

DEVELOPMENT OF NEW FINGERLIME CULTIVARS AT THE UNIVERSITY OF FLORIDA

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WHAT IS A FINGER LIME?

- Citrus relative.
- Thorny understory shrub or small tree.
- The juice vesicles are globular and likened to “caviar”.



<http://www.freshplaza.com/article/150064/AU-Finger-limes-set-to-boom>
<http://www.thegreenhead.com/2012/03/finger-lime-tree.php>

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PLANT
BREEDING

THE FINGER LIME AS A SPECIALTY CROP

- Tolerance to HLB.
- Similar cultural conditions to commercial citrus.
- Increasing demand in domestic and international markets.



Primary use of the finger lime – as a garnish in raw and cooked preparations

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food

Australian finger lime is the hottest new item in international cuisine

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A specialty ... a chef prepares an Australian Finger Lime also know as "tree caviar". Picture: AFP

AFP News from Australia Network

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THE BLOG

Meet the Finger Lime, That Strange Fruit That Looks Like Caviar

Life+Eat Living



Finger limes, or caviar limes, as they are often called, have appeared on the menus of innovative chefs and mixologists slowly but surely over the past few years. The finger lime plant, native to Australia and only recently commercially available in the U.S., produces small oval fruits about the size of a finger.

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MARKET WATCH

Finger lime: the caviar of citrus

The Australian native, now grown in California in small quantities, is beginning to show up in local markets and restaurants.

December 23, 2009 | By David Karp

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This year, for the first time, you don't have to be a scientist or an Australian to taste citrus caviar from legendary finger limes, as the initial, very small harvest from commercial plantings in California has started to show up at local markets and restaurants.

The finger lime is very different from other citrus, somewhat resembling a gherkin, elongated in shape, and up to 3 inches in length. Its skin is thin and can range from purplish or greenish black, the most typical color, to light green or rusty red. When the fruit is cut in half, the juice vesicles, which are under pressure, ooze out as if erupting from a mini volcano. Unlike the tender, tear-drop-shaped juice sacs in standard citrus, the translucent, greenish-white or pinkish vesicles in finger limes are round and firm, and pop on the tongue like caviar, releasing a flavor that combines lemon and lime with green and herbaceous notes. The rind oil is also quite aromatic, and contains isomenthone, which is common in mint but rare in citrus.

What do you do with these digit-shaped prodigies? Like other acid citrus, they're really too tart to eat fresh, but even so, the first time you encounter one, try cutting it in half and sucking out the caviar, squeezing it out of the rind like toothpaste from the tube, just to experience the fruit to the fullest. Next

FROM THE ARCHIVES

- Market Watch: Boom times for limes | December 2, 2014
- Market Watch: Australian finger limes make a splash in... | November 25, 2010
- Market Watch: Whaa citrus is past its prime | March 18, 2010

CURRENT STATUS IN FLORIDA

- Three older selections available from the Florida Citrus Budwood Program:
 - DPI-50-36 (pale pink pulp).
 - DPI-205-1 (white pulp).
 - Commercial variety popular in CA and HI: CRC 3672 (VI 697).
- Two new UF released varieties – UF SUNLIME and UF REDLIME.
- Very limited acreage: There are between 7 and 10 acres of finger limes being cultivated statewide.
- The most significant challenge for cultivation has been the harvest, due to the thorniness of the bushes/trees.

CULTIVAR DETAILS - DPI

Variety Clone	Entry Date	DPI Notes
Finger Lime DPI-205-1	6/27/1977	Received from Dr. Prevatt, Florida Southern College in 1977, originally from Australia. Very thorny branches. Small leaves with scalloped edges. Very long and slender fruit. Pear-shaped pulp vesicles, numerous seeds.
Red Finger Lime DPI-50-36	11/4/2003	Sanguinea red finger lime, received seed 11/4/2003, from the National Clonal Germplasm Repository, Accession PI539734, CRC 1484. <i>Microcitrus australasica</i> , var. <i>sanguinea</i> .
Australian Finger Lime 697 CGIP-233	6/21/2017	Introduced from California. Commercial cultivar grown in CA and HI.
Finger Lime Giant DPI-205-4	3/27/2006	This larger fruited selection resulted from a shoot-tip graft of the normal finger lime. Fruit of the giant finger lime is much larger with larger juice vesicles that are more tear shaped than the regular Finger Lime.
Sydney Hyb US	4/25/1983	Originally obtained from Drs. Hutchison and Barrett, USDA, Orlando 4/25/1983 for planting in the arboretum. Seedling line from this introduction. <i>Microcitrus</i> hybrid. Origin: Australia, hybrid of round lime and finger lime.

