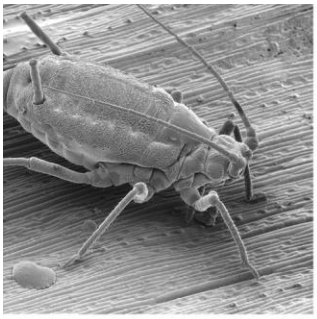
PFR SPTS No 8908

Phenological monitoring

Agnew R, Skilton T, Raw V

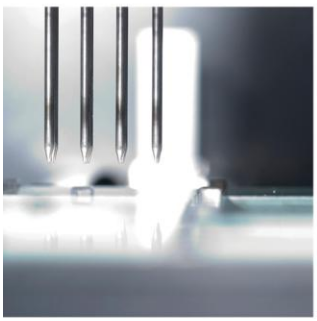
August 2013





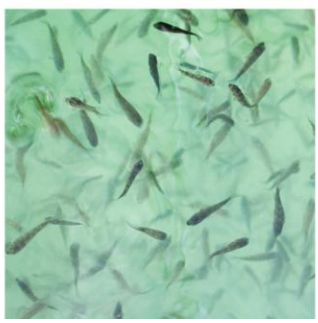
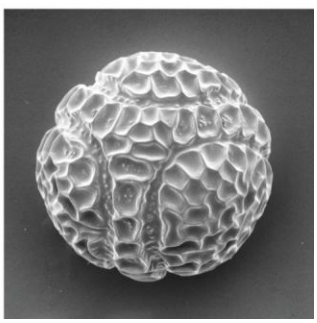










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Phenological monitoring

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The collection of phenological data on five sub-regional Sauvignon blanc vineyards in Marlborough was funded as part of the Foundation for Research Science and Technology programme “Quality New Zealand Wines, UOAX0404“ for the six seasons 2005 to 2010. The Marlborough Research Centre (MRC) have funded the Phenological Monitoring project for the past three seasons, 2011 to 2013. In the 2013 season a sixth site was added to the regional vineyards being monitored. This is the Marlborough Research Centre’s vineyard located in Rowley Crescent at Grovetown. A number of people had commented that it would be advantageous to have access to phenological records from a vineyard further east and closer to the coast than the existing four vineyards being monitored on the Wairau Plains. A crop load trial at the MRC vineyard had previously collected phenological data for four years between 2006 and 2009. It was therefore a logical step to continue the phenological data collection from the same plots within this vineyard.

We now have an almost continuous phenological record from the Sauvignon blanc vines within these six vineyards (Figure 1) for the nine seasons 2005 to 2013. Phenological data are collected on a weekly basis over the main growth stages (budburst, flowering and from véraison to harvest), the timing of which are largely dictated by the temperature within a season.

The importance of the collection of good phenological records for the benefit of the wine industry in a region such as Marlborough cannot be underestimated. Most wine companies and grape growers conduct some assessment of growth stages on their vineyard blocks. However, these records are generally fairly limited as to the number of observations around each growth stage being monitored. There is also no way that this information is currently being collated and shared for the benefit of the wider wine industry.

Phenology data summaries are included in the weekly VineFacts email service operated by Plant & Food Research in Marlborough. Many of the subscribers to VineFacts rely on the phenological summaries to give them advance knowledge of whether the current season is early or late. The phenological data contribute to a number of research programmes and provide a very valuable source of information for the Marlborough wine industry. The data help to quantify the season-to-season variability in harvest date and yield components as dictated by the climate.

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The value of making these phenological data available to the industry is becoming increasingly recognised both within and outside of Marlborough. Viticulturists from a number of other grape-growing regions in New Zealand who have had access to the VineFacts email are requesting that a similar service be made available in their region, e.g. Hawke's Bay. The possibility of collecting phenological data in other New Zealand wine regions is currently under investigation.

