- common - sense

"Secrets" to successfully handling mandarins on commercial citrus packinglines

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Mandarins

- Most problematic of citrus
- Very diverse
- Prone to peel disorders
- Prone to off-flavors



Citrus

- · Chilling sensitive
- Non-climacteric

Storage Temperature Requirements

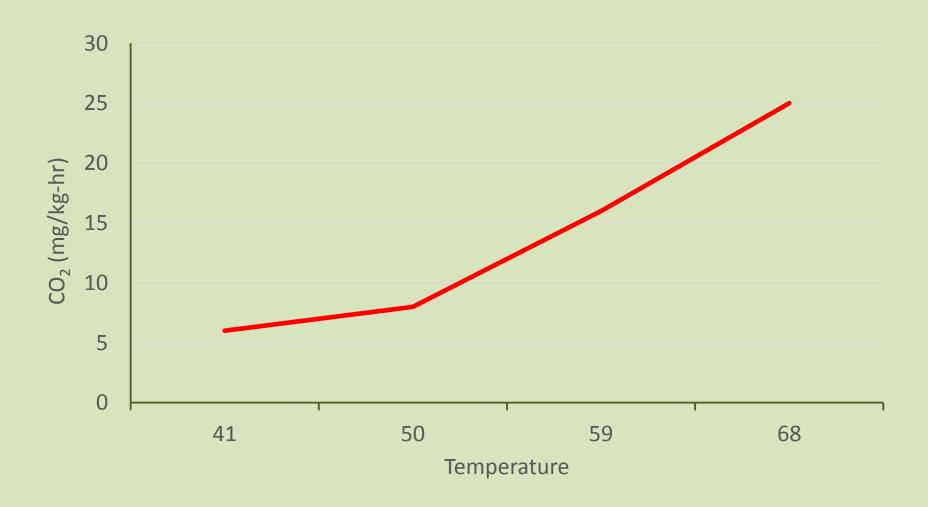
- √ Varies with citrus type and variety
- ✓ Ranges from approximately 32F to 59F

Most Cold Tolerant Least Cold Tolerant

Kumquats Oranges Limes, Citrons

Mandarins Lemons, Grapefruit

Relative Respiration of Mandarin



Why are we concerned about respiration rate?

The rate of deterioration (perishability) is generally proportional to the respiration rate

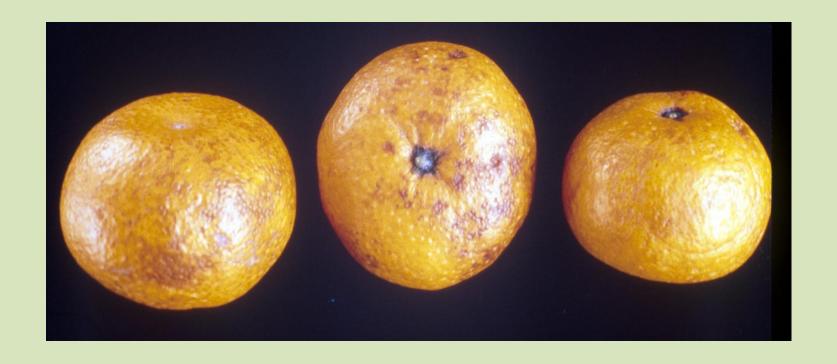
Relative Perishability	Potential storage life (weeks)	Commodity
Very High	<2	Strawberry, Blackberry, Blueberry
High	2 to 4	Grape, Mandarin, Peach
Moderate	4 to 8	Apple, Pear, Orange, Grapefruit, Lime, Kiwifruit
Low	8 to 16	Apple, Pear, Lemon
Very Low	>16	Tree Nuts, Dried Fruits





Fruit "burning" following degreening





SOPP Damage



Puffiness

Olleocelosis



Symptoms of Mandarin Rind Disorder





Mandarin Rind Disorder

- Observed in Central Valley Mandarins (Satsumas, Clementines)
- Symptoms occur in field initially as water soaked areas, typically on exposed side of fruit on outer tree perimeter
- Symptoms progress and leads to high fruit loss after harvest

