Best Practice Guidelines: Prevention of Pitting in Cherries

General:

- Pitting is caused by mechanical damage to cells in the flesh of the fruit
    - at harvest,
    - during transport between the orchard and packhouse,
    - during packing,
    - and in transit to the market.
- The damaged cells lose moisture and collapse and this manifests as pits/ depressions/ sunken skin on the shoulders, sides and/or stylar end of fruit.
- Since moisture takes time to escape from the damaged cells in the flesh of the fruit, pitting only manifests 7-10 days after the mechanical damage occurred. Therefore, pitting is usually not seen at the time of fruit inspection prior to export or before the fruit is transported to the local market. Generally, the client is the first to see the defect.

Types of mechanical injury that cause surface pitting:

- **Impact** - when fruit are dropped onto a hard surface or another object is dropped onto the fruit
- **Compression** - when fruit press against each other or a hard surface
- **Vibration or abrasion** - when fruit rub against each other or another surface

Summary of the most important factors to consider to prevent/ minimise pitting induction in the handling chain:

- The stem condition as well as the gloss of the fruit deteriorate quickly after harvest due to cherries' high respiration rate and low levels of stored carbohydrates.
- Mechanical injury results in an even higher respiration rate, ethylene production, and moisture loss which cause even faster fruit deterioration.
- The best way to prevent the quick deterioration of the fruit and to minimise pitting induction is to cool the fruit to a pulp temperature of 10 °C as quickly as possible after harvest. **Cold fruit (<10 °C) are very susceptible to pitting injury during the packing process.**

Factors to consider in the orchard:

1. **Cultivar:**

- Make sure about a cultivar's susceptibility to pitting in order to implement the best handling protocols to minimise pitting incidence.
- Later maturing cultivars are generally less susceptible to pitting because their cells have stronger cell walls that are able to deform, therefore rupture less easily.

2. **Pre-harvest sprays:**

- Three to four calcium sprays from pit hardening to 1 week before harvest are recommended to aid the fruits' cell wall and cell membrane structure, strength and integrity. For optimal rates, contact your local consultant.

3. **Crop load:**

- Fruit from lower cropping trees have a larger diameter, higher soluble solids and titratable acidity, are firmer and withstand mechanical damage much better than small fruit from overcropping trees.

Factors to consider at harvest:

1. **Harvest maturity:**

- Be careful to harvest fruit too mature as they will be too soft to withstand mechanical damage in the handling chain.
- Since skin colour is the main harvest maturity variable used to determine optimum harvest dates, make sure about the recommended picking window for your cultivar(s).
- Fruit harvested at a dark mahogany skin colour are more susceptible to pitting as they are too soft to withstand handling in the postharvest chain.
- In warmer areas it should be considered to harvest fruit at a lighter mahogany colour than in cool areas as the warmer temperatures tend to prevent skin colour development.

2. **Harvest protocol:**

- Harvest during the coolest part of the day – halt harvesting when the ambient temperature >30 °C. Fruit harvested later in the day tend to be softer and remain so during storage and the marketing period.
- Grasp the stems of the fruit and not the fruit when they are harvested.
- Fruit may never drop >15 cm while warm – place the fruit gently into the picking tote and pour them gently from the picking tote into the field bin.
- Line plastic or wooden field bins with plastic or any material that prevents abrasion and vibration damage during transport to the packhouse.
- Field bin size must be such that compression bruising is minimal.
- Keep fruit in the shade to prevent an increase in fruit temperature and moisture loss.

- Cover field bins with insulated bin covers, wet foam or reflective tarps – this practice increases the RH around the fruit, reduces moisture loss, and maintains fruit temperature.

3. During transport to the packhouse:

- Fruit must be transported to the packhouse within 2-4 h after harvest so that field heat can be removed at the packhouse.
- Keep the field bins covered during transport to maintain fruit temperature and a high RH around the fruit.
- If the orchard is far from the packhouse, consider field heat removal in the orchard by means of hydrocooling. If done, the lowered fruit temperature must be maintained during transport to the packhouse.