1.1 Location of the six sub-regional vineyards

Sub Region	Company	Vineyard Name
Awatere Valley	Pernod Ricard NZ Ltd	Awatere Estate
Brancott Valley	Pernod Ricard NZ Ltd	Brancott Estate
Central Rapaura	Pernod Ricard NZ Ltd	Squire Estate
Fairhall	Villa Maria Estate Ltd	Villa Maria, Winery Block
Western Wairau Plains	Oyster Bay Wines NZ Ltd	Oyster Bay, Airfields Vineyard
Grovetown	Marlborough Research CentreTrust	Rowley Vineyard

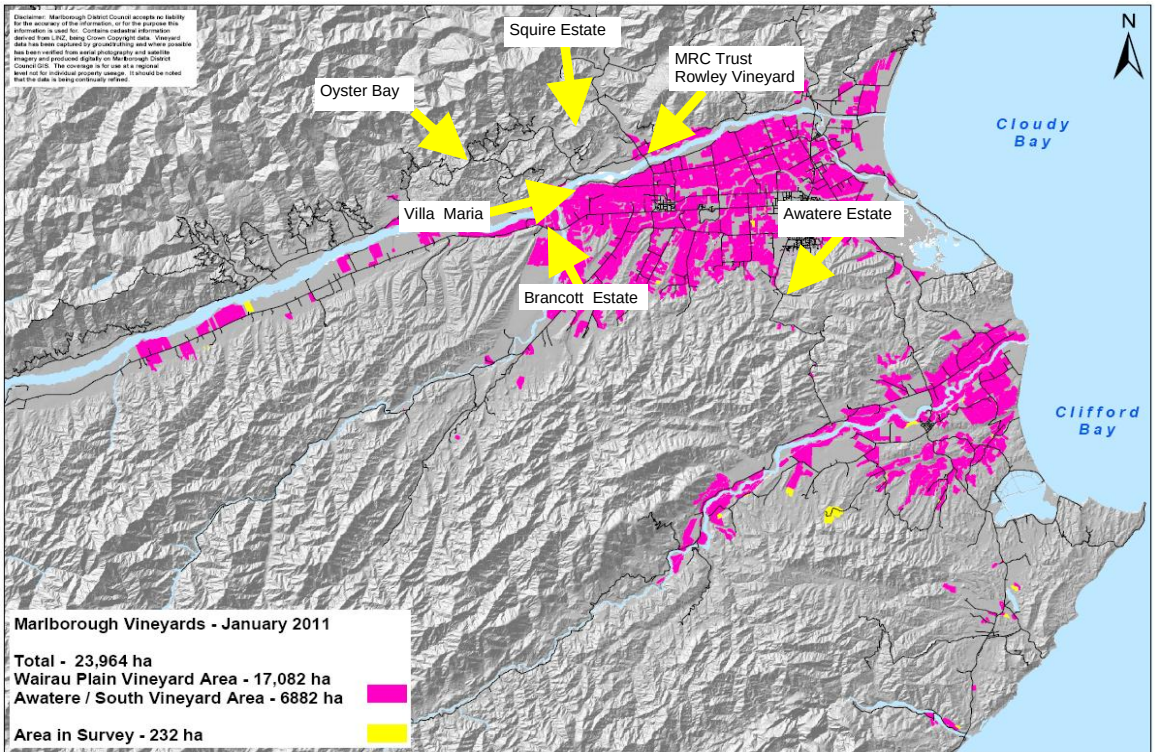

Figure 1. Map of the central Wairau plains and Awatere Valley, showing location of six Sauvignon blanc sub-regional vineyards.

2 Key results from 2013 and dissemination to industry

2.1 Monitoring of key phenological stages of Sauvignon blanc grapevines

Phenological monitoring of grapevines included:

- Weekly budburst assessments from late September until early November 2012
- Twice weekly flowering assessments during December 2012
- Weekly berry collections from pre-véraison through until harvest (early February to mid-April 2013) to measure berry maturity (soluble solids content, titratable acidity and pH).

The budburst, flowering and berry maturity data are collated and the summary tables are included in VineFacts, in the week following data collection. VineFacts was sent weekly by email, from 4 October 2012 until 24 April 2013 (30 issues), to 264 subscribers associated with the Marlborough wine industry.

