# Impact of global warming on the yields of strawberry in southern Queensland

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- Climate plays a key role on the productivity of strawberry
- The average daily mean temperature has increased by 2°C over the season on the Sunshine Coast since 1967
- The impact of global warming has been less severe on the Granite Belt, with a 1°C increase in the mean temperature
- These increases in temperature are associated with a decrease in potential yield of 6 to 12% in the two areas
- Further decreases in yield are expected in the next few decades, in the absence of heat-tolerant cultivars or other strategies

## Introduction

Environmental conditions have a strong effect on the productivity of strawberry plants. The main scenarios for global climate change include an increase in the concentration of carbon dioxide ($CO_2$) and an increase in average temperatures.

In most crops, there is an initial increase in productivity with climate change and then a decrease. Research in California indicated that yields under open-field conditions will decline by 10% by the middle of this century and by 43% by the end of this century, mainly because of temperature extremes and droughts. Global warming will alter plant, flower and fruit development with smaller and less-sweet berries under higher temperatures.

This article reports on the effect of global warming on the yields of strawberry in southern Queensland.

## The strawberry industry in Queensland

According to the 2020/21 Australian Horticulture Statistics Handbook, strawberry growers in Australia produced 77,751 tonnes of fruit worth AU$417 million.

The main production centres are in Queensland (42%), Victoria (36%) and Western Australia (11%). There are smaller industries in South Australia (7%), Tasmania (4%) and New South Wales (1%).

There are two principal areas in Queensland. The bulk of the winter crop is produced from May to October on the Sunshine Coast. The bulk of the summer crop is produced from October to May at elevation on the Granite Belt.

**Climate plays a key role on the productivity of strawberry. Increases in temperature over the past five decades in southern Queensland are associated with a decrease in potential yield of 6 to 12%.** Photo credit: Chris Menzel, QDAF

## Temperature conditions in southern Queensland

Temperatures across the globe have increased over the past fifty years. The rate of warming varies from one region to the next and that there are differences between winter and summer and between days and nights. The effect of climate change on productivity depends on the degree of warming, and whether the increase in temperature is mainly during winter or summer or during the day or the night.

The average daily mean temperature over the season at Nambour (Sunshine Coast) has increased since 1967 (Figure 1). The mean temperature from May to October has increased from 16.0°C in 1967 to 18.0°C in 2021, equivalent to a rise of 0.45°C per decade. The minimum (0.73°C per decade) has increased more than the maximum (0.17°C per decade).

The average daily mean temperature over the season at Applethorpe (Granite Belt) has increased, but not as much as in Nambour (Figure 2). The mean temperature from October to May has increased from 16.8°C in 1967 to 17.8°C in 2021, equivalent to a rise of 0.02°C per decade. The maximum (0.38°C per decade) has increased more than the minimum (0.09°C per decade). These changes in temperature will affect the yields of strawberry fields, especially those on the Sunshine Coast.

## Relationship between yield and temperature

Le Mière et al. (1998) examined the effect of temperature on the performance of strawberry in temperature-controlled glasshouses in the United Kingdom set at temperatures from 12° to 28°C. There was a strong relationship between yield and temperature (Figure 3). Average yield decreased from 200g per plant at 12°C to 50g per plant at 28°C. Yield decreased by 11.9 ± 0.9g per plant for each one degree increase in temperature, equivalent to a decrease of 6% from the maximum yield.

There is no information on the relationship between yield and temperature in Queensland. However, the data collected in the United Kingdom can be used as a guide. There are different cultivars between the two growing areas and different environmental conditions. Light levels are usually lower in glasshouses than in the open field. Maximum yields in the study in the United Kingdom were low compared with crops in Queensland.

## Impact of global warming on yields in southern Queensland

The daily mean temperature has increased by 2°C at Nambour over the past five decades. There has been a smaller change in the temperature in the Granite Belt, with the daily mean increasing by 1°C. This analysis suggests a decrease in potential yield of 12% on the Sunshine Coast over this period, and a decrease of 6% on the Granite Belt. Further decreases in yield are expected with the mean temperature predicted to increase by 1° to 2°C over the coming decades.