Similar symptoms in other mandarins (Encore, Fortune, clementines), oranges (Valencia rindstain) described in literature



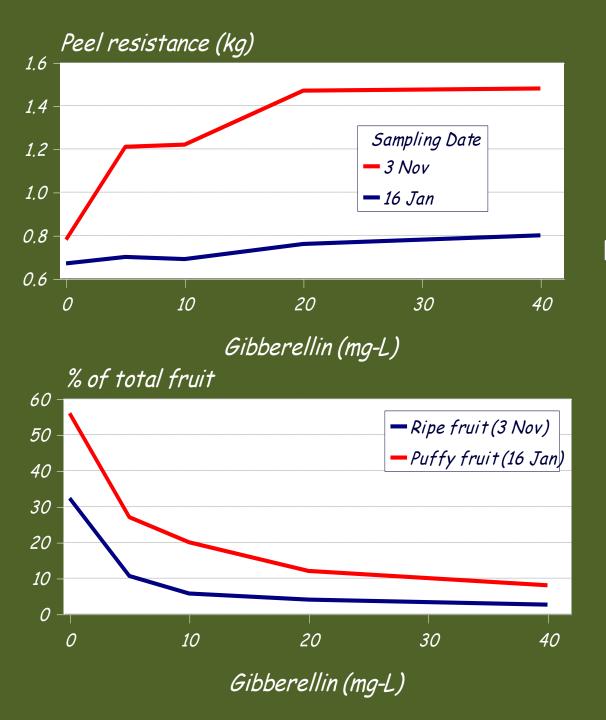
Mandarin Rind Disorder - RECOMMENDATIONS

- Multi-year study in Fresno and Butte County
- Noted that fruit are "predisposed" prior to color break
- Noted that "water-soaking" of predisposed fruit in lab conditions triggered symptoms
- Not correlated to a specific pathogen

Treatment with a light oil, antitranspirant or Gibb prior to color break reduced incidence of disorder

Plant Growth Regulators: GA₃

- Delayed color break
- Delayed rind senescence, increased firmness
- Reduced navel rindstain
- Reduced puff and crease in some varieties
- Reduced susceptibility to chilling injury
- Reduced wax deposition and changes in wax structure



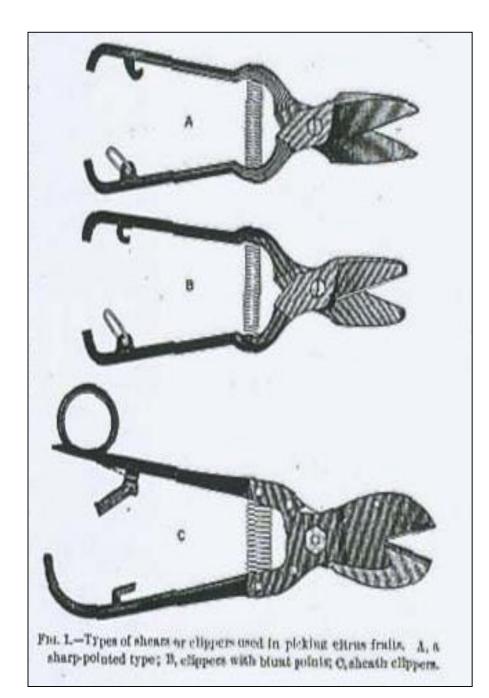
The influence of GA₃ on peel resistance and fruit aging in satsuma mandarin when applied on Sept. 30 (Garcia Luis et al, 1985)



Care needs to be taken during handling to minimize damage since the consequences of mechanical injury are:

increased decay enhanced water loss may result in peel breakdown in handling





"The most common type of injury was made by ... the clippers ... many were injured by stem punctures, while others showed scratches from thorns. Other common ... injury... were from gravel and twigs in the bottom of boxes and cuts by the finger nails of the pickers." Powell, 1908 Riverside, California

