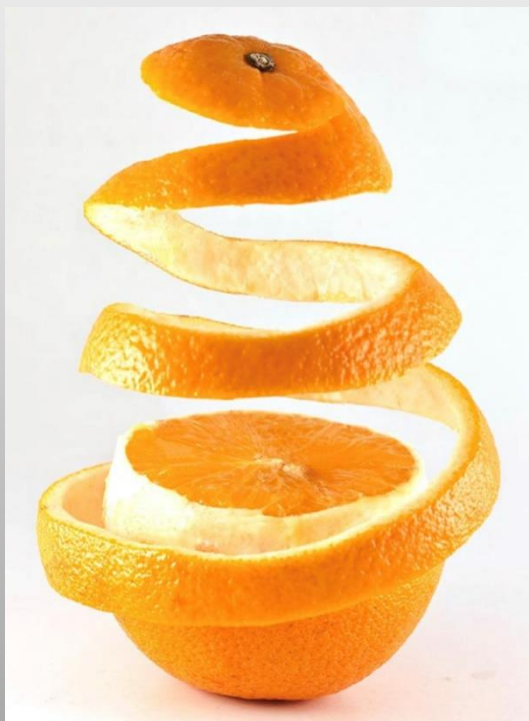


Postharvest: best practices for fruit quality



Paul Cronje

CRI Packhouse workshop
20 January 2021

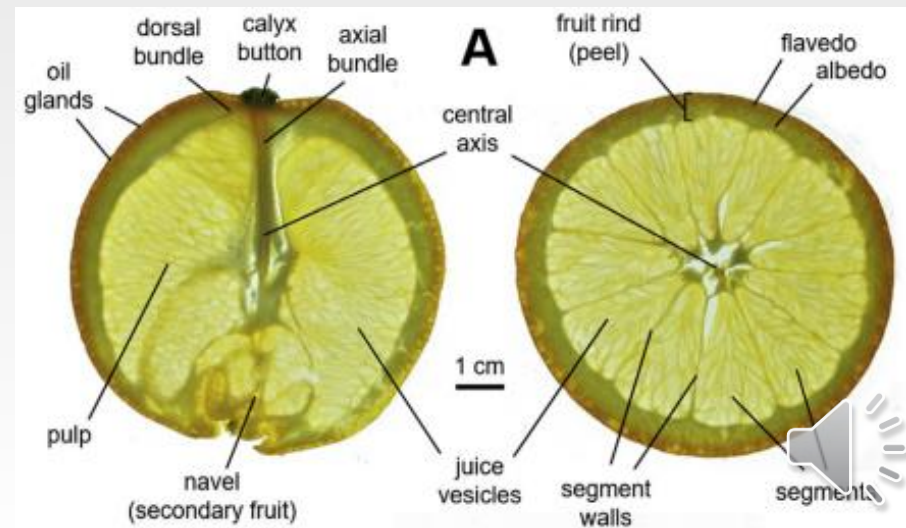
🍊 **Postharvest fruit quality = rind condition + internal quality**

🍊 **Rind condition**

- 🍊 Biochemical components: colour, sugar, moisture
- 🍊 Physical damage: wind, sun, insect, harvest injuries
- 🍊 Physiological disorders: rind breakdown/pitting, Chilling injury
- 🍊 Decay development

🍊 **Internal quality**

- 🍊 Total Soluble Solids (°Brix)
- 🍊 Titratable acid (Citric acid)
- 🍊 Taste and flavor



