

POSTHARVEST CHANGES THAT OCCUR IN FINGER LIMES AT CHILLING AND NON-CHILLING TEMPERATURES

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Introduction

- Finger limes, like other citrus fruits, cannot continue ripening after they have been harvested. However, the harvested fruit do senesce (age) and lose quality over time.
- Lowering the storage temperature is the main method for minimizing postharvest fruit quality losses, but finger limes are chilling sensitive and are therefore damaged when held at temperatures below 48-50F.

Today's Goal

- To demonstrate different postharvest changes in 'UF Sun Lime' finger limes under chilling and non-chilling conditions
- To share initial results on the use of fruit coatings on finger limes

POSTHARVEST CHANGES THAT OCCUR IN FINGER LIMES AT CHILLING AND NON-CHILLING TEMPERATURES

- 'UF SunLime' fruit were stored at 2 temperatures to induce chilling injury and senescence (aging) symptoms
 - Chilling temperature used: 39F with 95% relative humidity
 - Optimal storage temperature (chilling threshold): 50F with 95% relative humidity
- After 2 weeks at 39F, fruit were transferred to 50F w/95% relative humidity for 1 week, then 1 week at 68F w/95% relative humidity for shelf life evaluation
- After 3 weeks storage at 50F, fruit were held for 1 week at 68F w/95% relative humidity for shelf life evaluation

Postharvest changes in finger limes under chilling and non-chilling conditions

Defect level	Visual	Pitting level	Visual
1	No defects	1	No Pitting
2	0-25%	2	0-25%
3	25-50%	3	25-50%
4	51-75%	4	51-75%
5	75-100%	5	75-100%

- Evaluation times: Initial, 2 weeks, 3 weeks, and 4 weeks
- Types of evaluations:
 - Subjective evaluations were based on our rating systems and included pitting incidence and severity, decay incidence and severity, stomata discoloration, watersoaked peel, bleached peel, scabs, and shriveling at the blossom or stem ends
 - Objective evaluations included weight loss, fruit firmness by compression (opposite sides), and peel color (opposite sides)
 - On week 4 evaluation, internal color measurement (both sides) and fruit quality (sugar and acidity) were performed on all fruit

'UF Sun Lime' fruit stored at 39F (rep 1)

Day 0



Day 28



'UF Sun Lime' fruit stored at 39F (rep 2)

