

Marlborough meteorological services

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1 Introduction

The funding that the Marlborough Research Centre (MRC) allocates for meteorological services allows for the provision of a wide range of services to the Marlborough community, as follows:

- Provision of monthly meteorological summaries and press releases to local media.
- Publication of monthly meteorological summaries for the Blenheim and Dashwood Awatere weather stations on the MRC website.
- Provision of 11 monthly Met Report articles for inclusion in Winepress, the official magazine of Wine Marlborough.
- Access to the Grovetown Park weather station for education groups.
- Provision of data to the National Institute of Water and Atmospheric Research (NIWA) National Climate Database.
- Maintenance of a database of meteorological data for the Blenheim and Awatere stations by The New Zealand Institute for Plant and Food Research Limited (PFR).
- Provision of weather data to support many of the research projects that are conducted by PFR, Lincoln University, University of Auckland, Nelson Marlborough Institute of Technology.
- Provision of data to organisations associated with the wine industry, e.g. Bragato Research Institute, Sustainable Winegrowing New Zealand, Nelson Marlborough Institute of Technology Viticulture & Wine programme, Wine Marlborough and many wine companies.
- Provision of data for use by the wider agricultural and horticultural industries, e.g. Fruited Supplies, Farmlands Co-Operative Society Limited, Fruition Horticulture (SI) Limited.

Detailed summaries of data from the Blenheim and Awatere weather stations can be accessed on the MRC website www.mrc.org.nz.

2 Weather data for the 2020–21 year

Table 1 summarises the main weather parameters for the 2020–21 year, for the Blenheim weather station located at the Grovetown Park campus of the MRC.

Table 1. Blenheim weather summary for the 12 months from July 2020 to June 2021.

	LTA Mean Max °C	20/21 Mean Max °C	LTA Mean Min °C	20/21 Mean Min °C	LTA Mean °C	20/21 Mean °C	LTA GDD	20/21 GDD	LTA PET mm	20/21 PET mm	LTA Rain mm	20/21 Rain mm	LTA Sun hours	20/21 Sun hours
July	13.2	14.0	2.7	2.9	8.0	8.5	8.8	10.5	36.3	39.3	62.3	16.8	162.5	172.8
August	14.3	15.8	3.9	4.7	9.1	10.3	17.8	34.8	49.6	60.3	61.6	49.6	185.8	222.9
September	16.3	17.5	6.0	6.4	11.1	11.9	52.1	77.3	72.8	93.3	52.9	64.6	195.3	260.3
October	18.4	19.2	7.9	9.5	13.1	14.3	101.1	136.6	102.9	114.4	56.8	22.4	230.6	224.8
November	20.0	19.9	9.5	10.5	14.8	15.2	143.9	156.7	122.3	105.4	50.6	81.8	239.6	180.0
December	21.9	21.7	11.7	11.7	16.8	16.7	211.9	207	140.4	143.2	47.3	22.8	250.7	255.4
January	23.5	24.5	12.8	12.4	18.2	18.4	251.9	261.6	143.5	172.3	43.2	7.8	263.0	309
February	23.3	23.3	12.5	11.6	17.9	17.5	223.7	209.8	115.2	123.3	46.6	22.8	230.5	263.8
March	21.5	21.5	10.6	10.8	16.1	16.2	189.8	191.4	99.7	99.9	40.6	79.2	230.5	208.8
April	18.9	20.2	8.0	8.8	13.5	14.5	106.1	135.4	64.0	77.3	50.9	7.8	191.6	210.6
May	16.6	16.3	5.8	6.0	11.2	11.2	54.3	53.4	45.7	45.4	58.6	88.2	176.6	162.7
June	13.8	15.0	3.6	5.6	8.7	10.3	17.5	36.4	33.2	29.8	65.3	75.6	150.9	135.6
Total – July to June							1378.9	1510.9	1025.5	1103.9	636.7	539.4	2507.6	2606.7
Mean – July to June	18.5	19.1	7.9	8.4	13.2	13.7								
LTA comparison		+0.6°C		+0.5°C		+0.5°C		110%		108%		85%		104%
Sept to April – Mean Sept to April – Total	20.5	21.0	9.9	10.2	15.2	15.6	1280.4	1375.8	860.7	929.1	390.5	309.2	1831.9	1912.7

LTA – Long-term average Rainfall, Temperature, Sunshine, GDD – growing degree-days (1986–2020), PET – potential evapotranspiration (1996–2020).

