates in the organic Pinot Noir block were markedly different to the conventional block. Row infiltration rates have increased over time as a result of soil cultivation, which has in turn reduced surface runoff and erosion issues for the block.

- The majority of soil physical properties showed no clear trend in the three years as a result of the change in management to organic.

Gibbston Valley Wines

Topsoil erosion, conventional block

Runoff and topsoil erosion, conventional block

Vineyard Floor Management

This section discusses

- **How to manage undervine and interrow under organic production**
- **How much did undervine weed management cost?**

Vineyard floor management

- Weed control proved one of the biggest challenges for all three vineyards. However, all vineyard managers believed that they had achieved good weed control.
- Organic weed control improved each year, as vineyard managers focused more on reducing competition each season.
- Irrigation lines need to be lifted up out of the way of weeding equipment.
- All young vines, risers, etc. need to be staked to protect them from the weeder.
- Stony soils can provide additional challenge in terms of weed control, as stones are brought up by cultivation. This required additional labour to remove stones.
- Using a weeding contractor to start with can be a sensible option, to experience different organic weeding options before investing in your own equipment.
- Due to organic blocks requiring more passes, the costs of weed control in organic blocks were higher than the costs in the conventional blocks.

Management strategies for vineyard floors in an organic system

Bart Arnst – Viticultural Consultant

- Mow every second row once frost danger has passed, mowing alternate rows on the next pass. This encourages flowering of interrow crops, which contribute pollen for insect life, supporting an increase in biodiversity.
- Mulch prunings in combination with a good growth of ground cover crops (grasses, clovers, etc.). The combination of shredded prunings with cover crops helps to break down the pruning wood.
- Early season weed management is important. Whether undervine cultivating or mowing, aim for a clean understory pre-budburst. This will give the vines the best chance to maximise vigour.
- Timing of weeding operations is important. Cultivation is most effective when the soil is drying, as hotter, drier weather promotes die-off of weed roots. However, there are no hard and fast rules; weed when necessary to reduce competition with vines.
- Choose your weeding strategy and equipment based on an ecological understanding of your vineyard. This includes a consideration of soil type and vineyard history. If vine roots are concentrated close to the surface, consider how you will help them go deeper over time, to adapt to organic weed management.
- Monitor changes in pruning weights in order to pick up any changes in vigour early on. This will alert you to any impacts your weed management strategy may be having on the vines, before such changes become visually apparent.

Lessons learnt from undervine cultivating

Focus vineyard managers offered the following tips based on their own experiences.

- Lift irrigation wire to 500mm so it is above the weeder sensor bar.
- Young vines planted within established blocks need to be protected. There needs to be something strong and rigid to activate the sensor arm so that the blade can retract and move around the vine. Either two bamboo stakes around each vine, or a 10mm steel rod ($2.00 per rod).
- For the first pass with the disc, each row was driven twice, to break up the soil that had been compacted on the edge of the wheel tracks in past years.
- After the initial "mounding up" stage of cultivation, you don't need to cultivate too deeply. If you cultivate deeply, the weed roots seem to sit in the same place and then with irrigation or rain easily and quickly reroot and establish. Instead a shallower cut takes these weeds out, pulls them from their location and moves them slightly down the row, which disrupts the weed roots.
- Speed. If you go too fast, the machine leaves a 'shadow' effect around the base of each vine and post.
- When using a mounding disc, the operator was able to travel faster (about 6 km/hr) down the row, and was less likely to damage vines, as the implement is fixed. However, for mounding, each row must be travelled down twice, increasing compaction, fuel usage and time to complete the task.
- When using the blades (mounted on both sides of the tractor), the operator is able to travel at approximately 4 km/hr.
- Soil moisture needs to be right; if it's too wet, weeding is ineffective.
- If weeds get too big or too high, the sensor bar gets tripped and weeds are not removed.
- Plan bud rubbing rounds with weeding rounds in mind, so that you remove the most buds possible without covering them up with the weeder.
- We mounted an old spray unit on the back of the tractor used for weeding, which meant we were able to spray a fertiliser mixture every time we did a weeding pass.
- If on stony soils, undervine weeding may toss rocks out into the row. To try and get the rocks back undervine, attach an A-frame implement to the 3-point linkage, which pushes them out to the edge of the row.

Mission Estate

Key Points - Vineyard manager

Our Mere Road vineyard on the Gimblett Gravels is a low vigour site. We thought controlling undervine vegetation through mowing would limit growth too much, and so decided that cultivation was the best option.

Weed control the biggest challenge. Weed control has been the most difficult challenge in the overall organic conversion process. This was especially so in wetter seasons. However, the further we went down the path, the easier it became. We have noticed fewer of the aggressive weed species compared to when we first began cultivating.

When starting out, use a contractor. Use a contractor to start with for weed control, and look at the various options before you invest in a weeder of your own.

First cultivation pass (the 'mounding up' pass) is the most important pass, as you set the area up for cultivation under the vine. You need to be aware of the width of the implements to make sure your wheel width is significantly within the space between the cultivated strip, to avoid 'tracking' of vineyard equipment.

Keeping weeding costs down. The biggest challenge going forward will be how to keep weeding costs as low as possible while still being effective.

Weed management overview

		Organic	Conventional
Method / product used	Year 1	Moteo Ridge single sided front mounted cultivator	Roundup, Burnout and Buster
	Year 2	Cultivation – Ridgeback (single sided) and Tournesol	
	Year 3	Cultivation with Tournesol and Clements mechanical weeders	
Number of weed management passes and when	Year 1	4 passes	3 applications August, October, December
	Year 2	4 passes August, October, November, December + one hand weed in January	3 applications August, October, December
	Year 3	2 passes (1 pre bud-burst, 1 early Jan)	2 applications (1 pre bud-burst, 1 early Jan)
Width of weeding strip	90 cm		90 cm
Weed species present	Clover, mallow, annual grasses, fathen, couch		Clover, mallow, annual grasses, fathen, couch
Problem weed species	Year 2 - Mallow, couch Year 3 - Fathen		Year 2 - Mallow, couch Year 3 - Fathen, couch

Mission Estate

Seasonal performance of weed control

Year 1

- We achieved very good weed control in the organic blocks with the undervine cultivator.

Year 2

- Very good control of weeds
- In the first 'mounding up' cultivation phase this year, in our second year of cultivation, the soil turned a lot more easily than it did this time last year.
- We put the Tournesol through the organic blocks, as the mounding up phase hadn't broken down the soil sufficiently for blade cultivation to work. It did a fantastic job in terms of levelling and breaking down the mounds, which sped up future cultivation passes.
- Clumps were building up around the bases of vines in the organic blocks, so we had to walk through and remove with spades, a reasonably labour-intensive task.

Year 3

- We tried cultivating without 'mounding up,' as there was already a significant mound still in place from last season that we could cultivate using our undercutting blade.
- The Tournesol cultivator was put through the organic blocks to tidy up some of the remaining weeds.
- Only two passes were made this year, and as a result, weed control was quite erratic in the organic blocks, with a number of clumps building up around the bases of vines.

Weed control costs

	Merlot Organic $/Ha	Merlot Conventional $/Ha	Syrah organic $/Ha	Syrah Conventional $/Ha
Year 1	707	383	707	160
Year 2	623	335	623	351
Year 3	182	202	182	210

- Weed control required more passes organically than conventionally in the first two years, which increased the cost of undervine management.
- In Year 3, only two undervine cultivation passes were made, compared to Year 1 and 2 which had four passes.
- Weeding costs decreased in Year 2 and 3 due to Mission Estate purchasing their own equipment, rather than contracting out cultivation as done in Year 1.

Wither Hills

Key Points - Vineyard manager

"The biggest test around weeding is the strength of character in you, as the manager or owner, to allow your vineyard to look 'rustic,' and to change your belief of what a vineyard 'should' appear to look like from the outside."

Stony soils, which under previous management meant the rocks were largely undisturbed, have caused major problems. Cultivation of the interrow and undervine have unearthed rocks — a lot of them, and some dangerously big. Because of the hazard for machinery and staff, we picked up the large rocks and kept the number of passes cultivating the interrow area to a minimum.

The Braun undervine weeder was chosen, rather than an undervine mower, due to stony soils.

A change in weed species became apparent undervine as we moved to organic management – from mallow as the dominant weed, to fathen.

Impact on growth rate – In Year 1, the organically managed Pinot Noir was behind the conventional block from bud burst through to veraison. Although a difference in rootstocks may be involved, we also suspect that the undervine weeding had an impact on the growth rate – we did four passes with the scallop edged mounding disc, cutting the surface feeder roots. This is something to be aware of, particularly on compacted soils like ours, where vine roots may not have penetrated deeply into the soil. Other organic growers have said that vines may show stress in the first couple of years of organic management, until their roots become more deeply established.

Weed control costs

	Pinot Noir Organic $/Ha	Pinot Noir Conventional $/Ha	Sauvignon Blanc Organic $/Ha	Sauvignon Blanc Conventional $/Ha
Year 1	1,292	387	1,600	479
Year 2	1,271	437	780	238
Year 3	1,217	580	832	638

- Weed control costs varied seasonally.
- Weed control costs for the organic blocks using undervine cultivation were significantly higher than the cost of conventional herbicide sprays.

Mowing costs

- Mowing costs were generally higher in the organic blocks than in the conventional, as the vineyard floor was completely herbicided in the conventional blocks for early season frost protection.
- Mowing costs were reduced in the organic blocks in Year 3 as every other row was cultivated, decreasing the amount of hectares to be mowed.

Wither Hills

Weed management overview

		Organic	Conventional
Method / Product used	**Year 1**	Braun undervine weeder	Roundup, Goal Advanced , Buster
	Year 2	This machinery has a cultivating blade and a mounding disc.	Roundup, Amitrol, Buster, Li700, Tyllanex
	Year 3		Roundup, Goal Advanced, Li700, Latron, Browndown, Digester. Pinot Noir also received Tyllanex, Buster
Number of weed management passes and when	**Year 1**	4 passes We used the mounding disc more this season to mound the soil under the vines in winter, and then we mounded once more early in the season. We then used the blade to cut away at the soil that had been mounded.	2 applications Pre-budburst Late January
	Year 2	**Pinot Noir** - 5 passes Aug - soil mounded with mounding disc Sept - blades Nov - soil mounded with mounding disc Nov, January - blades **Sauvignon Blanc** - 3 passes Aug - soil mounded with mounding disc Nov - soil mounded with mounding disc Jan - blades	3 applications August November January
	Year 3	**Both blocks** - 5 passes (strong growing year along with increasing plant diversity in the understory) Start Sept - soil mounded undervine End Sept - blade Oct, Nov, mid-Jan	2 applications Pre-budburst December
Weed strip		50 cm	1m
Weed species present	**Year 1**	Rye grass, cocksfoot, fathen, nightshade, clover, willow herb, mallow	Rye grass, cocksfoot, fathen, nightshade, clover, willow herb, mallow
	Year 2	Thistle, fathen, mallow	Grasses, clover nightshade, fathen, mallow, Californian thistle, willow herb
	Year 3	Increasing levels of wild mignonette and woolly mullein in dry stony areas of SB, and creeping speedwell in the cultivated rows	Amaranthus, Californian thistle, mallow, scrambling speedwell
Problem weed species	**Year 1** - Mallow **Year 2** - Fathen **Year 3** - Unknown		**Year 1** - Willow herb, mallow **Year 2** - Mallow, Californian thistle **Year 3** - Unknown

Wither Hills

Mowing

	No. of passes with mower	
	Organic	**Conventional**
Year 1	Pinot Noir: 3 S. Blanc: 5	Pinot Noir: 1 S. Blanc: 2
Year 2	Pinot Noir: 5 S. Blanc: 3	Pinot Noir: 1 S. Blanc: 1
	• Our organic blocks need more passes on the mower than conventional blocks because the conventional blocks are completely 'sprayed out' with herbicide, including the interrow area, in spring, as a way of dealing with frost risk. • We think Pinot Noir needed more mowing passes because it is one year more advanced in the conversion process, so the interrow sward is more developed, while the Sauvignon Blanc organic block is still slowly regenerating with volunteer species. This, combined with the lighter soils in the Sauvignon Blanc, may contribute to lower weed pressure undervine and interrow in the Sauvignon. • There is no permanent frost protection in the Pinot Noir, so there is a need to keep the grass short during frost season to reduce the risk of frost damage. The Sauvignon Blanc is protected by a wind machine, which may reduce the frost risk and reduce the need for extra mowing. • Because of the continued problem of rocks being brought up during cultivation, mechanical operations in the organic blocks tend to be a bit slower than in the conventional.	
Year 3	Pinot Noir: 5 S. Blanc: 3	Pinot Noir: 3 S. Blanc: 3
	Generally a broadcast herbicide application in the conventional blocks early season means that there is less mowing in these blocks. However, both the conventional and organic S.Blanc were mowed three times. We achieved this by allowing the midrow of the organic block to grow higher than normal. Also, the rocky nature of the soil meant that weeds struggled to grow to a significant height.	

Wither Hills

Organic interrow crops

	Crop	Block	Rate	When sown	Sown every…	Comment
Year 1	Omaka barley	Sauvignon Blanc	120 kg/ha	Spring	2nd row	Barley was sown to build soil structure. Dug in post-harvest to increase soil fertility.
	Buckwheat and *Phacelia*	Both blocks	Buckwheat 35 kg/ha *Phacelia* 3 kg/ha	Spring	10th row	Sown to attract beneficial insects.
Year 2	Lupin Black oats	Both blocks	Lupin 50 kg/ha Black oats 50 kg/ha	Autumn	2nd row	Sown to act as a nutrient source for vines. Disked back into soil.
	Buckwheat and *Phacelia*	Both blocks	Buckwheat 35 kg/ha *Phacelia* 3 kg/ha	Mid-October	10th row	Planted to attract beneficial insects. Once flowering it was topped in every 4th bay to encourage longer flowering.
Year 3	Lupin and oats	Both blocks	Lupin 50 kg/ha Black oats 50 kg/ha	Autumn	2nd row	Winter cover crop to increase nitrogen levels. Also help to reduce early season frost risk. Mulched and disked back into soil late September so nutrients could be unlocked for spring growth.
	Clover-heavy mix containing grasses and herbs	Sauvignon Blanc	17 kg/ha	Autumn	2nd row	Sown to increase vigour in organic block. Clovers include crimson, subterranean and red – for spring nitrogen, building organic matter and nectar for beneficial insects.
	Buckwheat and *Phacelia*	Both blocks	Buckwheat 45 kg/ha *Phacelia* 5 kg/ha	Beginning of November	10th row	Planted to attract beneficial insects. Reasonable soil moisture meant crops thrived. Once flowering, topped every 4th bay to encourage a longer flowering for the duration of the summer.

