



Asian Markets: Serviced Supply Chains

**Does delayed cooling
(preconditioning) reduce
storage disorders in stone
fruit?**

John Lopresti
Horticulture Production Sciences
Agriculture Victoria Research

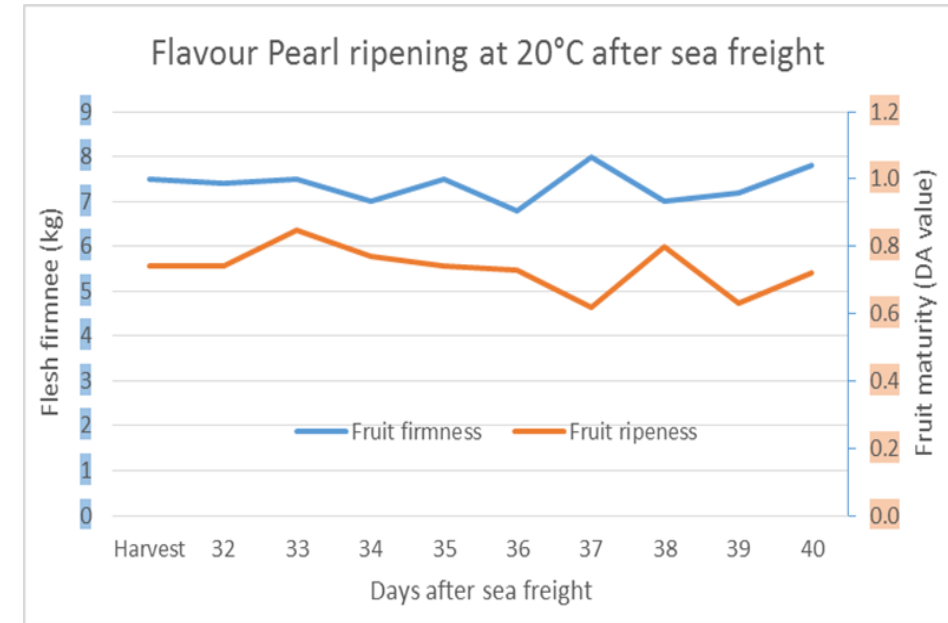
Today we will cover...

- Why preconditioning?
 - AKA Delayed cooling, step-wise cooling etc.
- Preconditioning trial approach
- Results from trials in 2019/20
 - Majestic Pearl nectarine
 - Polar Queen peach
- Commercial implementation

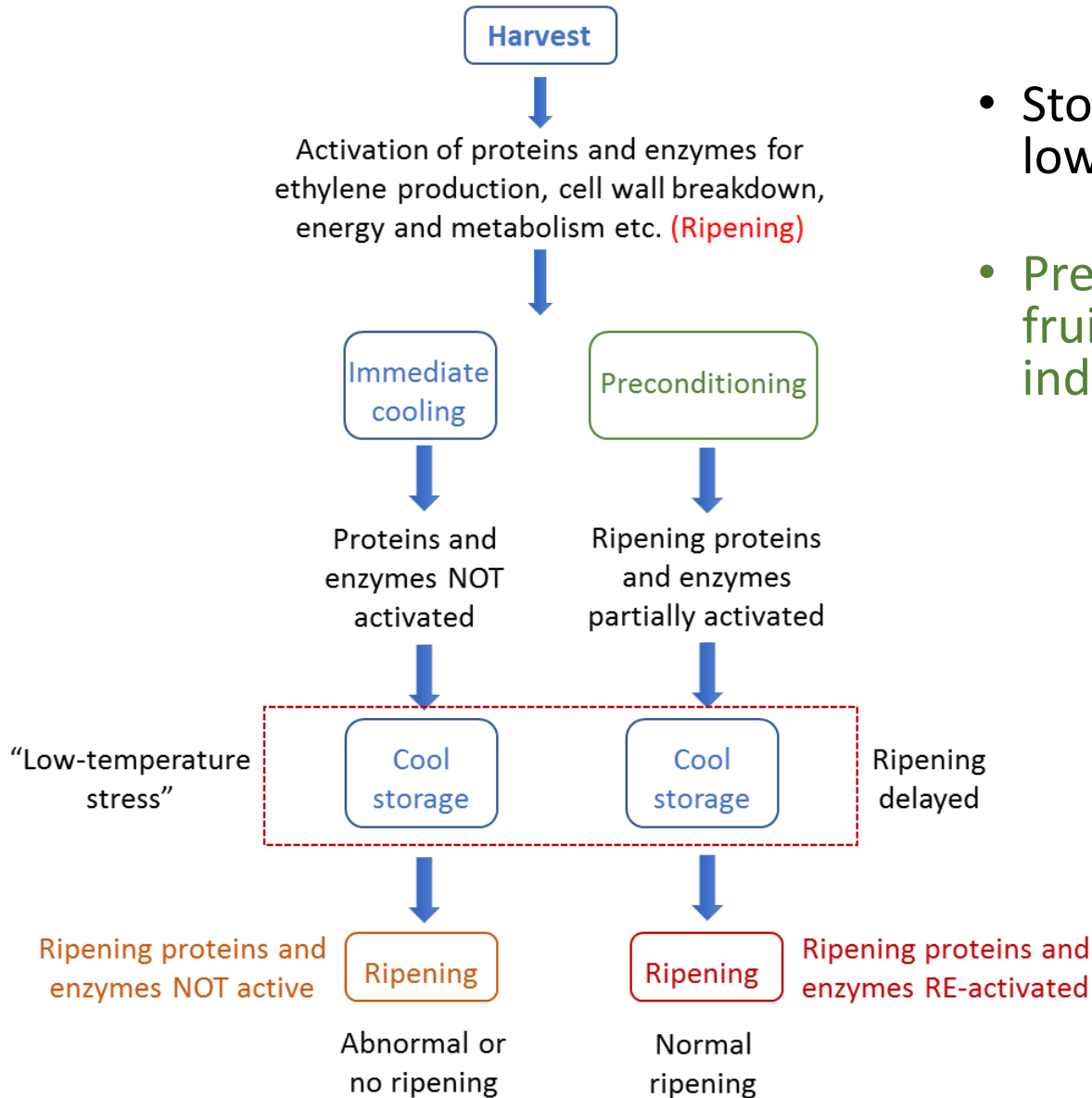


Storage disorders are a problem

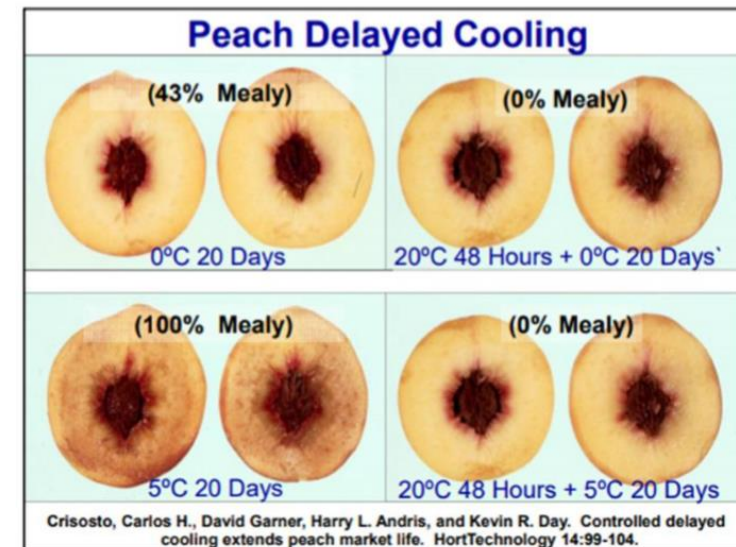
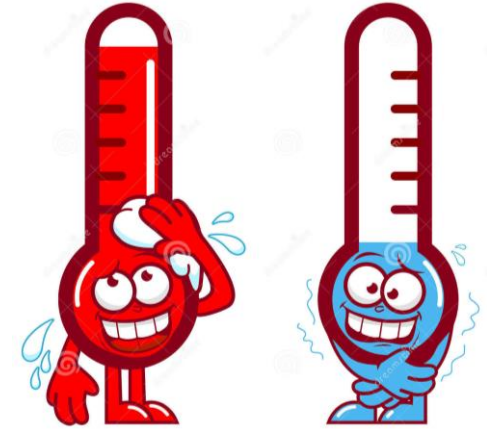
- Many current varieties are susceptible
- Standard practice is to cool immediately after harvest
 - May increase risk of storage disorders
- Extended sea freight duration
 - 3 to 4 weeks on the ship
- Cooling and warming through the 'kill zone'
 - Warming during packing, fumigation etc.



Why pre-conditioning (PC) might be beneficial



- Stone fruit susceptible to low-temperature stress
- Preconditioning prepares fruit against cold stress-induced storage disorders

