

It's not what you do, it's the way that you do it

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Postharvest temperature management is the single most important factor influencing strawberry shelf life and fruit quality. Bruising, caused by rough handling during picking and packing, follows closely behind.

- Strawberries are highly perishable and need careful handling to maintain optimal fruit quality.
- With optimal postharvest care and the appropriate cultivar, strawberries can have a shelf life of 7 to 10 days.
- To realise this potential, attention must be given to all aspects of product handling, packaging, postharvest temperature and relative humidity management.
- It is important to realise that poor postharvest handling at any stage will reduce quality and shelf life. You cannot undo bad practice.

Agronomic practices

Rain events are associated with a higher level of fruit damage from fungal infection and/or snail and slug damage. Many growers are moving to high tunnels for this reason. If you are growing under low cloches, make sure the hoops are away from the edges of the raised beds so that when the covers are raised and lowered, water doesn't drip on the outside rows.

Over-irrigation and over-fertilising can also adversely impact fruit quality. Trials in Western Australia showed that applications of more than 450kg/ha of nitrogen on sandy soils lead to poor fruit quality.

Hygiene

Good field hygiene impacts product quality both in the field and at the packing shed.

Diseased or damaged fruit should not be left anywhere on the property as it acts as a source of inoculum, enabling the spread of disease onto your plants and fruit.

Overripe fruit left in the field will also encourage insects such as fruit fly to breed.

To help prevent the spread of disease from infected or rotting fruits to healthy fruit, pickers should use a separate container to hold diseased fruit. Ideally, workers removing damaged and diseased fruit should be different from those picking fruit for sale.



Figure 1. Ideally, diseased or damaged fruit should be picked by someone that is not handling fruit picked for sale. Photo credit: DPIRD

Harvesting

Bruising caused by rough handling during picking and packing is a major cause of poor fruit quality in the market.

Warm fruit bruises more easily than cool fruit, so strawberries should be harvested in the coolest part of the day. Fruit should also be dry to touch, as wet fruit is prone to postharvest fungal problems.

Strawberries intended for export should not be picked when the pulp temperature exceeds 25°C. As a rule of thumb, pulp temperature is normally a few degrees less than ambient air temperature. Fruit with a high pulp temperature also requires more energy and cooling capacity to remove field heat after picking. (Figure 2)

Transfer to the shed

Harvested fruit should not be exposed to the sun or wind.

Transfer fruit from the field to the packing shed or cool room as quickly as possible. It's a good idea to set time limits on the period that picked fruit is left in the field.

Packing sheds should be designed for a smooth and rapid flow of fruit from the field to the grading and packing area, into the forced-air cooler and then to the cool room at 0 to 1°C.

Sheds can be insulated and cooled. Evaporative cooling is useful, particularly when ambient humidity is low. Packing and grading areas may be air-conditioned or even refrigerated to about 15°C. (Figure 3)

Cooling and refrigeration

For maximum shelf life, field heat must be removed rapidly after picking, and berries must be stored at between 0 and 1°C along the supply chain.

Begin cooling within one hour of harvest to avoid loss of quality and reduction in the amount of marketable fruit.

The incidence and severity of decay, mainly caused by Botrytis and Rhizopus, can be reduced by around 25% if the fruit is properly pre-cooled.