Gibbston Valley Wines

Key Points - Vineyard manager

- The School House vineyard site is not overly vigorous, and heavy weed competition can cause problems with vigour, soil moisture and vine health.
- We used the Braun undervine weeding system. The process basically takes a little soil from beside the vine and mounds it up underneath the vine row. Then we worked with that soil using a weeding blade.
- For us, the major cost of conversion was adapting the vineyard to accommodate this type of machinery, lifting the existing irrigation dripline up out of the way to a height of about 40cm. We also needed to stake young vines and protect irrigation flush valves, solenoids, etc.
- A lot of rocks were kicked out during the first weeding pass, requiring a tractor and trailer to follow through to collect all the large rocks (a full day job).
- The vineyard is very dry and dusty, so cultivation was timed to occur shortly after rain, and when there was no forecast of additional rain. This lessened the impact on machinery, provided better results and prevented erosion.
- Erosion from weeding was not an issue. The worked soil from the undervine cultivation and increased ground cover meant greater water retention in the organic blocks. This was at odds with people's perception of the gutters that are created from undervine mounding; the blading fills these in, and as long as the cultivation doesn't occur prior to a rain event, the erosion is negligible.
- Vigour in the organic block was an issue. We think this could be related to a number of undervine factors, including:
    1. Undervine weeding passes cutting established vine roots
    2. Weed competition
        - Inter-vine weed cover, which is easily managed, though it does compete.
        - Grasses and legumes that hug the trunks of the vines. Sometimes the blade catches these, especially when the wings are on; sometimes it doesn't. Drippers were moved from directly next to the vines to a third of the way along the inter-vine area in an effort to combat this.
        - Width of the weed strip. The interrow sward prior to organic conversion was very narrow. So there is a significant area around the vines that was formerly bare earth and is now covered in competing vegetation.
- In Year 2, we did a hand weeding pass in the 13 rows of Pinot Noir 777, which was a particularly weedy block with poor vigour.
- In Year 3, we tried to keep on top of weeds a bit more and reduce early season weed competition.
- The weeding itself went pretty well. We were fortunate that the vineyard was well established, and therefore lost very few vines to mechanical damage.
- Timing is crucial with weeding. We used an outside contractor and so weeded when gear was available. Ideally one would have the luxury of being able to choose the best days to weed.

Focus Vineyard 3

Gibbston Valley Wines

Weed management overview

		Organic	Conventional
Method / product used		Braun undervine weeder	Glyphosate
Number of weed management passes	**Year 1**	2 passes Before flowering During veraison	2 applications Start of growing season During veraison
	Year 2	3 passes Sept, Dec, March + hand weed	2 applications Sept, Jan
	Year 3	2 passes Oct, Jan + hand weed	2 applications Sept, Feb
Width of weeding strip		80 cm	100 cm
Weed species present	**Year 1**	Fathen, clover, viper's bugloss, sorrel	Fathen and clover
	Year 2	Lucerne, various grasses, clover, shepherd's purse, mallow	Grasses, clovers, fathen, nettle
	Year 3	Clover, grasses, fathen, mallow, horehound, Californian thistle	Clover, grasses, fathen, mallow, horehound
Problem weed species	**Year 1**	Fathen growing directly beside the vines was missed because of the sensor arm.	Fathen and clover
	Year 2	Grasses and lucerne	Fathen
	Year 3	Clover, grasses, fathen, mallow, horehound	Clover, grasses, fathen, mallow, horehound

Organic interrow crops

- Interrow cultivation was done every tenth row, to grow buckwheat, *Phacelia, Alyssum* flowering mix and some oats/lupins.
- We either planted early while we had moisture to get a strike, but then risked frost to the buckwheat in particular; or risked planting later. The issue with planting later is that typically the vineyard gets very dry and then we don't get a strike anyway. We tried both early and late but neither did very well. We always had some success, just not as prolific as we would like.
- If you interrow cultivate, we have found that you boost vigour. So depending on where in NZ you are, the grape variety in question, and perhaps whether you are undervine cultivating or mowing – you can use interrow cultivation to varying degrees to find your own vigour balance.
- In year 2, we noticed different species emerging in the organic blocks. Though only early in the game, there appeared to be a shift in the organic blocks to different (and more diverse) interrow species.

Organic interrow crops			
Year 1	Buckwheat and *Phacelia*	• Every 10th row • Buckwheat 45 kg/ha • *Phacelia* 5 kg/ha • Sown in 1.2m wide strip down the middle of the row.	• Planted mid-October • Great strike, but buckwheat badly damaged by frost. *Phacelia* fine. • Planted to attract beneficial insects for leafroller protection.
Year 2	Buckwheat and *Phacelia*	• Every 10th row • Buckwheat 45 kg/ha • *Phacelia* 5 kg/ha • Sown in 1.2m wide strip down the middle of the row.	• Planted first week December to avoid frost. • Excellent strike of buckwheat. *Phacelia* was less successful.
Year 3	Buckwheat/*Phacelia*/ *Alyssum* flowering mix	• Every 5th row	• Staggered sowing two weeks apart to manage frost risk and spread the flowering period.
	Oats and lupins	• Every 2nd row of organic Pinot Noir 777 block	• Planted to break compaction, increase N mineralisation and boost organic matter. Seeds inoculated with VAM product to increase fungal biomass.

Weed control costs

	Pinot Gris Organic $/Ha	**Pinot Gris Conventional $/Ha**	**Pinot Noir Organic $/Ha**	**Pinot Noir Conventional $/Ha**
Year 1	576	307	581	312
Year 2	857	470	863	474
Year 3	1395	345	1393	350

- Organic weeding costs were high in Year 3 due to a hand weeding operation to eliminate grasses around the base of vines in particular areas.

Canopy and Crop

This section discusses:

- **How did organic production influence canopy and crop management?**
- **What was the effect on vine vigour, grape maturity and yield?**

Canopy and Crop Summary Points

- Mission Estate did not notice any differences in canopy or crop development during the conversion to organic management, and therefore continued with the same crop and canopy management programme as on their conventionally managed blocks.
- The Mission Estate organic block's yields and ripening remained similar to the conventional block throughout the conversion period.
- Wither Hills' organic Sauvignon Blanc for the first two years did not show any differences in canopy or crop development. In Year 3, the vigour of the organic block reduced, and whilst both blocks had a high-yielding season, the conventional block yielded significantly more.
- Wither Hills' organic Pinot Noir in Year 1 and 2 showed significantly reduced vigour, unacceptably low yields and delayed phenological development. In Year 3, after significant viticultural inputs, vigour was improved and fruit quality was improved.
- Gibbston Valley's organic Pinot Noir block in Year 1 had slower growth rates than the conventional, and vines were a lighter green colour than conventional blocks. (However, a diversity of clones in the Pinot Noir blocks limits our ability to make direct comparisons.) By Year 3, with adaptive management, the vines were doing well.

Mission Estate

Canopy and crop management

Over the three year period of organic conversion:

- We did not notice any changes to the vigour of the vines, or difference between organic and conventional.
- Phenological dates remained the same in the organic blocks as in the blocks under conventional management.
- The organic blocks required no different canopy and crop management to the conventional blocks.

Sample Canopy and Crop Management Programme – Year 1

Pruning	Mix of cane and spur
Shoot growth	Similar across both the organic and conventional Syrah and Merlot
Shoot thinning	Shoot thinning undertaken to allow an open, well ventilated canopy and to balance vines. On cane pruned vines – removed double shoots and shoots coming from underneath and crossing at ends. On spur pruned vines – left two shoots per spur.
Leaf plucking	Collard leaf plucker removed caps from bunches, to assist with late season botrytis control. All blocks were 100% leaf plucked around the bunch zone early in the new year.
Tucking	Tucked five times to keep the canopy upright, growing vertically. Tucking wires were then clipped together with lock clips to better hold foliage in wires.
Trimming	All blocks trimmed. A final trim was done before nets on.
Crop thinning	Crop thinning carried out across all blocks, with a final colour thin before nets went on.

Year 2

- The phenological timings and physical development of canopy and crop were the same for the organic blocks as for the conventionally managed blocks.
- Shoot growth along canes was steady, but patchy in both Merlot and Syrah blocks in early spring.
- The dry spring brought on flowering quickly. Canopy growth was slow.
- Both the organic and conventional blocks had the same pruning and canopy and crop management, including thinning.
- We noticed that the trimming and other tractor and machinery operations within the organic vineyard have been slowed down considerably due to the uneven terrain created by undervine cultivation.

Year 3

- Again the phenological timings and physical development of canopy and crop were the same for both blocks for each variety.
- Both the organic and conventional blocks had the same pruning and canopy and crop management, including thinning.
- The vines were well balanced, with an ideal crop load to leaf area. Bunch exposure was excellent, and the fruit was very ripe and clean at harvest.
- Machinery operations within the vineyard continue to be slow due to uneven terrain.
- We were blessed with ideal ripening conditions, resulting in excellent fruit maturity and quality in both the Merlot and Syrah blocks.

Mission Estate

Yield and harvest data

- Crop thinning was carried out on all blocks and varieties in all three years.
- We didn't experience any differences in ripening between the organic and conventional blocks, with quality very high across both growing regimes.
- There was no real difference in Brix, TA or pH between the organic and conventional blocks.
- The quality of our grapes continued to be excellent.
- The yields in the organic blocks have remained similar to those in the conventional blocks. However, in Year 3, the organic Syrah yielded 10 percent less than the conventional Syrah.

	Merlot Organic			Merlot Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine			20			20
Brix (%)	19	23.5	23.5	19.2	23.5	23.5
TA (g/l)	6.4	6.9	5.6	6.4	6.9	5.6
pH	3.4	3.3	3.5	3.4	3.3	3.5
Yield (kg/vine)	2.2	2.7	2.7	2.3	2.8	2.7
Yield (t/ha)	4.84	6.1	5.9	5.02	6.2	6.0
Harvest date	Organic and conventional blocks were harvested on the same day in all three years.					

	Syrah Organic			Syrah Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine			16			16
Brix (%)	23	22.4	22.8	22.6	22.5	23
TA (g/l)	9	7.6	7.1	9	7.6	7.1
pH	3.1	3.36	3.4	3.1	3.34	3.45
Yield (kg/vine)	1.6	2.9	3.0	1.65	3.0	3.4
Yield (t/ha)	3.56	6.4	6.7	3.67	6.7	7.4
Harvest date	Organic and conventional blocks were harvested on the same day in all three years.					

Sauvignon Blanc - Canopy and Crop Management

Year 1

The Sauvignon Blanc vines were pruned to a four cane VSP. Canopy growth in the organic block was less vigorous than in the conventional, but fruit maturity was on par. Leaf plucking was the same, with both organic and conventional undergoing one Collard and two Hills passes. The organic block had one trim and the conventional had three. Both were clean of pests and disease, and there were no significant differences in maturity and crop levels. All Sauvignon Blanc was harvested on the same day.

Year 2

The Sauvignon Blanc vines were pruned, skirted, trimmed twice and leaf plucked once. (Trimming and mechanical leaf plucking were done at the same time – both implements on one tractor.) Both blocks had the same canopy and crop management, phenological timings and crop development. Crop thinning was not carried out in the Sauvignon Blanc blocks.

Year 3

Observing the organic Sauvignon Blanc over the past three seasons, there has been a significant shift in the vegetative vigour of the vine. This has been most noticeable this last season, with excess vegetative growth greatly reduced, leading to a better balanced canopy with less urgency for trimming and leaf plucking. Although both the organic and conventional Sauvignon Blanc blocks had high yields this season, the conventional was significantly higher, with more and bigger bunches per vine. The high conventional yield may have had impacts on conventional wine quality, however (see wine chapter for details). Crop thinning was not carried out in the Sauvignon Blanc blocks.

Yield and harvest

	Sauvignon Blanc Organic			Sauvignon Blanc Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine	55	67	60	55	64	68.5
Bunch weight (g)	93	111	129	93	107	161
Brix (%)	22.3	22.6*	21.3	22.3	22.6*	20.5
TA (g/l)	10.13	9.85*	9.53	10.13	9.85*	9.08
pH	3.09	3.2*	3.18	3.09	3.2*	3.20
Yield (kg/vine)	3.64	5.6	7.4	4.03	5.6	11.3
Yield (t/ha)	9.25	14.2	18.8	10.05	14.2	28.1
Harvest date	Organic and conventional blocks were harvested on the same day in all three years					

*Separate data were not obtained, as the two blocks went into the same tank at the winery.

End of Season Pruning

	Organic		Conventional	
	Year 2	***Year 3***	***Year 2***	***Year 3***
# of canes	32	31	28	33
Average cane weight (g)	41	50	59	49
Total pruning weight (kg) *(Includes est. weight of leftover canes)*	1.52	1.6	1.65	1.6

Wither Hills

Sauvignon Blanc - Pre-harvest

Organic – March 2012

Conventional – March 2012

Organic – March 2013

Conventional – March 2013

Organic – March 2014

Conventional – March 2014

Wither Hills

Organic Pinot Noir - Canopy and Crop Management

Year 1

- The organically managed block was behind the conventional block in phenological development and had signs of vine imbalance from budburst right through to veraison, when maturity was slower.
- The organic Pinot had more irrigation than the conventional in February, due to vines appearing water-stressed.
- For leaf plucking, the organic Pinot Noir only had a light Collard pass, due to the light canopy growth. No canopy trimming was needed. The conventional had two machine passes (Collard and Gregoire) and one hand pluck.
- Due to the small canopy, it became apparent that the organic vines might not be capable of ripening the crop. The decision was made in early March to reduce the crop load by bunch thinning. The crop was reduced to one bunch per shoot where the shoots were deemed healthy. All bunches were removed where this was not the case.
- The harvest of the organic Pinot Noir took place six days later than the conventional Pinot Noir harvest. The decision to harvest this block was made because the canopy was senescing and we were not getting any further ripening by leaving the fruit out longer.

Possible explanations for reduced vigour and slow development of the organic Pinot Noir:

- vine age – unformed root system
- rootstock different to conventional
- undervine weeding disturbing the root system
- competition from weeds undervine.

Year 2

- The organic Pinot Noir again displayed very low vigour, which meant that some different management was required during the latter half of the season.
- The organic canopy was very light, and there was very little mid to late season growth, hence we didn't trim and only did a light hand pluck in February.
- We thinned the crop in early January to remove excess bunches from small shoots and to decrease the crop load to 4-6 t/ha, taking bunch numbers back to one bunch per shoot where needed.

Year 3

- The organic Pinot Noir had by now experienced various viticultural interventions to increase the vigour and quality of the fruit, including interrow cultivation, ripping, nitrogen-rich cover crops and keeping on top of weed competition.
- The work put in showed signs of success by Year 3. The canopy was healthy, and phenological development occurred on par with the conventional block this season.
- Petiole tests showed a slight improvement in nitrogen to the previous season. Pruning weights increased significantly.
- Although yields remained low, the increase in quality this year surprised the winemakers.

