

Active sensors

NDVI imagery determines harvest strategies

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PA tools are helping introduce micro-management in NZ vineyards resulting in improved grape production, quality and product value.

For a long time significant variation across vineyard blocks has been recognised to impact on the final quality of the wine. However, these differences in vine canopy and fruit formation, which have formed the basis of harvesting decisions, were only being identified visually. The use of new technologies allows variation to be quantified and managed, resulting in targeted pest and disease control and improved fruit quality and increased dollar value per tonne.

Mission Estate Winery is located in the Hawke's Bay region of New Zealand's North Island. Precision agriculture (PA) applications were introduced to the vineyard management systems in 2006 to improve knowledge of the vineyard and quality of the fruit supply.

Biomass scanning

One tool that has been used with great success to help determine vine variation is biomass measurement with the Normalized Difference Vegetation Index (NDVI).

A CropCircle™ sensor is mounted on a quad bike (Figure 1). As the bike is driven up and down the vine rows, the CropCircle™ sensor takes five readings of the canopy biomass (vine vigour) every second. Each reading is GPS positioned and the data is stored on a logging device. Once the vine vigour data is recorded it is downloaded into a Geographic Information System (GIS) and overlaid onto a satellite image of

Figure 1. The CropCircle™ sensor is mounted on the rear of a quad bike at a sufficient height to scan the biomass of the whole canopy.



the block. The GIS software makes it possible to interpolate the data and produce images of NDVI that are split into defined zones, representing areas of variation in vigour. At Mission Estate Winery, a number of blocks were identified to have significant variation but visually this was difficult to quantify.

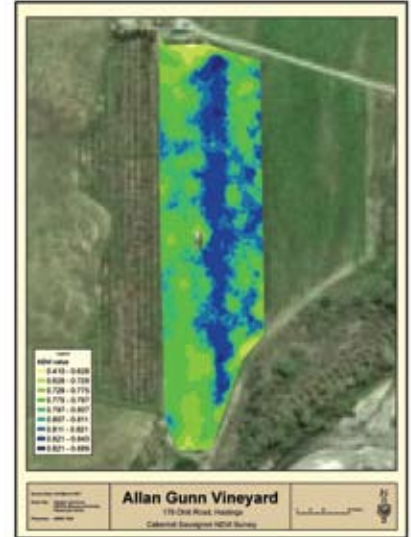
This biomass image (Figure 2) was used as the basis of the 2007 vintage harvesting plan. Having defined the biomass zones it was possible to sample fruit from these areas and to provide an indication of differences in phenological and maturity ripeness between the zones. Vast differences in maturity were found

Table 1. Differences in maturity analysis of grape juice by zone, after NDVI mapping Mere Road vineyard.

Syrah		Maturity parameters		
Date	Zone	Brix	Titrateable acidity (TA)	pH
9/04/2007	A (low vigour)	24	8.8	3.15
	B (high vigour)	23.3	8.6	3.11
11/04/2007	A HARVEST	24.6	7.1	3.33
18/04/2007	B HARVEST	25.2	6.4	3.35
Merlot		Maturity parameters		
Date	Zone	Brix	TA	pH
14/03/2007	A (low vigour)	21.8	8.06	3.17
	B (high vigour)	20.2	10.5	2.95
4/04/2007	A (low vigour)	23.4	6.5	3.36
	B (high vigour)	22.8	9	3.17
7/04/2007	A HARVEST	24	6.4	3.43
14/04/2007	B HARVEST	23.4	6.8	3.29

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Figure 3. This image shows clearly variation in biomass (Zone A, green lower NDVI and Zone B blue higher NDVI) that had not been observed visually. This image resulted in selective management of the two areas.