BRUISING CAUSED BY CAREFUL HANDLING VS COMMERCIAL HANDLING

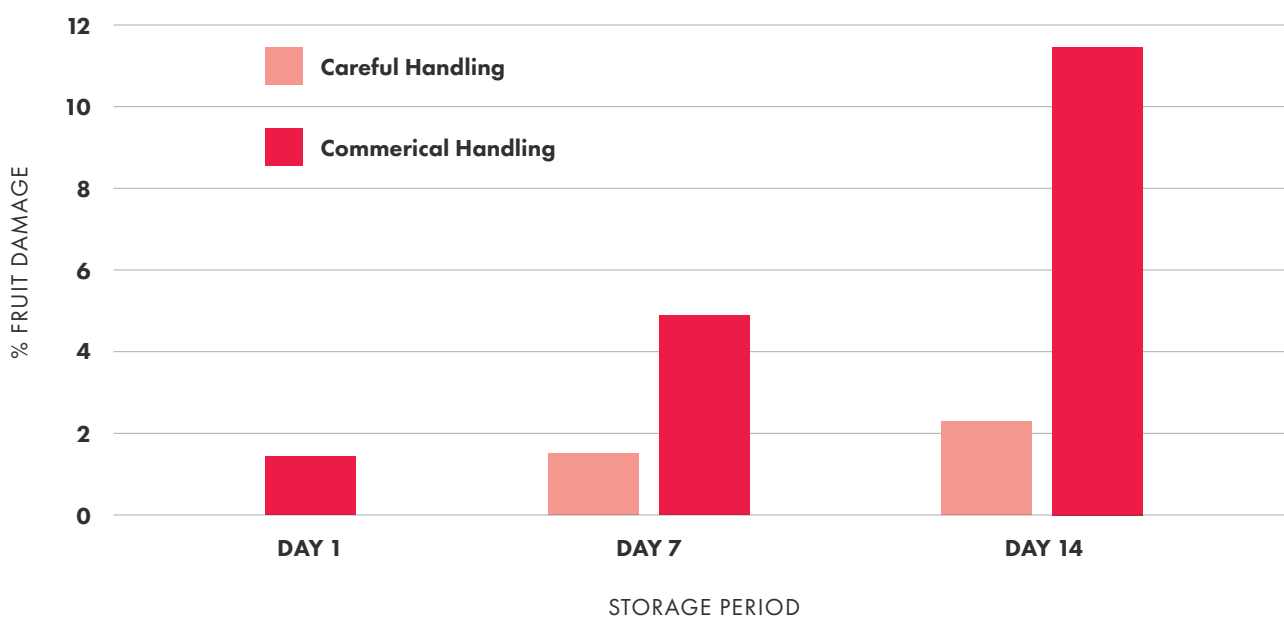


Figure 2. Comparison of commercially handled and carefully handled strawberries - the impact of bruising sustained during harvesting and packing is magnified by storage time (Bhat and Reid, 2010)



Figure 3. This covered wagon protects harvested fruit from the sun, wind, and rain as it is transported from the field to the shed. Photo credit: Anthony Yewers

Cooling extends shelf life by reducing:

- respiration rates
- water loss*
- ethylene production
- sensitivity to ethylene
- microbial development (spoilage)

Fruit that is not cooled after harvest deteriorates rapidly and may only have a shelf life of 1-3 days. A delay of 4 hours before refrigeration will result in one third of fruit becoming unmarketable after seven days (Figure 4).

Forced air cooling

Rapid cooling after harvest is essential. It is never a good practice to place packaged strawberries inside a cool room to cool gradually. Berries in the middle of the pallet would not be adequately cooled and would begin to decay.

The most widely used commercial method to pre-cool berries is forced-air cooling. Cold air is forced to move rapidly through the containers (versus around the containers as in room cooling), allowing the cold air to directly contact the warm berries.

Forced-air cooling is typically 10 times faster at cooling than room cooling. (Figure 5)

Transport

Once fruit is cooled it should be kept cool, because cycles of warming and cooling produce condensation on the fruit leading to Botrytis and other storage diseases.

Any break in the cold chain (0 to 1°C) will significantly decrease shelf life.

Cartons should be removed from the cool room and loaded into a pre-cooled refrigerated truck (close to 0°C) without breaking the cold chain. Ideally, strawberries should be transported to the market destination the same day they are picked.

Imperfect cool chains

While cooling to 0 to 1°C on-farm and maintaining this throughout the supply chain is ideal, it is not always possible. If you have an imperfect cool chain, the most important factors to maintaining quality are (1) removing field heat from the fruit within an hour of harvest and (2) maintaining an environment where fruit is continually cooling, as any temperature rises will produce condensation and decay.

