Back to Basics: Chill in Strawberries

Sandy Shaw (VIC/SA) & Helen Newman (WA), Berry Industry Development Officers

Strawberry growers know that, historically, certain varieties have required a specific number of chill hours to achieve optimal productivity. But what is chill, and how does it work? Chill (or chill requirement) is the cumulative period, normally measured in hours between certain temperatures, necessary to produce internal changes in the strawberry plant that result in a normal (or optimal) sequence of growth after dormancy.

The objective of managing chilling in strawberry is to ensure stable harvest and transport of freshly dug nursery runner plants, and to condition these plants for optimal performance in the fruiting field.

Strawberry plants do not have a true dormancy like deciduous fruit trees, growth and metabolic processes just slow down with low temperatures

It's generally accepted in strawberry that chill hours are the hours accumulated between 0 and 7°C prior to planting in the fruiting field[1]. Extreme high or low temperatures in the nursery may offset some of the effects of chilling.

Chill allows the plant to successfully transition from the nursery to the fruiting field and promotes satisfactory fruit and shoot development upon establishment. It's a measurement applicable to fresh plants, not frigo (frozen) plants.

Strawberries are not the only crop with chilling requirements. Rubus and blueberries have also historically been subject to chill requirements, and growers with older varieties of these crops may still need to be mindful of them. But those industries have generally moved to varieties which have been bred to be "no chill/low chill". Strawberries have also been bred to become less responsive to chill and there are several "no chill" and "low chill" varieties on the market in Australia currently.

Types of Chill

Chilling is a plant conditioning process and can be divided into two types: in-field chill and supplementary chill (Figure 1).

In-field chill

Cool (chilly) autumn temperatures along with short photoperiods (day lengths) induce flower bud formation, branch crown development, and reduced leaf size, signalling the onset of dormancy (or the strawberry equivalent of dormancy).

As temperatures drop and chill accumulates, chemical growth stimulants that help the plant to grow again after planting are accumulated. Carbohydrates (sugars) produced in leaves and stems are also accumulated in crowns and roots as starches instead of being used to make new leaves and fruit.

These starches are the plant's stored reserves. When plants are established in the fruiting field, they draw on these reserves to initiate new growth. This is particularly important for leaf-off runners, as they lack leaves for photosynthesis.

Supplemental (storage) chill

The amount of time harvested, boxed plants spend at a temperature of 1-2°C is called 'supplemental' or 'storage' chill. Plants in these conditions are not photosynthesising and are therefore not accumulating starches.

The mechanisms for why supplemental chill is beneficial for runners have long been studied but remain unknown. Samples of sugars and starches have been taken in various studies and have confirmed there are changes in sugar type and a decline in starch percentage, but the exact mechanisms and causes are still up for discussion. It's hypothesised that it is related to growth regulators.

How chill affects plants in the fruiting field

Fundamentally, chill influences vigour. The chilling process is generally understood to increase plant vigour: the more chilling hours a plant receives, the larger the plant size. Too little chill results in too little vigour and smaller plants that can't stand up to fruit load or can't bulk up fast enough to produce their optimum yield. However, excessive chill will lead to excessive plant vigour, resulting in vegetative plants with decreased yield.

Chill accumulation can also be beneficial for transport and transplant resilience - some cold acclimation and starch conversion can help plants tolerate the mechanical stress of harvest and shipping

Chill in Context

The right amount of each type of chill varies depending on variety, propagule type, planting date, and field conditions.

Specific cold storage treatments that optimise productivity will vary depending on individual grower practices.

Complicating things further, the influence of chill is difficult to separate in field trial experimentation from planting date.

Frequent points of confusion

Definitions of chill hours vary between breeding companies, researchers and regions

For example, the standard chill calculation for the California strawberry industry is 0-7°C and is assumed to be in-field chill prior to nursery digging, with additional advice sometimes available regarding supplemental chill.

Recommendations from some parts of Eastern America include post-establishment chill hours in the fruiting field. Some European or older American recommendations include all exposure time under 7°C.

To further complicate things, recommendations may or may not differentiate between in-field and supplemental chill.

Most varieties come with recommended chill hours. It is important to know where your varieties come from and how they define chill, so you can determine how to apply that knowledge.

Elevation and latitude are often mentioned but are simply a shorthand (convenient) way of talking about chill

Higher elevation or high latitude nurseries usually cool off earlier than low elevation or low latitude nurseries, so chill hours naturally begin to accumulate earlier. They also often accumulate chill hours more rapidly as cooler temperatures persist for longer in the day.

