Yields of strawberry plants vary more with the season than with the cultivar

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- Variations in yield were greater than variations in fruit weight or fruit chemistry across all years and cultivars
- Variations in yield between years (across all cultivars) were greater than the variations between individual cultivars(!)
- There was no correlation between yield and the weather during the study except for during extreme weather events
- Other factors, possibly related to variability in planting materials each season, had an overriding influence on yield

In south-east Queensland, strawberries are produced over winter and spring on the Sunshine Coast and in Bundaberg, and over summer and autumn on the Granite Belt. A wide range of cultivars are grown, including those that are adapted to cold winters and frosts in spring or heat in summer. Cultivars also vary in their need for chilling for flower initiation and the time of flowering and ripening.

The long-term sustainability of strawberry production in the region depends on high-yielding cultivars with acceptable fruit quality in the prevailing weather conditions.

This article reports on the productivity and quality of strawberry cultivars developed in Queensland and Florida. The plants were evaluated over winter and spring on the Sunshine Coast from 2020 to 2023.

Experimental design

Three or four cultivars were planted each year at Nambour in randomised blocks, with six replicates per cultivar (Table 1). Fruit was harvested every week for an assessment of marketable yield (fresh weight) and average fruit fresh weight from June to October. Mature fruit were classified as those that were at least three-quartered coloured. Marketable fruit weighed at least 12 g fresh weight and were not affected by rain and/or grey mould or were misshapen. Information was also collected on fruit total soluble solids content (SSC) and titratable acidity (TA) as citric acid measured at 20°C in the first three experiments.

Table 1. Dates of planting and the cultivars used in each year of the research

Year	Planting date	Cultivars
2020	29 April	Brilliance, Festival & Red Rhapsody
2021	19 April	Brilliance, Festival, Fortuna & Red Rhapsody
2022	20 April	Festival, Fortuna, & Red Rhapsody
2023	30 March	Brilliance, Festival, Fortuna & Red Rhapsody

Weather conditions during the experiments

Figures 1 to 3 show weather conditions during the experiments. Day temperatures were generally average to slightly higher than average during the experiments (April to October) except for in 2022 which was up to 2°C cooler than the long-term average.

Night temperatures were more than 3°C above the long-term average in May 2022 (associated with very high rainfall) but cooler than average from June to August. May 2023 was also cooler than average by 2.5°C. Other years were generally average.