2.1 Temperature

The mean temperature for the 12 months from 1 July 2020 to 30 June 2021 was 13.7°C; 0.5°C above the long-term average (LTA). Nine months in the 2020–21 year recorded above average temperatures, 1 month an average temperature and 2 months below average temperatures (Table 1).

The 2020–21 year is the sixth warmest July to June year on record for Blenheim, in the 89 year period from 1932–33 to 2020–21 (Table 2). The equal warmest July to June years on record are 2017–18 and 2018–19, both of which recorded a mean temperature of 14.0°C. Since 1932–33, four of the 10 warmest years have occurred in the last 8 years, between 2013–14 and 2020–21. The LTA data in

Table 2 also highlights that the average temperature over the period 1986 to 2020 is 0.5°C warmer than the LTA over the period 1932 to 1985.

Table 2: The 10 warmest July to June mean temperatures on record for Blenheim (1932 to 2021).

Year	Mean temperature (°C)
2018–19	14.02
2017–18	14.01
2013–14	13.93
1989–90	13.82
1998–99	13.76
2020–21	13.75
1997–98	13.70
1974–75	13.69
1970–71	13.69
1988–89	13.68
LTA	13.20 (1986–2020) 12.72 (1932–1985)

One of the clearest pictures of Blenheim’s warming temperatures is seen in the large decrease in the total number of ground frosts recorded per annum (Figure 1). The trend line in Figure 1 indicates that in 2020 Blenheim recorded an average of 74 fewer ground frosts than in 1932.

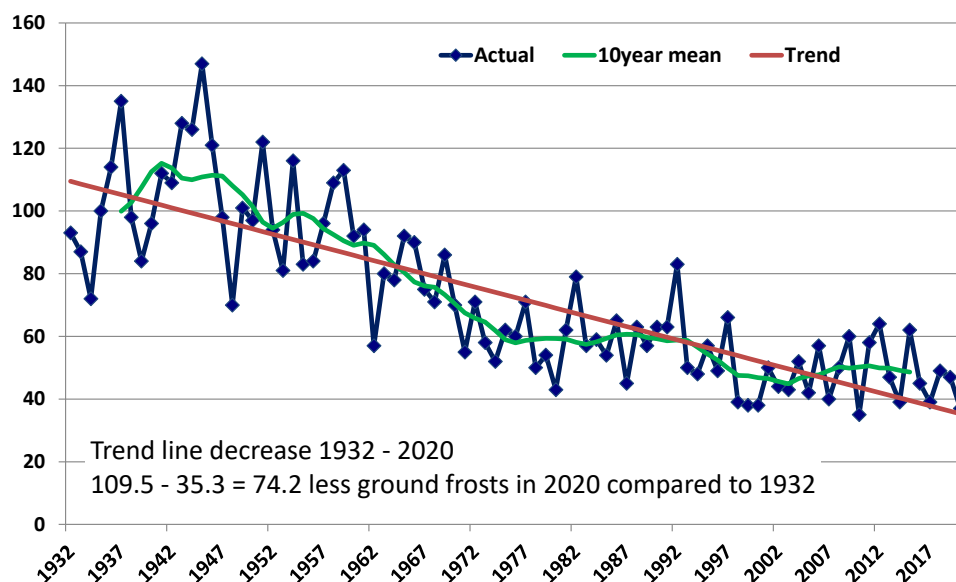


Figure 1. Annual number of ground frosts recorded in Blenheim over the 89 years 1932 to 2020.

2.2 Sunshine

Total sunshine for the 12 months from 1 July 2020 to 30 June 2021 was 2606.7 hours (Table 1). This is the 13th sunniest July to June year on record for the 91 year period 1930–31 to 2020–21. Sunshine hours for Blenheim have increased slightly over recent decades, with many of the sunniest years on record having occurred since 2000.