Ultimately we need to increase the yield of the organic Pinot to above its current average of 4 t/ha to make it economically viable for Wither Hills as a company. Pruning weights for the winter following Year 3 show that vigour has increased significantly and that the organic Pinot Noir has a greater fruit-bearing capacity for 2014/2015 season.

End of Season Pruning

	Organic		Conventional	
	Year 2	***Year 3***	***Year 2***	***Year 3***
# of canes	14	12	22	22
Average cane weight (g)	18	68	69	60
Total pruning weight (kg) *(Includes est. weight of leftover canes)*	0.29	0.79	1.65	1.30

Wither Hills

Pinot Noir – Pre-harvest

Organic – March 2012

Conventional – March 2012

Organic – March 2013

Conventional – March 2013

Organic – March 2014

Conventional – March 2014

Wither Hills

Pinot Noir Canopy and Crop Management Summary

		Organic	Conventional
Pruning	Year 1	Two cane VSP	Two cane VSP
	Year 2	Shorter canes were laid, due to there being poor shoot growth and few cane options for tying down.	
	Year 3	Short canes laid again to try and achieve vine balance. Pruning weights are still lower than conventional, but better than last season.	
Stripping	Year 1	No information	No information
	Year 2	Hand stripped	Mechanically stripped with the Langlois
	Year 3	Hand stripped as canes too short for machine	Mechanically stripped with the Langlois
Bud rubbing	Year 1	Bud rubbing is timed to coincide with the November spray round	No information
	Year 2	One bud rubbing pass Very little mid to late season growth	Two bud rubbing passes
	Year 3	No information	No information
Shoot thinning	Year 1	No information	No information
	Year 2	Shoot thinned (Nov) to keep the vine in balance with the aim of achieving better shoot and canopy growth	Shoot thinned (Nov) to optimise the growing conditions for the primary shoots and prevent disease by reducing canopy density
	Year 3	Shoot thinned – 10-15 cm two weeks earlier to encourage stronger growth and larger canes for next season.	Shoot thinned
Trimming	Year 1	No trim	1 trim
	Year 2	No trim	2 trims
	Year 3	1 trim	3 trims
Leaf plucking	Year 1	1 pass	2 passes
	Year 2	Light hand leaf pluck late in the season (February)	Two mechanical leaf plucks: Gregoire followed by Collard at flowering (December), hand leaf pluck in February
	Year 3	2 leaf plucks (Gregoire), no hand leaf pluck as leaf cover was not excessive and disease low	Three mechanical leaf plucks (Gregoire and Collard), hand leaf pluck (Feb)
Canopy	Year 1	Low canopy vigour, needed to have crop removed to achieve ripening. Harvest decision was because canopy was senescing and fruit not ripening any further.	Matured earlier throughout the season – and had earlier veraison and higher brix levels.
	Year 2	What little leaf cover there was, was generally retained throughout the season to help ripen the crop.	The denser, more vigorous canopy required more labour. The vineyard team thinks that this canopy may have led to higher botrytis levels, as well as increased Brix during ripening.
	Year 3	Strong canopy. Canopy looked healthy and the growth stages were similar to conventional block.	Bigger crop and denser canopies compared against the organic. Heavy hand leaf plucking and crop thinning helped to ensure that botrytis was not a problem late season.

Wither Hills

Yield and harvest data

	Pinot Noir Organic			Pinot Noir Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine	19	22	20.3	23	28	27
Bunch weight (g)	83	106	109	85	138	135
Brix (%)	22	24.5	23.8	24.1	27.4	25.3
TA (g/l)	6.68	5.4	6.0	7.2	5.78	5.85
pH	3.33	3.57	3.62	3.52	3.61	3.46
Yield (kg/vine)	1.3	1.7	1.5	1.75	3	3.5
Yield (t/ha)	2.09	4.3	3.9	4.44	7.6	8.7
Harvest date	19th March & 2nd April	8th April	23rd March	27th March	8th April	25th March

Two separate harvest dates are noted in the organic Pinot Noir for Year 1; this was due to slower ripening. 2.66t were removed on 19th March for sparkling base. The remainder was harvested on 2nd April. The 2.66t removed for sparkling are not included in the final 2.09t reported yield, as without the production of sparkling wine the crop would have simply been thinned and dropped due to poor canopy growth.

Crop thinning

	Pinot Noir Organic	Pinot Noir Conventional
Year 1	3 crop thinning passes The decision was made in early March to reduce the crop load by bunch thinning. The crop was reduced to one bunch per shoot where the shoots were deemed healthy. All bunches removed where this was not the case.	1 crop thinning pass.
Year 2	Early January: removed excess bunches from small shoots and to decrease the crop load to 4-6 t/ha, taking bunch numbers back to one bunch per shoot where needed.	Aggressive crop thinning due to high crop loads, to bring the yield in line with our desired yield of 7 t/ha for Pinot Noir.
Year 3	No crop thinning – as the vines had strong canopies to ripen the low-yielding vines.	Severely crop thinned, as early yield estimates put the crop at 14 t/ha.

Gibbston Valley Wines

Canopy and Crop Management

Note: Different clones are present in the organic and conventional blocks in this vineyard, for both grape varieties. Thus observations about the organic and conventional blocks should be viewed independently rather than comparatively.

Year 1

- Frost caused some damage through the middle of the vineyard. With selective shoot thinning, the vines recovered well.
- As the growing season progressed, the organic blocks were slower growing.
- The colour of the canopy was different, with the organic blocks a lighter green. Organic consultant Bart Arnst said that this was something he had also noticed in the first years of organic conversion, almost like a stress mechanism.
- The organic blocks had a higher degree of weed competition. It is possible that this led to growth suppression through reduced water uptake, in combination with the surface root cutting that goes on from weeding.
- There were no differences observed across the blocks with regard to phenology.
- There were no differences in tucking, clipping, shoot thinning, leaf removal or trimming.

Year 2

- Canopy management was based on one factor: vigour.
- Vines were cane pruned, double guyot. Same for both blocks, with more aggressive pruning (to vigour) in areas that had suffered stress the previous year – bony parts of the vineyard, and the organic Pinot Noir 777 clone.
- The organic blocks again showed a lighter green/yellowish colour in various parts of the vineyard. This meant that some of the organic blocks were trimmed, while some of the lower-vigour areas did not need to be.
- Pinot Noir clones were crop-thinned differently according to vigour and according to value. The vigorous block of conventional Pinot Noir Clone 5 was green thinned only and de-clumped, as were the organic and conventional Pinot Gris (though sections on the bony section of the bottom Pinot Gris block were single-bunched). Thus, plants that could handle higher yields were loaded accordingly, and vice versa for the weaker plants with less canopy. The averages fell within desirable cropping windows of 5-6.5 t/ha, in keeping with the $50+ price-point for the Gibbston Valley Pinots off this vineyard.
- The weaker organic Pinot Noir 777 block was targeted for crop thinning earlier (pre-veraison), and it did seem to colour up sooner than the other blocks.

Year 3

- We had a more intensive and holistic approach to canopy management in the organic blocks this year. We especially focused on timing, making sure canopy management practices were carried out at the right times.
- Pruning was quite aggressive in places. We did not measure pruning weights, but generally, the organic blocks definitely had less wood than the conventional.
- More leaf removal on the conventional Pinot Noir Clone 5 and the conventional Pinot Gris, as these are on the heaviest soils and have always had the strongest growth.
- There were no noticeable differences in phenology.
- In Year 3, a better understanding of the block resulted in the vines doing well.

Gibbston Valley Wines

Vigour

Vigour was the number one area where differences showed up in transitioning conventional blocks to organic management. The 12 rows of organic Pinot Noir 777 became particularly low in vigour (2012 - cropping rate of 4 t/ha).

In Years 1 and 2, the vigour in the organic blocks was acceptable, albeit slowly declining.

The vineyard managers believe there were several reasons for this decline.

1) Weeding passes cut established vine roots.
2) Weed competition
    a. Inter-vine weed cover, which is easily managed, though it does compete.
    b. Grasses and legumes that hug the trunks of the vines.
    c. Width of the former weed-strip. A significant area of soil that was bare earth is now covered in vegetation.

- In Year 3, a better understanding of the block resulted in the vines doing well. We addressed some problem areas with regard to pruning, nutrition and water requirements. Pruning adjustments included pruning to vigour and especially pruning quite hard in some of the very bony spots. These areas also received extra water.

- The organic Pinot Noir 777 block recovered well after two hard years. This followed on detailed care for the block, including an application of blood and bone, extra weeding around the base of plants by hand, and attention to detail on pruning (heavier pruning for weaker vines).

- Looking back, we could have given the vines more nutritional support from the start. It can be a big change for the vines from a conventional state to one with a little more competition and alternative nutritional inputs.

Organic Pinot Noir 777 - 12 March 2012

Organic Pinot Noir 777 – 27 Feb 2014

A local organic manager described the effect of converting conventional vineyards to organic as…

"...a crack addict having to quit cold turkey. There is a let-down period where, during the first year of conversion, the vines seem quite content with the new approach and it can often be quite easy. However, the second and third year can be a struggle. Even with proactive management and a thorough nutrition program, one has to expect the vines to sulk somewhat during this phase, as they grow accustomed to their new lodgings. It's almost as if the residual conventional nutrition in the soil becomes exhausted after that first year of conversion and the vines limp through the next couple of years as the soil begins to heal and slowly build its biomass."

Gibbston Valley Wines

Yield and harvest data

Crop thinning - The desirable cropping rate for this vineyard is 5-7 t/ha.

	Pinot Noir		Pinot Gris
Year 1	Bunch thinning and green thinning in keeping with the quality and yield requirements set by the winery team. The sections of the organic blocks that were struggling with vigour received more aggressive fruit thinning.		Bunch thinning and green thinning in keeping with the quality and yield requirements set by the winery team.
Year 2	**Organic** Fruit destined for top end, reserve labels was given full treatment. (For example, the organic Clone 6 had shoulders removed, third bunches removed, short shoots single-bunched.) Due to poor vigour, the organic 777 was single-bunched.	**Conventional** Crop thinning occurred to varying degrees across all blocks. The vigorous block of conventional Clone 5 was green thinned only and de-clumped.	Both organic and conventional blocks were green thinned only and de-clumped (though sections on the bony section of the bottom block were single-bunched).
Year 3	All Pinot Noir had the shoulders removed and was green thinned.		Both organic and conventional had similar potential. All Pinot Gris was treated the same, with crop removed from vines that were showing low vigour or short shoots.

Important Note: For both the Pinot Noir and Pinot Gris, the organic blocks had different clones to the conventional block. This means that organic and conventional yields and other harvest data cannot be compared directly.

	Pinot Noir Organic			Pinot Noir Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine	13.4	13	12.6	12.4	14	14.3
Brix (%)	24.7	24	24.9	25.7	24.6	24.8
TA (g/l)	8.5	7.9	7.1	8.4	7.8	6.6
pH	3.14	3.09	3.23	3.2	3.11	3.29
Yield (kg/vine)	1.63	1.6	1.2	1.34	1.8	1.5
Yield (t/ha)	5.7	5.6	4.0	4.7	6.4	5.2
Harvest date	20th April	16th April	8th April	21st April	17th April	9th April

	Pinot Gris Organic			Pinot Gris Conventional		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Average bunches / vine	12.4	12	12	11.7	13	13.4
Brix (%)	24.3	23.3	23	25	23.5	23
TA (g/l)	8.2	6.8	7.5	8.1	6.7	7.4
pH	3.32	3.19	3.21	3.31	3.24	3.15
Yield (kg/vine)	1.52	1.7	1.4	1.4	1.9	2.2
Yield (t/ha)	5.3	5.9	4.7	4.9	6.8	7.7
Harvest date	28th April	23rd April	10th April	28th April	22nd April	10th April

Soil Moisture and Irrigation

This section discusses:

- **How did organic management affect soil moisture and irrigation?**

Soil Moisture and Irrigation Summary Points

- Irrigation lines need to be lifted for undervine cultivation.
- Early in the season, organic blocks tended to dry out at a faster rate than the conventional blocks.
- Later in the season, soil moisture patterns changed, and there was little difference between organic and conventional sites.
- Organic management seems to have improved the water infiltration into the erosion-prone Gibbston Valley soil.

Soil moisture and irrigation monitoring

- Soil moisture, irrigation and rainfall were recorded at each focus vineyard.
- For each focus vineyard, one grape variety was monitored. Two irrigation scheduling sites were installed, one in the organic block and one in the conventional block.
- Each site had three neutron probe tubes and a water meter. One rain gauge was used for each property.
- From mid-October to harvest, weekly soil moisture readings were collected and graphed. These graphs showed soil moisture at eight depths, summed over the estimated rootzone, as well as rainfall and irrigation application.
- Irrigation readings were collected using a lateral line water meter recording litres flowing past a point, converted to millimetres of irrigation applied.

Mission Estate

Soil moisture deficit, rainfall and irrigation application

- Organic block typically was drier earlier in the season, except in Year 2, when five undervine cultivation passes were done.
- Two years out of three, overall irrigation rates were higher in the organic blocks.

Year 1

- The irrigation stayed at the same height in the organic blocks; covers and stakes were installed around valves and risers to protect these from potential cultivation damage. This was a one-off cost.
- Additional competition from weeds is one possible explanation for soil moisture patterns. This would have continued during the active spring weed growth period, up until either undervine cultivation removed these weeds or vines started to make greater use of deep soil moisture reserves. In the early part of the season, the most active vine roots are near the surface, a similar location to weed roots, while later in the season, grapevines will draw water from lower down in the soil profile.
- Irrigation of 108-125mm was just below the regional average for similar sites also monitored by Fruition Horticulture in 2011-12.

Year 2

- In the organic blocks, we needed to lift the irrigation height. Following this, we also placed additional casing around irrigation risers to further protect them from undervine cultivation.
- The early part of the season was dry, so we irrigated earlier than what we have done in previous years.
- Irrigation at 192-215 mm was about 15-20% higher than similar soil type grape blocks that Fruition Horticulture monitor in Hawkes Bay. The higher irrigation tended to occur in the early part of the season compared to other monitored blocks.

Year 3

- The season had dry weather, which meant that irrigation was kept up leading into flowering. Also high temperatures and periods of strong gusty winds meant that all blocks were continually irrigated through February.
- Irrigation at 159-175mm was about 15-20% higher than similar soil type grape blocks that Fruition Horticulture monitor in Hawkes Bay. This is similar to the previous season.