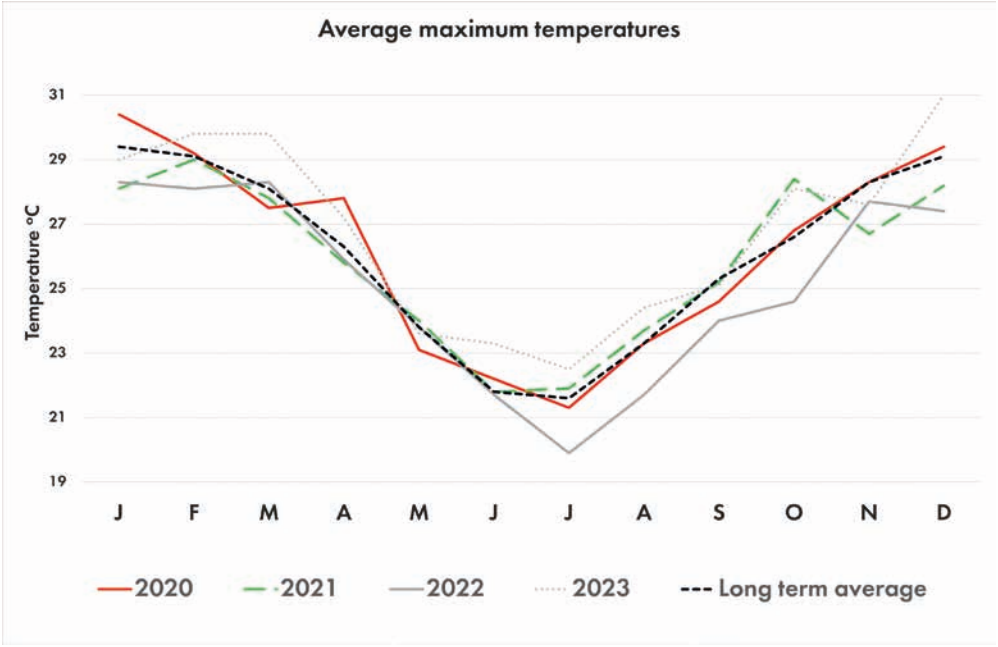

Figure 1. Average monthly maximum temperatures recorded at Nambour from 2020 to 2023. The long-term average is from 2007 to 2023.

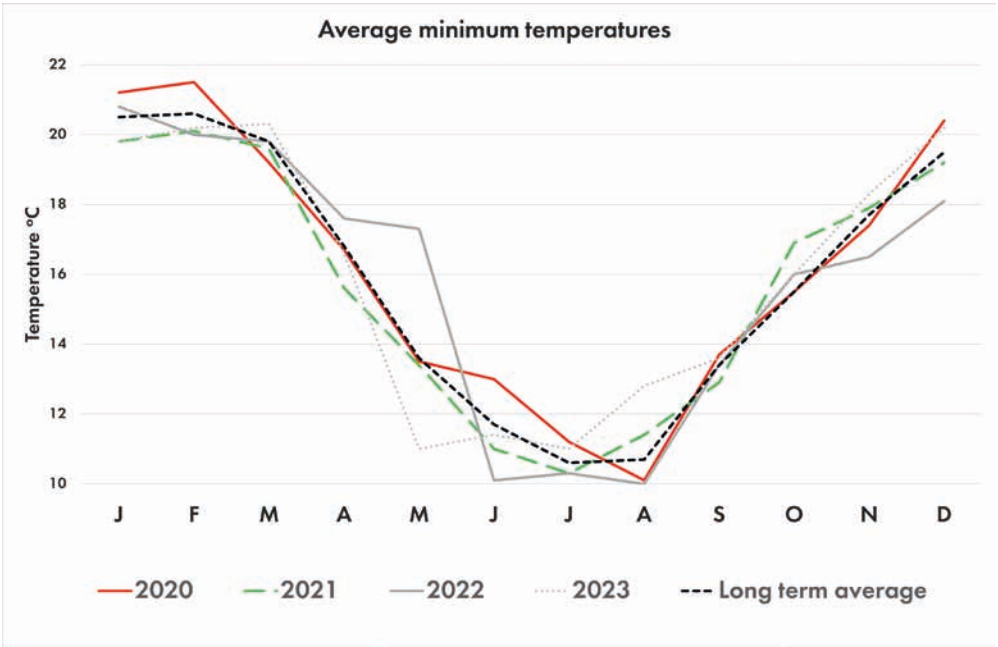

Figure 2. Average monthly minimum temperatures recorded at Nambour from 2020 to 2023. The long-term average is from 2007 to 2023.