2.3 Rainfall

Blenheim’s LTA monthly rainfall has little month-to-month variation, with March having the lowest LTA total of 40.6 mm and June having the highest LTA monthly total of 65.3 mm. However, any particular month can exhibit marked variation in rainfall from year to year. Almost every year also has at least one month with very low rainfall and another month with high rainfall. This was again the case in the 2021–21 year. January and April 2021 both recorded only 7.8 mm rain and November 2020 and May 2021 recorded 81.8 and 88.9 mm rain respectively (Figure 2). For the third year in a row January and February were very dry. This 12-month period was actually largely very dry for 5.5 months, from December 2020 to mid-May 2021. Figure 1 indicates that March 2021 recorded well above average rainfall of 79.2 mm, however, almost the entire month’s rainfall was confined to the final 4 days of March and this was then followed by a very dry April.

Marlborough farmers are largely geared towards growing grass in the spring and autumn. Dry summers with little pasture growth are normal. From a pastoral farming point of view the early part of the growing season from August to November 2020 received good rainfall and consequently good pasture growth. The rainfall in late March and again in late May 2021 with warm soil temperatures meant that good grass growth occurred in the autumn.

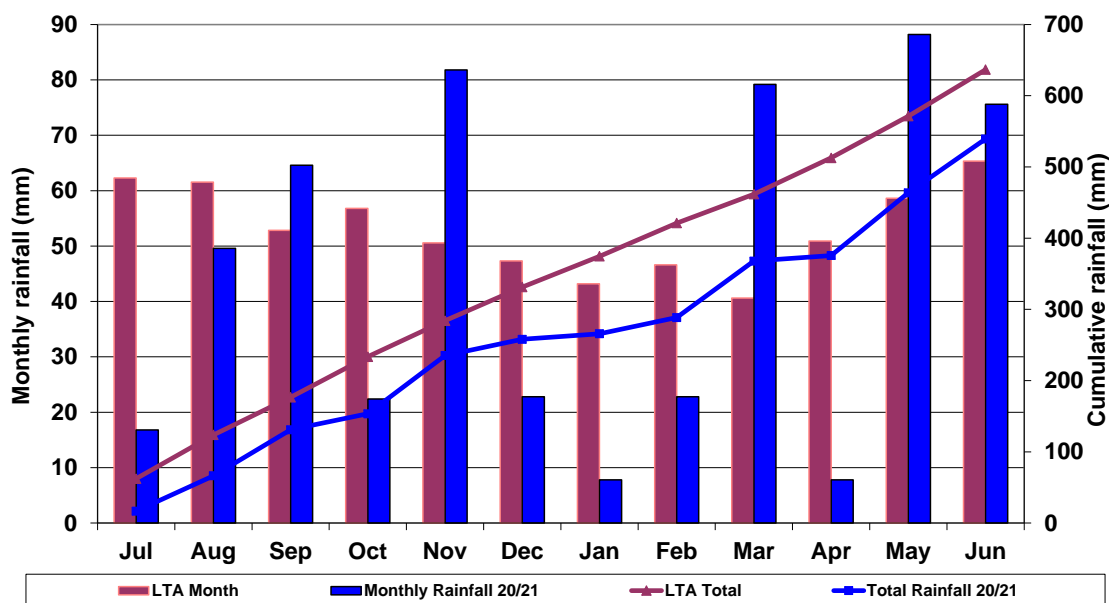


Figure 2. Monthly and cumulative rainfall in Blenheim for the 12 months from 1 July 2020 to 30 June 2021 compared with the long-term average (LTA).

2.4 Wind-run

Daily wind-run is a measure of the total wind received in a 24-hour-period, measured in kilometres (km). The easiest way to understand total daily wind-run is to imagine a balloon released at 9 am today and able to travel in the same direction unimpeded for 24 hours. The daily wind-run recorded at 9 am tomorrow is the distance the balloon would have travelled over the 24-hour-period.