Targeted pest control

The second PA tool used for improved vineyard management at Mission Estate is a hand held GPS unit. This is used for marking, recording and tracking the spread of Leaf Roll Virus (LRV). This data is then mapped over a satellite image of the block using a GIS. LRV delays fruit ripening, causes increased acidity, slows development in flavour expression and results in yield reductions. Once the vine is infected with LRV, the incidence and level within the vine will increase over time and the described effects will become more and more evident. LRV spread is mainly from the vector mealy bug that transmits the virus to vines after feeding on other virus-infected vines. With GPS tracking, 'hotspots' of virus and potential high populations of mealy bug can be identified. These technologies help determine the zones of high mealy bug populations to spray or which infected vines to remove.

In the coming years this form of micro-management that is facilitated by PA is anticipated to expand to all areas of vineyard management.

For more information

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ripe flavours and soft silky tannins.

The fruit from the higher vigour zones (Zone B) was left to 'hang' for longer, allowing the sugar levels to increase to a desired level as vintage conditions remained settled. The performance of these grapes will be monitored in the barrel.

The second property mapped for NDVI was a block of Cabernet Sauvignon. Before the CropCircle™ Sensor was used on this property the block was thought to be fairly uniform. It had been agreed that this parcel of fruit (25t) would be picked as one block and used for the entry level estate Cabernet Sauvignon. Figure 3 contains the NDVI image, which clearly defined two zones.

The zones were sampled for fruit maturity and substantial differences in the maturity of the fruit between these vigour zones were found (Table 2).

It was decided that the variation was enough to warrant selective harvesting of these zones. Zone A was significantly more advanced than Zone B. The quality in Zone A was to a level that meant that this parcel of fruit was upgraded to reserve status, thus giving the grower an increased return of \$200 per tonne. The fruit from Zone A was picked eight days earlier than Zone B. The major advantage of this, when growing in a cool climate conditions, is that a reserve quality Cabernet Sauvignon was achieved significantly earlier than expected, reducing the risk of vintage rains and cooling temperatures.

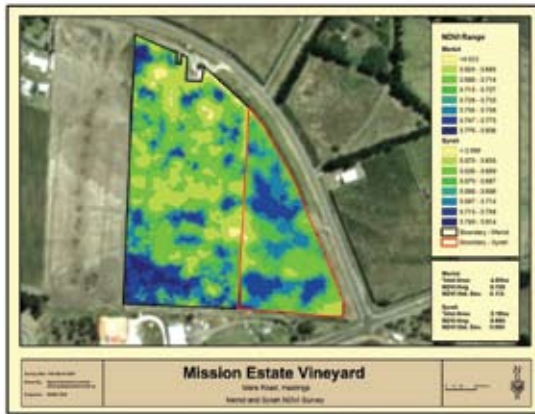


Figure 2. Mission Estate – Mere Road vineyard on the Gimblett Gravels was the first block to be NDVI mapped. To the left of the red line is Merlot and to the right Syrah. The yellow and green areas are low vigour and the blue high vigour.

from areas of low NDVI compared to areas of high NDVI (Table 1).

In consultation with Mission Estate's Chief Winemaker Paul Mooney, it was decided to separate the fruit from these vigour zones. The goal was to produce premium fruit from the low vigour zones (Zone A) for 'Jewelstone', Mission Estate's most exclusive label.

An extremely high input management model was introduced within the boundaries of these low vigour zones. This included bunch thinning clusters down to one bunch per shoot, removing apical and wing bunches, lateral thinning, and bunch and shoot positioning. This resulted in vines that were very well balanced and provided the basis for even fruit ripening and consistent flavour development. The fruit from these low/medium vigour zones was ready for harvest seven days earlier than the remainder of the block and had

Table 2. Differences in maturity analysis of grapes by zone after NDVI mapping.

Cabernet Sauvignon		Maturity parameters		
Date	Zone	Brix	Titratable acidity (TA)	pH
23/03/2007	A	22	8.25	3.31
23/03/2007	B	21.8	8.1	3.32
31/03/2007	A	22.6	7.5	3.38
31/03/2007	B	21.8	7.8	3.36
12/04/2007	A HARVEST	24	5.25	3.78
20/04/2007	B HARVEST	25	5.6	3.81