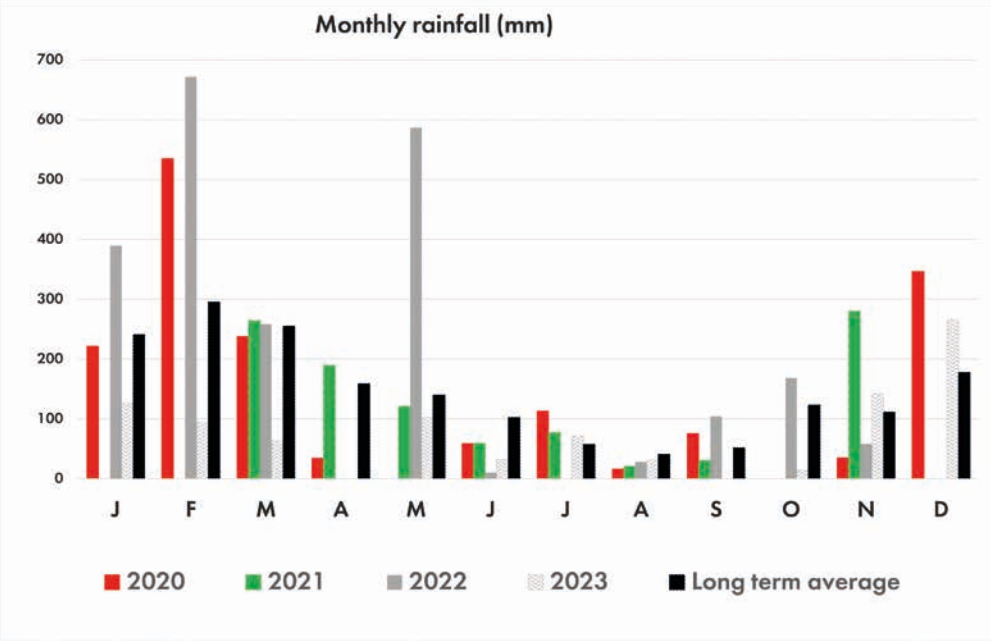

Figure 3. Monthly rainfall recorded at Nambour.

Overall results

Looking at all cultivars across all years, the variations in marketable yield were greater than the variations in fruit weight or fruit chemistry (Table 2).

When comparing the variation in yield across all the cultivars and years, the variation between years was greater than the variation between cultivars (Tables 2 and 3). In 2020, yields ranged 457 to 617 g/plant, whereas in 2023 they ranged from 330 to 339 g/plant. Figures 4 to 7 give a picture of the variation for each cultivar through each growing season.

There was no association between yield and the weather during the study, except for 2022, when heavy rainfall during May impacted plant establishment and growth. This suggests that other factors, possibly the size of the transplants each season, had an overriding influence on productivity.

There were variations in fruit size across the cultivars, but the ranking of the cultivars changed with the year. Overall, 'Festival' had smaller fruit than the other cultivars.

There were small differences in mean berry chemistry across the cultivars, but no consistent trends. This reflects the low genetic diversity in the cultivars and common ancestors in the two breeding programs in Florida and Queensland. The uniform growing environment (fertiliser, irrigation, sunlight, etc.) may have also contributed to this pattern.

Table 2. Effect of cultivar on the performance of the strawberry plants across all years.

Cultivar	Yield (g/plant)	Fruit weight (g)	Soluble solids content (%)	Titratable acidity (%)
Brilliance	412 ± 52	23.6 ± 0.7	7.2 ± 0.1	0.56 ± 0.02
Festival	457 ± 108	21.8 ± 1.5	8.2 ± 0.2	0.64 ± 0.01
Fortuna	392 ± 66	23.3 ± 1.2	7.4 ± 0.2	0.58 ± 0.01
Red Rhapsody	451 ± 118	24.5 ± 0.4	7.4 ± 0.1	0.64 ± 0.02

Combined means (averages) of all replicates for all years are presented with standard deviations (±) to show variability.

Table 3. Effect of year on the performance of the strawberry plants across all cultivars.

Year	Yield (g/plant)	Fruit weight (g)	Soluble solids content (%)	Titratable acidity (%)
2020	563 ± 75	22.3 ± 1.5	7.6 ± 0.5	0.62 ± 0.03
2021	497 ± 25	23.0 ± 1.4	7.5 ± 0.3	0.59 ± 0.03
2022	365 ± 11	23.7 ± 1.7	7.7 ± 0.4	0.64 ± 0.04
2023	332 ± 5	23.1 ± 1.4	–	–

Combined means (averages) of all varieties for individual years are presented with standard deviations (±) to show variability.