FINGER LIMES FROM A GLOBAL CONTEXT

- Australia has the most acreage under finger lime cultivation.
- Small acreages in Asia, Europe and Africa.
- In the US, majority of the finger limes are produced in California and Hawaii.
- In Florida, finger lime acreage is expanding as growers become aware.



THE UNIVERSITY OF FLORIDA'S FOCUS ON DEVELOPING IMPROVED FINGER LIMES

Utilize existing germplasm to develop varieties that can thrive under Florida's unique environments.

- **HLB tolerance.**
- Improved fruit quality while maintaining the “caviar” trait.
- Enhanced anthocyanin content even under consistent warm conditions.
- Good yield.

Variety development is a continual process, one that builds successively on the work already undertaken – F. Gmitter



UF CULTIVAR RELEASES



UF SunLime



UF RedLime

Attractive external appearance that enhances fresh market potential

UF SUNLIME



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PLANT
BREEDING

UF SUNLIME

- Fruit weight: Ranges from 26.14 grams to 34.66 grams.
- Average fruit length: 2.8 to 3 inches.
- Average number of seeds: Ranges from 0-6.



UNIQUE CHARACTERISTICS OF UF SUNLIME

- Makes a medium sized scraggly bush. Trees at 7 years of age were 8 feet tall in Lake Alfred, FL.
- The anthocyanin content in the pulp is not cold dependent.
- Precocious. Budded trees produce fruit in the first year after planting.
- Trees flower sporadically throughout the year. Main bloom is in Feb-March.



UNIQUE CHARACTERISTICS OF UF SUNLIME

- Yield data is limited; however, a 6-year-old mature tree can produce approximately 150 fruits.
- No graft incompatibility observed, however rootstocks without trifoliolate orange genetics is recommended.



UF SUNLIME



IMMATURE FRUIT



MATURE FRUIT

LIMITATIONS

- Susceptible to citrus scab.
- Fruit size is not uniform in heavily cropped plants. May require manual thinning.
- HLB tolerant. 6-year-old trees had average Ct values of 30 ± 0.6 .
- Fruits do not hang on the tree following maturity.

UF REDLIME

- Average fruit weight: 18.72 to 24.10 grams.
- Average fruit length: 2.91 to 3.92 inches.
- Average number of seeds: 16 to 23.



UF REDLIME



IMMATURE FRUIT



MATURE FRUIT



MATURE FRUIT IN TREE

UNIQUE CHARACTERISTICS OF UF REDLIME

- Makes an upright scraggly bush with an open canopy. Plants at 6 years of age were around 6 feet tall (Lake Alfred).
- Young flush is always red in color.
- Precocious. Budded trees produce some fruit in the first year after planting.
- Preliminary data indicates trees to be resistant to HLB. No bacterium has been detected from these trees.



UNIQUE CHARACTERISTICS OF UF REDLIME

- Trees flower sporadically throughout the year. Main bloom is in Feb-March.
- Yield data is limited; however, a 6-year-old mature tree can produce 80-90 fruits.
- No graft incompatibility observed, however rootstocks without trifoliolate orange genetics is recommended.



LIMITATIONS

- Fruit size is not uniform in heavily cropped plants. May require manual thinning.
- Fruits are prone to thorn damage.