	Organic			Conventional		
	Rainfall	**Irrigation**	**Average Deficit (% RAW)**	**Rainfall**	**Irrigation**	**Average Deficit (% RAW)**
2012	493	108	-10%	493	125	0%
2013	131	215	-53%	131	192	-49%
2014	224	175	-69%	224	159	-66%

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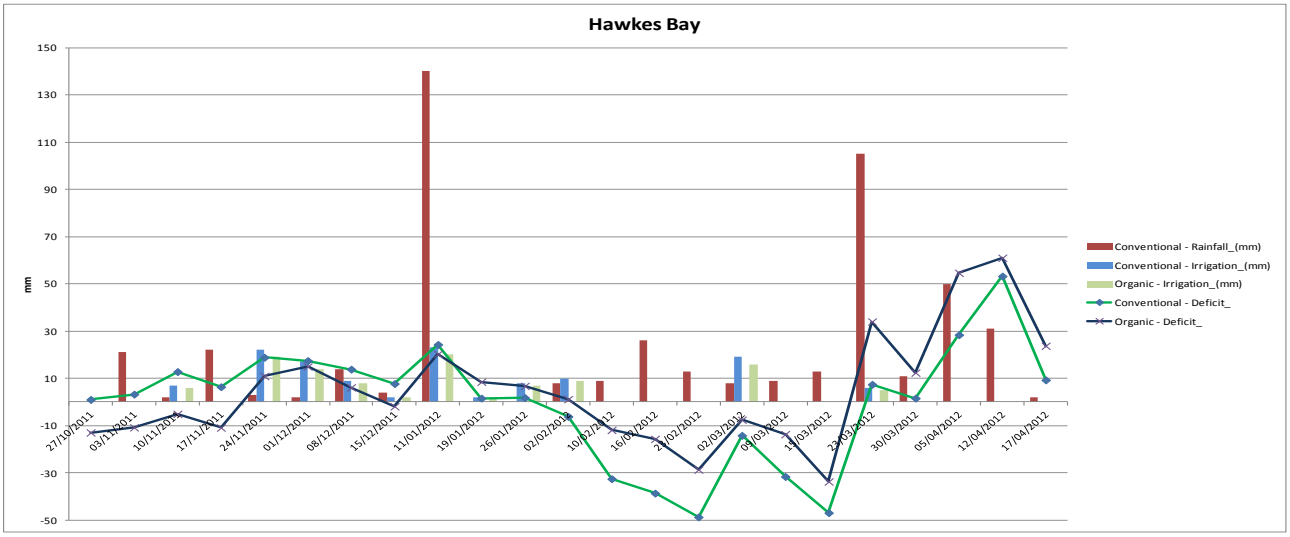
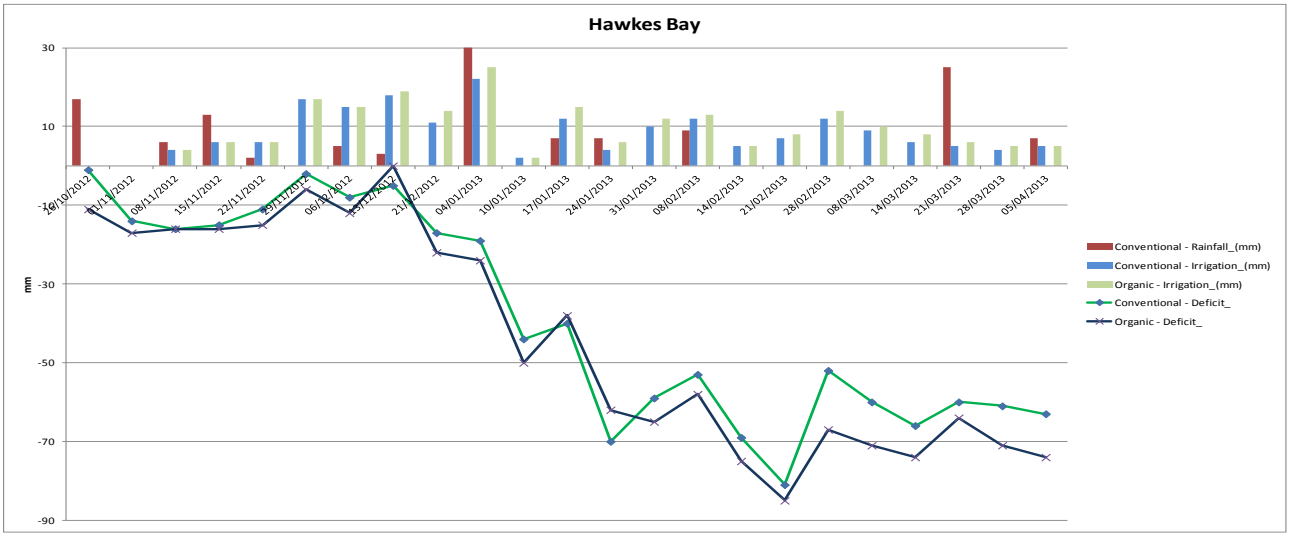
Seasonal comparison

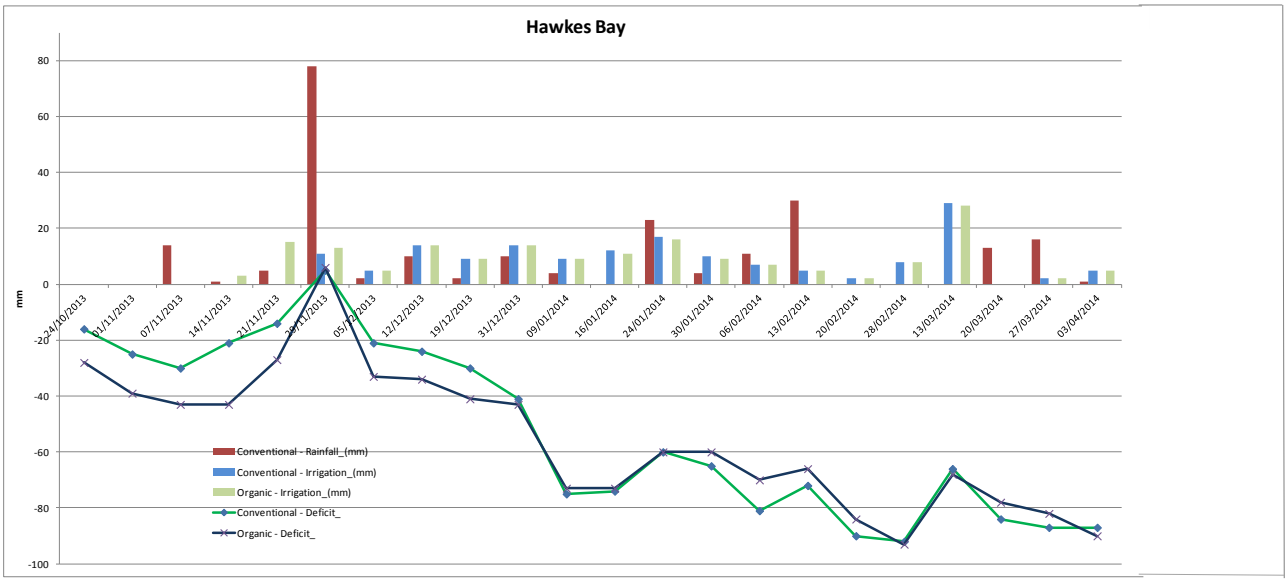
Year 1



Year 2



Year 3



Wither Hills

Soil moisture deficit, rainfall and irrigation application

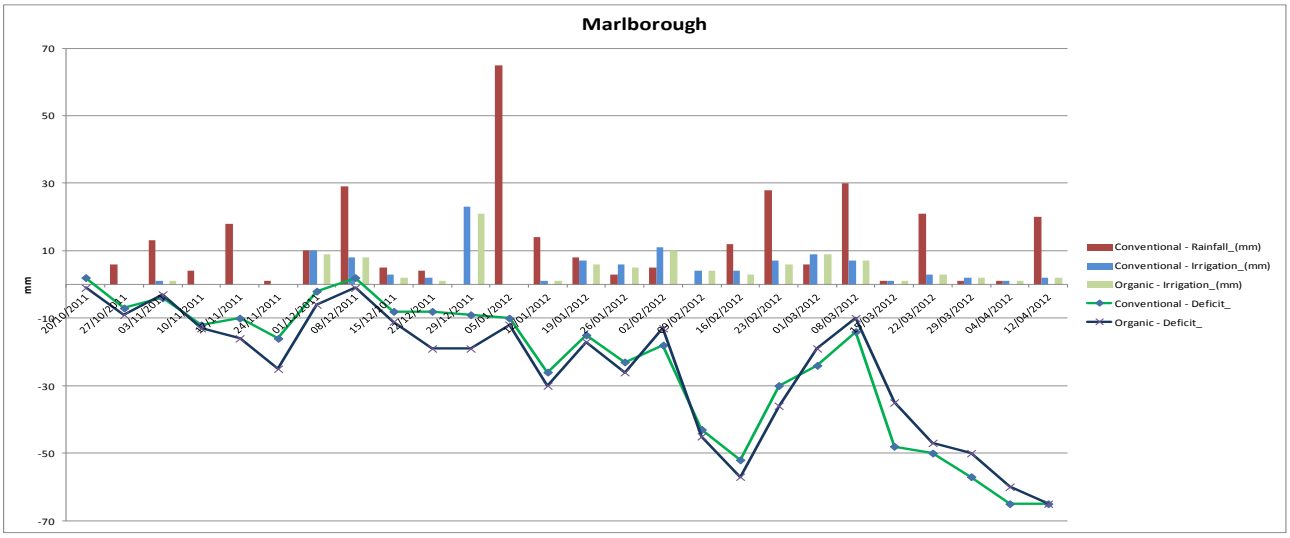
- Irrigation wires were lifted to a height of 500mm above ground to accommodate undervine cultivation.
- The Sauvignon Blanc site was managed so that once the soil had dried out, weekly irrigation application was required to maintain soil moisture above fully depleted RAW levels.
- In Year 1, the organic Pinot Noir had more irrigation in February, due to the vines appearing water-stressed. This could have been due to undervine weeding affecting surface roots, although there could be several other factors at play, such as rootstock or crop levels.
- The organic sites showed greater soil moisture depletion early in the season. Later in the season, the pattern changed, and there was generally not much difference between the organic and conventional sites.
- Year 3 showed a slightly different pattern. The organic site showed much greater soil moisture depletion early in the season. This is unlikely to be due to competition from undervine vegetation, as this block was cultivated five times prior to Christmas 2013. Later in the season, there were no differences between organic and conventional crop use, irrigation application or soil moisture levels.

	Organic			Conventional		
	Rainfall	**Irrigation**	**Average Deficit (% RAW)**	**Rainfall**	**Irrigation**	**Average Deficit (% RAW)**
2012	305	102	-33%	305	112	-30%
2013	160	136	-44%	160	143	-45%
2014	200	157	-68%	200	152	-44%

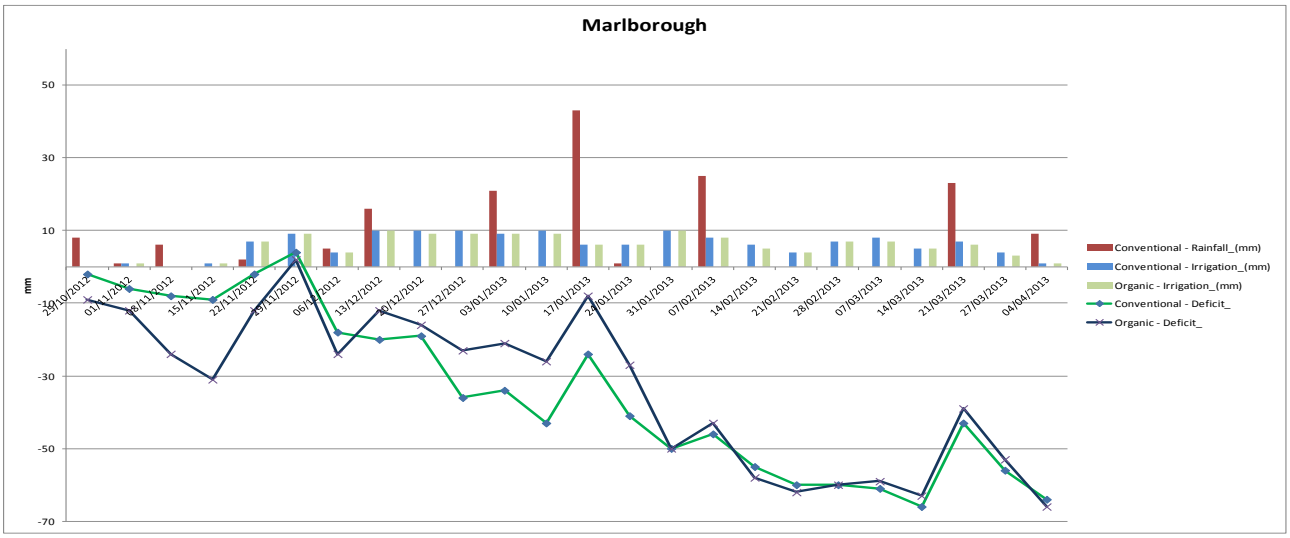
Wither Hills

Seasonal comparison

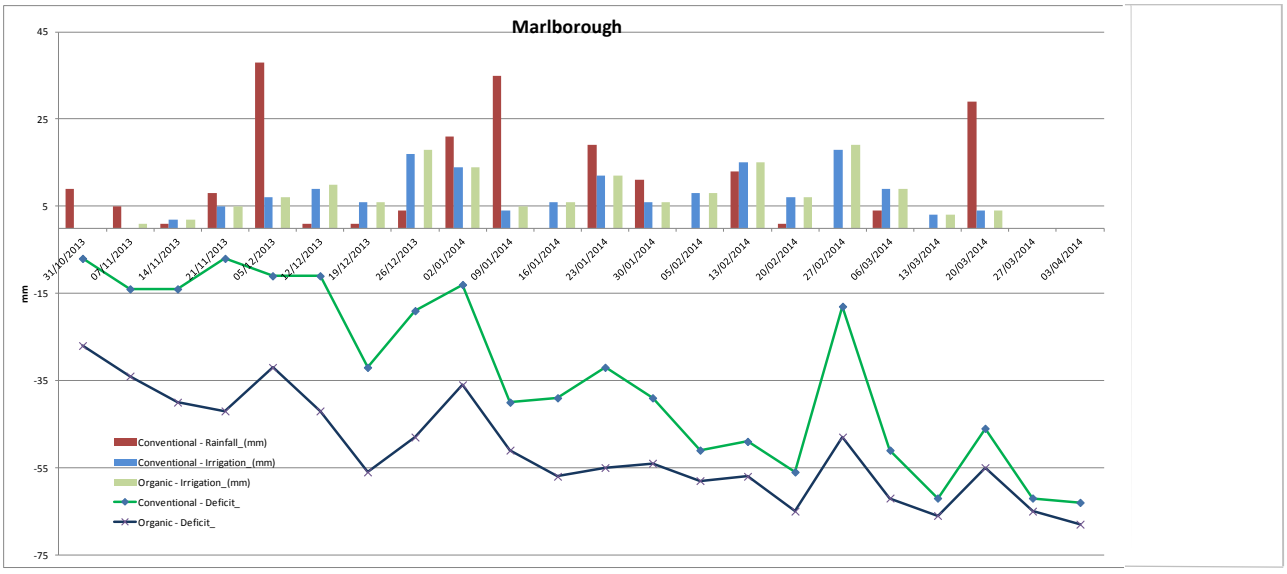
Year 1



Year 2



Year 3



Gibbston Valley Wines

Soil moisture deficit, rainfall and irrigation application

- Organic block was typically drier early in season, except in Year 3.
- Organic block always had higher soil moisture later in season, and appeared to have lower vine water use.