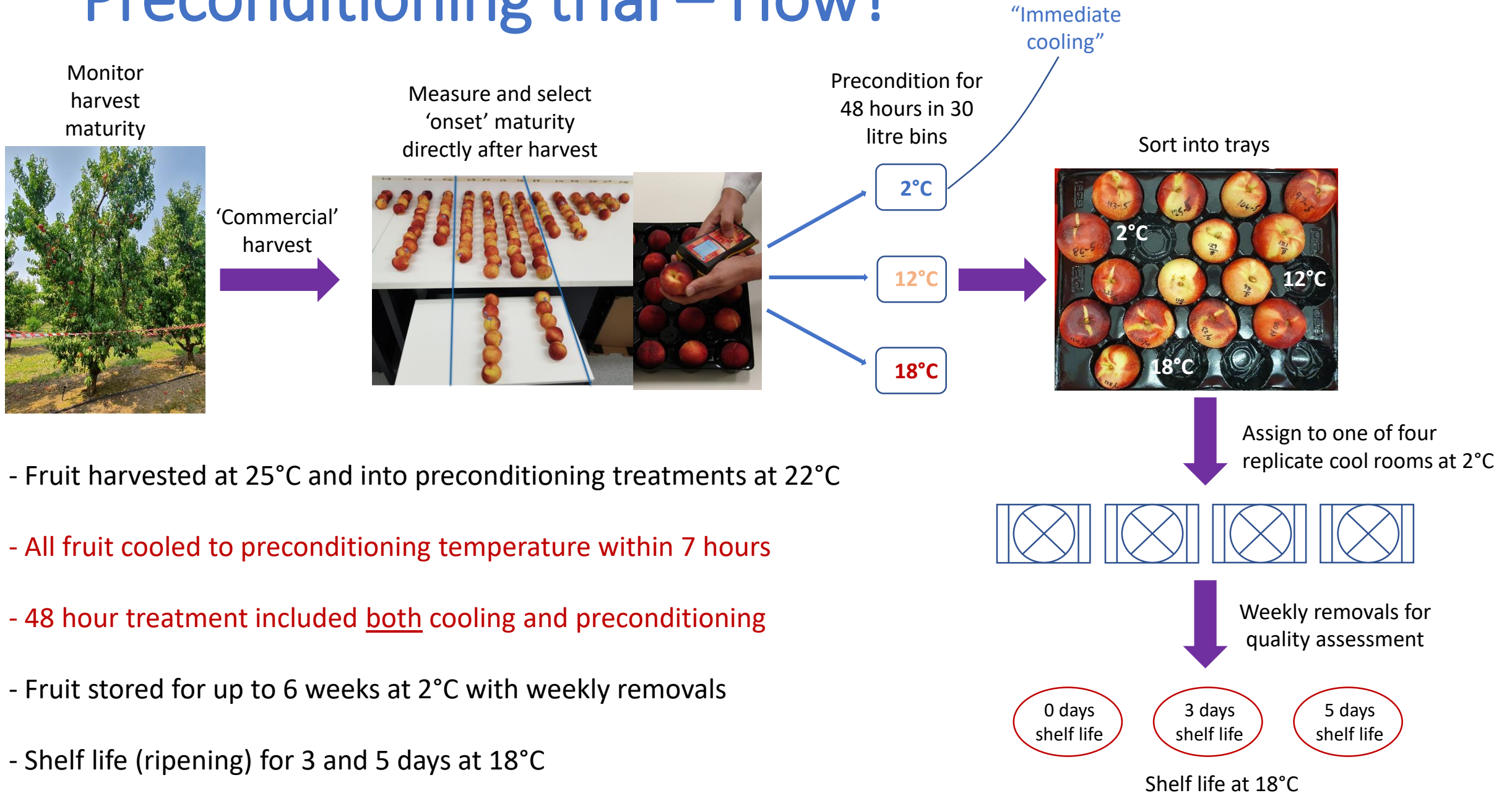


Our R&D approach....

- Previous preconditioning trials:
 - Not our varieties
 - Harvest maturity based on firmness not ripeness stage
 - Single preconditioning temperature – usually 20°C
 - Few storage and ripening periods
 - Fruit juiciness based on small sample per fruit (expressible juice)
- Our trials....
 - Uniform harvest maturity based on fruit ripeness (DA meter)
 - Two preconditioning temperatures (12°C and 18°C)
 - Trial similar to what a grower can implement
 - Multiple cool storage and ripening periods
 - Fruit juiciness measured on whole fruit



Preconditioning trial – How?

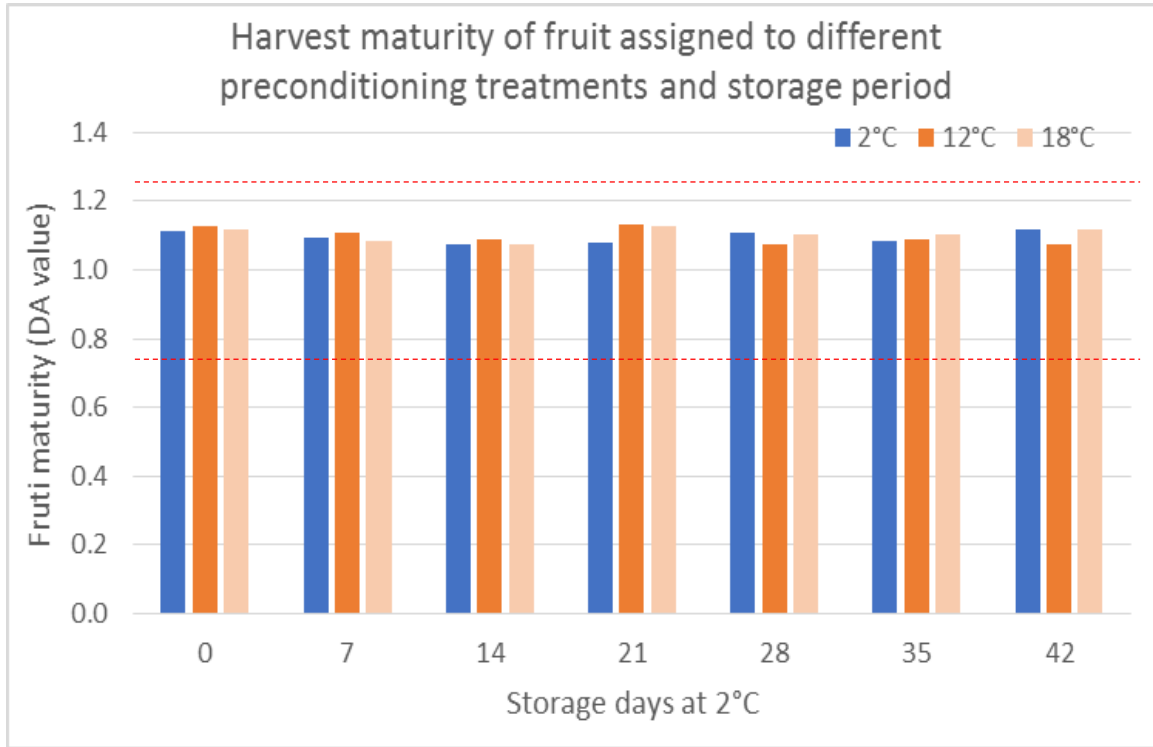


Quality measurements

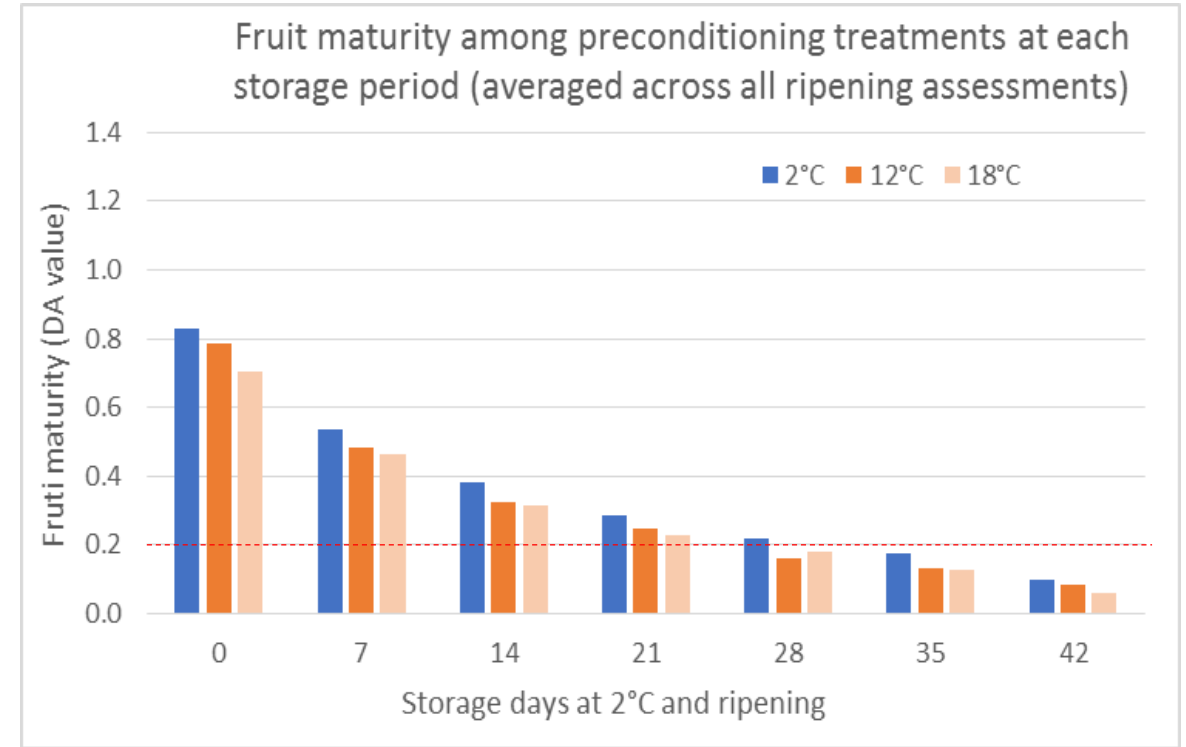
- Fruit maturity (initial and assessment), Background colour, Flesh firmness, SSC, Titratable acidity
- Flesh browning incidence and severity
- Free juice (single assessor) – Majestic Pearl only
- Shriveling, sugar spots, other physiological disorders



Majestic Pearl – Maturity



Uniform harvest maturity among fruit assigned to each preconditioning treatment and removal