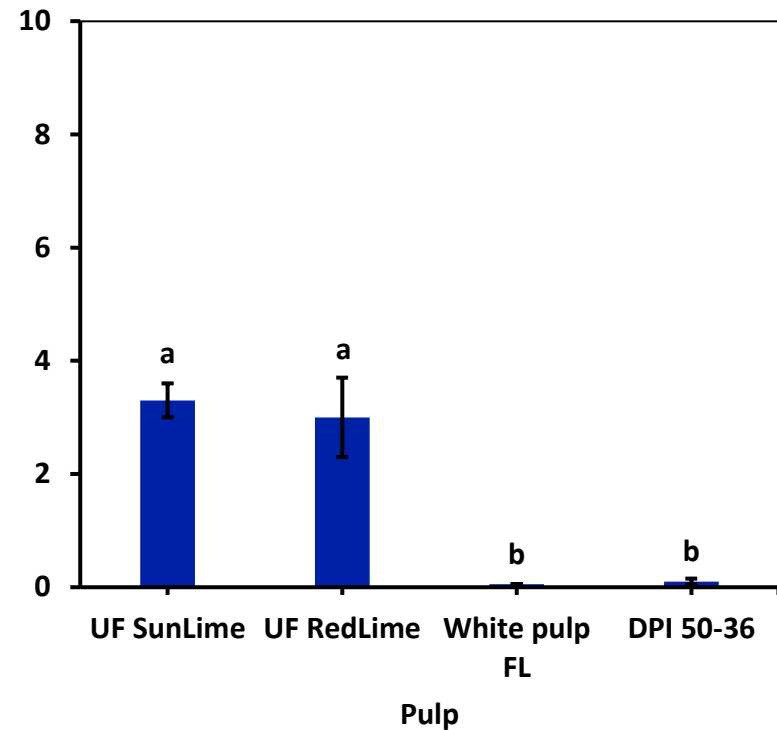
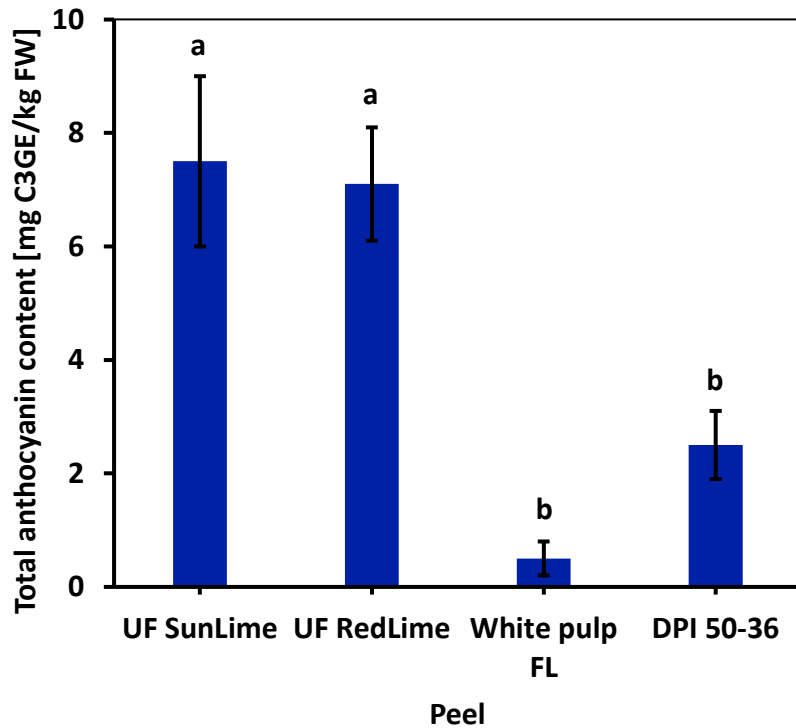