🍊 Good rind condition

🍊 Ability to remain ***physiological intact*** for < 40 days

🍊 Manage postharvest chain to maintain quality

1. Harvest

2. Orchard to packhouse

3. Packhouse

1. Degreening

2. Chemical application

4. Cold chain

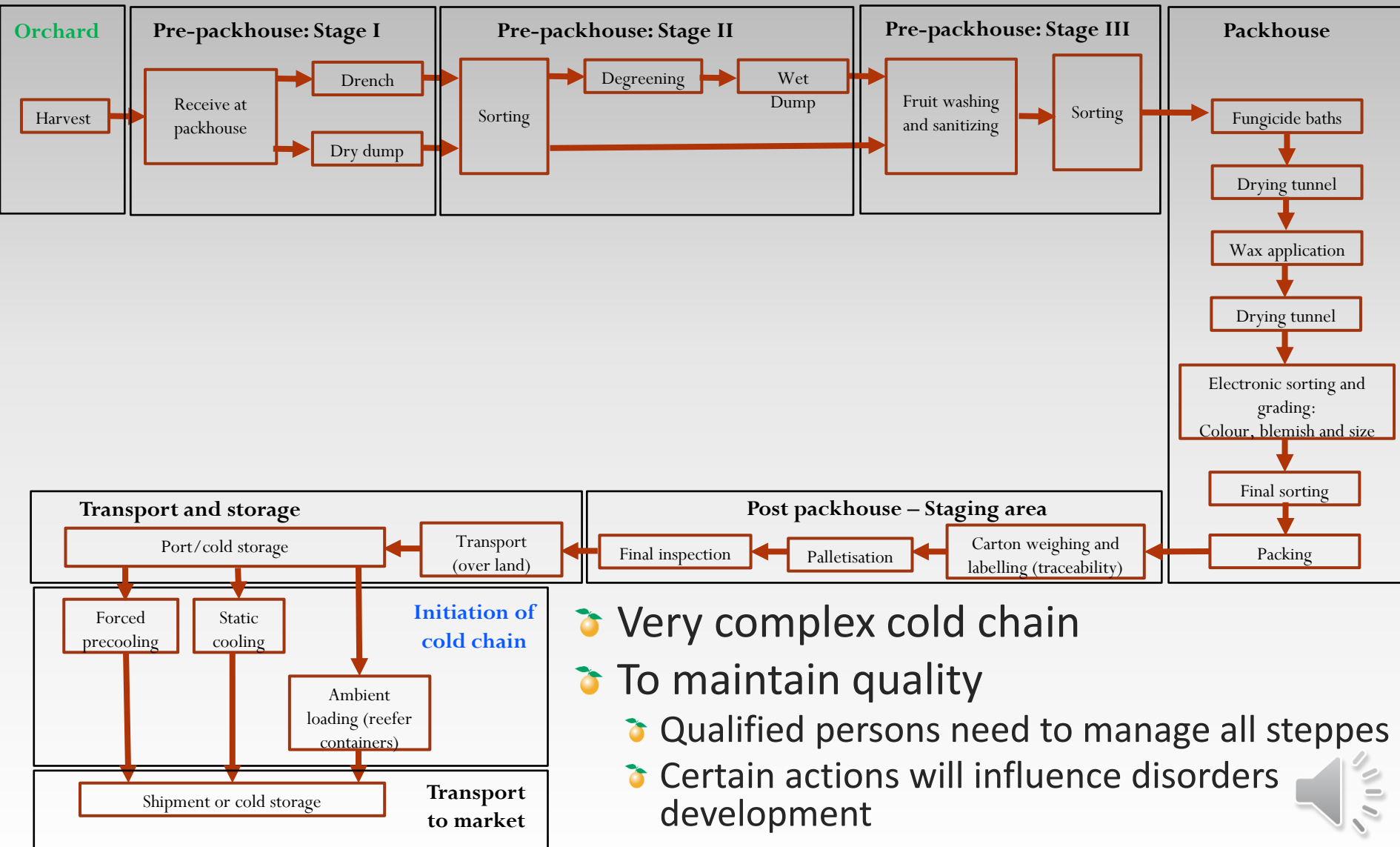
1. Time to cooling (inland transport + time in port)

2. Ship temperature and duration

3. Cold storage in market



Citrus handling and cold chain



Very complex cold chain

To maintain quality

- Qualified persons need to manage all steps
- Certain actions will influence disorders development