Day 0



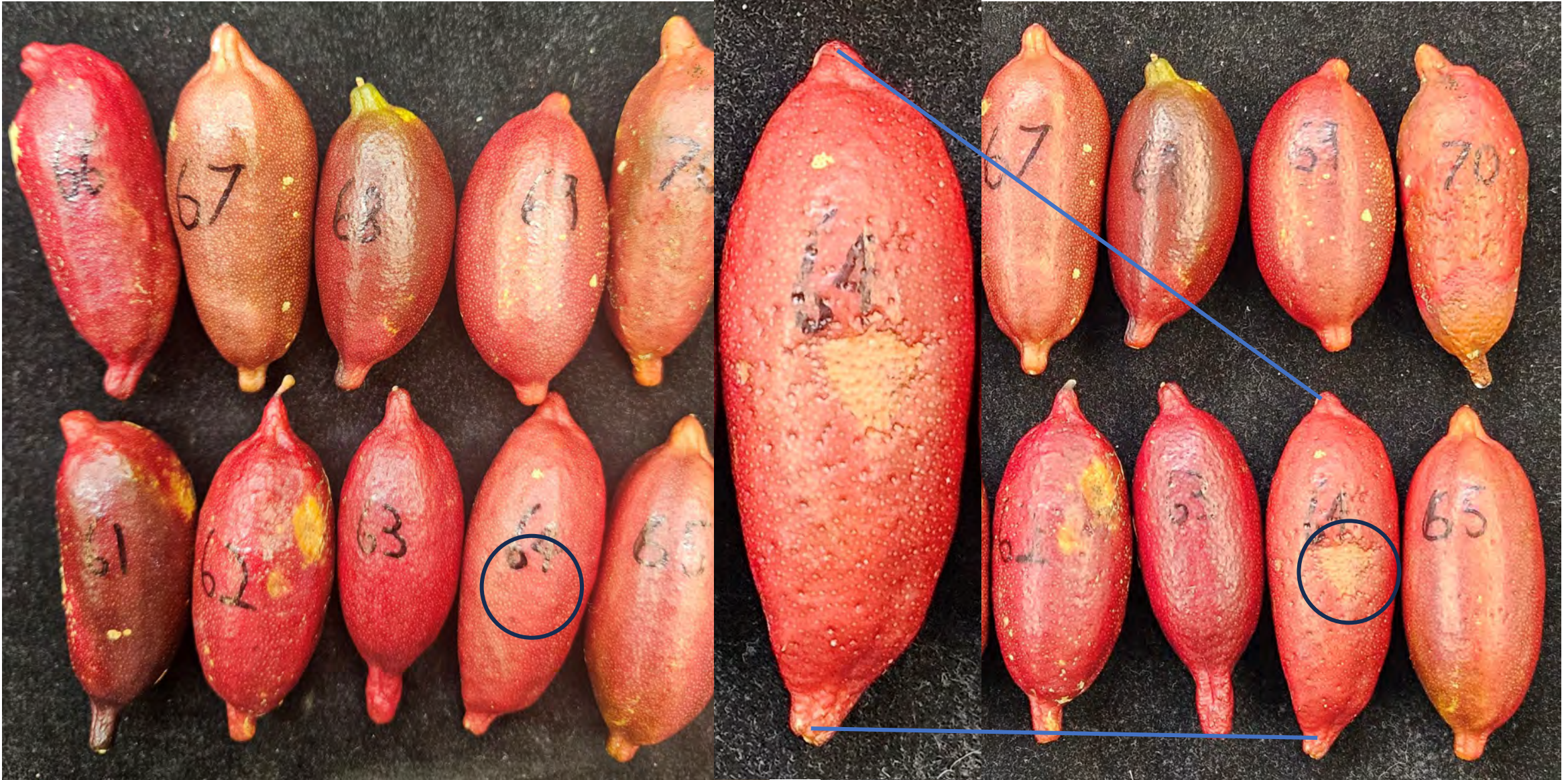
Day 28



'UF Sun Lime' fruit stored at 39F (rep 3)

Day 0

Day 28



'UF Sun Lime' fruit stored at 50F (rep 1)

Day 0



Day 28



'UF Sun Lime' fruit stored at 50F (rep 2)

Day 0



Day 28



'UF Sun Lime' fruit stored at 50F (rep 3)

Day 0



Day 28



'UF Sun Lime' fruit internal quality on week 4

Fruit stored at 39F



Fruit stored at 50F



Postharvest changes in finger limes under chilling and non-chilling conditions










Conclusions:

- Fruit stored at optimal temperature (50F) better retained their appearance and quality compared to fruit stored at chilling temperatures
- Fruit stored at chilling temperature developed peel pitting

Next steps:

- Inducing anthocyanins (red color) development postharvest
- Investigate in more detail the chilling threshold temperature
- Create rating scales with illustrations and definitions for chilling and senescence symptoms

Strawberry rating scale with illustrations and definitions

	<p>(5.0) 75 to 90% bright and glossy red color; calyx is stiff and green; no signs of bruising or shriveling on fruit; fruit appear to be very fresh (excellent quality)</p>
	<p>(4.5) 90 to 100% slightly less bright and glossy red color; calyx is green but slightly less stiff than at harvest; no signs of fruit shriveling (very good quality)</p>
	<p>(4.0) Full red color that is less bright and less glossy than at harvest; calyx is green but slightly less stiff than at harvest; minor signs of fruit shriveling may be noticeable (good quality)</p>
	<p>(3.5) Full red color that is less bright and less glossy than at harvest; calyx is less fresh and stiff than at harvest; signs of fruit dryness may be noticeable (good to acceptable quality)</p>
	<p>(3.0) Full red to dark red color with slight to moderate loss of brightness and glossiness; calyx may appear to be dry and wilted; isolated areas of dryness or shriveling on fruit; some fruit may also show some soft spots (acceptable quality)</p>
	<p>(2.5) Full red dark color with moderate loss of brightness and glossiness; calyx appears to be wilted and dry; fruit are moderately dry and shriveled; some fruit may also show soft spots (acceptable to poor quality)</p>
	<p>(2.0) Very dark red color that is dull and not shiny; calyx appears to be dry and slightly yellowish or brownish-green; fruit appear to be overripe and dry; fruit are soft (poor quality, non-salable under normal conditions)</p>
	<p>(1.5) Very dark and dull purplish-color; calyx is dry and wilted; fruit appear to be very soft, overripe and dry; some fruit may be leaky (poor to very poor quality; not salable)</p>
	<p>(1.0) Very dark brownish or purplish-red color that is very dull and has no shine; calyx may appear to be very dry and yellowish or brownish-green; fruit appear to be extremely overripe, dry or leaky (very poor quality)</p>

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Courtesy Dr. Cecilia Nunes, Univ. of South Florida