TOTAL SOLUBLE SOLIDS, TITRABLE ACIDITY AND ACID CONTENT

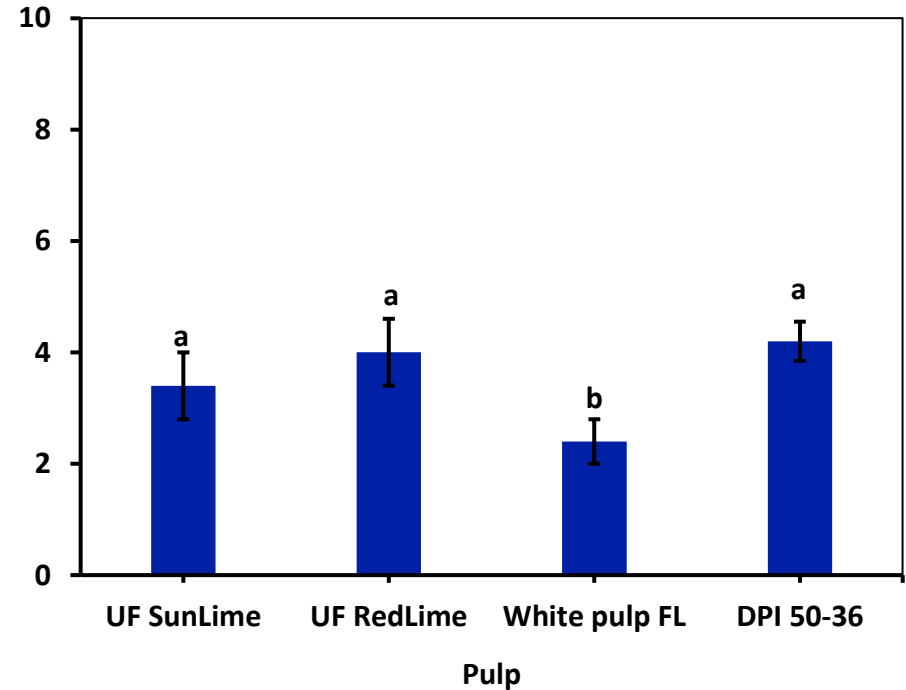
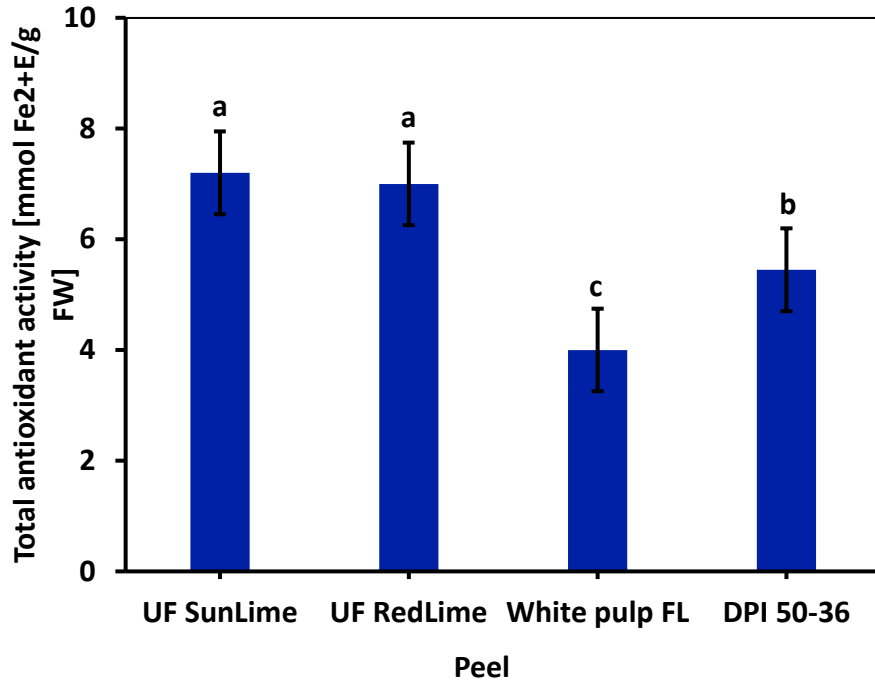
Cultivar	TSS (Brix)	TA	TSS/TA ratio	Citric acid (mg/L)	Malic acid (mg/L)
UF SUNLIME	10.1± 0.2	3.5± 0.2	2.8±0.1	14.6±1.9	10±3.8
UF REDLIME	13.8± 1.1	2.8± 0.3	4.9±0.5	36.2±3.6	5±1.1
DPI 50-36	13.7± 0.6	3.6± 0.2	3.8±0.2	38.8±3.3	15±3.2



ANTHOCYANIN CONTENT IN PEEL (A) AND PULP (B) (MEAN \pm STANDARD DEVIATION).