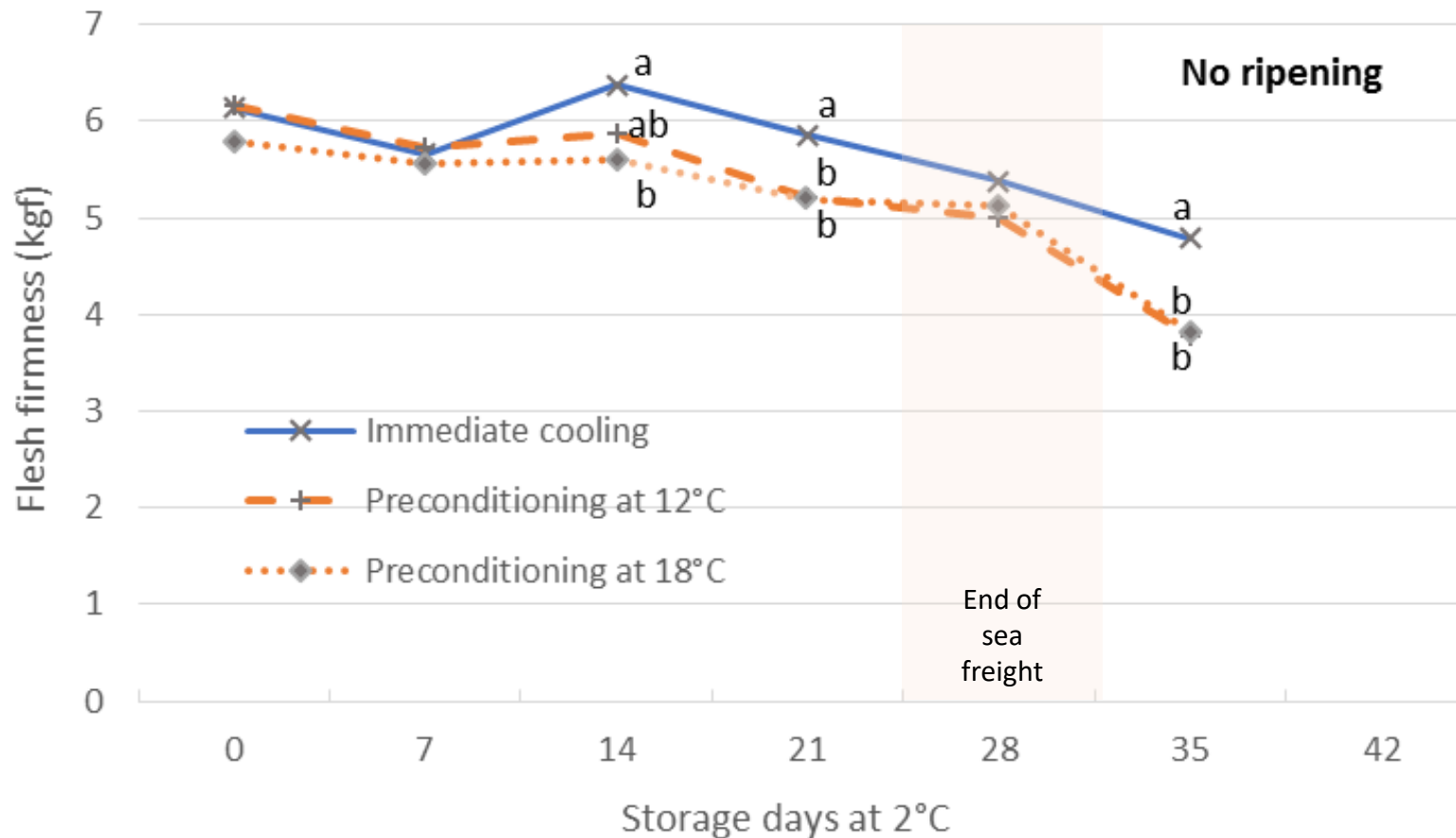


Little difference in fruit maturity among preconditioning temperatures at storage removals and during ripening

Majestic Pearl – Fruit firmness after storage

Does preconditioning at 12°C or 18°C increase fruit softening during cool storage?

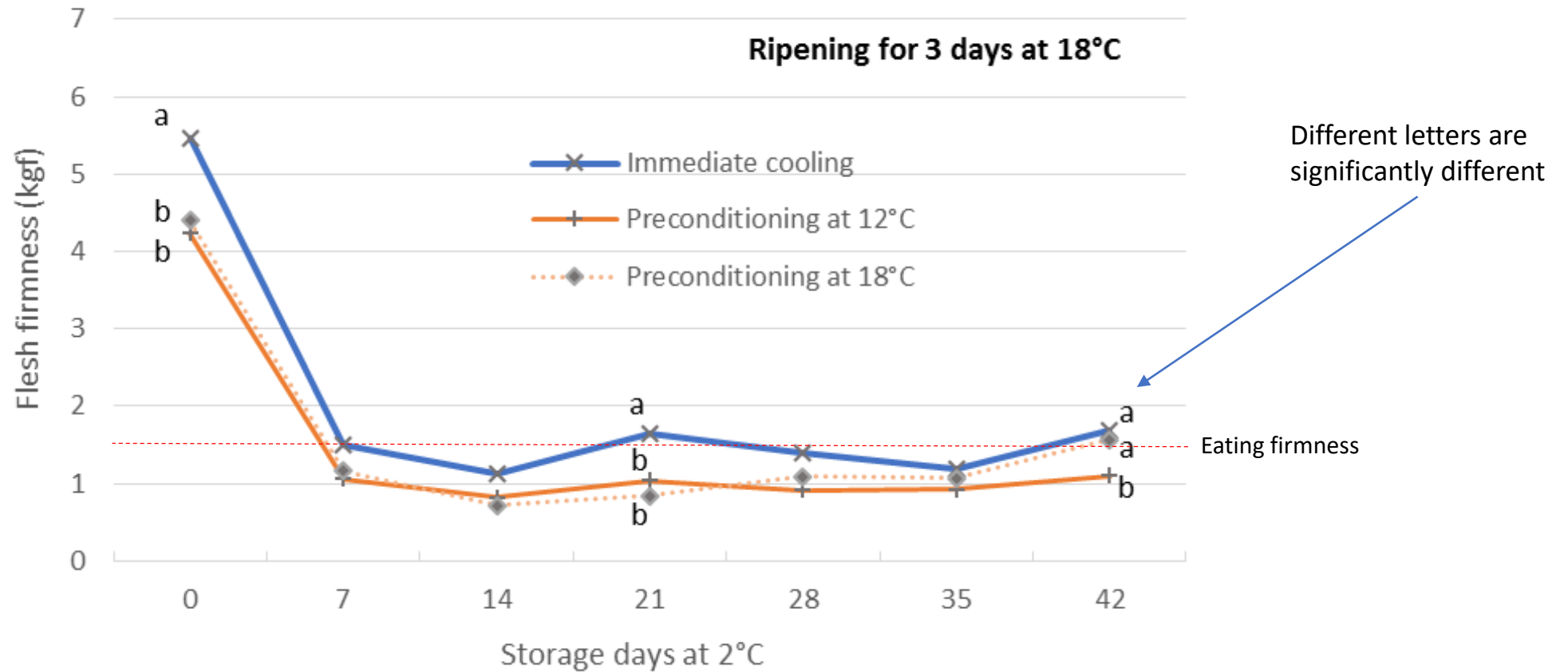
(Immediate cooling = Preconditioning at 2°C = 'standard' commercial cooling)



Majestic Pearl – Fruit firmness after ripening

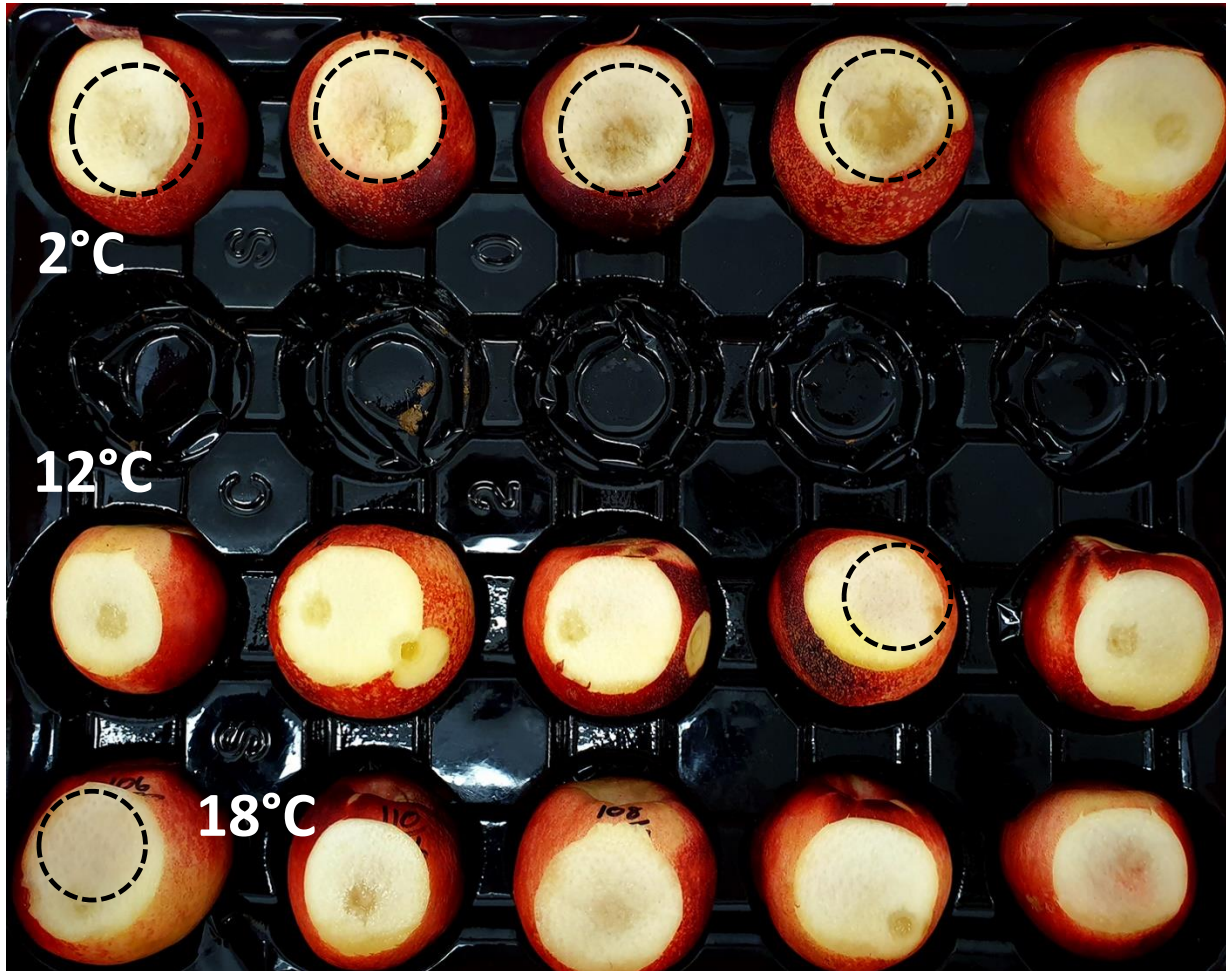
Does preconditioning at 12°C or 18°C increase fruit softening during storage followed by ripening?