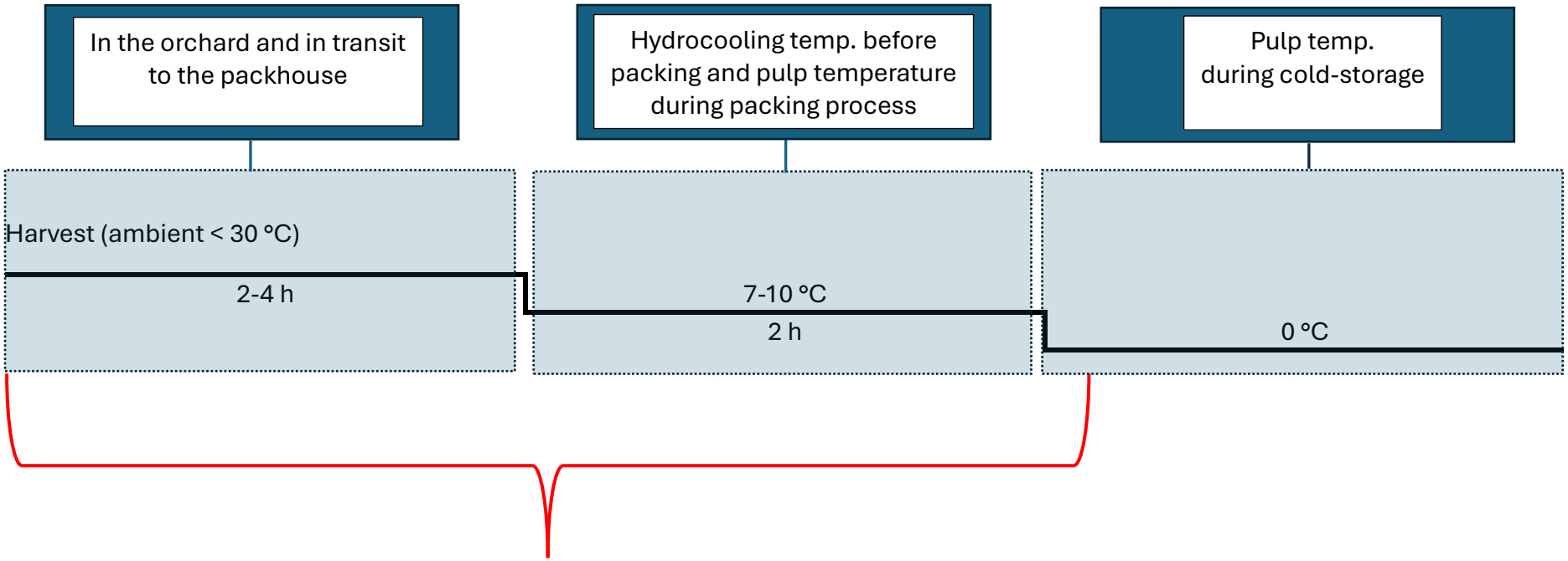
4. At the packhouse:

- On arrival at the packhouse the fruit must be pre-cooled/ hydrocooled to a pulp temperature not lower than 7-10 °C. Colder fruit will be more sensitive to mechanical injury on the pack line. It can be considered to add 0.2 - 0.5% $CaCl_2$ to the hydrocooling water to aid in the maintenance of fruit firmness.
- Place the cooled fruit in a holding room at the same temperature until pack.
- Pack fruit within 2 h after arrival at the packhouse.
- If fruit cannot be packed within 6 h after harvest, cool the fruit to 4 °C to manage the respiration rate and, consequently, the deterioration rate of the fruit. This fruit must be packed within 24h after arrival at the packhouse. If the fruit cannot be packed within 24h after arrival at the packhouse, cool the fruit to 0 °C. Note that cooling the fruit to such a low temperature holds a high risk for pitting induction on the pack line and special care must be taken to prevent mechanical injury of the fruit if packed at a pulp temperature <6°C.
- The maximum drop height on the pack line may never exceed 5 cm due to the low fruit temperature.
- In the packhouse the highest level of pitting injury are caused by the cluster cutter and hydrocooling prior to box filling.
    - **Cluster cutter:** It was found that pitting injury decrease with an increase in fruit throughput in the cluster cutter, because high throughput rates decrease the chances of fruit-tine impacts. Cluster cutters should be operated at such a speed so that clogging of the cluster cutter cannot occur. A cluster cutter belt speed of 0.4 m s^{-1} is recommended in literature. Another recommendation is to lower the cluster cutter tines to the belt level or just below to prevent fruit striking the ends of the tines.
    - **Hydrocooling:** In-line hydrocoolers cause damage to cherries when water falls on the product from an excessive height – water drop height should not be

more than 20 cm or as close as possible to the top of the expected fruit levels. Damage can be reduced further by adding a plastic mesh screen to diffuse the water and to reduce water droplet size and velocity. The mesh size must be small enough to intercept and reduce the velocity of the water droplets falling on the fruit but must not reduce the flow rate of the water.

- MAP bags or plastic liners can be used to maintain fruit quality. Good temperature management is important when these packaging materials are used to prevent internal fruit damage.
- Ideally cherries must be packed and cooled to 0 °C within 4-6 h after harvest. However, this is rarely possible in practice. If fruit cannot be packed within 6 h after harvest, cool fruit to 4 °C and pack within 12-24h after arrival at the packhouse.
- Store the fruit at 0 °C and 90-95% RH.
- Prevent temperature fluctuations during cold-storage.

Summary of fruit temperature management after harvest to reduce the risk of surface pitting



4-6 h from harvest until fruit pulp temperature at 0 °C*.

*If fruit cannot be packed within 6 h after harvest, cool fruit to 4°C and pack within 24h after arrival at the packhouse.

* If the fruit cannot be packed within 24h after arrival at the packhouse, cool the fruit to 0 °C

Both these contingency practices hold a high risk for pitting injury as cherries at such a low pulp temperature are prone to mechanical damage on the pack line.