- Harvest window

- 🍊 Area x cultivar specific

- 🍊 **Immature fruit**

- 🍊 Low colour, high disorder

- 🍊 **Over mature**

- 🍊 Rind dehydrate, TA low, calyx abscise

- 🍊 Time of day

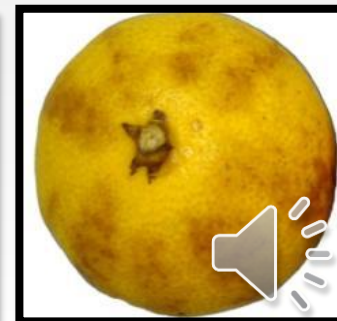
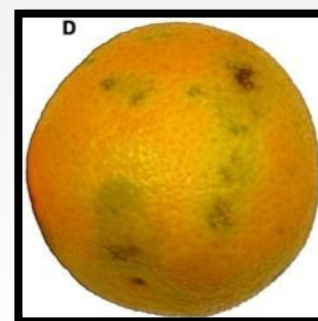
- 🍊 Wet vs. dry conditions

- 🍊 Balance risk of oleo vs. dehydration

- 🍊 Calculate VPD

- 🍊 Determine rate of moisture loss

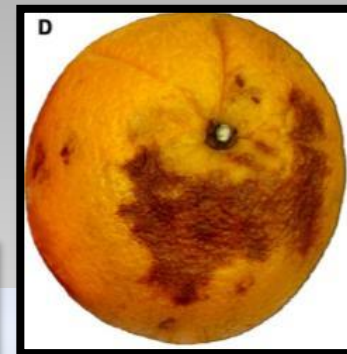
- 🍊 RORP test with penetrometer



2. Orchard to pack house

🍊 Transport and duration

- 🍊 Prevent bruising/injuries and moisture loss
- 🍊 Long time from orchard to wax + cooling
 - 🍊 SERB, Zebra
 - 🍊 Nadorcott/tango pitting



🍊 Drench

- 🍊 Remove field heat
- 🍊 24-D application (retain calyx)
- 🍊 Fungicides



🍊 Storage before pack line

- 🍊 Keep fruit cool and reduce
 - 🍊 Water loss
 - 🍊 Respiration rate
- 🍊 Cool area + increase RH



🍊 Positive

🍊 Enhance rind colour via reduction of chlorophyll

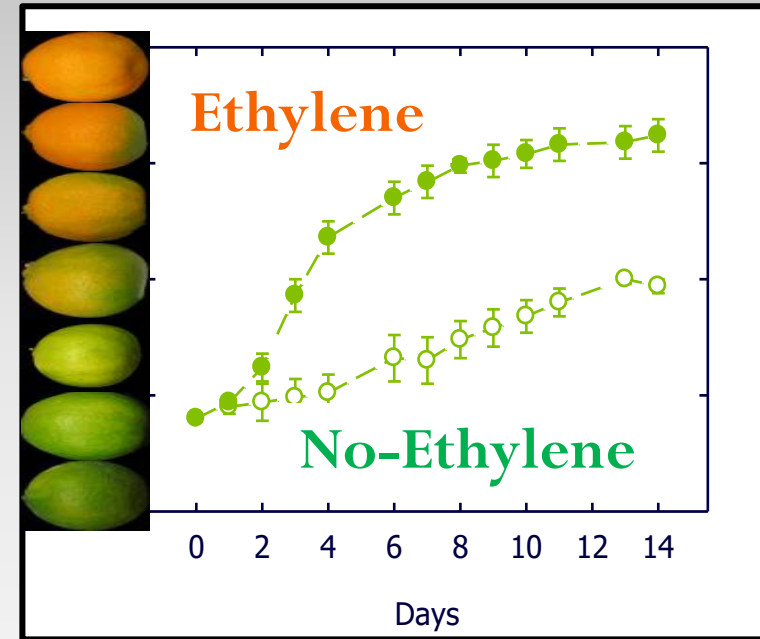
🍊 Negative

🍊 Accelerated senescence

🍊 Calyx abscission

🍊 Increased decay

🍊 Increased physiological defects



🍊 **Make sure all factors must be 100% controlled and measured during degreening**



Cultivar

- 🍊 Not all cultivars respond similar
- 🍊 Nadorcott/Tango **do not** respond to ethylene