(Immediate cooling = Preconditioning at 2°C or standard cooling practice)

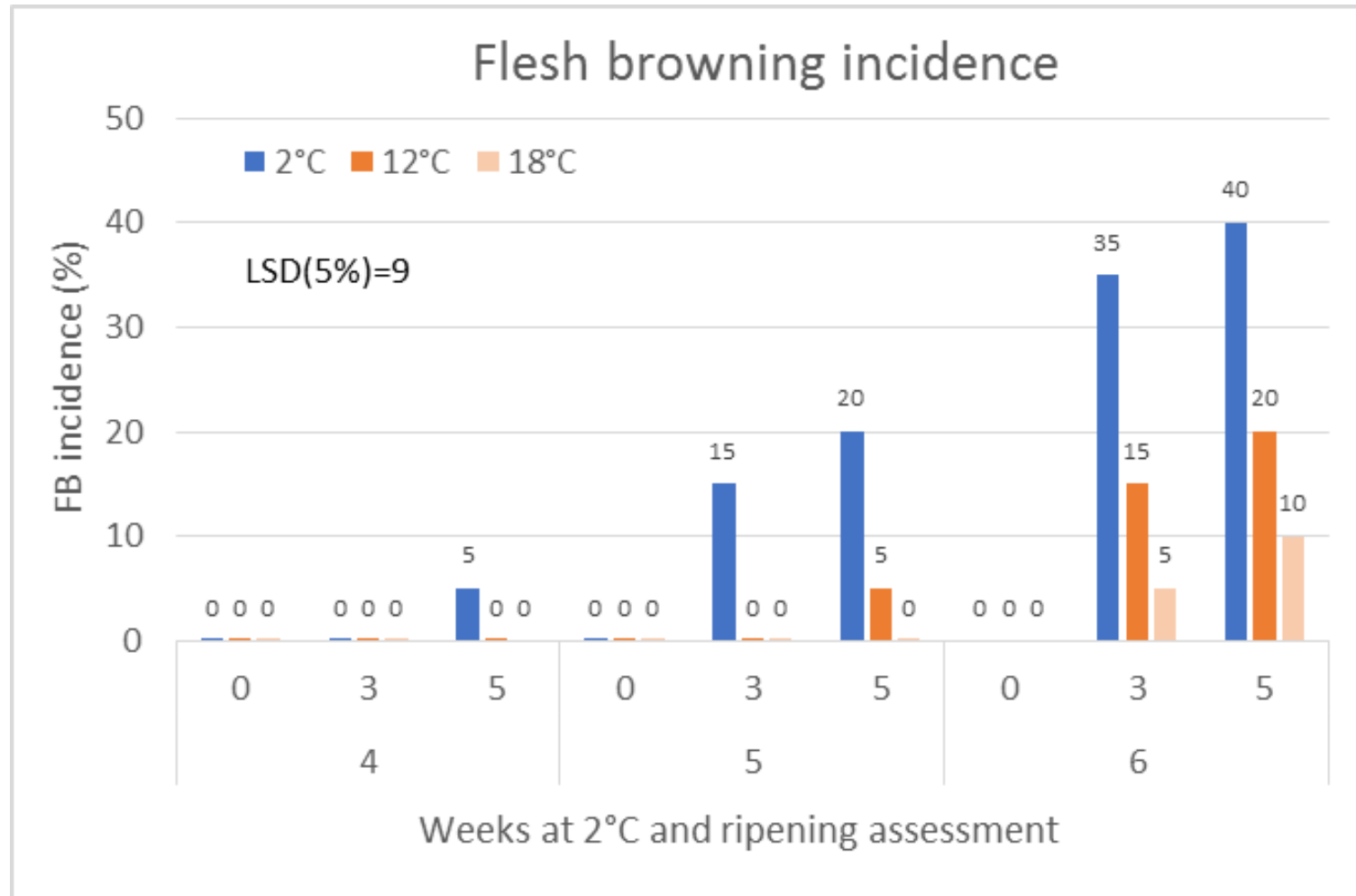


Majestic Pearl chilling injury

6 weeks at 2°C and ripening at 18°C for 3 and 5 days

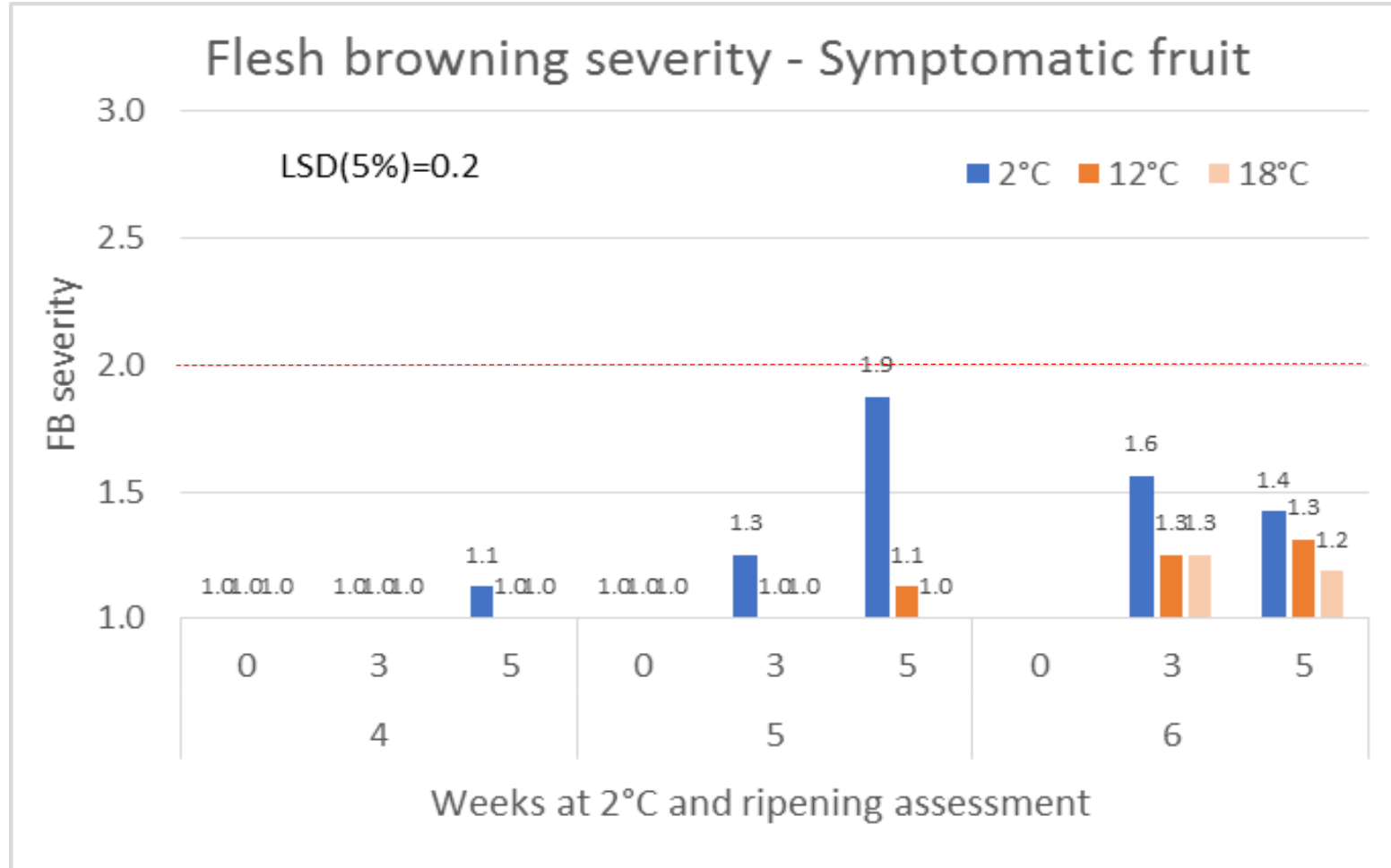


Majestic Pearl – Incidence of flesh browning (FB)



No flesh browning detected after cool storage at 2°C for 1, 2 or 3 weeks

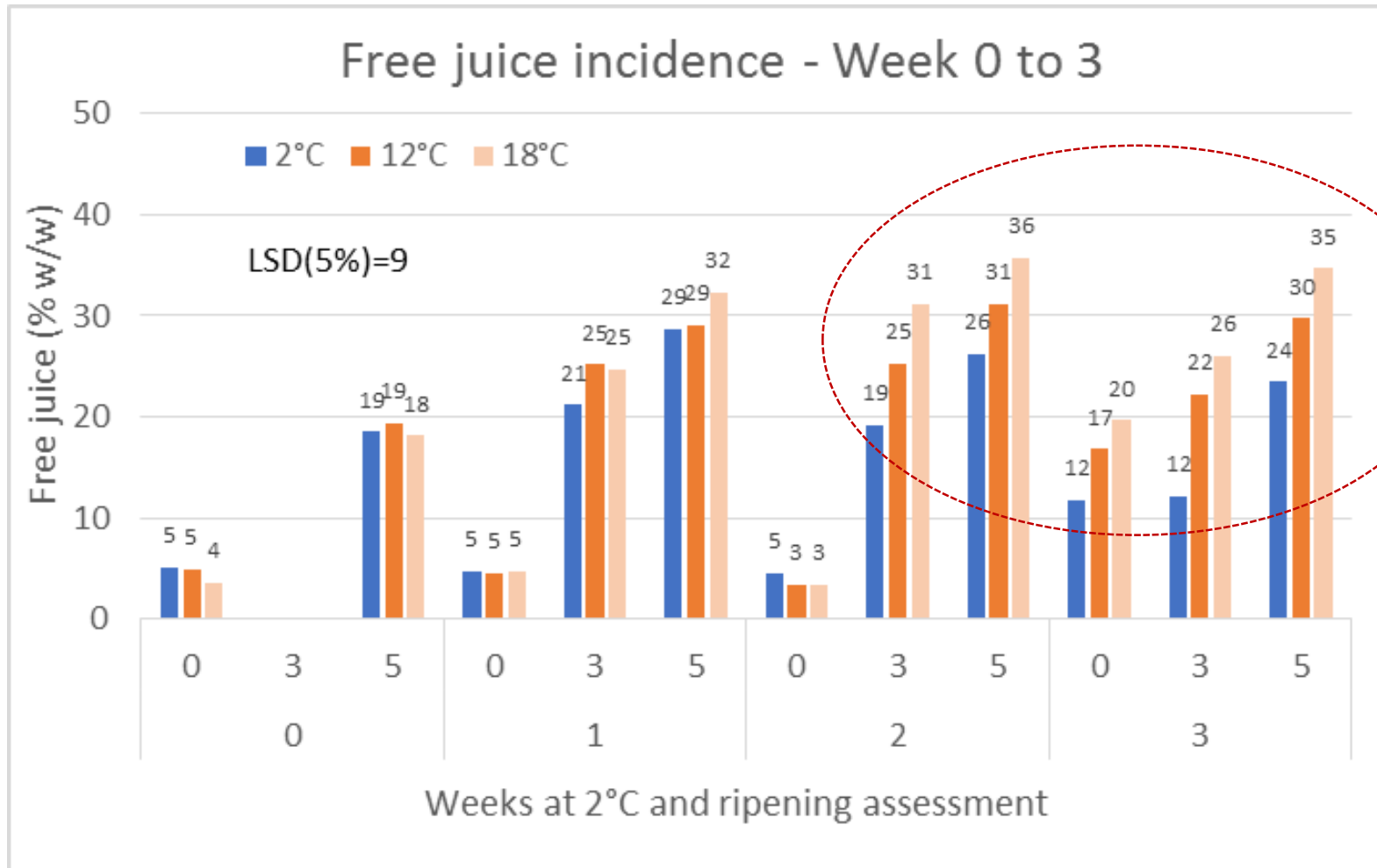
Majestic Pearl – Severity of flesh browning (FB)