The following are examples of phenological data tables that were included in VineFacts during the 2012-2013 season. Test in italics is as it was reported in issues of VineFacts.

Table 1: Percentage budburst at two of the sub-regional Sauvignon blanc vineyards in 2012, compared to previous seasons

Assessment date 2012	Awatere – Seaview								Mid Rapaura - Squire							
	05	06	07	08	09	10	11	12	05	06	07	08	09	10	11	12
10 Sept	0								0							
17 Sep	34	3	-		0	0	0	**0**	13	0	-		0	0	0	**0**
24 Sep	84	34	14	1	30	0	0	**0**	34	9	1	0	23	0	0	**0**
01 Oct	100	68	69	57	49	41	0	**25**	75	72	15		44	22	0	**11**
08 Oct		86	94	88	80	79	12		97	94	84	81	80	63	10	
15 Oct		100		96	98	100	53		100	100	89	100	93	88	55	
22 Oct				98			75				95		95		82	
29 Oct			93				96				100				97	

The following summary with reference to the data in Table 1 was intended to give the reader a general overview, right at the beginning of the growing season, of how the timing of budburst compared with previous seasons.

From VineFacts Number 1 on 4 October 2012. Interesting points to note from the budburst data at 01 October 2012

1. *As detailed in previous seasons, the Seaview site in the lower Awatere Valley is generally slightly earlier going through budburst in comparison to Squire Estate on the Wairau plains. Seaview is warmer in the winter and spring through until early- to mid-October. This is the case in 2012, with Seaview at 25% budburst on 1 October compared to 11% at Squire Estate in Rapaura*

2. *In a season when budburst is late (2011), it appears that budburst at Seaview is no earlier than on the Wairau plains. Seaview 12% budburst on 8 Oct 2011 compared to 10% at Squire Estate in Rapaura. These two vineyards tracked very closely in 2011*

3. *Budburst in 2012 currently appears to be later than in 2005-2009. Possibly very much on a par with 2010. Assessment was conducted on 1 October 2012 a few days ahead of assessment on 4 October 2010, so I suspect that the slight difference in % would be minimal if assessment had been carried out on 4 October 2012.*

Table 2: Comparison of flowering progression for Sauvignon blanc at the Squire Estate vineyard in 2012 compared to previous seasons

Assessment dates	Mid Rapaura – Squire							
	05	06	07	08	09	10	11	**12**
27–30 Nov	2.7	5 27						
1-**4** Dec	20	56	2	NA		1.2	0	**0.1**
5-**7** Dec	86	72	11	30		54	0.3	**2**
8-**11** Dec	100	78	59	62	3 13	66	0.8	**42**
12–**14** Dec		95	90	92		90	9.9	**80**
15–**18** Dec		98	98	96 99	50 77	97	35	**96**
19-**21** Dec					93	NA	70	
22-25 Dec					95		90	
26-28 Dec					NA		98	
30 Dec								

The following summary with reference to the data in Table 2 was intended to update the reader as to how the timing of flowering in December 2012 compared with previous seasons.

From VineFacts Number 12 on 20 December 2012. Points to note re flowering in 2012

4. *Flowering has progressed a lot more rapidly in 2012 compared to 2011, e.g.at Squire Estate it took about 10 days longer in 2011*

5. *There was some indication of flowering at Squire Estate on 8 December 2011, a similar date as in 2012. However, flowering was much slower to get underway at all vineyards in 2011*

6. *Average temperature in Blenheim over the main period of flowering at Squire Estate in Rapaura, 7 to 18 December 2012, was 16.6°C. This was very close to the December long-term average of 16.7°C. However, the first six days from 7-12 December were cool, at 14.9°C and the final six days from 13-18 December were hot, at 18.3°C.*

As you will probably be aware the period of bunch initiation for next season (2013/2014) is occurring at the present time. The current hot weather which is forecast to last for at least another week should push the bunch initiation temperature up to above average, which should mean a return to above average bunch numbers at harvest in 2014.

2.2 Development of a flowering prediction model from historical phenological and temperature data

In the past season the historical phenology and temperature data from the five sub-regional vineyards have been put to very good use in the development of a flowering prediction model. The following was included in VineFacts Number 7, on 15 November 2012.