Harvest and data collection stops each season when fruit size drops below 12g or fruit becomes too soft for market

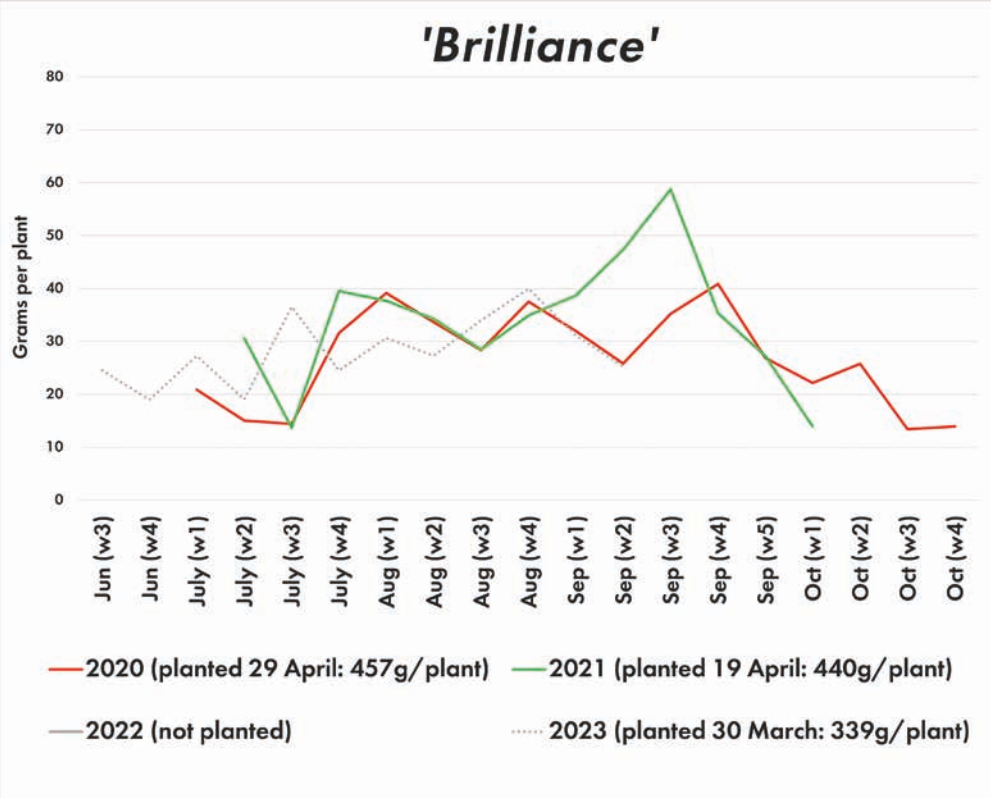

Figure 4. Average yield of *'Brilliance'* plants reported weekly throughout the season.