Flesh browning severity lower than in previous year's experiments

FB severity scored from 1 to 5 where 1 = none; 2 = <20%; 3 = 21 to 40%; 4 = 41 to 60%; and 5 = >60% flesh area

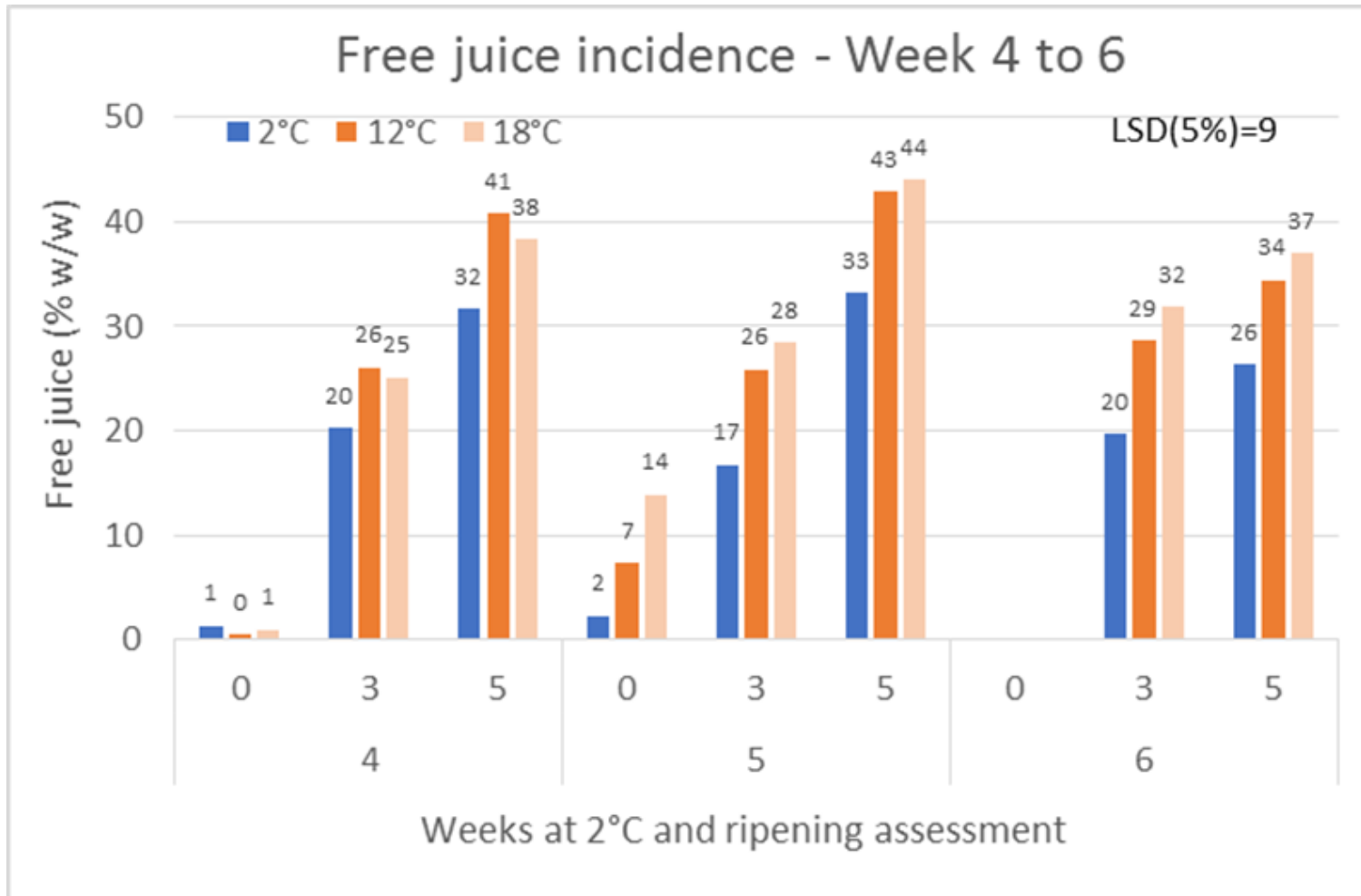
Majestic Pearl – Fruit juiciness (No flesh browning)



No flesh browning but immediately cooled (blue) fruit already mealy?

- Fruit among preconditioning treatments of similar ripeness at each assessment

Majestic Pearl – Fruit juiciness

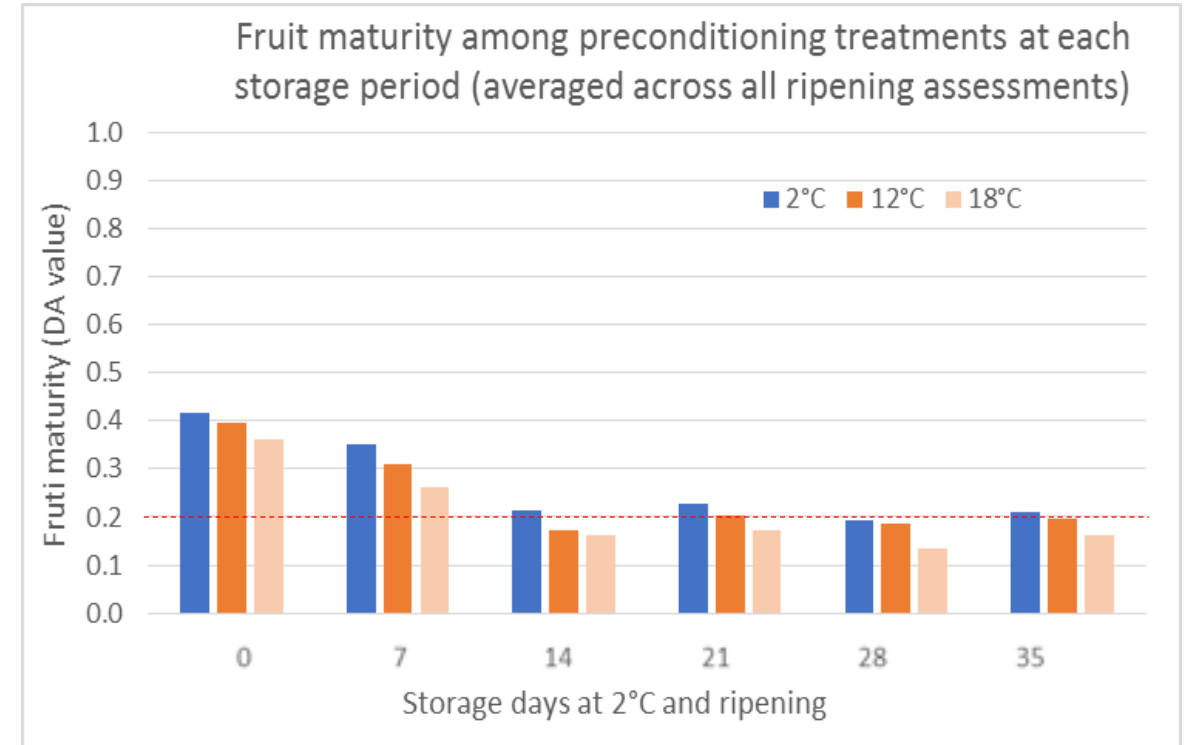
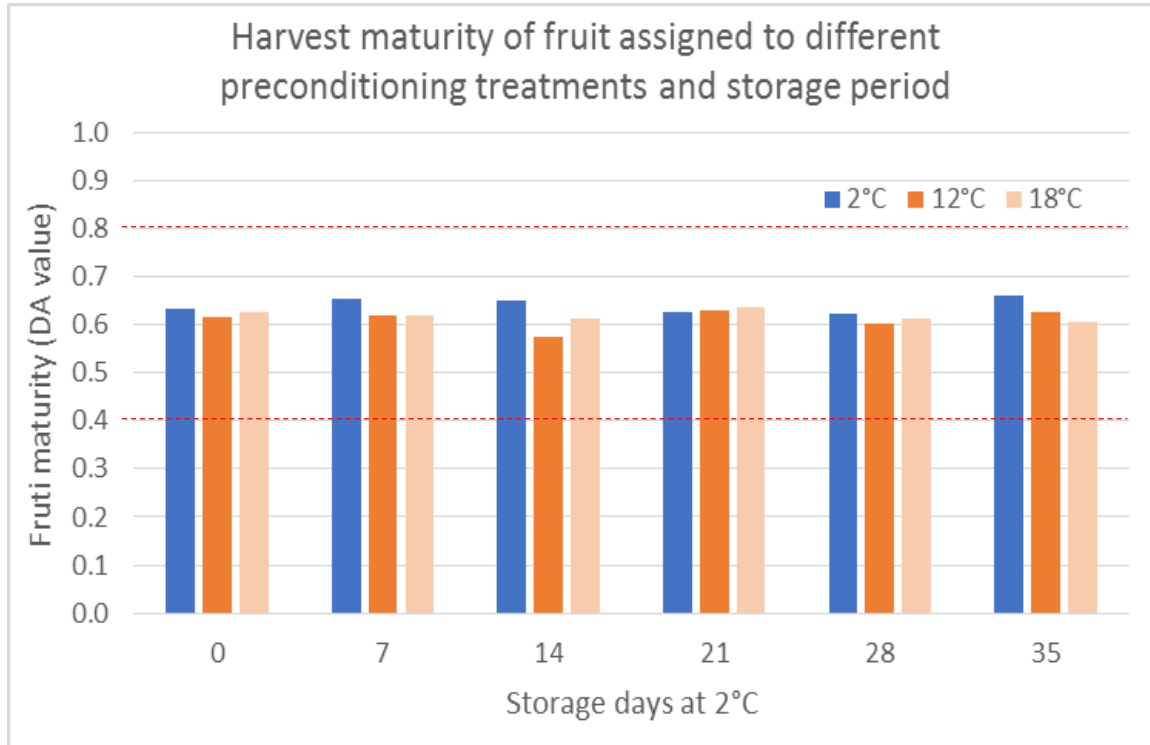