Year 1

- Irrigation was lifted to a height of 400mm to allow the Braun weeder to pass, and prevent drip line damage.
- Metal stakes were used to stake irrigation risers.
- The irrigation was steadily increased throughout the growing season, based on demand from growth.
- Erosion is a problem for the vineyard. Sections of the blocks have considerable runoff. Soil conditions in the organic blocks have started to show greater wetting and ground penetration around the vine.
- Water analyses showed that there was significantly greater water penetration into the subsoil of the organic blocks, particularly after larger, soaking rain events. It is perhaps too early to attribute this to organic management, though the fact that the soil had been worked along with increased ground cover was clearly contributing. Runoff from the organic rows was minimal, compared to the excessive runoff and erosion that occurred from conventional rows.
- To reduce the runoff for all blocks, we increased the number of irrigation cycles whilst maintaining the amount of water applied. So instead of one hour per day, three 20-minute cycles were used to get water down into the soil.

Year 2

- Soil moisture levels again dried out more quickly and were lower in the organic blocks in the early part of the season, until a large unintentional irrigation event occurred in mid-December. After this, the conventional site remained at a lower soil moisture level than the organic.
- Readings from both blocks showed similar water requirements, though as the season progressed, higher amounts of vigour in the conventional blocks meant higher water needs.
- In November we experimented with irrigation soaking – reduced frequency, higher doses – to encourage deeper water penetration and promote subsoil root exploration. However, the lack of organic matter and sieve-like qualities of these soils prevented any short term water-holding ability, so we switched back to regular frequency, smaller doses.
- The growing season leading up to harvest was dry. Our irrigation stations were on 24/7 for several weeks during and after veraison, in a bid to keep up with demand. The conventional blocks were just as needy as the organic blocks; the issue wasn't the narrow topsoil, but the deeper subsoil layers that were struggling to hold and retain moisture.

Year 3

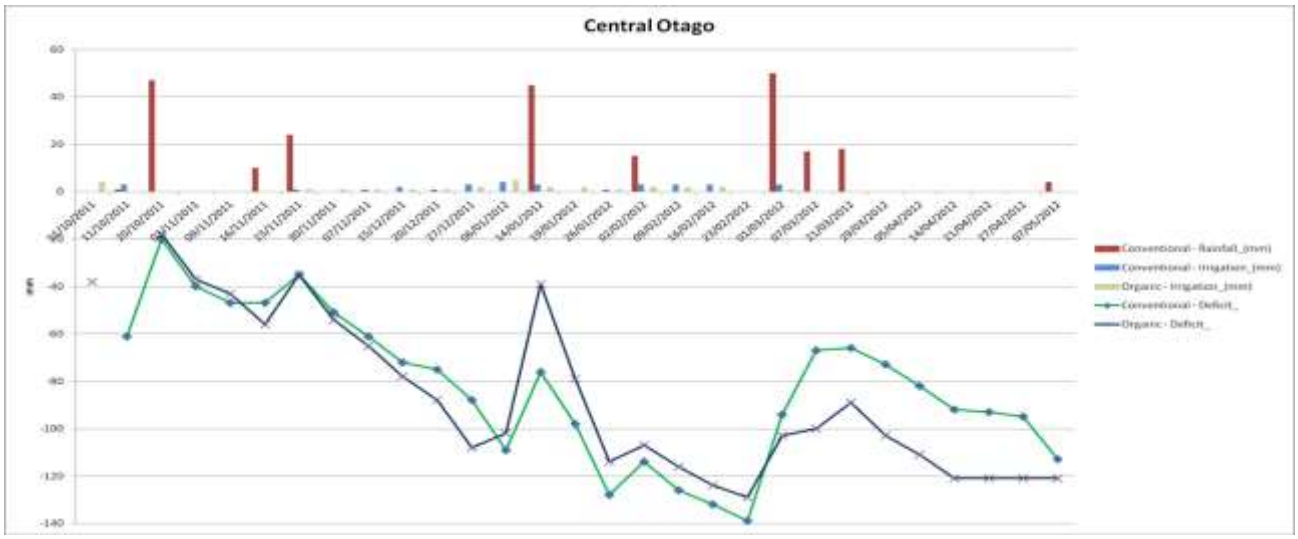
- This season's vine water use and soil moisture were very different to the previous two seasons. The organic site maintained higher soil moisture levels all season. The curve was typically flatter, which would indicate lower vine water use, particularly early in the growing season.

	Organic			Conventional		
	Rainfall	**Irrigation**	**Ave Deficit (% RAW)**	**Rainfall**	**Irrigation**	**Ave Deficit (% RAW)**
2012	268	28	-52%	268	31	-49%
2013	263	161	-52%	263	117	-68%
2014	178	116	-50%	178	151	-67%

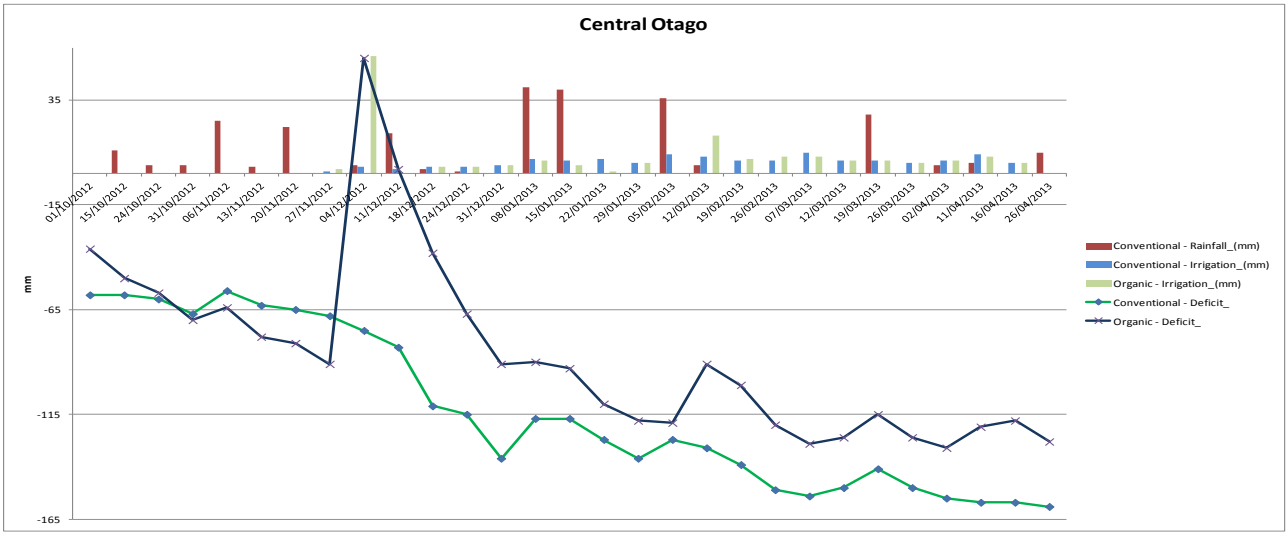
Gibbston Valley Wines

Seasonal comparison

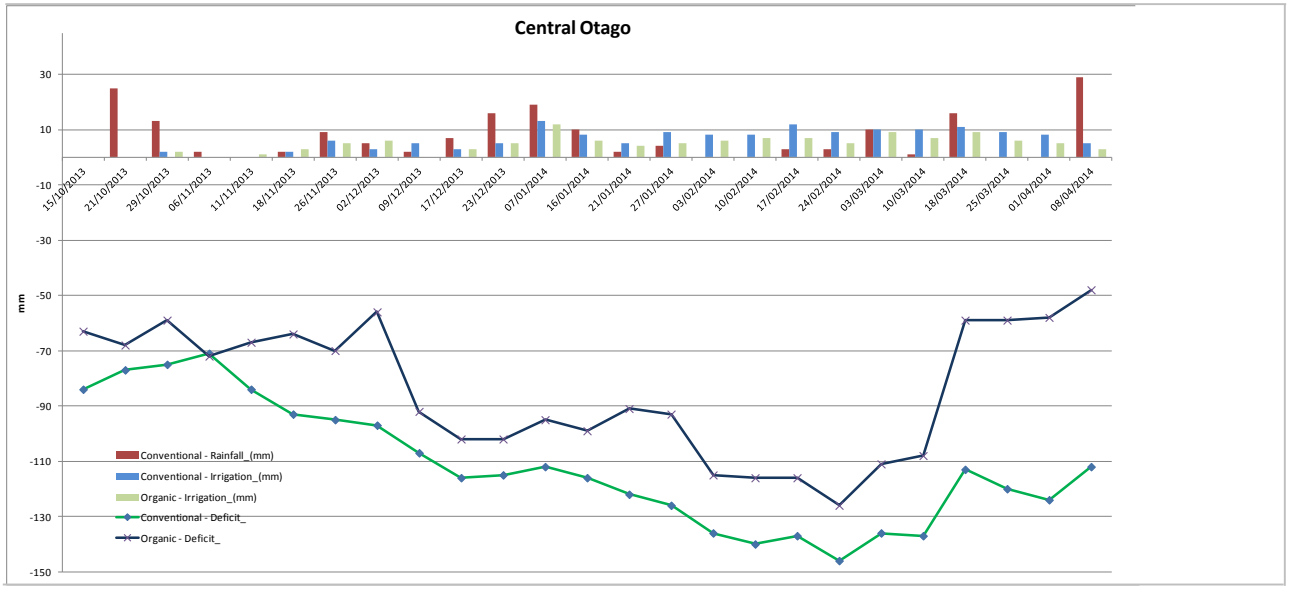
Year 1



Year 2



Year 3



Production costs

This section discusses:

- **What did it cost to grow grapes organically?**
- **How did costs change from year to year?**
- **How did the costs of organic management compare to the costs of conventional management?**

Summary of Production Costs

- Weed management costs were higher in the organic blocks.
- Pest and disease control costs were lower in the organic blocks at two of the three focus vineyard sites.
- Production cost trends were specific to individual vineyards and their management practices, and labour costs were affected by vine vigour and yield.

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Summary of operating costs

Merlot	Organic			Conventional		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Yield (t/ha)	4.8	6.1	5.9	5.0	6.2	6.0
Cost / tonne	$1,667	$1,089	$1,041	$1,655	$1,166	$1,125
Cost / ha	$8,075	$6,592	$6,143	$8,314	$7,173	$6,736
Potential income / ha based on industry average payment of $1830/tonne (t/ha x $/t)	$8,784	$11,163	$10,797	$9,150	$11,346	$10,980
Syrah	**Organic**			**Conventional**		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Yield (t/ha)	3.6	6.4	6.7	3.7	6.7	7.4
Cost / tonne	$2,273	$1,024	$892	$2,259	$997	$858
Cost / ha	$8,081	$6,509	$5,950	$8,284	$6,708	$6,392
Potential income / ha based on industry average payment of $2240/tonne (t/ha x $/t)	$8,064	$14,479	$15,008	$8,288	$15,008	$16,576

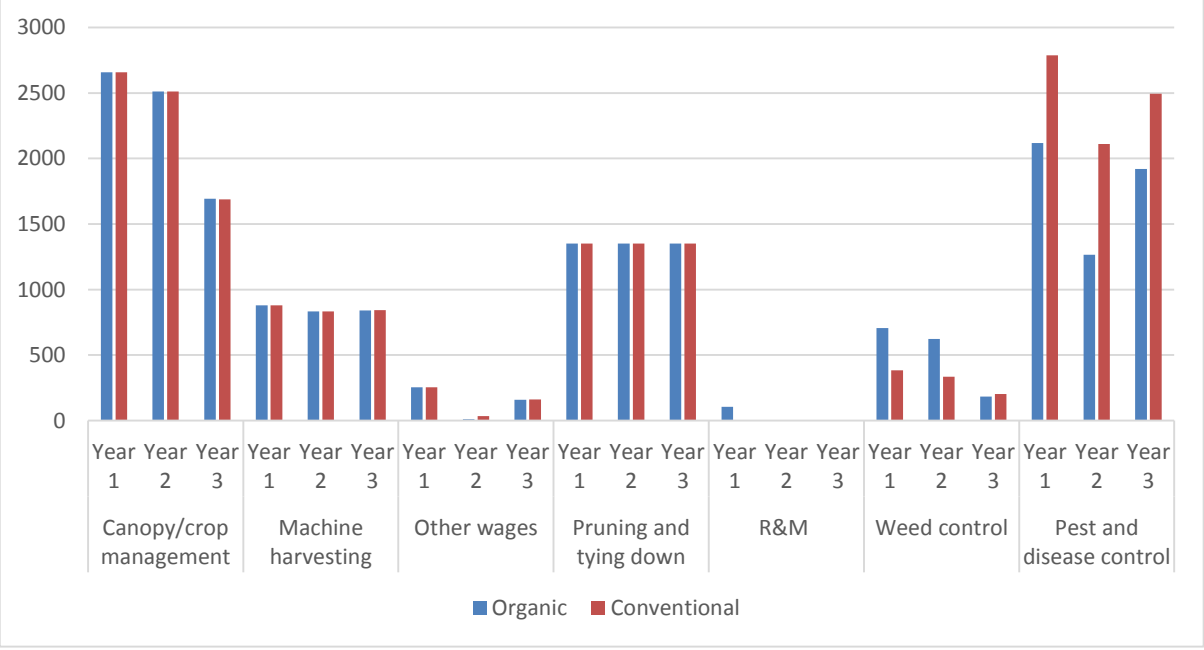
*Average regional payment figures sourced from *Viticulture Monitoring Report 2013* – NZ Winegrowers. Actual figures may vary widely across individual vineyards in each region. Focus vineyards were not asked to supply information on their incomes.

- The Merlot and Syrah showed very similar production costs and trends over time. The following comments relate to both varieties.
- Organic weed control costs dropped from an initial $707/ha in Year 1 and $623 in Year 2 to $182/ha in Year 3. This reflects the different number of weeding passes made. Year 1 and 2 had four passes plus some hand weeding and in Year 3 there were only two passes.
- Other costs did not vary greatly over the organic conversion period.
- Weed management costs were higher in the organic blocks than in the conventional blocks due to additional undervine cultivation passes being required in the first two seasons.
- Pest and disease control was more expensive in the conventional blocks. This was due to the use of conventional mealybug sprays (no corresponding organic spray was used), and the fact that some conventional sprays were more expensive than organic sprays.