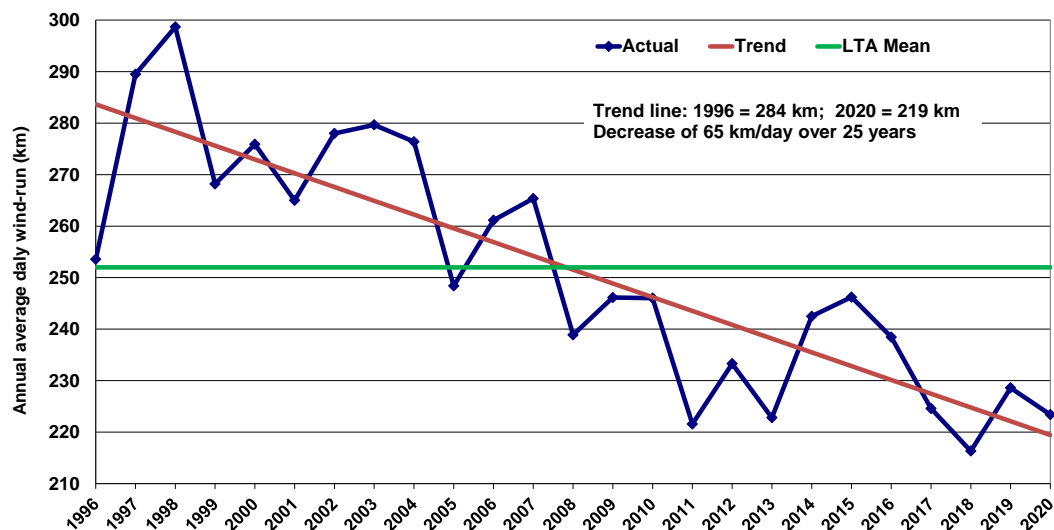


Figure 3. Annual average daily wind-run in Blenheim over the 25 years 1996 to 2020.

Figure 3 displays the annual average daily wind-run over the 25-year-period 1996 to 2020. The red trend line clearly indicates that the average daily wind-run in Blenheim has decreased substantially over the 25-year-period. The horizontal green line is the LTA daily wind-run over the 25 years. Only one year in the 12 years from 1996 to 2007 recorded less than the LTA. Conversely all 13 years from 2008 to 2020 recorded less than LTA daily wind-run.

2.5 Growing season 2020–21

The growing season for winegrapes in New Zealand is generally considered to be the 8-month period from 1 September through until 30 April. The mean temperature for the 2020–21 growing season was 15.6°C, 0.4°C above the LTA. Total growing degree days (GDD) for the season were 1375.8, 107% of the LTA (Table 1). GDDs in the first 3 months of the season from September to November 2020 were greater than in almost all previous seasons (Figure 4) and it looked as if Marlborough was heading for another very warm season, as in 2017–18. However, the much warmer than average summer that was predicted at the beginning of December 2020 did not eventuate. The fairly flat GDD line from December 2020 through until March 2021 indicates that temperatures were reasonably close to average. However, the GDD line for 2020–21 does indicate that there were short cold periods in late-December 2020 and again in late-January/early-February 2021.

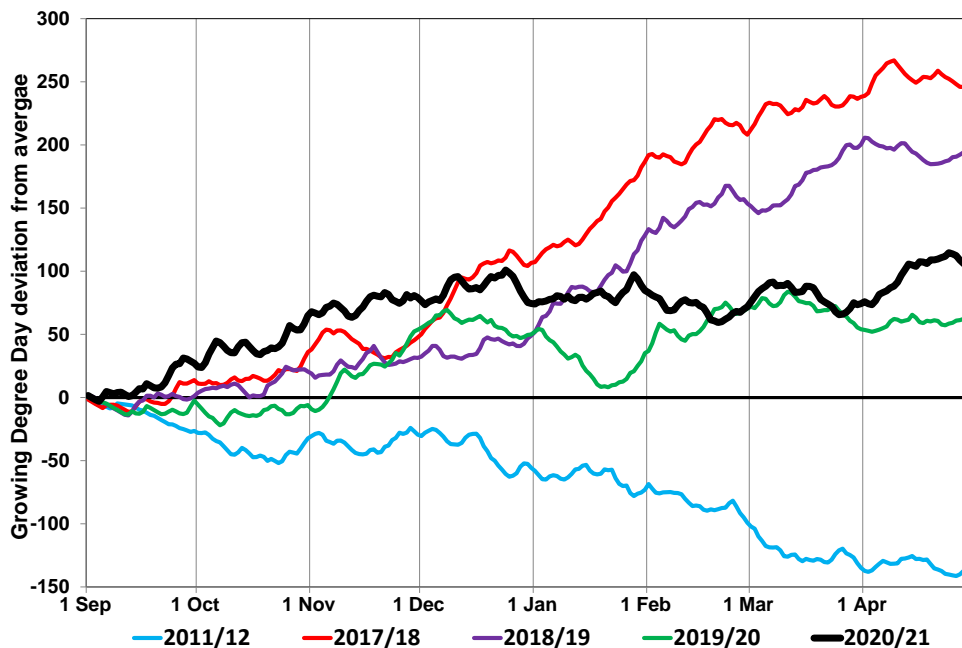


Figure 4. Normalised growing degree days for Blenheim: days above (+) or below (-) the long-term average (LTA) for the period 1 September to 30 April.