- Fruit among preconditioning treatments of similar ripeness at each assessment

Majestic Pearl preliminary findings

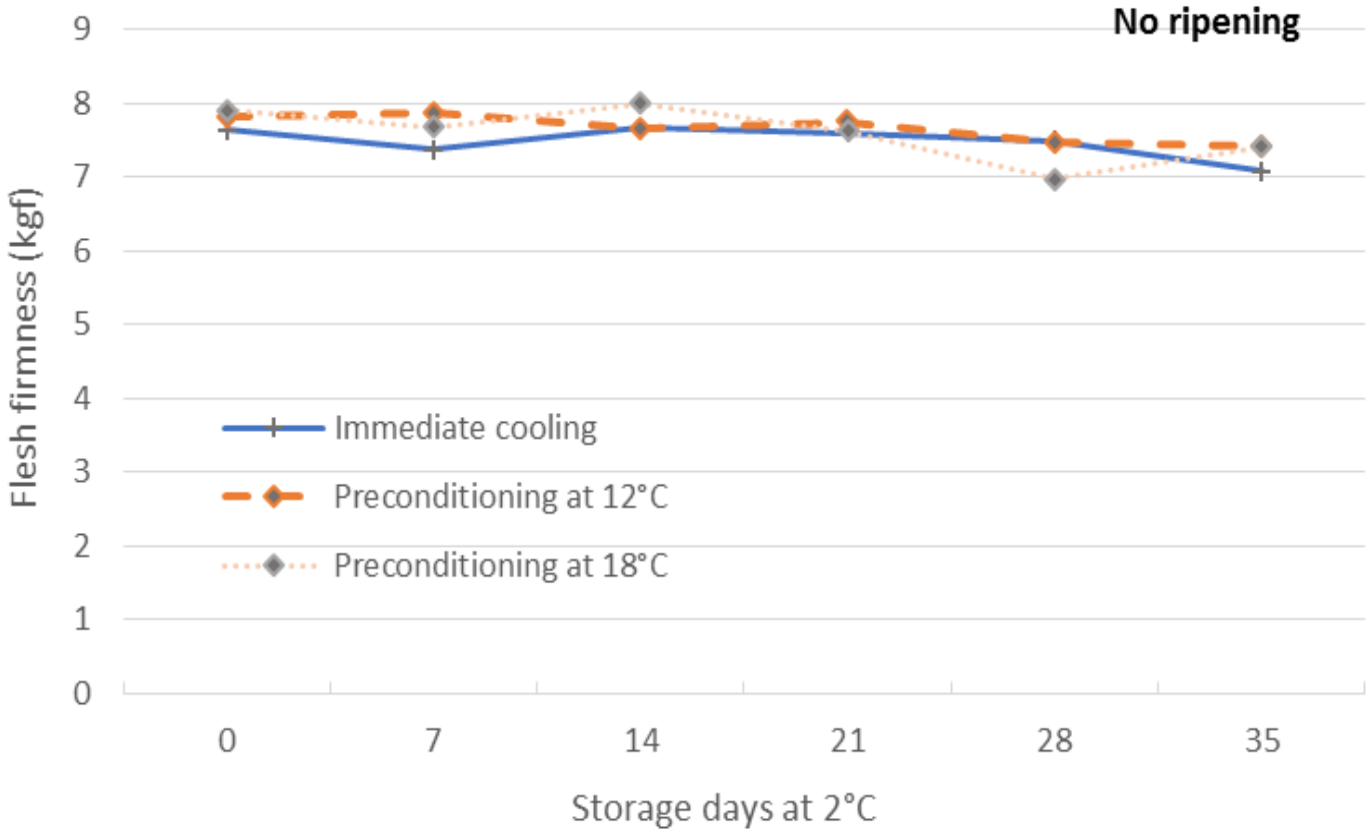
- Preconditioning reduces storage disorder incidence and severity beyond 3 weeks
- Preconditioned fruit juicier (less mealy?) at similar ripeness
- Similar fruit maturity (ripeness) among PC treatments at each removal
- Preconditioned fruit softens marginally faster during extended storage
 - Unlikely to impact on commercial/ export storage potential
- Lower disorder incidence and severity than previous years
 - Orchard climate, harvest maturity....??

Polar Queen -Maturity



- Uniform harvest maturity among fruit assigned to each preconditioning treatment and removal
- Little difference in fruit maturity among preconditioning temperatures at storage removals and during ripening

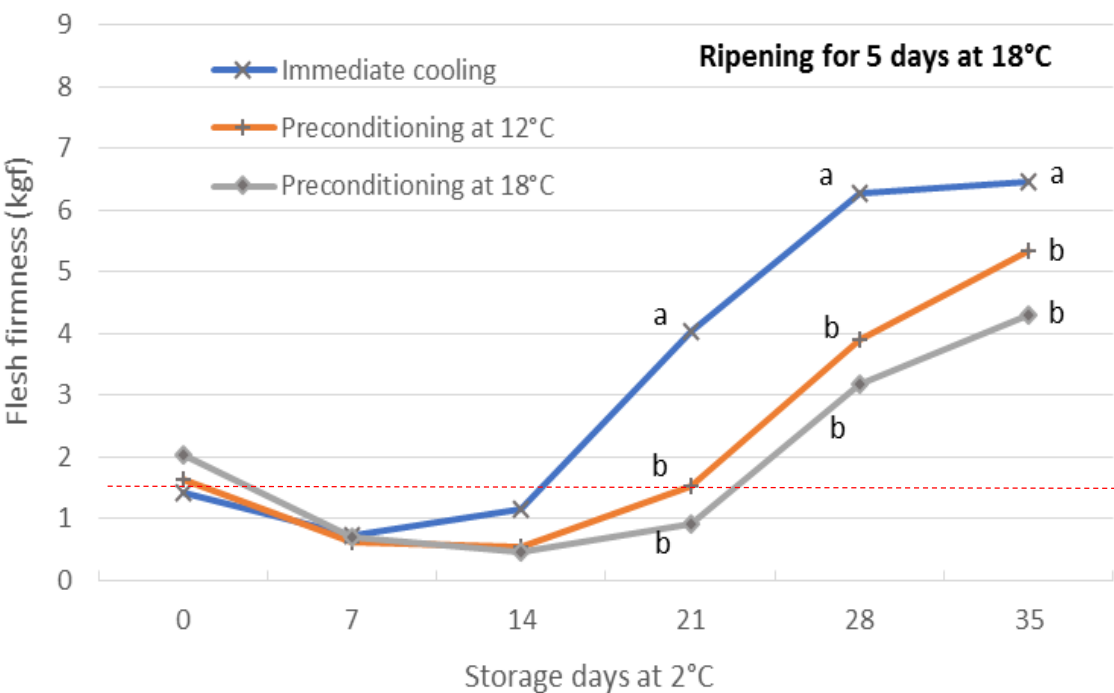
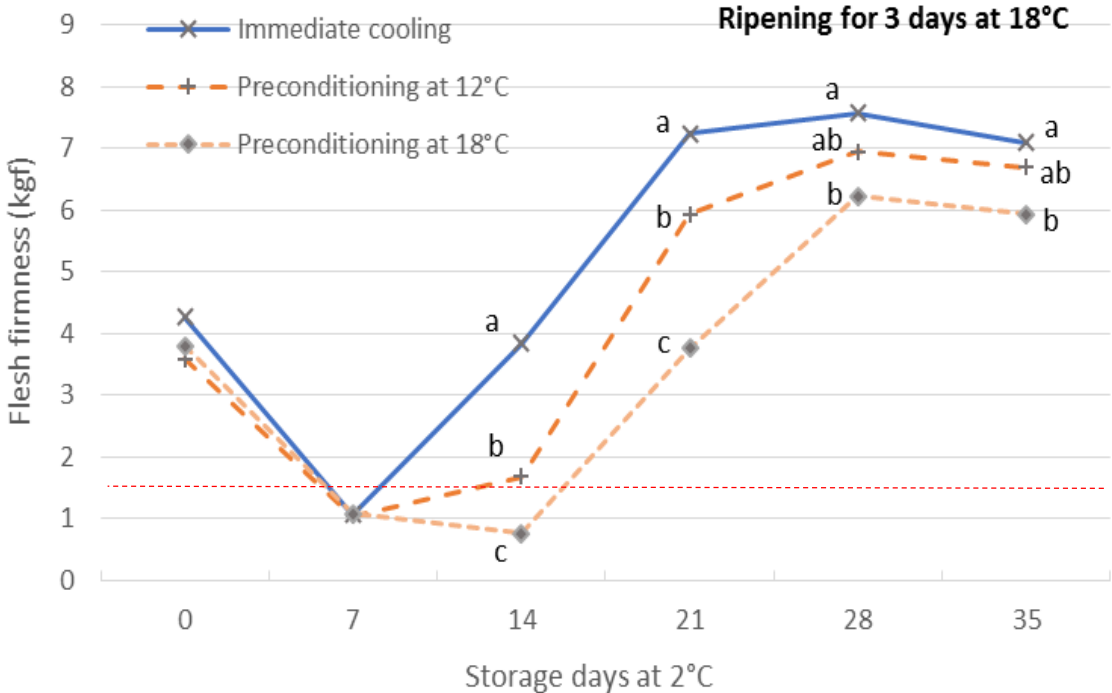
Polar Queen – Fruit firmness after storage