Mission Estate

Operating cost breakdown - Merlot

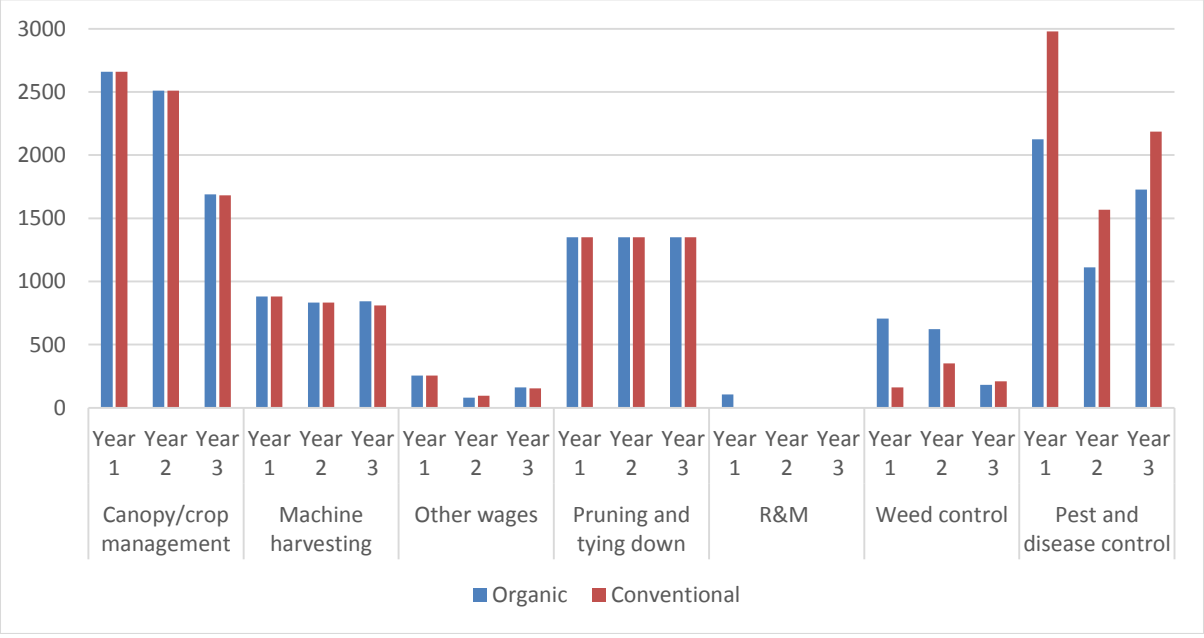
Merlot	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$2,659	$2,511	$1,692	$2,659	$2,511	$1,689
Machine harvesting	$880	$833	$841	$880	$833	$842
Other wages	$255	$10	$159	$255	$33	$160
Pruning and tying down	$,1350	$1,350	$1,350	$1,350	$1,350	$1,350
R&M	$106	-	-	-	-	-
Weed control	$707	$623	$182	$383	$335	$202
Pest and disease control	$2,118	$1,265	$1,921	$2,787	$2,111	$2,494
Total	**$8,075**	**$6,592**	**$6,145**	**$8,314**	**$7,173**	**$6,737**



Mission Estate

Operating cost breakdown - Syrah

Syrah	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$2,659	$2,511	$1,690	$2,659	$2,511	$1,681
Machine harvesting	$880	$833	$842	$880	$833	$811
Other wages	$255	$80	$160	$255	$96	$154
Pruning and tying down	$1,350	$1,350	$1,350	$1,350	$1,350	$1,350
R&M	$106	-	-	-	-	-
Weed control	$707	$623	$182	$160	$351	$210
Pest and disease control	$2,124	$1,112	$1,727	$2,980	$1,567	$2,186
Total	**$8,081**	**$6509**	**$5,950**	**$8,284**	**$6,708**	**$6,392**



Wither Hills

Summary of operating costs

Pinot Noir	**Organic**			**Conventional**		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Yield (t/ha)	3.3	4.3	3.9	4.4	7.6	8.7
Cost / tonne	$3,028	$2,302	$2,107	$1,565	$1,413	$1,287
Cost / ha	$9,992	$9,828	$8,124	$6,945	$10,774	$11,259
Potential income / ha based on industry average payment of $3008/tonne (t/ha x $/t)	$9,926	$12,934	$11,731	$13,235	$22,861	$26,170
Sauvignon Blanc	**Organic**			**Conventional**		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Yield (t/ha)	9.2	14.2	18.8	10.1	14.1	28.1
Cost / tonne	$921	$492	$341	$603	$409	$213
Cost / ha	$8,516	$6,976	$6,403	$6,064	$5,762	$5,984
Potential income / ha based on industry average payment of $1637/tonne (t/ha x $/t)	$15,060	$23,245	$30,776	$16,534	$23,082	$46,000

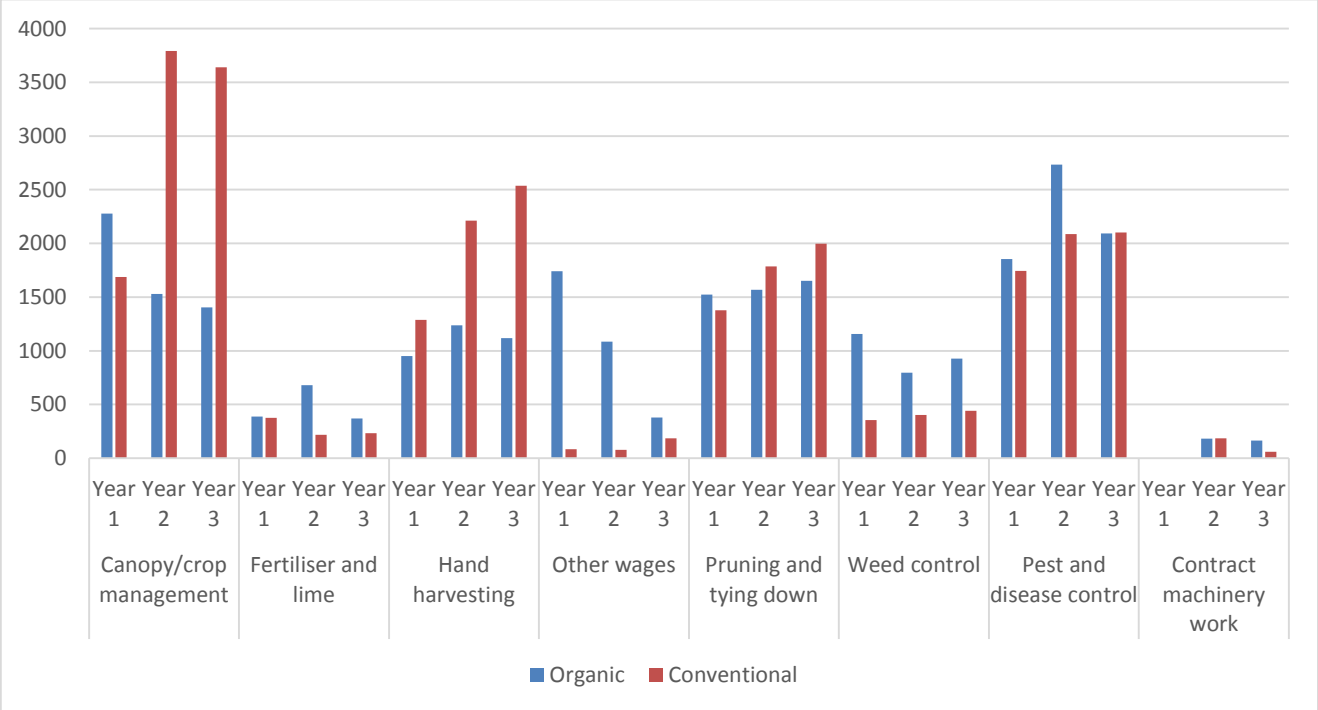
*Average regional payment figures sourced from *Viticulture Monitoring Report 2013* – NZ Winegrowers. Actual figures may vary widely across individual vineyards in each region. Focus vineyards were not asked to supply information on their incomes.

- The cost of canopy and crop management reduced over the conversion period for both organic blocks. For the Pinot Noir, this was due to high levels of crop thinning in Year 1 ($1,369) compared to Year 2 ($220) and Year 3 ($0). For the Sauvignon Blanc, variations in the use of leaf plucking and the cost of interrow cultivation for the organic block accounted for the main variations in cost over time.
- In Years 2 and 3, the conventional Pinot Noir block required hand leaf plucking, trimming and higher levels of crop thinning, resulting in higher costs.
- Hand harvesting costs were directly related to seasonal yields.
- Other wages were high for the organic blocks in the first year of organic conversion due to the costs of lifting irrigation wires and picking up rocks to prepare for undervine cultivation. The organic blocks also had additional mowing and mulching costs.
- Pest and disease control costs varied by season. Organic pest and disease costs included additional costs for seed drilling and rolling for interrow plantings for biocontrol, but reduced costs for canopy sprays.
- Weed control costs varied seasonally. However, weed control costs for the organic block using undervine cultivation were significantly higher than the cost of conventional herbicide sprays.

Wither Hills

Operating cost breakdown – Pinot Noir

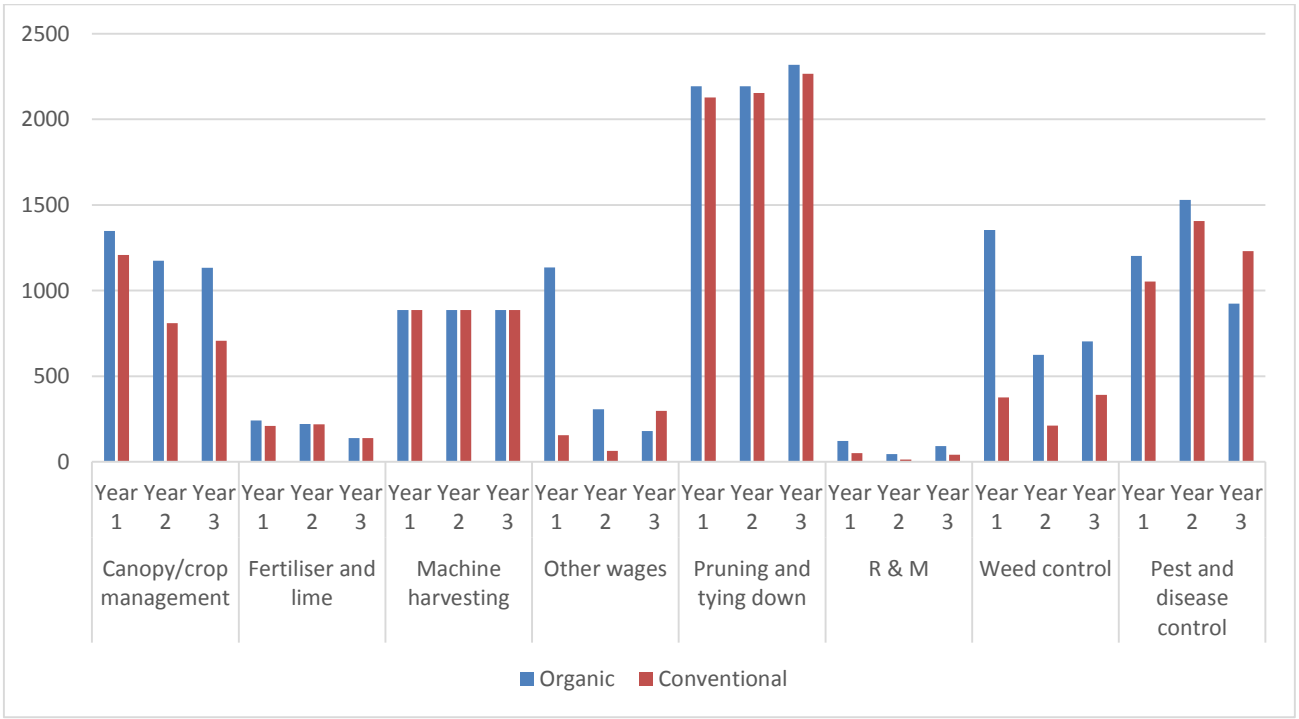
Pinot Noir	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$2,279	$1,529	$1,404	$1,686	$3,791	$3,639
Fertiliser and lime	$389	$679	$371	$377	$218	$232
Frost protection	$63	-	-	-	-	-
General / Other	$65	-	-	-	-	-
Hand harvesting	$952	$1,238	$1,118	$1,287	$2,212	$2,536
Other wages	$1,740	$1,086	$379	$85	$77	$184
Pruning and tying down	$1,522	$1,569	$1,652	$1,378	$1,785	$1,997
R&M	$51	415	$15	$33	$16	$68
Weed control	$1,077	$797	$926	$354	$404	$441
Pest and disease control	$1,854	$2,734	$2,093	$1,745	$2,087	$2,102
Contract machinery work	-	$181	$165	-	$184	$60
Total	**$9,992**	**$9,828**	**$8,124**	**$6,945**	**$10,774**	**$11,259**



Wither Hills

Operating cost breakdown – Sauvignon Blanc

Sauvignon Blanc	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$1,348	$1,174	$1,132	$1,208	$810	$706
Fertiliser and lime	$241	$220	$138	$210	$218	$138
General / Other	$39	-	-	-	-	-
Machine harvesting	$886	$886	$886	$886	$886	$886
Other wages	$1,134	$307	$180	$156	$63	$297
Pruning and tying down	$2,192	$2,192	$2,318	$2,128	$2,154	$2,265
R&M	$122	$44	$92	$50	$14	$41
Weed control	$1,353	$624	$702	$375	$212	391
Pest and disease control	$1,202	$1,529	$924	$,1052	$1,405	$1,230
Contract machinery work	-	-	$30	-	-	$30
Total	**$8,516**	**$6,976**	**$6,403**	**$6,064**	**$5,762**	**$5,984**



Gibbston Valley Wines

Summary of operating costs

Note: Different clones are present in the organic and conventional blocks in this vineyard, for both grape varieties. Thus observations about the organic and conventional blocks should be viewed independently rather than comparatively.