Fruit maturity and quality

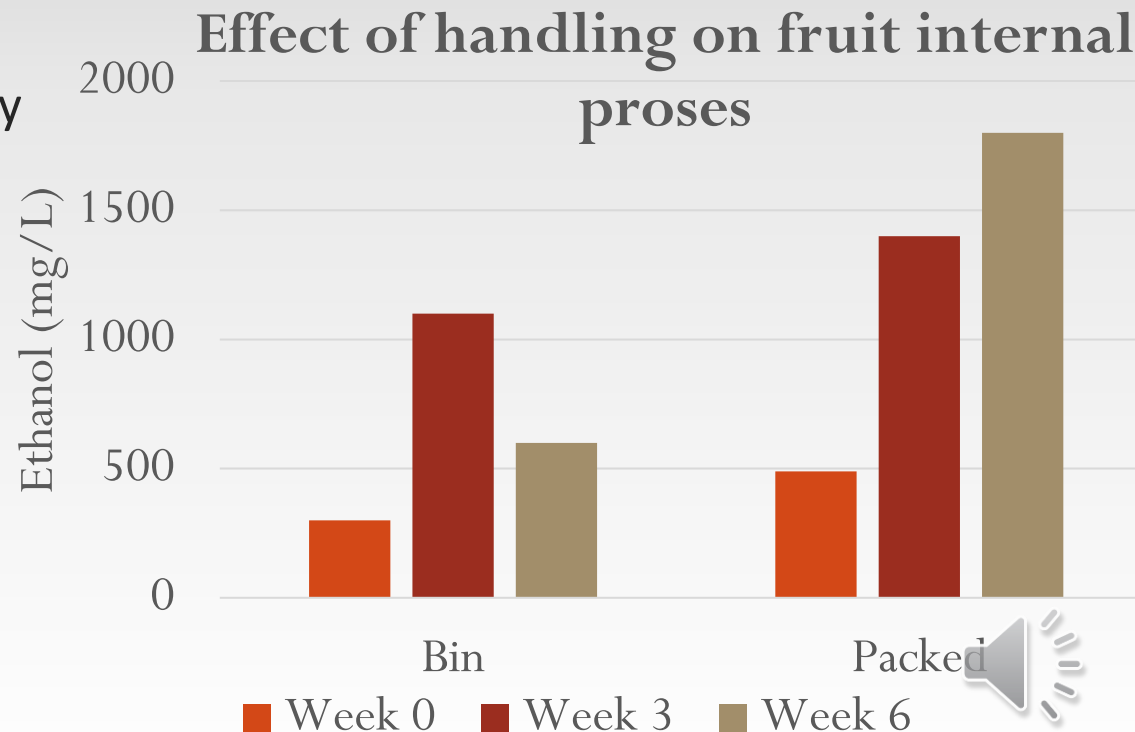
- 🍊 Rind colour process must start on tree
 - 🍊 E.g. T6 with < 20% T5
- 🍊 Careful harvest : Oleo blemish

Measure and application

- 🍊 Ethylene (1 - 3 ppm)
- 🍊 CO₂ – extract continuously
- 🍊 Temperature – cultivar specific
- 🍊 RH > 90%



- 🍊 All steps in packhouse can negatively influence fruit quality
- 🍊 Minimize negative impact
 - 🍊 Dump = injury = moisture loss and off flavours
 - 🍊 Brushing speed/type (soft citrus)
 - 🍊 Waxing
 - 🍊 Know products
 - 🍊 Application rate and efficacy
 - 🍊 Dry tunnels
 - 🍊 Temperature X Time



Sorting technology: reduce variation in quality

🍊 Use aspects indicating quality

🍊 Rind colour

🍊 Blemish

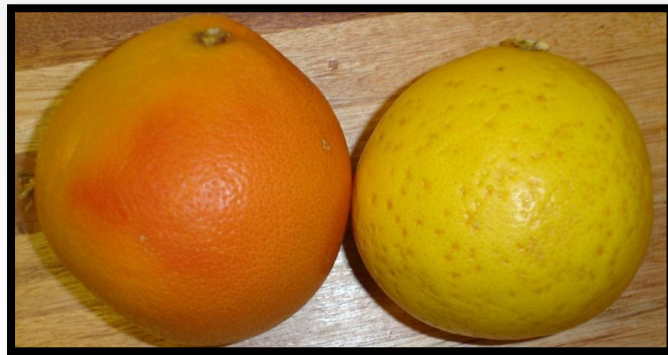
🍊 Size

🍊 Ratio (size/mass) (granulation)