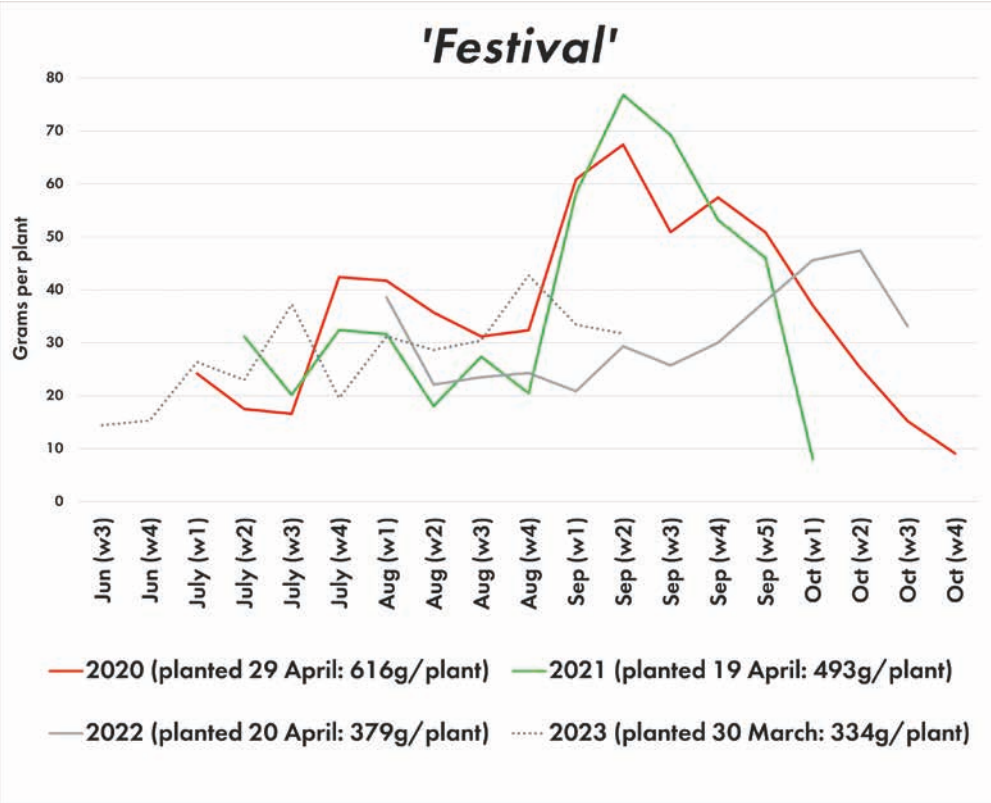

Figure 5. Average yield of *'Festival'* plants reported weekly throughout the season.

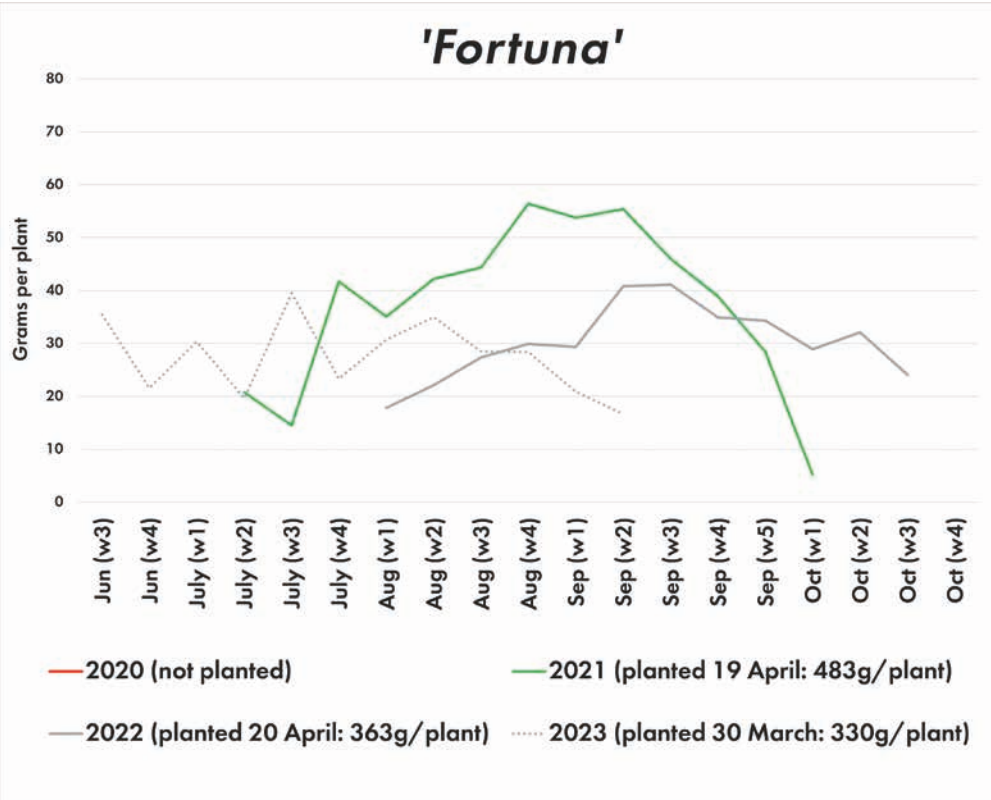

Figure 6. Average yield of *'Fortuna'* plants reported weekly throughout the season.