Pinot Gris	**Organic**			**Conventional**		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Yield (t/ha)	5.3	5.9	4.7	4.9	6.8	7.7
Cost / tonne	$2,496	$2,101	$2,677	$2,281	$2,024	$1,658
Cost / ha	$13,160	$12,293	$12,593	$11,088	$13,667	$12,757
Potential income / ha based on industry average payment of $2444/tonne (t/ha x $/t)	$13,686	$14,420	$11,487	$11,976	$16,619	$18,819
Pinot Noir	**Organic**			**Conventional**		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Yield (t/ha)	5.7	5.6	4.0	4.6	6.4	5.2
Cost / tonne	$2,331	$2,217	$3,346	$2,393	$2,156	$2,189
Cost / ha	$13,189	$12,345	$13,439	$11,120	$13,840	$11,314
Potential income / ha based on industry average payment of $3480/tonne (t/ha x $/t)	$19,836	$19,488	$13,920	$16,008	$22,272	$18,096

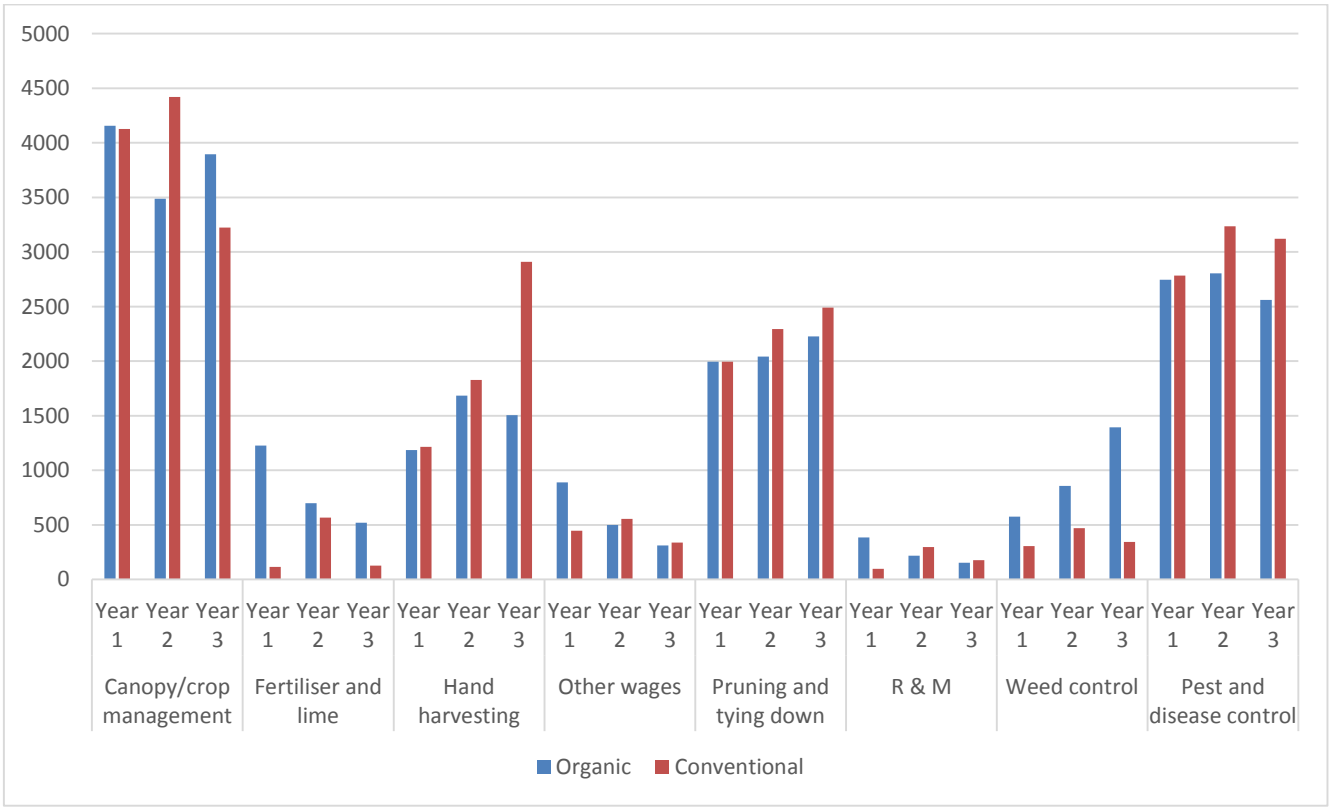
*Average regional payment figures sourced from *Viticulture Monitoring Report 2013* – NZ Winegrowers. Actual figures may vary widely across individual vineyards, in each region. Focus vineyards were not asked to supply information on their incomes.

- Yields in all blocks fluctuated between seasons; the cost per tonne figures reflect this. The cost per hectare showed no pattern.
- Fertiliser costs were higher in the organic blocks.
- Hand harvesting costs were directly related to seasonal yields for Pinot Gris. For the conventional Pinot Noir, harvesting costs are consistent with the fluctuations in yield over the three years. However, costs in the organic block do not match yield, as 2014 had the lowest yield but highest harvesting cost. This was due to a high amount of shrivel in the organic Pinot Noir, which is thought to be due to its position in the vineyard.
- Other wages were higher in the organic blocks in Year 1 compared to Years 2 and 3, due to one-off setup costs to prepare the blocks for undervine cultivation.
- The cost of weed control in the organic block was highest in Year 3. This was mostly due to costs associated with hand weeding to eliminate problem grasses around the base of vines.
- Pest and disease control costs remained steady over time. The conventional block had higher costs in Year 2 and 3. This was mostly because of higher canopy spray costs.
- At a field day held at the Gibbston Valley focus vineyard, there was consensus among all the organic vineyard managers that yes, the conversion costs initially result in a higher per hectare operating cost for organic vineyards. However, once equilibrium is achieved, the costs are comparable for organic and conventional.

Gibbston Valley Wines

Operating cost breakdown – Pinot Gris

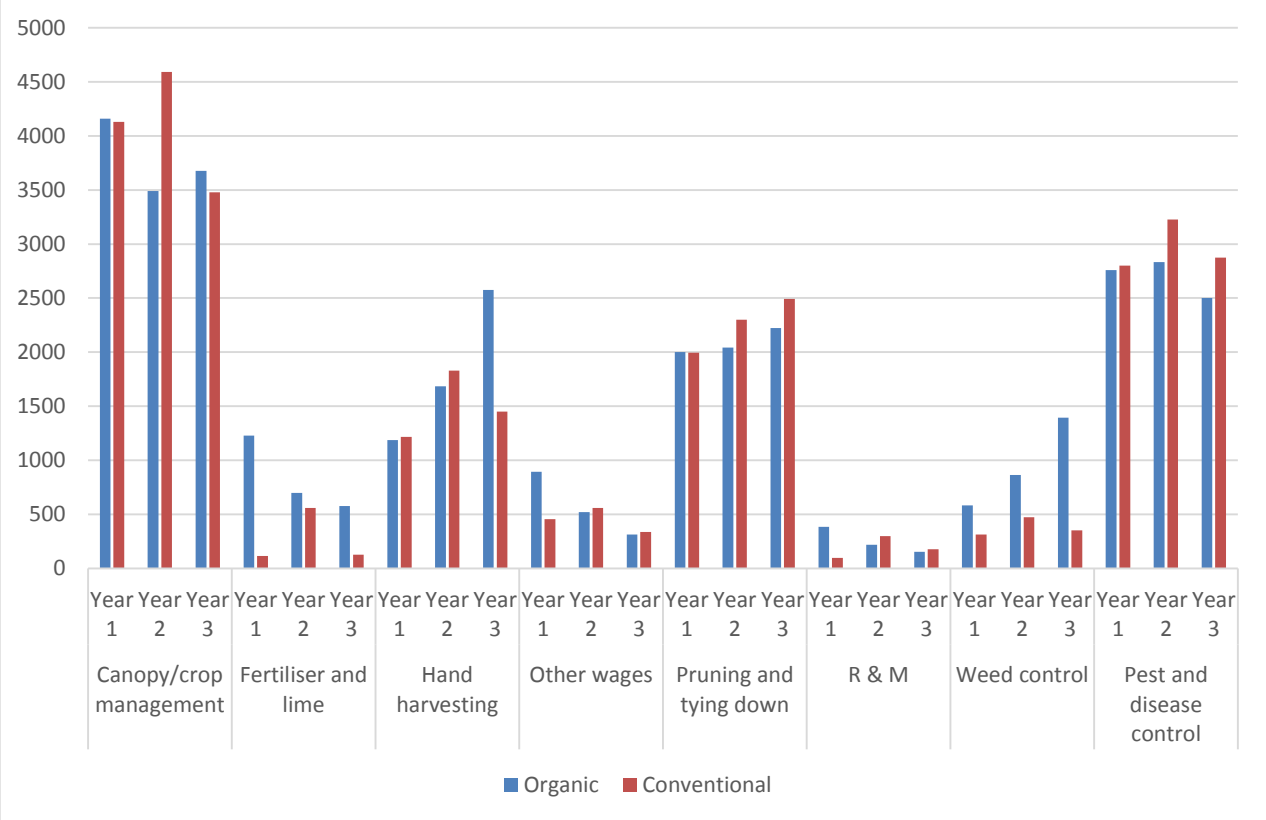
Pinot Gris	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$4,157	$3,489	$3,895	$4,126	$4,419	$3,223
Fertiliser and lime	$1,227	$700	$520	$115	$566	$126
Frost protection	-	-	$24	-	-	$24
Hand harvesting	$1,185	$1,683	$1,504	$1,215	$1,829	$2,910
Other wages	$889	$501	$313	$447	$555	$338
Pruning and tying down	$1,996	$2,043	$2,227	$1,996	$2,295	$2,491
R&M	$385	$217	$154	$98	$297	$178
Weed control	$576	$857	$1,395	$307	$470	$345
Pest and disease control	$2,745	$2,803	$2,561	$2,785	$3,235	$3,122
Total	**$13,160**	**$12,293**	**$12,593**	**$11,088**	**$13,667**	**$12,757**



Gibbston Valley Wines

Operating cost breakdown – Pinot Noir

Pinot Noir	Organic $/Ha			Conventional $/Ha		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Canopy/crop management	$4,158	$3,489	$3,678	$4,131	$4,593	$3,479
Fertiliser and lime	$1,227	$699	$576	$115	$560	$126
Frost protection			$24			$24
Hand harvesting	$1,186	$1,683	$2,575	$1,215	$1,829	$1,451
Other wages	$894	$519	$313	$454	$558	$338
Pruning and tying down	$2,001	$2,042	$2,224	$1,996	$2,301	$2,492
R&M	$385	$218	$154	$98	$299	$178
Weed control	$581	$863	$1,393	$312	$474	$350
Pest and disease control	$2,758	$2,832	$2,502	$2,799	$3,227	$2,875
Total	**$13,189**	**$12,345**	**$13,439**	**$11,120**	**$13,840**	**$11,314**



Wine

This section discusses:

- **How did organic management affect juice and wine quality?**

Wine summary

Organic and conventional wines were made separately and compared in the final season of the project, once the organic blocks had attained full organic certification.

Winemakers from the focus vineyards were instructed to make the organic and conventional wines in as similar a way as practically possible, but to work within their own usual frameworks for producing commercial-scale organic and conventional wines. The winemakers recorded their processes, results and impressions of the finished wines. Juice samples were analysed by Hill Laboratories.

Organic and conventional microvins were made for three varieties: the Mission Estate Merlot and Syrah, and the Wither Hills Sauvignon Blanc. These varieties were selected for microvinification because the organic and conventional blocks had identical clones and rootstocks, reducing the number of possible variables affecting the wines. The microvins were chemically analysed by Hill Laboratories.

Wine quality is inherently a subjective topic. The comments below reflect the views of the winemakers at each focus vineyard's winery.

Mission Estate Merlot – The organic and conventional Merlot wines were combined at the winery due to a shortage of tank space. However, separate microvins were made from the organic and conventional grapes, with the resulting wines showing no major chemical differences.

Mission Estate Syrah – The organic and conventional Syrah were vinified separately. According to the winemaker, the organic Syrah showed more fruit weight and intensity, had riper aromas and better tannins, and was perceived to be a better wine. Microvins of the organic and conventional Syrah showed no major chemical differences.

Wither Hills Sauvignon Blanc – The two Sauvignons produced are stylistically very different. The organic has strong green bean aromatics, with a rich palate and tight acidity. In contrast, the conventional adheres more typically to the fruitier style of Sauvignon, with fresh citrus notes and a green apple finish, and is considered to be a good base for a blend. Significantly different cropping levels in the organic and conventional blocks likely affected wine quality.

Wither Hills Pinot Noir – The organic Pinot was described as having a line of fruit purity and favourable textural qualities, an elegant wine. The conventional has strong ripe fruit characters and a well-integrated fruit palate, overall a bigger style of wine.

Gibbston Valley Pinot Gris – The organic and conventional were very similar.

Gibbston Valley Pinot Noir – The organic Pinot Noir has very good concentration, structure and length. Some of the ferments became reduced, with sulphide production appearing during fermentation, and in the barrel. There is no doubting the intensity and phenolic complexity of the organic wines.

Mission Estate

Winemaker's comments - Paul Mooney

Our winery was very full during vintage 2014. We were forced to consolidate small batches of wine earlier than we would have liked; we did not have enough small tanks and had to make pragmatic blending decisions.

Merlot: The winery did not have enough small fermenters to vinify the organic and conventional separately.

Syrah: Fermented the organic separately from the conventional, but were forced to blend the conventional Syrah into another Gimblett Gravels batch of wine, as there were no tanks available.

Syrah

Juice analysis at harvest

Syrah		Organic	Conventional
L - Malic acid	*g/l*	3.8	3.5
Ammonia	*mg/l*	11	18
Primary Amino Acid Nitrogen	*mg/l as N*	60	70
Yeast Assimilable Nitrogen	*mg/l as N*	69	85

Winemaker's assessment

	Organic	Conventional
Grapes	No differences	
Processing	No differences	
Juice flavour and aroma	No differences	
Fermentation	Started at same time, but rate of fermentation was slower in the organic. Required supplementary yeast hulls to aid the fermentation. A bit sluggish towards the end. No sulphides.	No problems, additions or sulphides.
Post-fermentation	The organic wine had slightly higher phenolics and stronger colour than the conventional.	
Additions post-ferment	None	None
Time on gross lees before racking	24 days	28 days
Final additions	SO_2	SO_2
Overall assessment	The organic wine is showing more fruit weight and intensity.	
Taste and aroma	The organic wine had riper aromas and better tannins.	
Which is the better wine?	Organic	

Mission Estate

Microvin report

- Organic and conventional microvins were made for the Mission Estate Merlot and Syrah by an independent contractor.
- Microvin assessments and the following comments were made by Kirsten Creasy - Sabrosia Winegrowing Services (microvin winemaker).
- Each microvin was made from approximately 22-23 kg of fruit.
- No adjustments were made to the juices other than good winemaking practices of sulphur dioxide, bentonite to aid settling, yeast and yeast supplements.
- Additions of additives were made at the same rate to the juice from the organic and conventional blocks.