What matters isn't whether a nursery is high, low, or subterranean, but what level of chill it provides and when. Plants that need a lot of chill quickly will naturally get that if they are grown in cooler locations.

The impact of chill hours accumulated post-establishment in the fruiting field, such as winter-plantings in southern regions that over-winter before spring production, is still unclear.

There is not enough research on this to draw definitive conclusions.

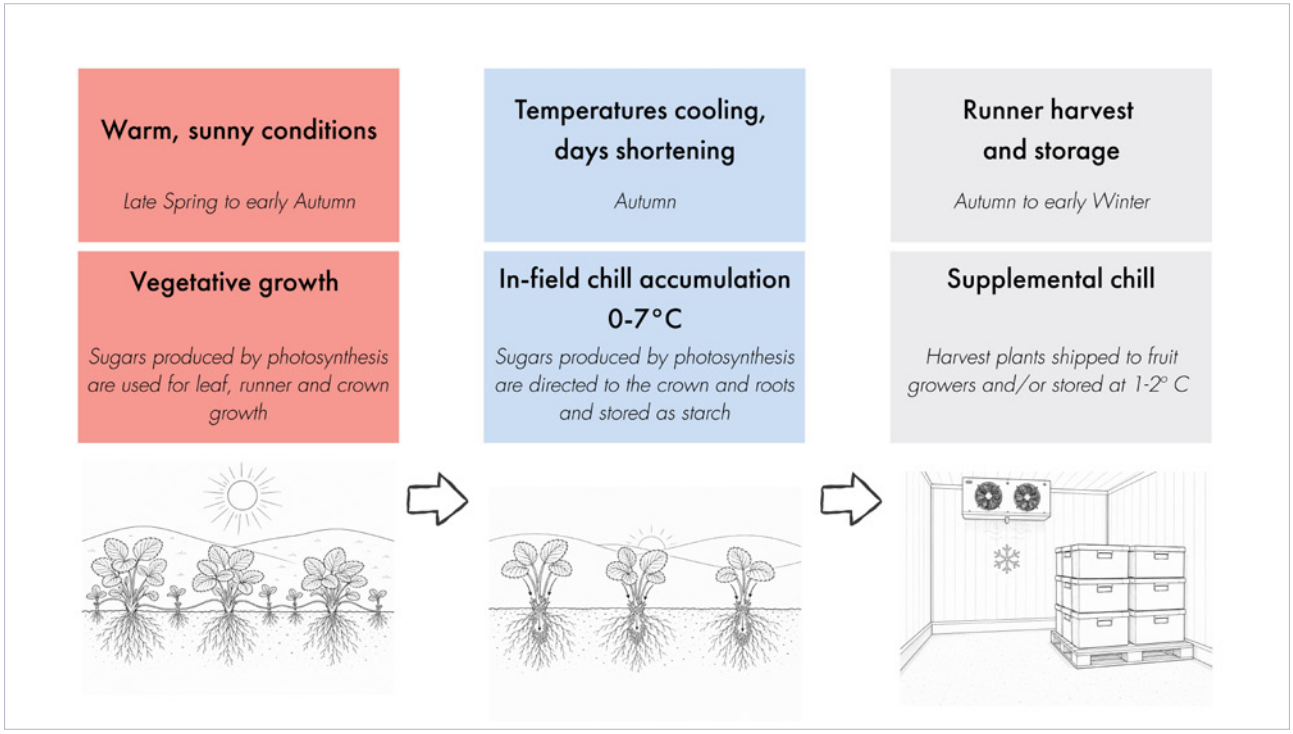
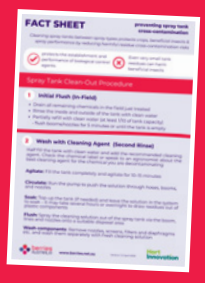


Figure 1. Chill infographic - created by Berries Australia using ChatGPT

Note[1]: Some researchers count all hours below 7°C but there is debate as to whether hours below freezing contribute to chill response and in what way. Consequently, some literature counts time spent as frigo plants as chilling hours. This is an area of ongoing debate.

The Industry Resource Library now features over 1,000 items from Fact sheets to Videos to R&D Project Reports

Every article of the Australian Berry Journal is available, as well as hundreds of other useful industry publications

Do you know how to ensure your spray tank is properly cleaned?

Download the latest Factsheet by visiting **bit.ly/BA-RL** and searching **'spray tank'**