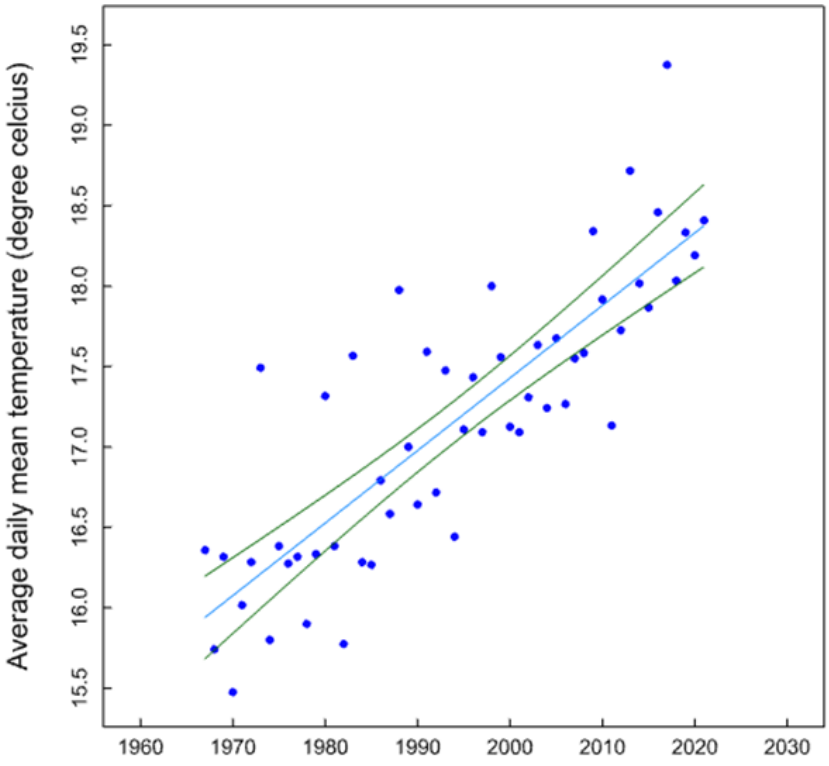


**Figure 1. Changes in average daily mean temperature from May to October at Nambour from 1967 to 2021. Temperature = Intercept + 0.0451 × Year ($P < 0.001$, $R^2 = 0.69$).** Data are from www.bom.gov.au

