

Flowering and Fruiting Patterns of the Three Common Strawberry Classifications

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This article provides an overview of the genetic factors that control flower induction in short-day, day-neutral and everbearer cultivars in strawberry.

Floral initiation is the foundation of strawberry cultivation. After all, if there are no flowers, there is no fruit! Floral initiation is controlled by several factors, influenced by genetic and environmental interactions.

Distinctions between short-day, day-neutral and everbearer classifications are general. There is a high level of variability within these classifications based on the genetics of the specific cultivar and how the cultivar interacts with the growing environment. Australian growing environments are diverse, and hard and fast rules are almost impossible to apply. The genetics are just one factor to consider in the wider tapestry.

The distinction between short-day, day-neutral, and everbearer cultivars is based on the day length conditions required to stimulate their initial floral initiation response. Once flowering, all strawberry cultivars can continue to produce flowers, regardless of day length, provided they are not subject to stress. Once subjected to enough stress plants will stop flowering. To initiate flowering again, plants must be exposed to the required initiation (generative) conditions to recommence flowering.

Examples of conditions that can slow or stop the flowering response include heat stress, transpiration stress, disease stress, excess plant vigour, nutritional excess or deficiency, and other common stress factors.

Excess plant vigour (excess vegetative growth) is an often-overlooked factor in flowering stress. For an overview of how climatic and agronomic factors can encourage a strawberry plant towards vegetative or generative growth see pages 67-68 of the article entitled 'What yield pattern are you aiming for?' published in the Winter 2024 Australian Berry Journal. You can find the article in the industry Resource Library at bit.ly/BA-RL by searching 'Klaas Plas'.

Short-days

Also referred to as 'June bearers', short-day cultivars are the original production berries, and they have remained the dominant strawberry type planted worldwide. Definitions of all other berry types are in comparison to this original category.

Examples of short-day cultivars:

Camarosa, Festival, Fortuna, Fronteras, Grenada, UCD Victor, Adelanto, Belvedere and Medallion.

Short-day cultivars start to initiate flower buds when daylight hours are short, generally between 12-13 hours, depending on the variety. Based on this factor, they are predominantly grown in the winter months, leading into spring.

Once flower initiation has commenced, short-day cultivars can continue to flower well into the Australian summer (regardless of day length), if they are carefully protected from stress factors. Longer days can be a stressor for short-day cultivars that can reduce flowering, however, under Australian conditions long days alone do not generally bring an end to flowering.

The most common triggers that remove short-day cultivars from production are excess fertiliser or excess heat. If the stressors are removed and shorter day-lengths return, the plants will initiate flowering again.

Day-neutrals

As the name suggests, day-neutral cultivars are not sensitive to day length. They can initiate flowers under all day lengths and may be used in year-round production.

Examples of day-neutral cultivars:

Albion, Cabrillo, Monterey, San Andreas, and Alturas.

Day-neutrals contain a single partial-dominant gene that controls their response to day length (to an extent). Partial-dominant means that the gene doesn't completely control the physiological response. Up to 30% of the genetic variation of a day-neutral is attributable to other genes.

Day-neutrals are often classed into **weak**, **intermediate**, **strong**, and **extreme** types based on the strength and consistency of their flowering response. The original classification, which included two categories, was designated by the original breeder of day-neutral strawberries, Royce Bringham. He classified cultivars as weak or strong day-neutrals depending on the proportion of daughter plants of a clone that flowered during the summer in high-elevation California strawberry nurseries.

Day-neutrals can fall victim to all the same stressors that befall the other categories. For example, like short-day cultivars and everbearers, day-neutral cultivars can suffer physiological stress during the hottest months of the year and can cease flowering due to extreme heat stress.

However, their return to floral initiation and production once the heat stress is gone is independent of any daylength requirements. All they require to resume floral initiation is the removal of stress factors.

Everbearers

Also referred to as long-days, remontants, perpetual flowering, and recurrent flowering, everbearers are temperature-sensitive day-neutrals. There is scant published research detailing the genetics of the everbearing trait in strawberry. It suffers from being a catch-all term, distinguished mostly as being not short-day but also not possessing the partially-dominant day-neutral gene.

Everbearers can initiate flowers under all day lengths when temperatures are low, but once a certain temperature is reached, they become sensitive to day length. If low temperatures are maintained, everbearers will continue to flower. If they are kicked out of their fruiting cycle, they need to return to cooler temperatures to re-initiate flowering.