Temperature modelling for prediction of flowering date

Over the past few months, Dr Alistair Hall, at Plant and Food Research in Palmerton North, has developed a model that uses the past seven seasons' phenology data and growing degree days (GDDs) for each of the five regional vineyard sites. Taking the point at which 50% budburst is calculated he has been able to determine the number of GDDs to achieve 50% flowering. This work has been conducted as part of what was previously known as the Designer Grapevines programme, funded by the Ministry of Science & Innovation (now MBIE) with co-funding from New Zealand Winegrowers.

NB: We are in the process of testing this model at present. However, rather than keep it hidden in the cupboard we have decided to show you some of the early results. We think that this will be a great tool for the industry in the future.

The model is able to use the current season's temperature data up until the current point in time. Looking forward from this point the model is able to predict flowering using different season's temperature data from previous years. This then gives different scenarios of the possible date of 50% flowering for the current year.

In Figure 1 GDDs from three different years from 1 November until the end of December are 'added onto' the end of the actual GDDs for this season.

The predicted date for 50% flowering 2012 varies from:

- *7 December (earliest prediction based on the current season to 31 October, and 2005 data from 1 November onwards) to*
- *18 December (latest prediction based on the current season to 31 October and 2000 data from 1 November onwards), giving an 11 day gap.*

*Looking at the overall **prediction** based on all the years' data, 50% flowering would be on 11 December 2012.*

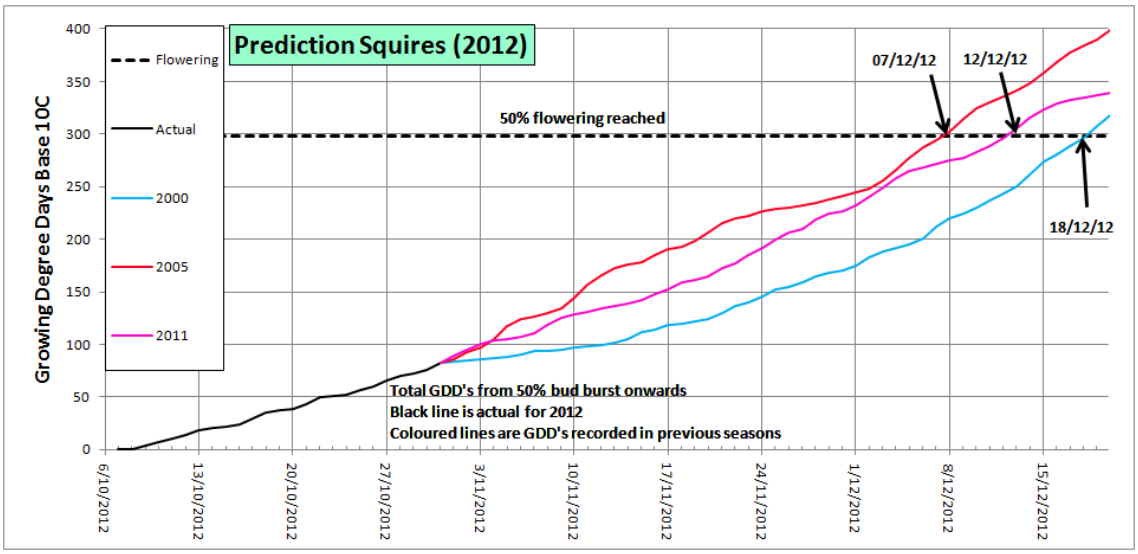

Figure 1. Prediction of 50% Flowering dates for Sauvignon blanc at Squire Estate using actual temperature data from 50% budburst (7/10/12) until 31 October 2012 and data from three previous seasons from 1 November onwards.

Figure 2 describes the consequences of the cool November so far in 2012. When the met data is added for the first two weeks of November 2012, the GDD line was largely unchanged for a week, then rose and then flattened off again. Using the same years as in Figure 1, the prediction of 50% flowering has changed. Using the temperature data up until 13 November 2012 and adding on data from the year 2000, the predicted date moves forward to 15 December 2012 (from the 18 Dec in Figure 1). This is because the first two weeks of November 2000 were cooler than the first two weeks of November 2012.