Delays Between Harvest and Processing results in increased

Decay

Quality (Rind Disorders)

Grove Sanitation

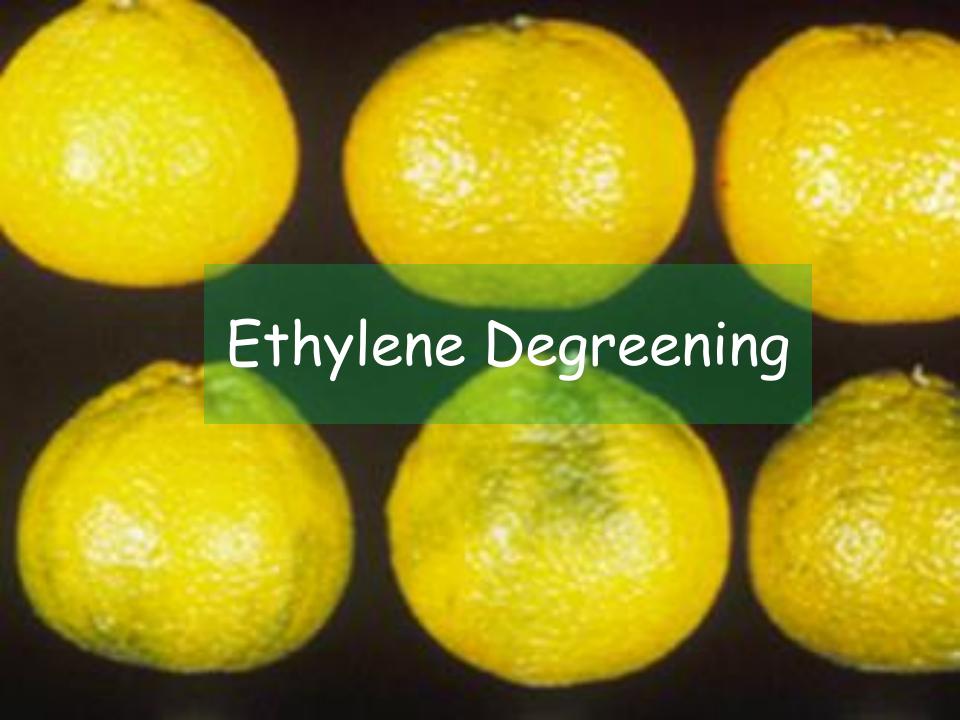


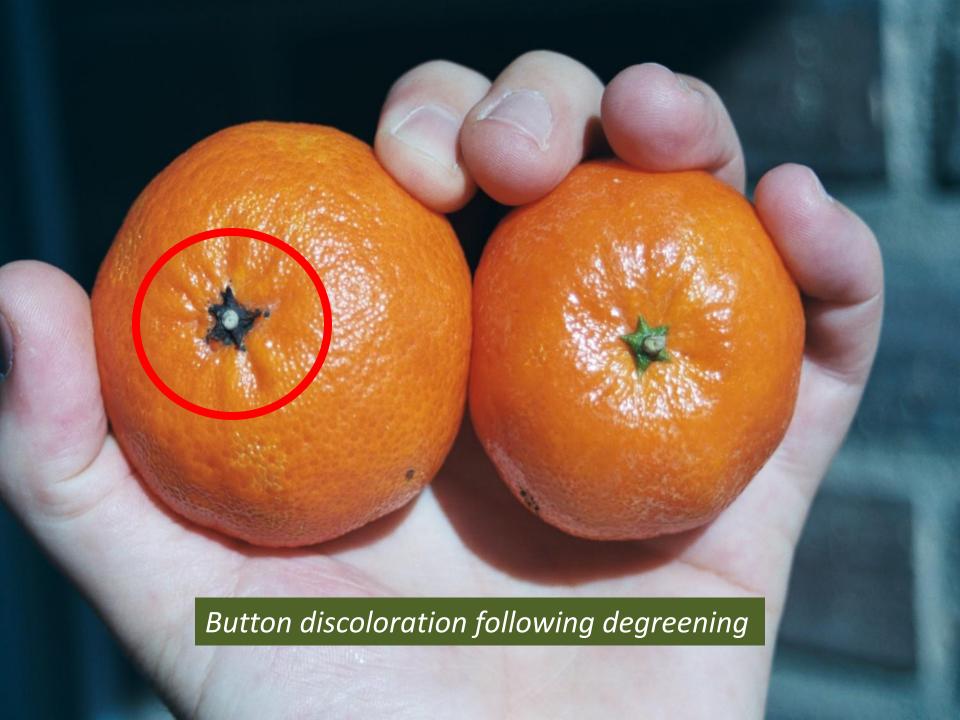


Preharvest Fungicide Option

Quadris Top

- Syngenta
- Combination of Azoxystrobin amd Difenonconazole
- Can be Ground or Aerial Application
- May be applied the day of harvest





MANDARIN FLAVOR:
THE IMPACT OF STORAGE,
TEMPERATURE, COATINGS AND
GENETICS

Mandarins often develop off-flavor during storage

Not fresh



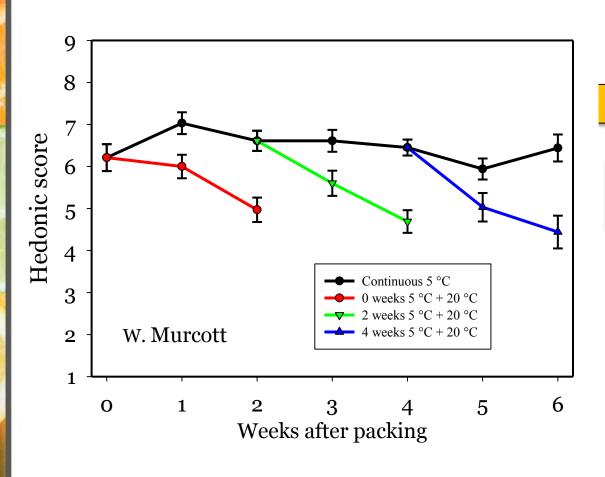
Over ripe

Spoiled

Strange aftertaste

Really old

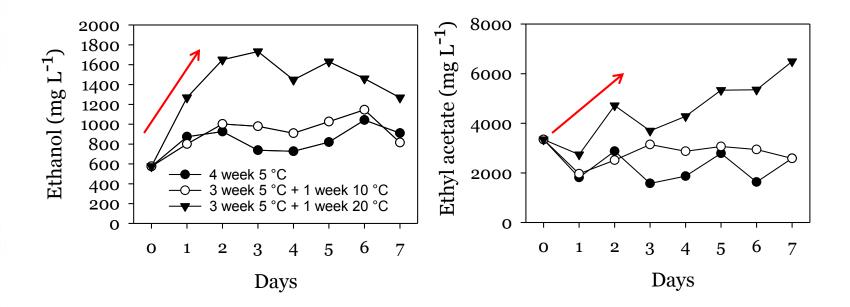
Temperature effect on off-flavor



Warm temps enhance

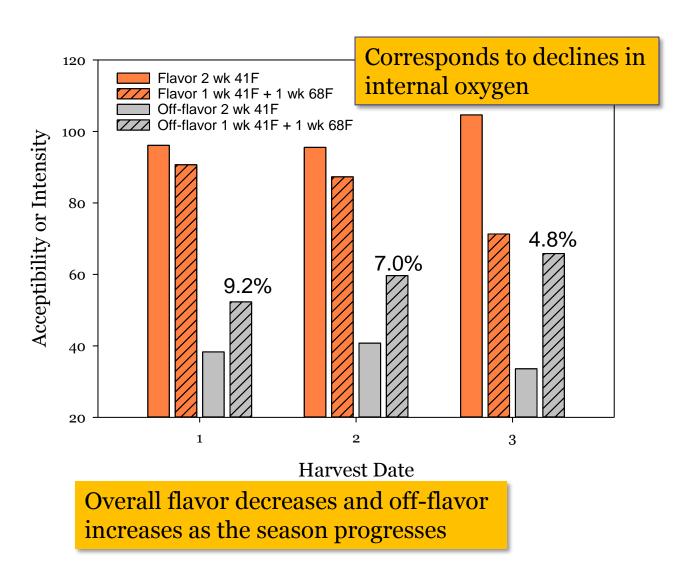
Time in cold storage influences response