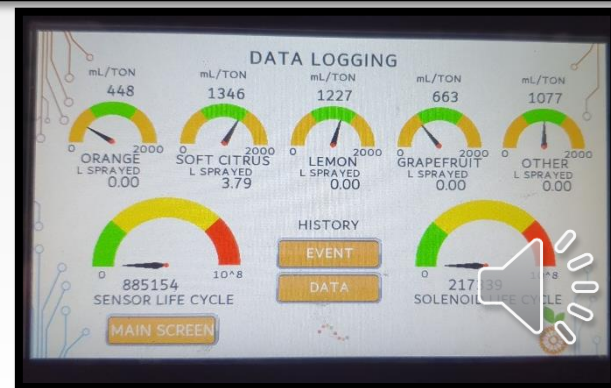
🍊 Examples

🍊 Small + yellow Nules = rind breakdown

🍊 Pink colour in Star Ruby = reduce chilling injury



- 🍊 Protection against **moisture loss**
- 🍊 Reduce **development of CI**
- 🍊 Best equipment needed
 - 🍊 Wax mixing
 - 🍊 Brush types
 - 🍊 Application on brushes
 - 🍊 Drying
- 🍊 Wax for purpose/market
 - 🍊 Poly vs natural
 - 🍊 % Solids (high = CI protection)
 - 🍊 Be careful for “bio” waxes in Chem free programs



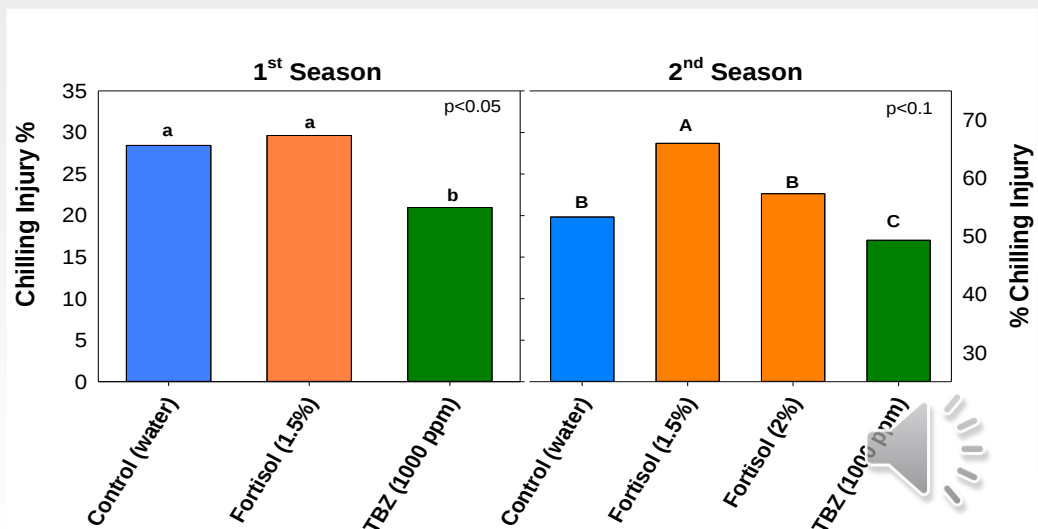
- Develops **above freezing point** ($> 0^{\circ}\text{C}$), but below a critical threshold temperature
- **Time x Temperature** dependent i.e. certain min. exposure time to sub-critical temperatures
- Damage **cumulative**
- Increased incidence in EU since 2018



- 🍊 Know cultivar susceptibility (Turkey vs Late Valencia)
- 🍊 Harvest date (Early and late = high susceptibility)
- 🍊 Only **well coloured fruit** to cold-steri markets
- 🍊 **Cull small fruit** (high susceptibility)