Further reading

Postharvest Management of Vegetables: Resources for Australian Supply Chains www.postharvest.net.au/postharvest-fundamentals/cooling-and-storage/cool-rooms

North Carolina Cooperative Extension — Postharvest Cooling and Handling of Strawberries content.ces.ncsu.edu/postharvest-cooling-and-handling-of-strawberries

North Carolina Cooperative Extension — Postharvest Technology series: <https://content.ces.ncsu.edu/catalog/series/153>

- Forced-Air Cooling
- Design of Room Cooling Facilities: Structural & Energy Requirements
- Proper Postharvest Cooling and Handling Methods
- Cool and Ship: A Low-Cost, Portable Forced-Air Cooling Unit

EFFECT OF COOLING DELAY AFTER HARVEST ON THE MARKETABILITY OF STRAWBERRIES

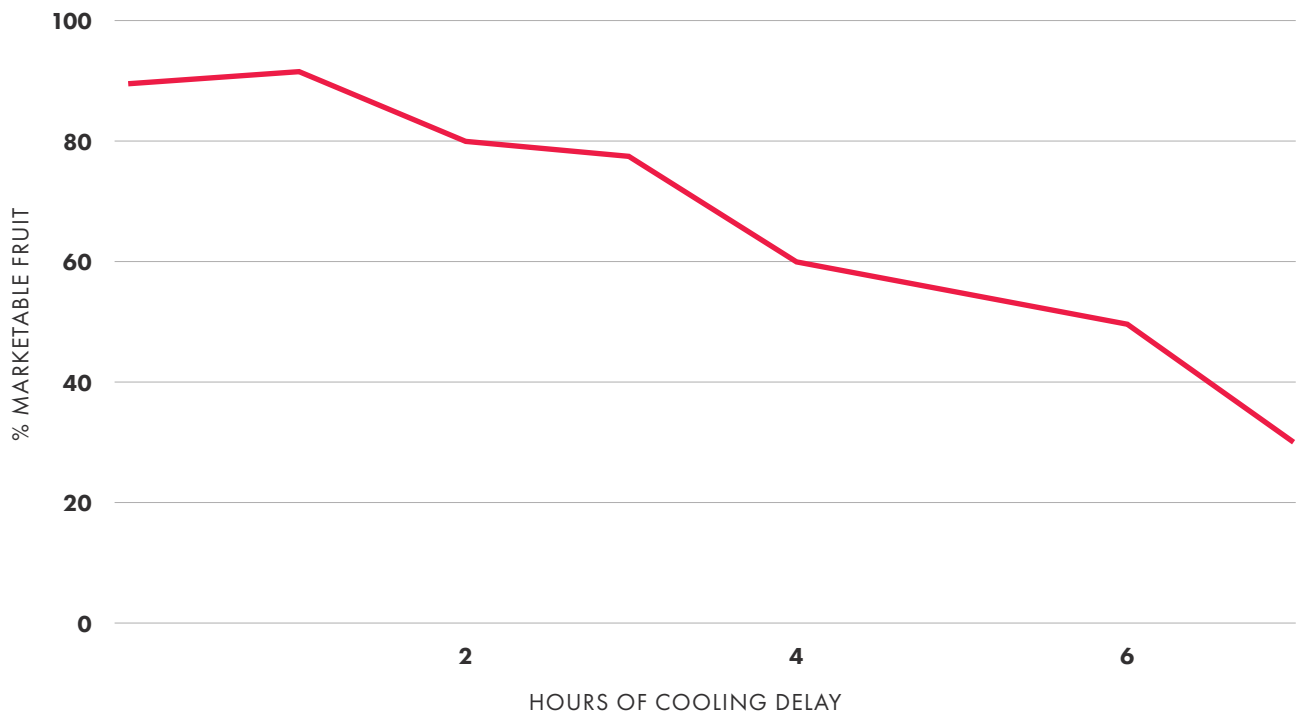


Figure 4. Effect on cooling delay after harvest on the marketability of strawberries (Mitcham et al., 1996).

*Strawberries lose water rapidly after harvest. To prevent fruit shrivelling and wilting or dehydration of the green calyx it is important to maintain a relative humidity of between 90 to 98%.



Figure 5. Simple Forced-Air Cooling System. Photo credit: Polter's Berry Farm, Ohio