10 degrees C (50F) also inhibits off-flavor

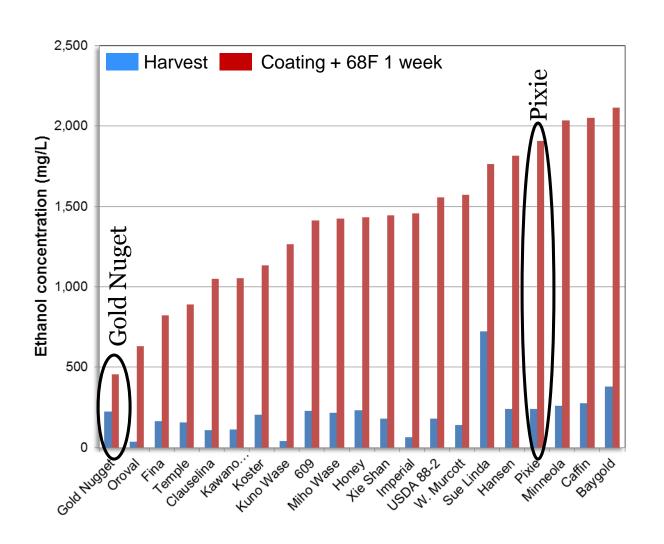


Flavor compounds increase rapidly in amount at warm temperatures.....off-flavor development does not take long

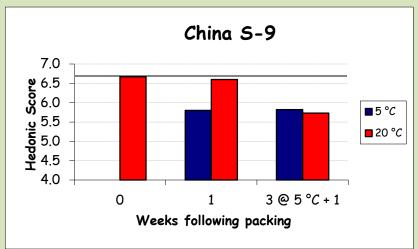
Date of harvest can influence the negative effect of storage on mandarin flavor

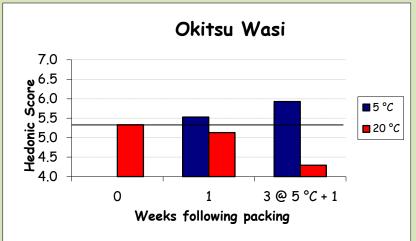


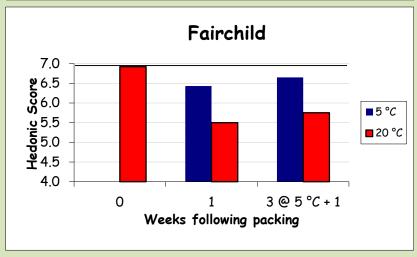
Large varietal differences exist in the amount of ethanol accumulated after waxing and storage

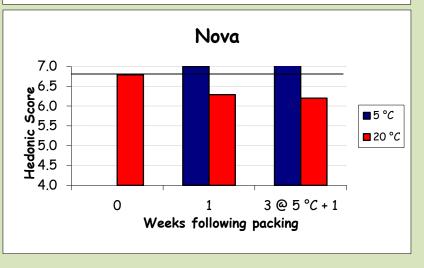


Response to warm storage temperature - other mandarin types









Take Home Message

- Most problematic of citrus
- Very diverse Need to gain better understanding of postharvest requirements when new varieties released
- Prone to peel disorders Soft handling required at all steps from harvest through packing
- Prone to off-flavors Temperature management critical especially after waxing

Thank you for your attention

Any questions?