Using 2005 data the predicted date becomes 13 December 2012 (later by 6 days compared with Figure 1) and using 2011s data it is also predicted as 13 December 2012 (one day later compared with Figure 1).

Using all temperature data from 2000 to 2011 the predicted flowering date is 14 December 2012. The earliest date is 10 December using 2007, 2008 and 2010 data. The latest date is 19 December using 2004 data. These predictions have not been added to the graph or it would be too cluttered. The closer the Actual line gets to the time of flowering, the tighter the possible range of predicted dates should be.

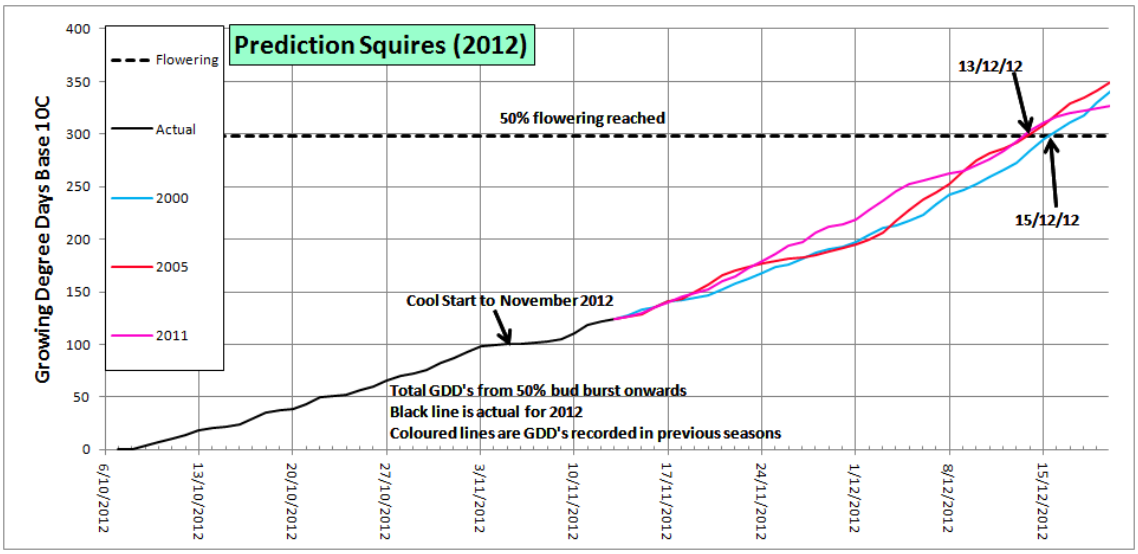

Figure 2. Prediction of 50% Flowering dates for Sauvignon blanc at Squire Estate using actual temperature data from 50% budburst (7/10/12) until 13 November 2012 and data from three previous seasons from 14 November forwards.

What are the consequences if flowering in 2012 is later than average but flowering occurs during hot weather, as in Dec 2000? We could again experience an above average yield, but late harvest. If flowering is late in 2012, but occurs during cool weather, then yields could be below average, but harvest earlier than we would expect. Remember that during the period of bunch initiation in December 2011 and early January 2012 that the temperatures were below average. This should result in bunch numbers being below average at harvest in 2013.

2.3 Use of historical phenological data to predict date of véraison and harvest

The previous section outlined how the phenological and temperature data have been used to develop a flowering prediction model. In time we also hope to develop reliable prediction models for the dates of budburst, flowering and harvest. However, even without these models, we have been making informed predictions of the dates of véraison and harvest based on phenological data averaged over previous seasons. Soon after flowering we are able to take the average time in days between 50% flowering and 50% véraison over previous seasons and then estimate the likely dates of flowering and véraison in the current season. Estimating the likely dates of véraison and harvest approximately six and twelve weeks prior to their occurrence allows the wine industry to adjust vineyard or winery management decisions well in advance of these events occurring. The following information was provided in Vinefax Number 14 on 3 January 2012. At this point in the season we made predictions of the date of véraison and the date of harvest for the 2013 season.