Finger lime chilling injury symptoms scoresheet

- (5.0)** Smooth, bright and glossy reddish peel, (or reddish peel with green or yellowish areas); firm with full pedicel and stylar end and no signs of pitting, watersoaked peel, bruising, color fading, or shriveling; fruit appear to be very fresh (light colored lenticels are normal in appearance). (Excellent quality)
- (4.5)** Smooth, but slightly less bright and glossy reddish peel; firm fruit with full pedicel and stylar end and no signs of pitting, watersoaked peel, bruising, color fading, or shriveling; fruit appear to be fresh (light colored lenticels are normal in appearance) (Very good quality)
- (4.0)** Smooth, less bright and glossy reddish peel; firm fruit with full pedicel and stylar end and no signs of pitting, watersoaked peel, bruising, color fading, or shriveling; lenticel depression may be noticeable on a small peel area (1 to 10%) (Good quality)
- (3.5)** Partly smooth, or leathery peel with partially dull ($\leq 10\%$ surface area) peel; firm fruit with a small area of mild pitting ($\leq 10\%$), or mild sheet pitting or watersoaking ($\leq 10\%$; rough looking area), or pronounced lenticels depression on a large peel area ($\leq 50\%$); minor signs of bruising, or faded (bleached) color may be noticeable on the peel; on some fruit, shriveling may appear on the pedicel or stylar end ($\leq 10\%$ of those regions) (Good to acceptable quality)
- (3.0)** Partly smooth, or leathery ($\leq 25\%$) with $\leq 50\%$ somewhat dull peel; slight softening of fruit with isolated areas of mild pitting ($\leq 25\%$) or bleached areas ($\leq 25\%$). Moderate bruising ($\leq 25\%$ of surface); minor ($\leq 25\%$) shriveling, watersoaking, or partial collapse of the pedicel and stylar end (10-25% of those regions) (Acceptable quality)
- (2.5)** Partly smooth, or leathery ($\leq 50\%$) peel with faded color; moderate softening of fruit with substantial areas of mild pitting ($\leq 50\%$), or small isolated areas of medium severity pitting (still $\leq 25\%$) or bleaching ($\leq 50\%$); fruit have soft spots or first sign of watersoaked peel ; severe bruising or moderate shriveling or collapse of the pedicel and stylar end (25-50% of those regions). (Minimally acceptable to poor quality)
- (2.0)** Leathery, rough, and dull peel ($\geq 50\%$); soft fruit with moderate to severe pitted or discolored peel ($\geq 50\%$), or a small area of watersoaked peel ($\leq 10\%$)*; severe shriveling or collapse of the pedicel and stylar end (50-75% of those regions) . (Poor quality, unsalable under normal conditions)
- (1.5)** Leathery, rough, and dull peel with pitting (100%), or discolored peel with no smooth areas (100%); Medium-sized areas of watersoaked peel ($\leq 25\%$)*; severely shriveled, collapsed pedicel and stylar end (75-95% of those regions) (Poor to very poor quality; unsalable to inedible)
- (1.0)** Leathery, rough, and dull peel with pitting (100%), or discolored peel with no smooth areas (100%); medium-sized areas of watersoaked peel ($>25\%$)*; collapsed pedicel and stylar end (100%) (poor to very poor quality; inedible).

Initial results on the use of fruit coatings on 'UF Sun Lime' finger limes

- Two types of coatings were tested and compared to non-coated fruit
 1. Coconut oil
 2. Commercial coating (Akorn Technologies)
- Water was used as the control treatment
- Fruit were manually coated using a brush and air dried before storage
- The 2 temperature schedules mentioned earlier were used (39F and 50F)

'UF Sun Lime' fruit on day 0

Water coating



Coconut oil coating



'UF Sun Lime' coconut oil coated fruit stored at 39F (rep 3)

Day 1

Day 28



'UF Sun Lime' coconut oil coated fruit stored at 50F

Day 1



Day 28



Initial results on the use of fruit coatings on finger limes

Coatings effects at both temperatures

- After 2 weeks storage at 39F, fruit coated with coconut oil lost significantly less weight compared to water coated fruit
- Coconut oil coated fruit was firmer compared to water coated fruit after 3 and 4 weeks storage at 50F
- For fruit at 39F, on days 14, 21, and 28, more severe incidences (level 5) of fruit pitting were counted in non-coated fruit compared to coated fruit

Initial conclusion on the use of fruit coatings on finger limes

Coconut oil coating could extend finger lime storage and shelf life durations

Next steps:

- Other coatings
- Chilling injury conditioning
- Effects of humidity



Thank you!

Any questions?



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Also, Manjul Dutt and Jonathan Crane for supplying the finger lime fruit used in our research.

'UF Sun Lime' coconut oil coated fruit stored at 39F (rep 1)

Day 1



Day 28



'UF Sun Lime' coconut oil coated fruit stored at 39F (rep 2)

Day 1



Day 28



'UF Sun Lime' coconut oil coated fruit stored at 50F (rep 1)

Day 1



Day 28



'UF Sun Lime' coconut oil coated fruit stored at 50F (rep 2)

Day 1



Day 28



'UF Sun Lime' coconut oil coated fruit stored at 50F (rep 3)

Day 1



Day 28



Coconut oil coated 'UF Sun Lime' fruit internal quality on week 4

Fruit stored at 39F



Fruit stored at 50F





'UF Sun Lime' fruit internal quality

Fruit stored at 39F



Fruit stored at 39F

Day 1



Day 28