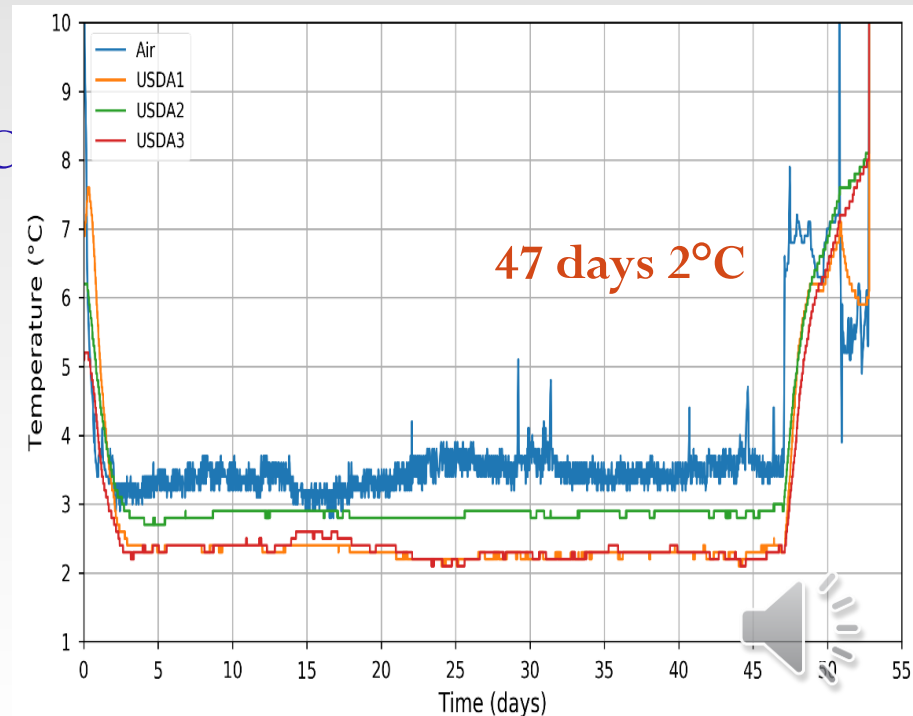
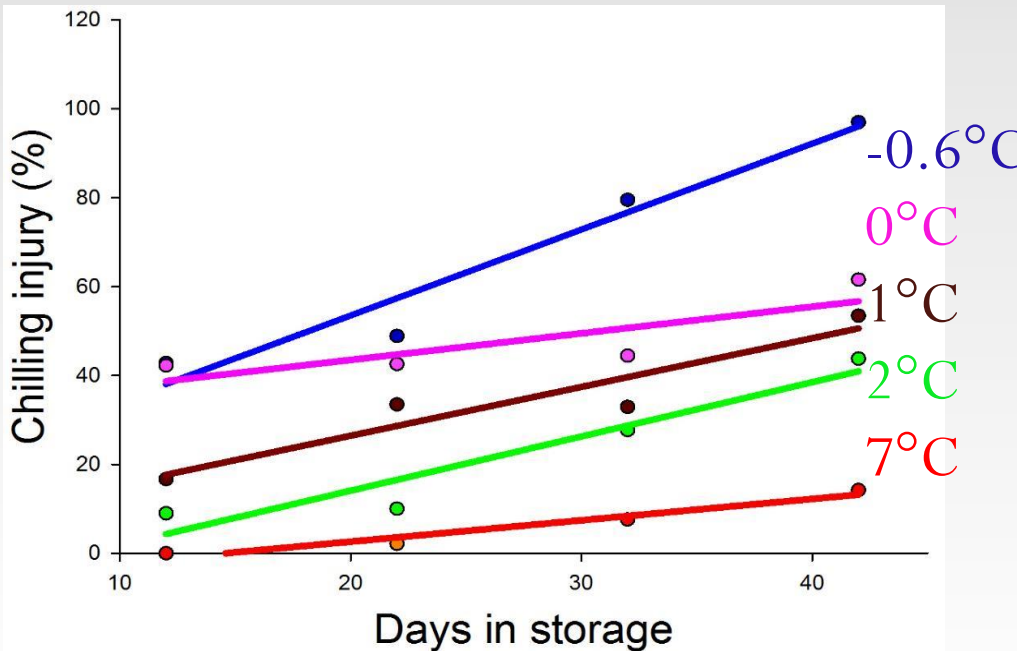
Postharvest treatments