Almost no flesh browning observed in any treatment directly out of cool storage

(Immediate cooling = Preconditioning at 2°C or standard cooling practice)

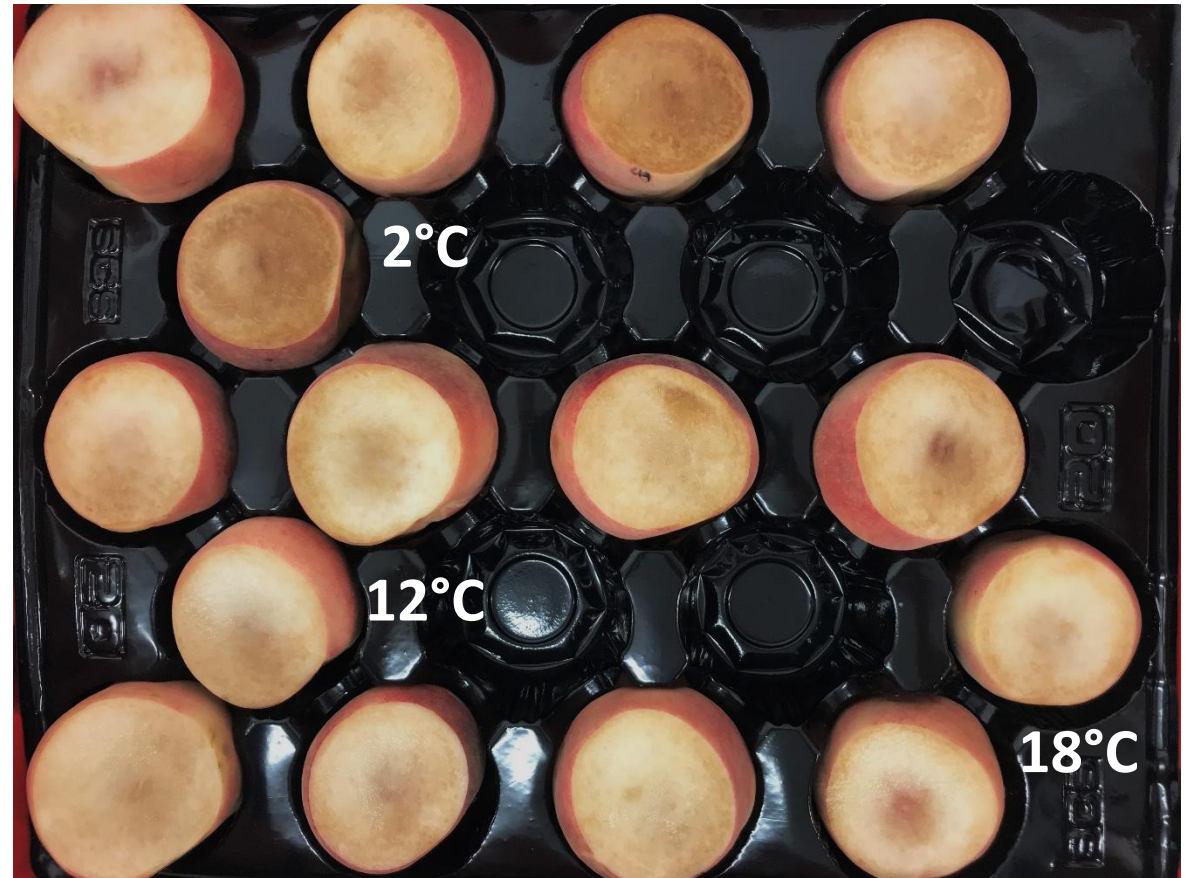
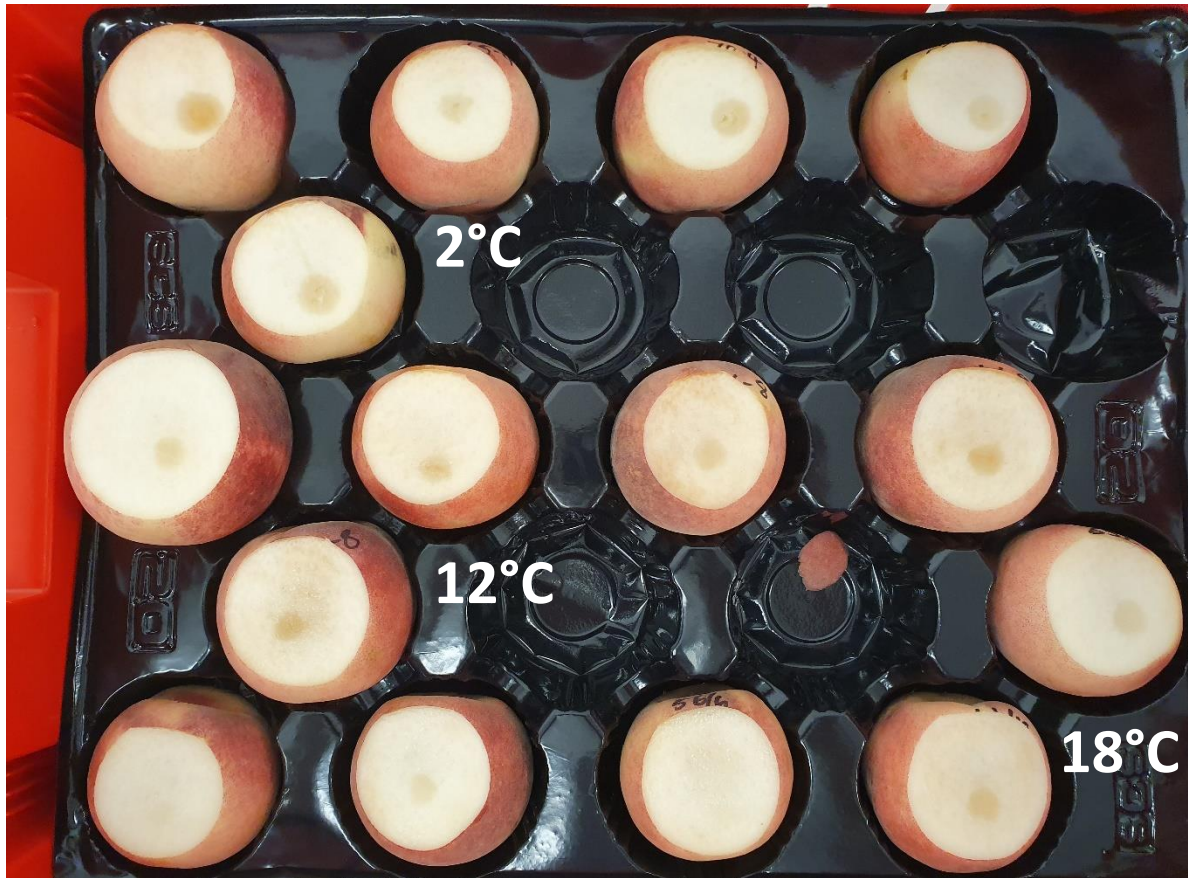
Polar Queen – Fruit firmness after ripening



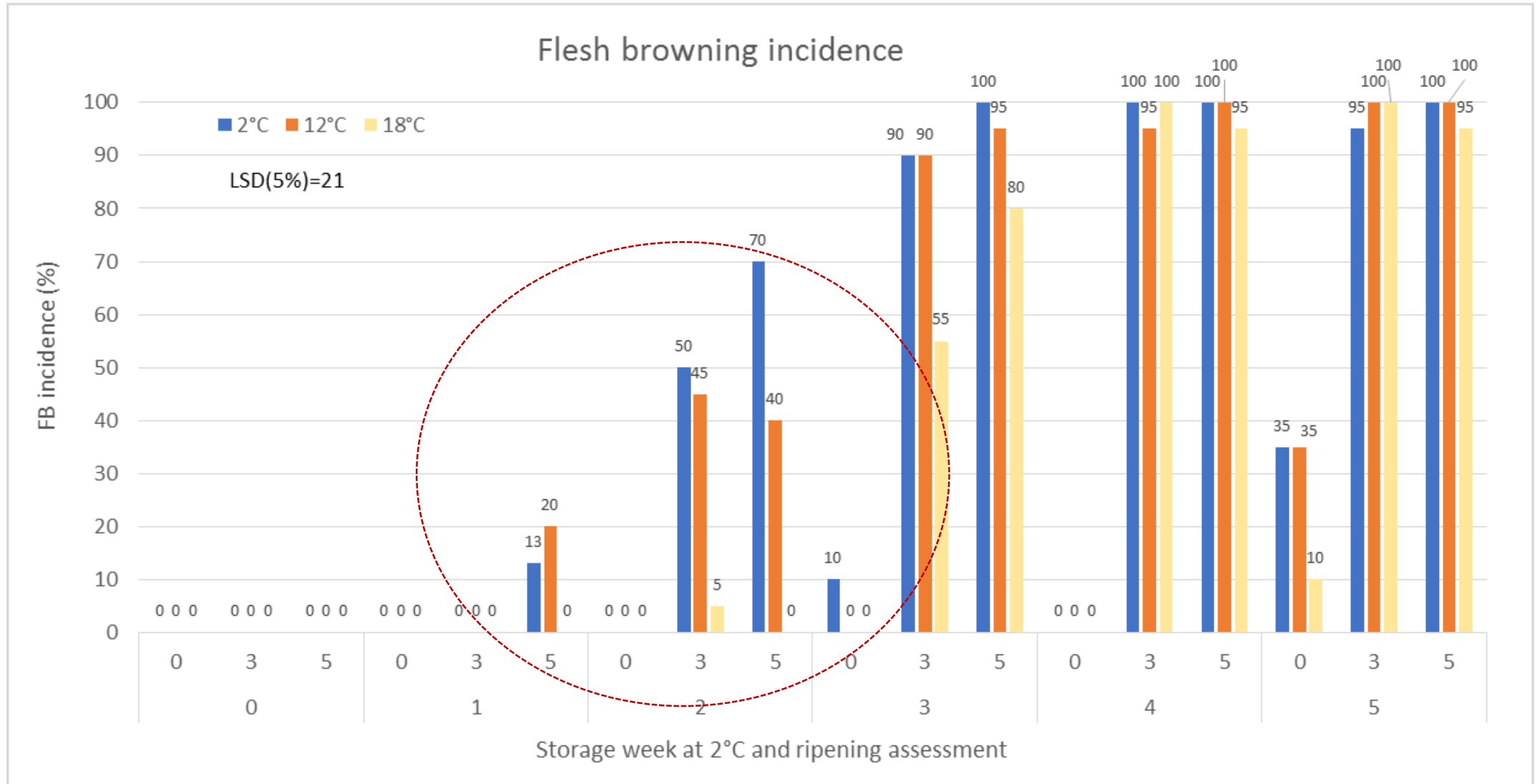
(Immediate cooling = Preconditioning at 2°C or standard cooling practice)