In fruit production systems where the 24-hour average temperature rarely exceeds 18°C and all other factors are favourable to production, everbearers and day-neutrals can be difficult to distinguish. It's because of this that there is a great deal of confusion within the strawberry industry with some people using "everbearer" and "day-neutral" interchangeably. However, in systems with more extreme temperature conditions, growers will see a distinct difference between everbearer and day-neutral cultivars.

	Flower initiation day length trigger	Conditions where plants will continue to flower	Conditions needed to retrigger flowering
Short-day	Short days – 12-13 hours or less	Any day length as long as there is no physiological stress	Return to short days and removal of physiological stress
Day-neutral	Insensitive to day length		Removal of physiological stress
Everbearer	Insensitive to day length until over 18°C (24-hour average temperature)		24-hour average temperature under 18°C and removal of physiological stress

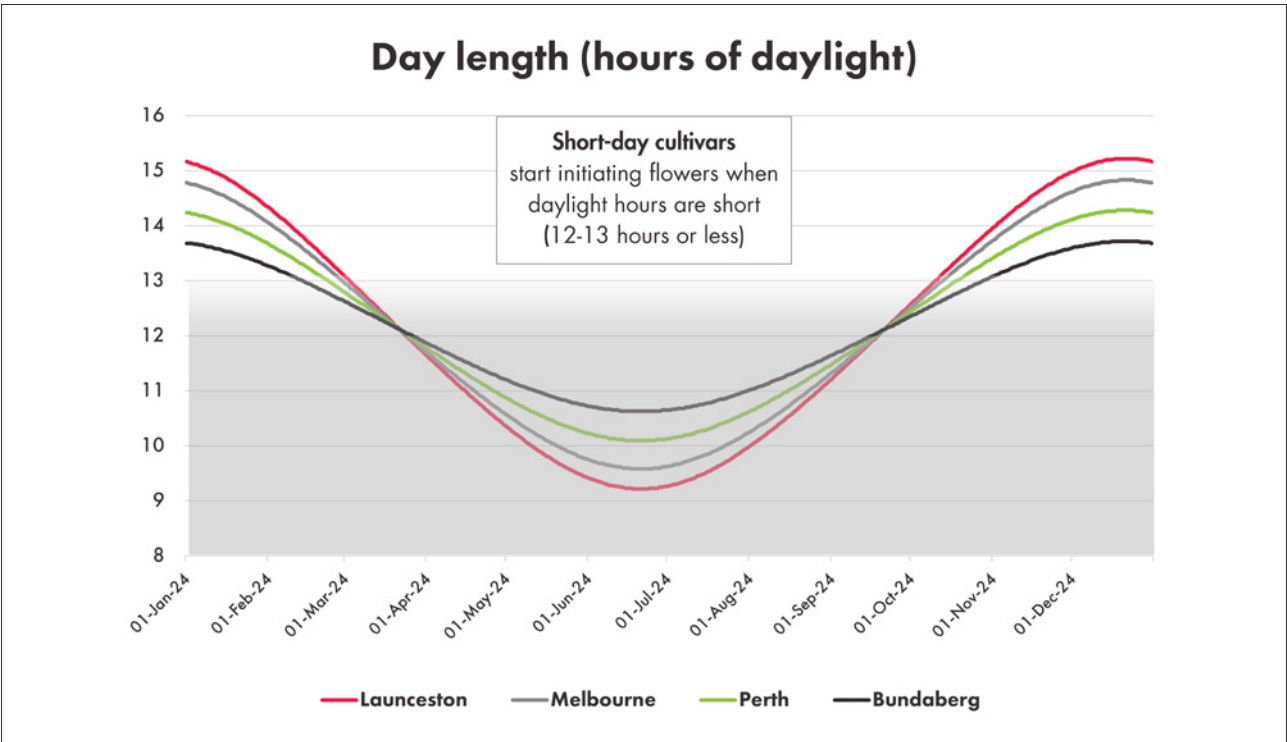


Figure 1. Average annual day lengths of four major growing regions in Australia

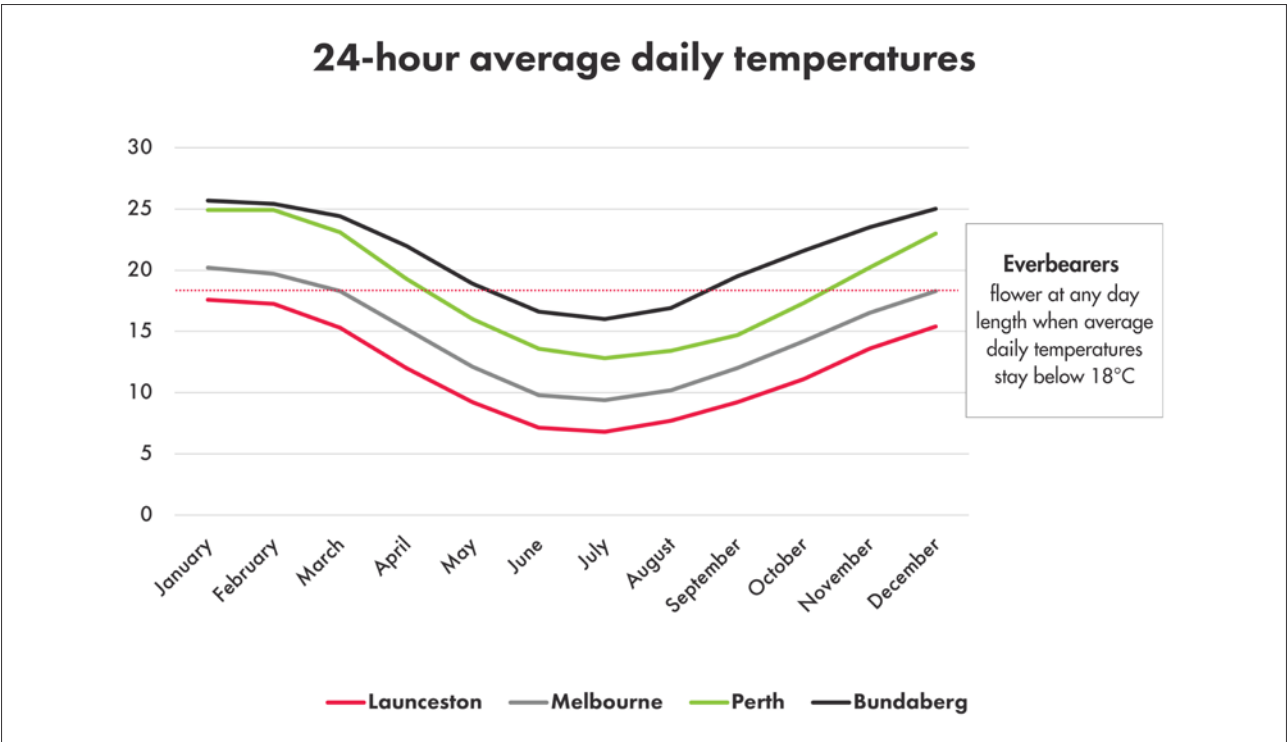


Figure 2. Average annual 24-hour temperatures of four major growing regions in Australia

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Why does all this matter?

Depending on the environment you grow in and the yield pattern you are aiming for, some cultivar types will be more suitable or offer more advantages than others. Key points to consider:

- Assess the environment you are operating in to determine the best type of varieties to grow, paying attention to your day lengths and average temperatures, and the production windows you are targeting
- If deciding between a day-neutral or an everbearing variety, look closely at the historical temperature patterns and at other potential stress factors at the site to see if there are conditions that could reduce flowering in day-neutrals or kick everbearing varieties out of their flowering response before conditions return to a window where flowering can re-initiate
- Know that the terms “everbearer” and “day-neutral” are sometimes used interchangeably in science and marketing. If you’re in a growing system where the difference between the two is important, always check with the breeding program to verify the underpinning genetics
- If you’re testing a new cultivar, remember that cessation of flowering doesn’t necessarily mean that the plant is in a different classification than claimed. Consider other environmental factors first and observe how the plant responds when the stress is removed

Scientists have been debating strawberry classifications and their associated definitions for over 60 years. There’s still not complete consensus, so if you’re confused, don’t worry – it is confusing!

Technical Terms Explained:

Vegetative State: This is the phase where the plant focuses on establishing its structure, developing leaves, stems, and roots

Generative State: The phase where a plant shifts from vegetative growth (producing leaves and stems) to reproductive growth, focusing on flowering, fruit development, and seed production. It describes the period when the plant is actively producing reproductive structures and allocating resources to them



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