Figure 4 gives a general picture of the temperature profile of individual seasons. It allows the reader to examine the season as a whole, or to look at specific periods within the season as to whether they were warmer or cooler than the LTA. However, as GDDs integrate both the daily maximum and minimum temperatures, it is sometimes useful to examine how each of these compares with their respective LTAs. Figures 5 and 6 contrast the cumulative differences between the maximum daily temperature and the maximum LTA, and the minimum daily temperatures and the minimum LTA, for the 2019–20 and 2020–21 seasons; i.e. if a line is sloping upwards, the temperature is above the LTA or if downwards, the temperature is below the LTA. If the maximum and minimum temperature lines are diverging, it means that one of the temperatures is further above average than the other. Examination of the cumulative maximum and minimum temperatures allows you to see if one or the other is having a greater effect on the accumulating GDDs during the season. This can be important when interpreting the effects of temperature on the phenology of plants such as grapevines.

The main period of grape flowering in Marlborough is indicated on Figures 5 and 6. The flowering period in late-November/early-December 2019 was largely very warm with both the daily maximum and minimum temperatures being well above average (Figure 5). The consequence of the warm temperatures over flowering in 2019 were that fruit set in grapes was very good and as a result the number of berries per bunch of grapes were well above average at harvest in 2020.

In contrast Figure 6 indicates that during the main period of grape flowering in late-November/early-December 2020 that the daily maximum temperatures were mainly below average. The daily minimum temperatures were fairly close to average. As a consequence of cooler daytime maximum temperatures over flowering in 2020, berry numbers per bunch at harvest in 2021 were well below average. The contrasting daily maximum temperatures (Tmax) over flowering in 2019 and 2020 and their effects on fruit set and subsequent yield at vintage in 2020 and 2021 are in line with yield modelling work conducted by Zhu et al., 2020, which demonstrated that daily Tmax in the lead up to flowering is a key factor in determining yield at harvest.

In addition to temperature having a significant effect on fruit set, wet weather over the flowering period also contributes to poorer fruit set. The main flowering period in 2019 covered a period of approximately 20 days, across the main varieties. Rain was recorded on 5 of the 20 days. The main flowering period in 2020 covered a period of approximately 26 days. Rain was recorded on 12 of the 26 days. The higher proportion of rain days over flowering in 2020 undoubtedly also contributed to the poorer fruit set.

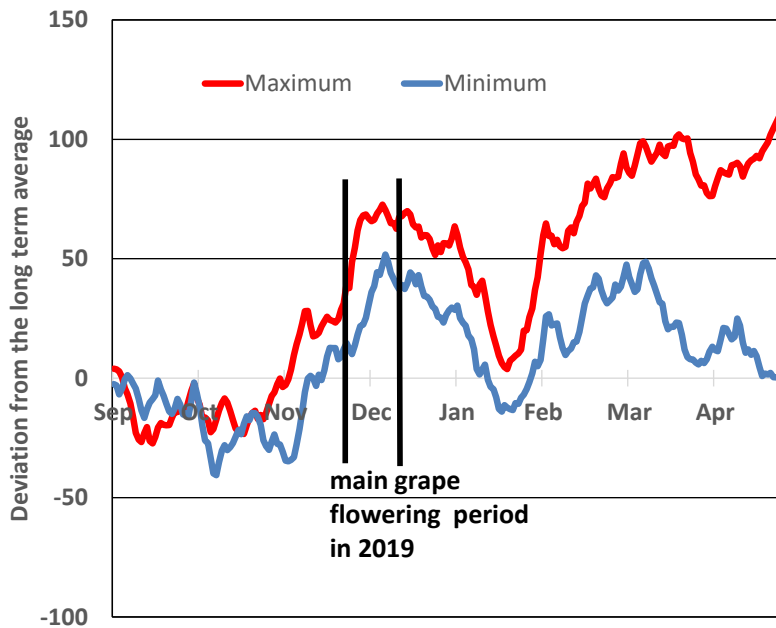


Figure 5. Cumulative difference between maximum temperatures and the long-term average and minimum temperatures and the long-term average for Blenheim: 1 September 2019 to 30 April 2020.