Merlot: Fruit assessment	
Organic	**Conventional**
• Both bunch size and berry size smaller than conventional • Ripe in phenolics and flavour • The acid/sugar was well balanced • Brix 23	• Slight shrivelling on the fruit • Brix 24

Syrah: Fruit assessment	
Organic	**Conventional**
• Very little visual difference • Flavour profile and balance – ripe with spicy notes, great acid/sugar balance, nice skin phenolics • Brix 22.1	• Very little visual difference • Flavour profile and balance – green, acidic with less ripe phenolics • Brix 21.1

Mission Estate

Microvinification practices for Merlot and Syrah	
Pressing / settling	• Hand destemmed • Berries hand crushed with 5% whole berries left in the container • All musts inoculated with 250ppm EC-1118 yeast and plunged • Although the Syrah looked clean, the conventional showed slip skin with fragile skin. • Before inoculation and after several hours of skin soaking, the Brix was tested.
Fermentation	• Fermented at 28°C • Plunged 3 times daily • Day 2 - FermControl Bio was added at 120ppm • No problems during fermentation • Ferment 10-12 days
Post-ferment	• Pressed off using a water bladder press • Inoculated for MLF using Malobacti HF2 • Left at 20°C to complete MLF • MLF did not complete, possibly because temperature was not kept warm enough; also, culture was not a direct-add MLF culture, which is far better for small volumes. The culture worked well to start with, but then reduced activity in the wine. Decided to sulphur up the wines. • Racked off gross lees • Filtered through a 1 micron filter and into bottle under gas • A total of 14 bottles of each treatment were bottled
Winemaker comment	Several weeks after bottling, the wines were blind tasted by several winemakers. There was a clear preference for the organic wines, although there were some comments that the conventional wines seemed more 'commercial.'

Final wine analysis of Merlot and Syrah microvins

		Merlot Organic	Merlot Conventional	Syrah Organic	Syrah Conventional
Alcohol	%	13.9	14.1	13.1	12.6
Total acidity	g/l	7.0	7.0	7.1	7.0
Volatile acidity	g/l	0.46	0.45	0.43	0.38
L - Malic acid	g/l	1.08	0.99	1.52	1.68
Total sugars	g/l	0.28	0.20	0.14	0.10
pH		3.52	3.56	3.57	3.59
Total SO_2	ppm	70	55	61	78
Free SO_2	ppm	22	18	21	10

Mission Estate

Phenolic profile of Merlot and Syrah microvins

	Merlot		Syrah		Comment
	Organic	Conventional	Organic	Conventional	
Gallic Acid *(ppm)*	17	18	17	18	Finished wines have up to 30ppm prior to barrel. All within normal range.
Quercetin *(ppm)* *Produced as a direct result of UV interception*	31	25	15	9	Can relate to levels of fruit exposure to sun. However, organic and conventional fruit received similar exposure in the vineyard.
Catechin *(ppm)* *Seed tannin*	33	32	26	22	Seed ripeness similar in organic and conventional.
Tannin *(ppm)* *Skin tannin*	315	350	340	280	Low. UV influences skin tannins.
Cat/Tan ratio	0.11	0.09	0.07	0.08	Similar for each block, indicating a similar level of extraction from the seeds for all treatments.
Resveratrol *(ppm)* *Indicator of disease status. Produced by plant to protect against infection*	2.5	1	4	2.5	Levels are very low and not really significant.
Polymeric anthocyanins *(ppm)* *Fixed or bound colour. Determined by time or winemaking process. Formed when tannins extracted from seeds/skins bind with the anthocyanins becoming fixed.*	20	22	26	25	Colour is indicated by the anthocyanin results. Organic Syrah shows the most potential colour.
Total anthocyanin content *(ppm) Colour*	260	260	290	260	

Focus Vineyard 2

Wither Hills

Winemakers' Comments - *Andrew Petrie, Brett Oliver, Wietske van der Pol*

Sauvignon Blanc: Stylistically, the Sauvignons produced are very different. The organic has strong green bean aromatics with a rich palate and tight acidity, and greater length and texture. In contrast, the conventional adheres more typically to the fruitier style of Sauvignon, with fresh citrus notes and a green apple finish, a good base for a blend. A significant difference in organic and conventional yields likely affected the wines.

Pinot Noir: Although the organic block's yields have been similar over the past two seasons, the increase in quality has been surprising. This year's organic Pinot was described as having a line of fruit purity and favourable textural qualities, an elegant wine. The conventional has strong ripe fruit characters and a well-integrated fruit palate, overall a bigger style of wine.

Sauvignon Blanc

Juice analysis at harvest

Sauvignon Blanc		Organic	Conventional
Brix	*°Brix*	21.3	20.8
Total acidity	*g/l as Tartaric Acid*	8.8	8.4
L - Malic Acid	*g/l*	5.0	4.7
pH		3.11	3.15
Ammonia	*mg/l*	40	42
Primary Amino Acid Nitrogen	*mg/l as N*	111	116
Yeast Assimilable Nitrogen	*mg/l as N*	144	151

Wither Hills

Winemaker's assessment

	Organic	Conventional
Method of harvest	Machine	Machine
Yield	18 t/ha	27 t/ha
Grapes	Both blocks were clean, no measures required to clean up the fruit.	
Additions at the crusher/press	• 0.25 kg/l PMS/water solution is made up • 2 litres (0.5 kg PMS) per 5 tonne is added to fruit in gondola in the vineyard • Pectinase enzyme, such as Rapidase Vino Super, is added at a standard rate for clean fruit. Usually 15 ml/t	
Processing	• Press - maximum pressure 0.4-0.6 bar free run (depending on quality/temp) • Cut to separate pressings tank • Press cut on taste, approx. 620-650 l/t • Settle juice at 8-10°C for 72 hours • Rack clear juice to tank, warm to 16°C in preparation for inoculation	
Juice yield post-racking	774 l/t	810 l/t
Additions to juice	Enzyme, PMS, Seporit Yeast (X5) & Fermaid O (during ferment)	Enzyme, PMS, DAP, Seporit, DAP (during ferment)
Fermentation	Temperature 12-16°C for 14 days	
Sulphides produced?	Yes	No
Problems during ferment	Had to use 'baby tanks' with manual cooling, so temperature fluctuations quite large during ferments. Both had some stressed notes due to temperature shock and were fed nutrients to help alleviate this.	
	Retained sweaty notes	Cleaned up
Post-ferment	Slight straw colour	Bright lime colour
Additions post-ferment	PMS	
Final additions	0.0125 ppm Cu++	
Date of bottling	16th June	
Taste and aroma	Richer, more complex nose, with tropical fruits, hints of green bean and a distinct but not unpleasant sweaty note. Also slightly deeper in colour.	A crisp, lighter style with vivacious citrus and crunchy greens, some florals, and not really in the tropical spectrum. Bright light colour.
Which is the better wine?	Both have their good points.	

Wither Hills

Microvin Report

- Microvins were made for the Wither Hills Sauvignon Blanc by an independent contractor.
- Microvin assessments and the following comments were made by Kirsten Creasy - Sabrosia Winegrowing Services (microvin winemaker).
- Each microvin was made from approximately 48 kg of fruit.
- No adjustments were made to the juices other than good winemaking practices of sulphur dioxide, bentonite to aid settling, yeast and yeast supplements.
- Additions of these additives were made at the same rate to the juices from each block.

Sauvignon Blanc: Fruit assessment

Organic	Conventional
• More exposed • Yellow-green bunches • Small amount of shrivelling • Bunches less full and smaller • Skins were tougher and thicker	• Bright green colour normally associated with Sauvignon Blanc • Far less exposed • No shrivelling • Bunches were full, large and thin-skinned

Microvinification practices for Sauvignon Banc

	Organic	Conventional
Pressing / Settling	• Longer to press out • Juice heavier and more balanced • Gooseberry and passionfruit with some herbal notes • Juice browned off quickly	• Fully pressed out at lower pressure • 10% more juice • Juice less ripe, with strong herbal nettle and coriander notes and some gooseberry • Palate was thinner, more acidic with less weight • Juice stayed green/yellow
	• Received 30 ppm SO_2 and 100 ppm bentonite, then left to settle for two days. • Neither juice settled well. Could be due to some botrytis infection. However, the conventional juice settled better than the organic.	

Wither Hills

Photo of Conventional juice (left) and Organic juice (right) post pressing

Fermentation	• Day 1: Warmed and inoculated with 250ppm Viniferm Cool White • Day 2: 120ppm of FermControl Bio • Day 3: FermControl Clearup added when H_2S appeared. Splash rack. • 14-18°C, when H_2S detected cooled to 14 °C. • Did not clear up the H_2S which persisted throughout the fermentation and post-ferment, in spite of more splash racking and removing gross lees.
Post-ferment	• Activated yeast lees was added post-ferment, which cleaned up some of the aromatics, but not much. • Once it became obvious that the volatile sulphides would not be removed, the wines were sulphured up. Trials using ascorbic acid and copper sulphate were conducted and added to the wines. This helped to some extent, but stripped varietal sulphur-containing compounds from the wines as well. • Unhappy with the amount of sulphides left in the wine and felt these would override any differences there may been between the two treatments, so further detailed analysis of the wines was not conducted.
Bottling	• Tartrate stabilised but not protein stabilised. • Sulphur was adjusted to 30ppm FSO_2. • Filtered through 1 micron and 0.45 micron Millipore filter and bottled under gas. • Total number of wine bottles was 15 bottles from each block.

Final wine analysis of Sauvignon Blanc microvin

		Organic	Conventional
Alcohol	*%*	13.0	11.6
Total acidity	*g/l as Tartaric Acid*	7.8	8.8
Volatile acidity	*g/l*	0.41	0.28
L - Malic Acid	*g/l*	1.74	3.0
Total sugars	*g/l*	0.19	0.15
pH		3.08	3.05
Total SO_2	*ppm*	62	67
Free SO_2	*ppm*	34	33

Wither Hills

Winemaker's Comments - John Clark

Pinot Noir

Juice analysis at harvest

Pinot Noir		Organic	Conventional
Brix	*°Brix*	24	25.6
Total acidity	*g/l as Tartaric Acid*	6.0	6.0
L - Malic acid	*g/l*	4.0	3.5
pH		3.6	3.61
Ammonia	*mg/l*	50	60
Primary Amino Acid Nitrogen	*mg/l as N*	164	191
Yeast Assimilable Nitrogen	*mg/l as N*	205	240

Winemaker's Assessment

	Organic	Conventional
Method of harvest	Hand	Hand
Grapes	Organic berries were smaller with slightly tighter bunches, thicker skins and a darker colour.	
Additions at the crusher /press	80 g/t PMS	80 g/t PMS
Processing	Maximum pressure – destemmed and put to red fermenter	
Juice yield post-racking	650 l/t	650 l/t
Flavour and aroma profile of the juices	Slightly leaner fruit	Riper, fuller taste
Soak before ferment	7 days	9 days
Additions to juice	Wild, + 2 g/l H_2T	D254, + 2 g/l H_2T
Fermentation	Capped at 30°C 8 days	25°C 9 days
Sulphides produced?	Both had pump-overs for minor sulphides	
Problems during ferment	No	Slow at finish due to tank configuration
Post-ferment	Very bright purple sheen	Dense dark
Additions post-ferment	No	No
Time on gross lees before racking	Drained to hold tank and then to French oak	Drained to hold tank and then to French oak
Final additions	Malo bug in barrel	Malo bug in barrel
Taste and aroma	Lifted spice, floral, nice purity and some elegance with leaner, tighter style.	Deeper, richer, broodier. More plum, coffee notes, fleshier structure.
Which is the better wine?	Impossible to say – fermented in different style tanks, which would have affected ferment dynamics. Both wines looking good, but they are very different in style.	

Gibbston Valley Wines

Winemaker's Comments - *Christopher Keys*

Pinot Gris

Juice analysis at time of harvest

Pinot Gris		Organic	Conventional
L - Malic Acid	*g/l*	3.0	3.4
Ammonia	*mg/l*	43	48
Primary Amino Acid Nitrogen	*mg/l as N*	101	94
Yeast Assimilable Nitrogen	*mg/l as N*	136	134

Winemaker's assessment

	Organic	Conventional
Method of harvest	Hand	
Additions at the crusher/press	30 ppm SO_2	
Processing	Max press 1.8 bar 17 °C Overnight settling	
Juice yield post-racking	696 l/t	675 l/t
Additions to juice	Yeast 58W3, 300 ppm Fermcontrol	
Fermentation	Max 18°C 28 days Stainless barrel	Max 18°C 19 days Oak barrel Started faster
Additions post-ferment	66 ppm SO_2	
Time on gross lees before racking	In barrel	
Final additions	Bentonite	
Date of bottling	March 2015	
Which is the better wine?	The organic and conventional are very similar.	

Focus Vineyard 3

Gibbston Valley Wines

Winemaker's comments - *Christopher Keys*

The Pinot Noir consisted of three clones in the organic block and three other clones in the conventional. Each of the clones was fermented separately, so there were three organic ferments and three conventional.

Juice analysis at time of harvest

		Organic			Conventional		
		Clone 6	**Clone 667**	**Clone 777**	**Clone 115**	**Clone 114**	**Clone 5**
L - Malic Acid	*g/l*	2.8	3.3	2.8	2.8	2.9	2.4
Ammonia	*mg/l*	61	44	61	49	50	55
Primary Amino Acid Nitrogen	*mg/l as N*	142	123	156	123	127	143
Yeast Assimilable Nitrogen	*mg/l as N*	192	159	210	163	167	189

Gibbston Valley Wines

Winemaker's assessment – Pinot Noir

	Organic	Conventional
Method of harvest	Hand	Hand
Additions at the crusher/press	50 ppm SO_2	50 ppm SO_2
Processing	Maximum pressure 1.8 bar	
Soak before ferment	8 days	6-8 days
Chemical	One organic clone (667) tracked at lower sugar level / higher TA than the conventional but no other differences noticed	
Additions to juice	1 g/l tartaric acid, 200 ppm Firmcontrol at active ferment, 200 ppm if reductive at 12 Brix	
Fermentation	33°C max 8 days	35°C max 8 days
Wine produce sulphides?	Yes, at the peak of ferment both lots were reduced.	
Problems during ferment	Reduction at 12 brix	Some ferments heated to 35°C
Additions post-ferment	No	No
Time on gross lees before racking	10-11 months	10-11 months
Final additions	44 ppm SO_2 post-MLF, then adjusted to around 30 ppm SO_2 pre-bottling	
Date of bottling	April 2015	
Taste and aroma	Very good concentration, structure and length. Some of the ferments have shown a tendency to become reduced, with sulphide production appearing during fermentation, and subsequently in barrel. There is no doubting the intensity and phenolic complexity of the organic wines.	Wines have excellent concentration and balance.
Which is the better wine?	Outside the usual tried and true methods of analysis, the organic wines do have a compelling energy – but that is a purely personal reflection. There are a lot of variables in the creation, a combination of many factors, and it is impossible to separate them all. Both are really good – and we will be reviewing with time. It is difficult to make quality assessments about wine like this, especially considering that we are lucky to have a vineyard that produces high quality fruit across all management systems. Organic yield reduction is a factor which we hope benefits our very top releases. However, the conventional, higher-yielding wine still sits well within premium production levels and quality.	