Polar Queen chilling injury

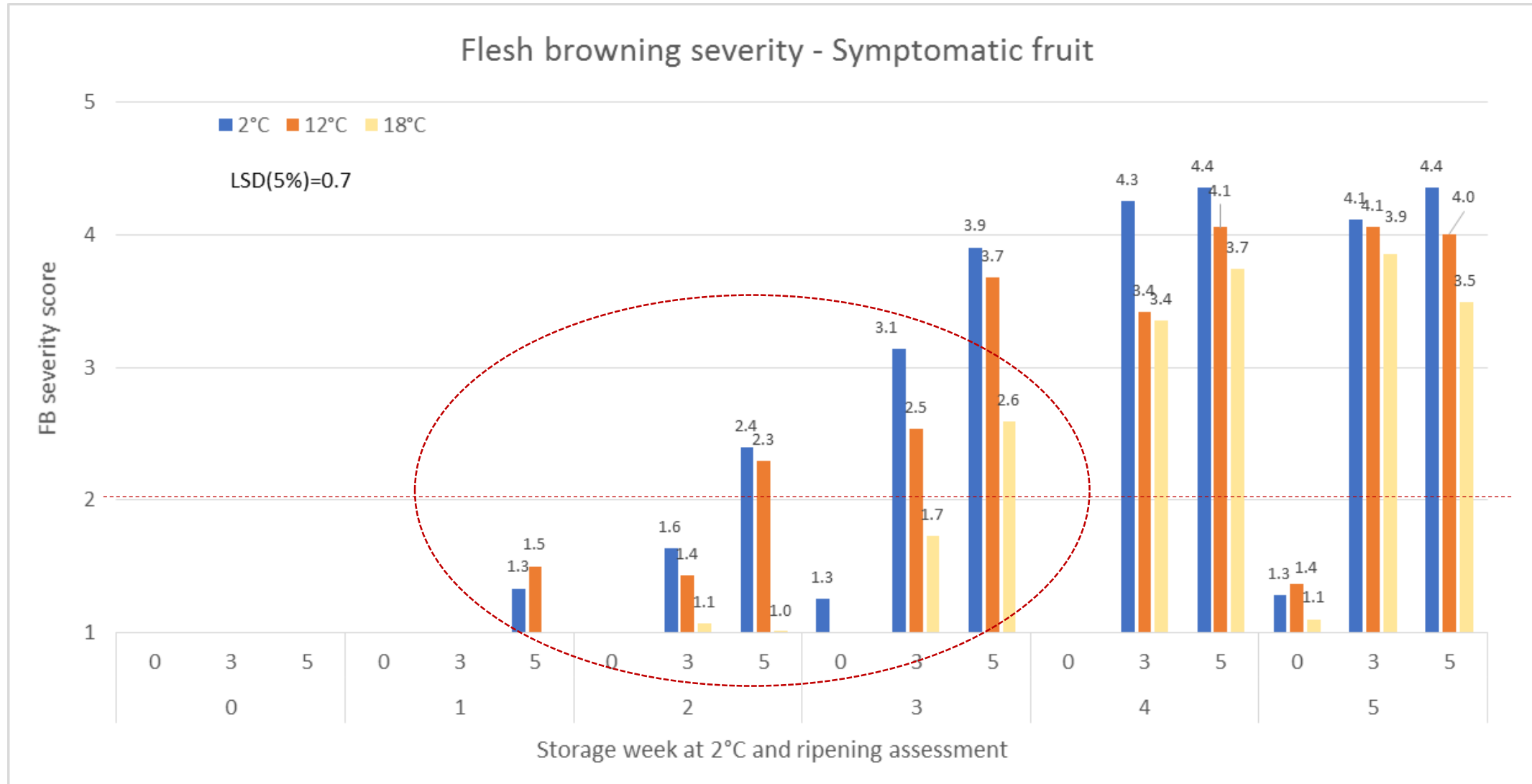
5 weeks at 2°C and ripening at 18°C for 3 days



Polar Queen – Incidence of flesh browning (FB)



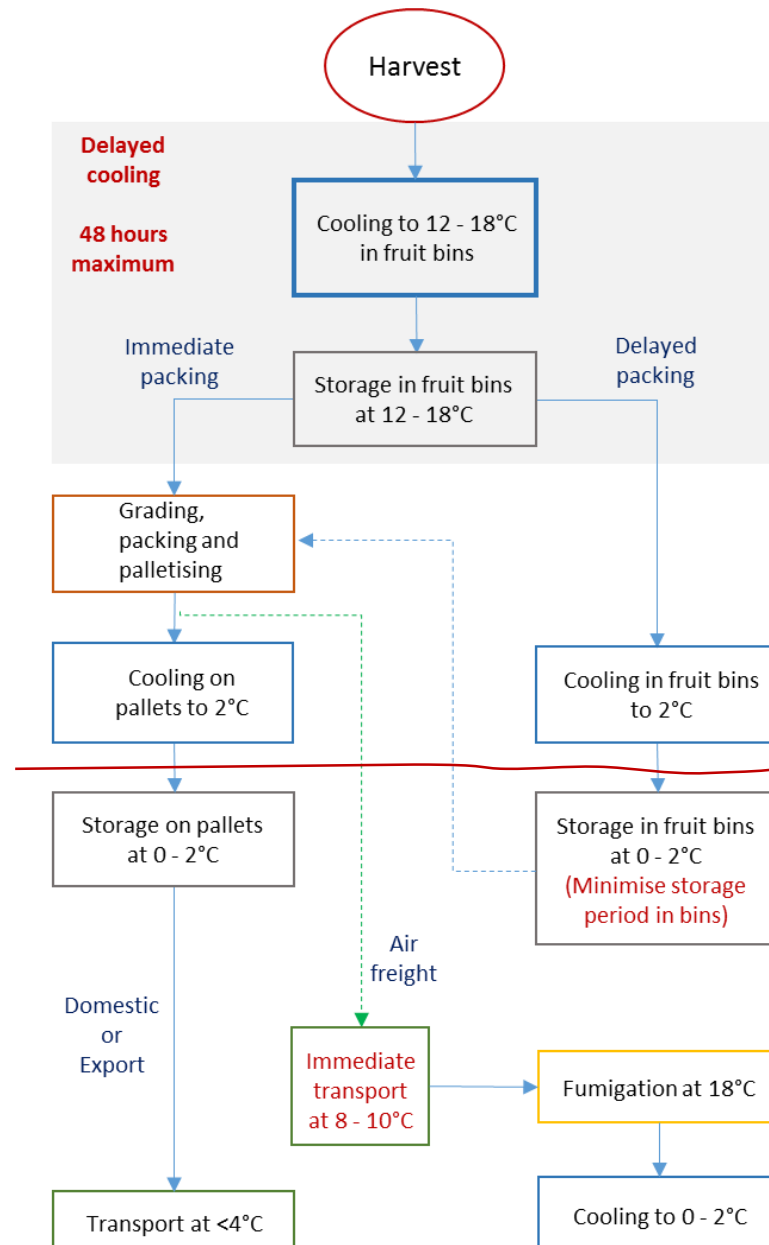
Polar Queen – Severity of flesh browning (FB)



Overall findings – Majestic Pearl & Polar Queen

- Preconditioning at 12°C and 18°C reduces storage disorders compared to immediate cooling to 2°C
 - Among fruit of similar harvest maturity
- 18°C marginally more effective than 12°C
- Variety still the limiting factor for cool storage potential
- Other factors may impact on size of preconditioning effect and risk of disorders
 - Orchard climate, harvesting unripe fruit etc.

Commercial implementation of delayed cooling?



Harvest through to final cooling operation conducted within 48 to 60 hours

Initially may be safer using preconditioning temperature of 10°C or 12°C

Ideally implement for all chains including domestic

‘First in – First out’ handling a must!

Avoid temptation to pick early if using delayed cooling

Commercial implementation

- Precondition all fruit then cool to 1-2°C whether packed, or left in bulk bins for later packing
- Monitor fruit temperature from harvest and during preconditioning
 - Uniform temperatures in fruit bin?
 - How quickly is fruit cooling to preconditioning temperature?
 - How does harvest temperature effect preconditioning treatment?
- Preconditioning and air freight
 - Is it necessary?
 - Will it reduce fruit condensation during warming and fumigation?
- **Implement on a small scale first!**
 - Each grower needs to adjust their own harvest and cooling logistics
 - E.g., Do you have a second cool room that can be dedicated to preconditioning?

Questions?



The Serviced Supply Chains project is funded by the Hort Frontiers Asian Markets Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation with co-investment from:

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