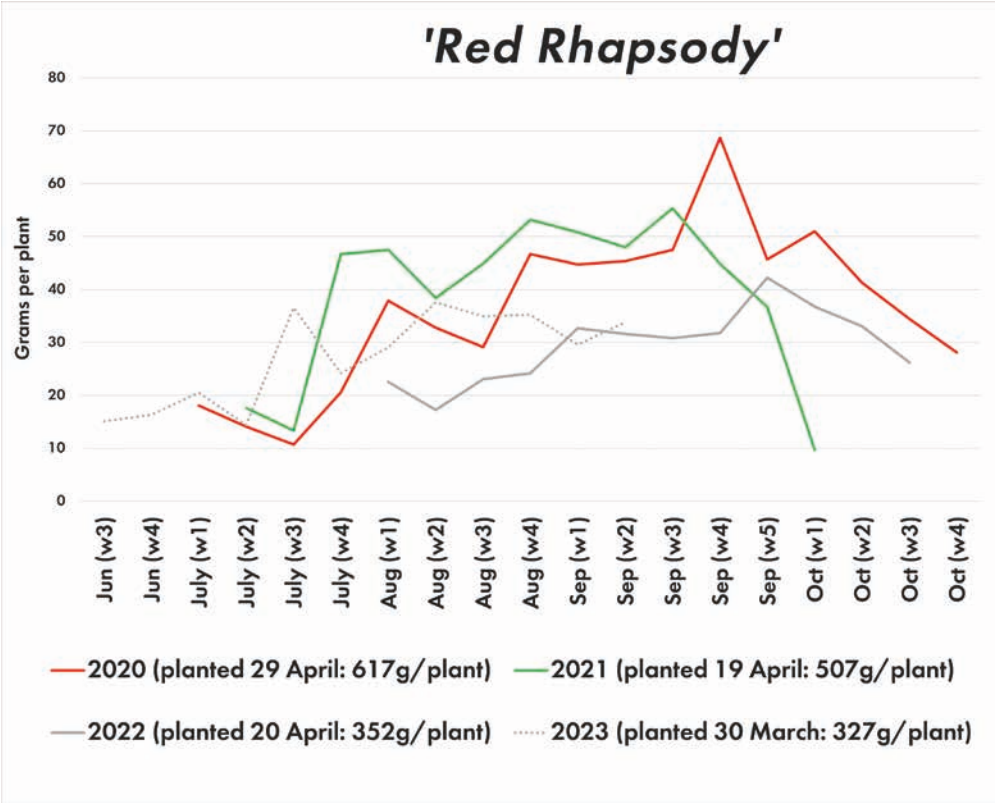

Figure 7. Average yield of *'Red Rhapsody'* plants reported weekly throughout the season.

Strawberry farm on the Sunshine Coast. Yield and fruit quality vary across cultivars and seasons.
Photo credit: Christopher Menzel

Implications for commercial production

Yields from year to year varied considerably across all varieties during the experiments. Apart from the impact of extreme conditions, there wasn't a clear association between yield and the weather. Other factors such as the size and quality of transplants appear to have had a greater influence on productivity.

New technologies that provide more established plants and a mixture of plant types that yield in favourable patterns could stabilise overall seasonal yields. This may also allow for earlier planting times that extend the growing season or shift the production window to avoid the warmer temperatures in October.

Across the experiments, warming temperatures in October saw a decline in fruit size and quality which brought the season to an end. To extend the season, efforts need to be made to develop cultivars that continue to produce large, sweet fruit as conditions warm up.

Queensland Government

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