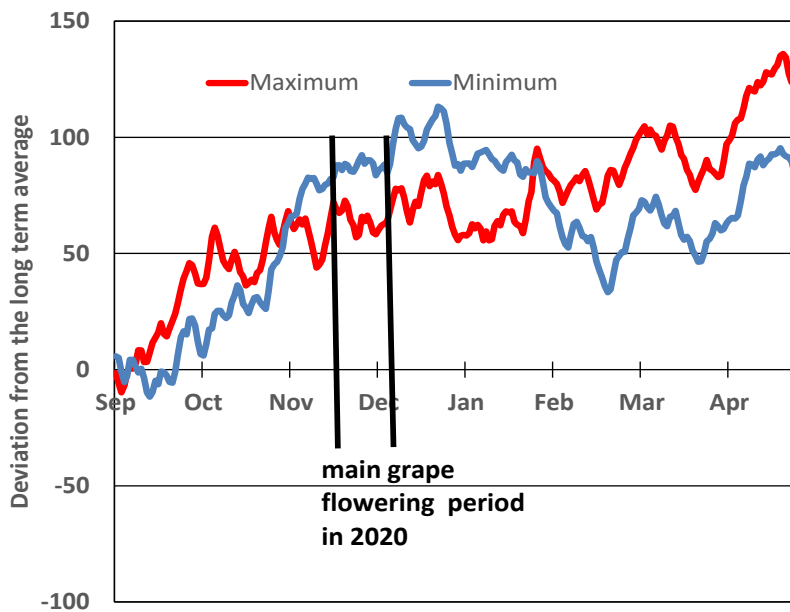


Figure 6. Cumulative difference between maximum temperatures and the long-term average and minimum temperatures and the long-term average for Blenheim: 1 September 2020 to 30 April 2021.

2.6 Warming temperatures and their effect on grape phenology

Section 2.1 outlined that the 2020–21 year was the sixth warmest on record for Blenheim (1932–2020) and that 4 of the 10 warmest years on record have been since 2013–14. Global warming is constantly in the news, so how is this warming making its impact felt in Marlborough? Figures 7 and 8 highlight the effects that warming temperatures in Marlborough are having on Sauvignon blanc phenology. Grapevine phenology is the relationship between the climate, predominantly temperature, and the growth stage development of the grapevines.

In Marlborough we have been recording grapevine phenology on four Sauvignon blanc vineyards for 17 seasons, from 2004–05 to 2020–21. Bear in mind that 17 years is still a relatively short time period over which to be trying to detect advances in vine phenology due to warming temperatures, compared with Old World countries such as Spain and France that have much longer datasets.

Figure 7 presents the days of the year (DOY) on which 50% budburst and 50% flowering were recorded over the 17 seasons 2004–05 to 2020–21 at a vineyard in central Rapaura. The trend lines indicate that budburst has advanced by 4.7 days and flowering by 5.6 days, over this 17 year period, at this vineyard.