- 🍊 **Apply TBZ** in drench and wax
- 🍊 **Wax** coverage of whole fruit +24-D
- 🍊 Use high solids wax
 - 🍊 (18-20%)



Shipping regimes

- 🍊 CI will occur at 2°C during too long shipping/storage
- 🍊 Some cultivar more susceptible
- 🍊 Weak rind colour increase susceptibility
- 🍊 Control duration via cold chain management
- 🍊 STEP UP of containers



🍊 What % of containers were not stepped-up after 30 days?

A. <5%

B. 5-10 %

C. 10-20 %

D >20 %



- 🍊 In market the cold storage at could affect rind condition
 - 🍊 Recommended no lower than 4°C
 - 🍊 Could increase CI incidence if <4°C
 - 🍊 Progressive disorders could increase
 - 🍊 Certain pitting types – e.g. RBD of Nules Clementine will increase
 - 🍊 It should be noted that CI symptoms often only develop and become visible after storage at >4°C
 - 🍊 However the CI damage occurred during shipment



Question 2

-  What is normal duration of cold storage in EU
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5 weeks?



Question 3

At what temperature are citrus fruit stored in EU

- A. 0 °C
- B. 2 °C
- C. 4 °C
- D. >7 °C



Before harvest

- 🍊 ID problematic cultivars (e.g. Benny vs. Turkey vs. Midnight)
- 🍊 ID susceptible orchards (history)
- 🍊 Harvest maturity/picking window
 - 🍊 Early vs. late influence susceptibility



At harvest

- 🍊 Prevailing climate
 - 🍊 High VPD cause high water loss from fruit
 - 🍊 *make a plan to prevent it!*
- 🍊 Time from harvest to packhouse
 - 🍊 Manage rind moisture content



Peteca spot of lemons

🍊 Sudden changes in pre-harvest temperatures (cold fronts/rain)

🍊 Harvest maturity:

🍊 Too early harvest = high peteca

🍊 **NB For New lemons producers**

🍊 Test sensitivity with plastic bag method

🍊 Reduce handling, leave in bins for 2-4 days before pack

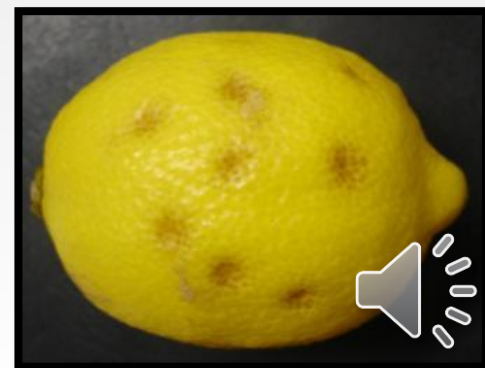
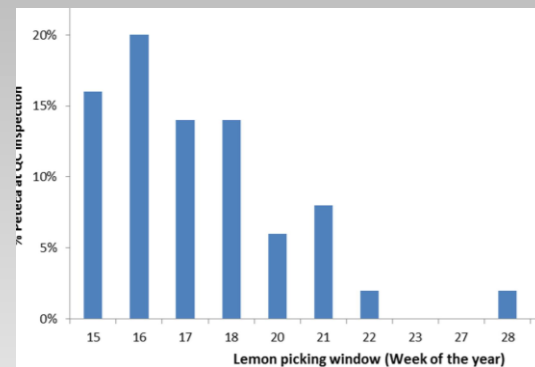
🍊 Cool well ventilated areas

🍊 Degreening must have low CO₂

🍊 **If in doubt do not harvest!!**

🍊 Test Ethephon 7-10 days before harvest

🍊 40-60 ml/100L water



Please contact
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