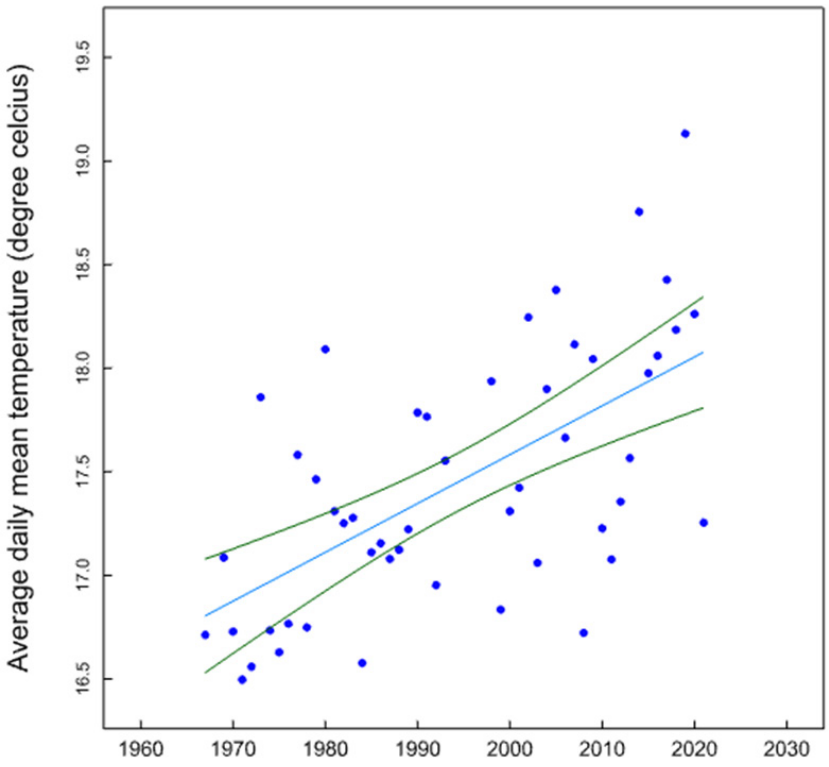


**Figure 2. Changes in average daily mean temperature from October to May at Applethorpe from 1967 to 2021. Temperature = Intercept + 0.0236 × Year ($P < 0.001$, $R^2 = 0.37$).** Data are from www.bom.gov.au

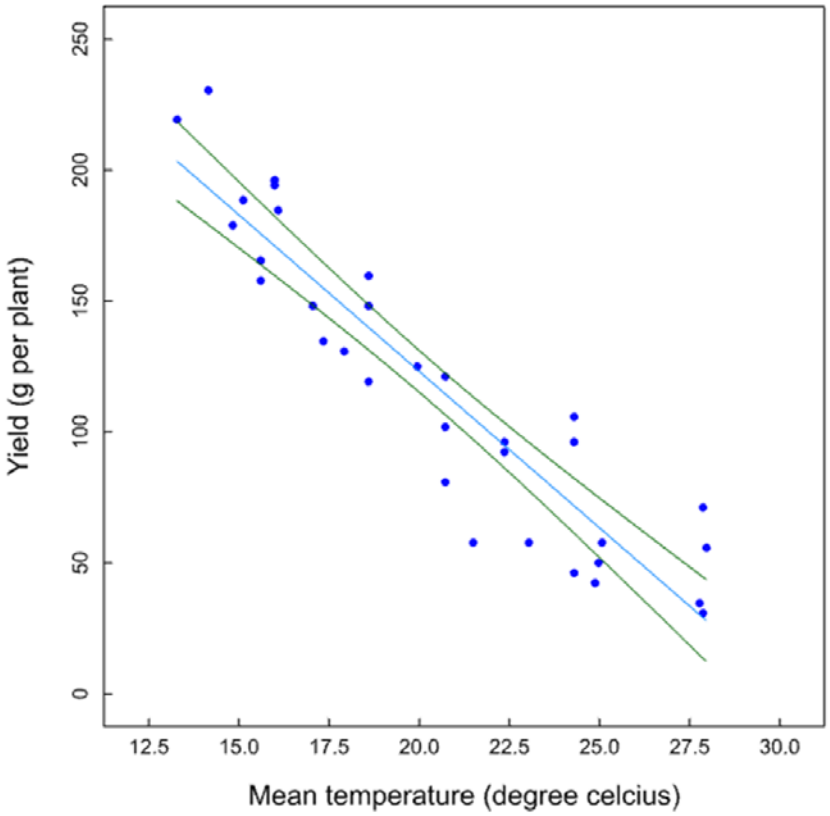


**Figure 3. Relationship between yield and temperature in strawberry plants in temperature-controlled glasshouses in the United Kingdom. Yield (g per plant) = Intercept – 11.9 × Mean temperature (°C) ($P < 0.001$, $R^2 = 0.85$).**
Data are from Le Mière et al. (1998).

## Conclusions

- The main scenarios for global climate change include an increase in the concentration of carbon dioxide ($CO_2$) and an increase in average temperatures.
- The daily mean temperature has increased by 2°C on the Sunshine Coast over the past five decades.
- The impact of global warming has been less severe on the Granite Belt, with a 1°C increase in the mean temperature.
- These increases in temperature are associated with a decrease in potential yield of 6 to 12% in the two areas.
- Further decreases in yield are expected in the next few decades, in the absence of heat-tolerant cultivars and other strategies.

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