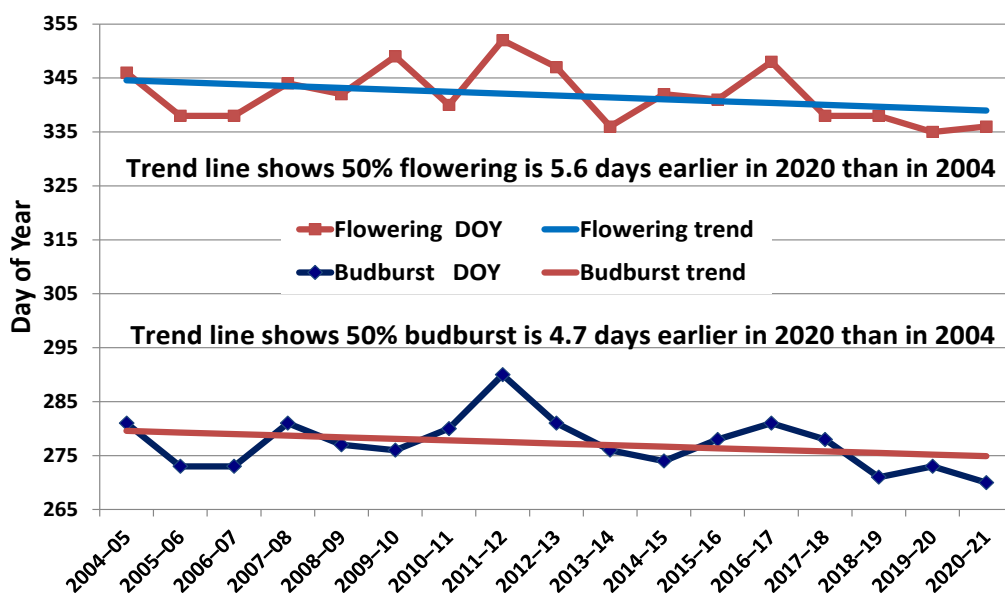


Figure 7. Actual day of year for 50% budburst and 50% flowering at a Sauvignon blanc vineyard in central Rapaura, Marlborough, over 17 seasons 2004–05 to 2020–21 and trend in advancement of budburst and flowering dates. DOY=days of the year.

Figure 8 presents the days of the year (DOY) on which 50% véraison and 21.5°Brix were recorded over the 17 seasons 2004–05 to 2020–21 at the same vineyard block. The trend lines indicate that véraison has advanced by 15 days and 21.5°Brix by 7.7 days, over this 17-year period, at this block.

The main consequence of the warmer temperatures in recent seasons has been earlier grape harvests in Marlborough.

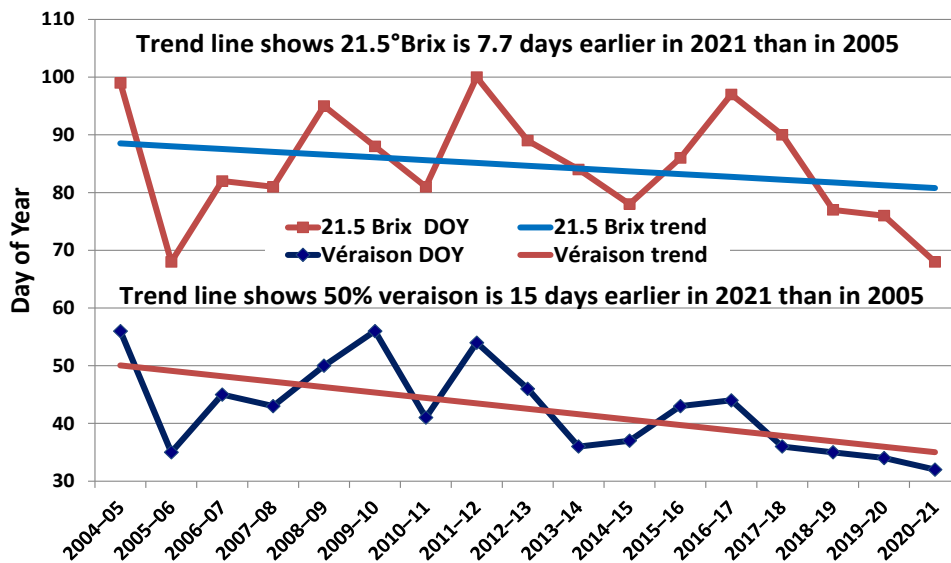


Figure 8. Actual day of year for 50% véraison and 21.5°Brix at a Sauvignon blanc vineyard in central Rapaura, Marlborough, over 17 seasons 2004–05 to 2020–21 and trend in advancement of véraison and 21.5°Brix dates. DOY=days of the year.

3 Key funding sources

- Marlborough Research Centre Trust
- The New Zealand Institute for Plant and Food Research Limited
- Wine Marlborough/Tasman Crop Protection
- National Institute of Water & Atmospheric Research (NIWA) (annual calibration and maintenance of the Blenheim weather station).

Confidential report for:

Marlborough Research Centre Trust

Project #1

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