Table 3. Dates of key stages of phenological development for 2-cane pruned vines at Squire Estate vineyard central Rapaura and corresponding time in days between each of these phenological stages; Dates highlighted yellow are estimates for 2012, using the average interval of the previous 8 years

Phenological stage/duration	04/05 Year 1	05/06 Year 2	06/07 Year 3	07/08 Year 4	08/09 Year 5	09/10 Year 6	10/11 Year 7	11/12 Year 8	12/13 Year 9
50% Budburst	7 Oct	30 Sept	30 Sep	7 Oct	3 Oct	3 Oct	7 Oct	16 Oct	8 Oct
50% Flowering	11 Dec	4 Dec	4 Dec	9 Dec	7 Dec	15 Dec	6 Dec	17 Dec	12 Dec
Duration Fl (days)	15	11	26	17	17	18	16	20	13
50% Véraison	25 Feb	4 Feb	14 Feb	12 Feb	19 Feb	25 Feb	10 Feb	23 Feb	19 Feb
Yield per vine (kg)	4.2	3.4	3.7	4.3	6.2	5.2	4.8		
Harvest date	14 Apr	13 Mar	26 Mar	22 Mar	6 Apr	31 Mar	25 Mar	10 Apr	2 Apr
Harvest Brix	22.8	22.3	22.3	21.6	21.1	21.6	22.1	21.7	
BB to Fl (days)	65	65	65	63	60	73	60	62	65
Fl to V (days)	76	62	72	65	74	72	66	68	69
V to H (days)	48	37	40	39	46	34	43	46	42
Fl to H (days)	124	99	112	104	120	106	109	114	111
BB to H (days)	189	164	177	167	180	179	169	176	175

BB = bud burst, Fl = flowering, V = Véraison, H = Harvest

As was the case with the projections of flowering dates that we gave in December, the following projections of véraison and flowering dates for 2013 are intended as a guide only:

Estimate of Véraison Date 2013 *– Using a 69 day interval from flowering to véraison, (the average of the 8 years 2005-2012) would put 50% véraison on the 19 February 2013, four days earlier than in February 2012, but 9 days later than in February 2011. However, the warm weather that Marlborough has experienced since flowering is highly likely to lead to a shorter than average flowering to véraison interval. If the average temperature was to remain well above average during January 2013, (as it was in January 2006) then the flowering to véraison interval could be as low as 62 days. This would move the date of véraison forward to the 12 February 2013; but note that this would still be eight days behind the date of véraison in 2006.*

Estimate of Harvest Date 2013 – *Using a 42 day interval from veraison to harvest would put harvest date on 2 April 2013. Or again, if véraison was on 12 February 2013 (early due to hot weather), harvest could be as early as 26 March.*

NB: However, given that the Squire Estate vineyard is generally the earliest of the five regional vineyard sites to be harvested, then harvest 2013 for Sauvignon blanc is looking like it won't really get underway until April 2013.

3 Summary

The Phenological Monitoring project funded by the Marlborough Research Centre Trust has now built up a substantial database of reliable phenological data for Sauvignon blanc vineyards in Marlborough. These data are being extensively communicated to the wine industry in Marlborough through the VineFacts Information Services project. Many people within the wine industry have communicated how they value being able to access this information. This has been highlighted by the fact that viticulturists from Hawke's Bay have expressed an interest to see the same collection and communication of the phenological information take place in their region.

The phenology data have provided a base of information from which a flowering prediction model has been developed for Sauvignon blanc in Marlborough over the past year. The historical phenology data are also used to make projections as to the timing of véraison and harvest. Further model development will be undertaken in the coming year.

4 Key funding sources and collaborating companies

- Marlborough Research Centre Trust
- The New Zealand Institute for Plant & Food Research Ltd.
- Pernod Ricard New Zealand Limited
- Villa Maria Estate Ltd
- Oyster Bay Wines New Zealand Ltd.

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