TOTAL ANTIOXIDANT ACTIVITY (PEEL(A) AND PULP (B))



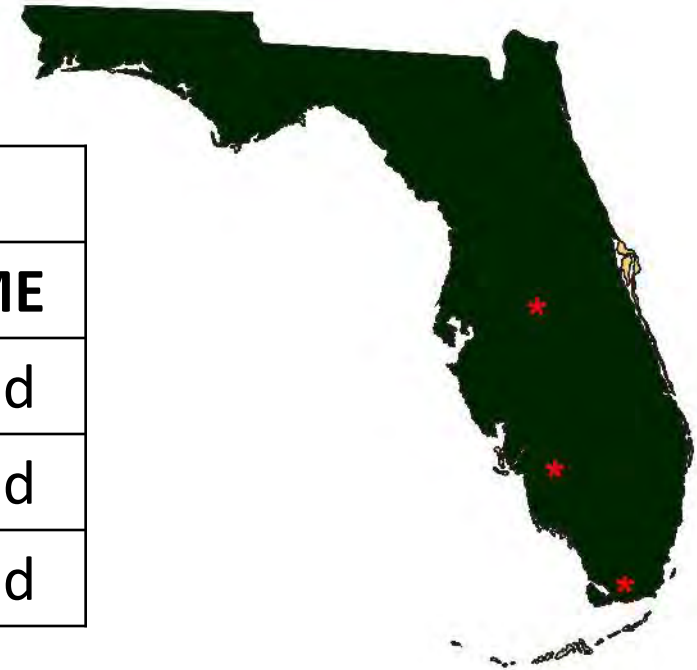
PLANT PROPAGATION

- Both UF SUNLIME and UF REDLIME can be easily propagated on any standard citrus rootstock.
- Tree vigor is highest in lemon derived rootstocks (Rough Lemon, Volkamer).
- *In vitro* propagation has been standardized for rapid multiplication of both cultivars.



HLB STATUS (MARCH 2022)

Location	Average Ct values	
	UF SUNLIME	UF REDLIME
Lake Alfred	31.42 ± 2.6	Undetected
Immokalee	33.41 ± 1.1	Undetected
Homestead	32.61 ± 2.4	Undetected



COLD TOLERANCE IN THE UF FINGER LIMES?

- Finger lime originates from the rainforests of the border ranges of SE Queensland and Northern NSW.
- This region has a sub-tropical climate and freezing events are rare.
- It is unknown if the occasional frost damage can cause twig dieback, which can result in young trees being killed.



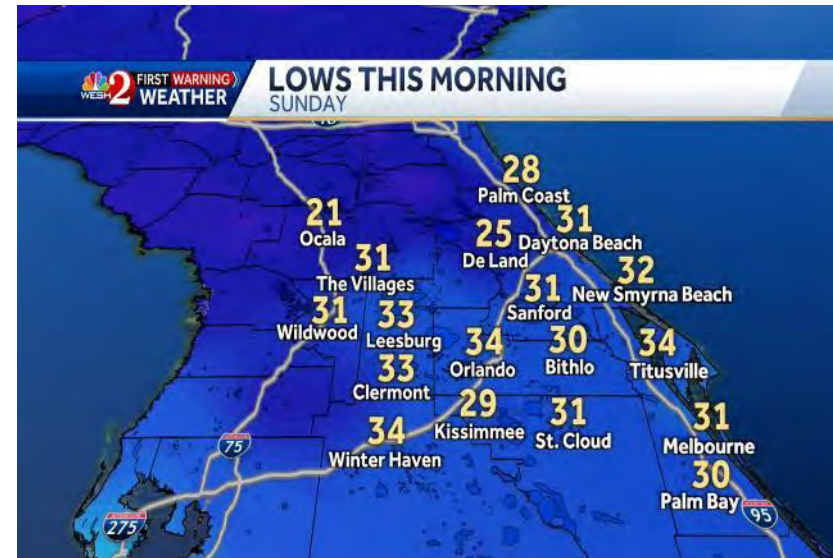
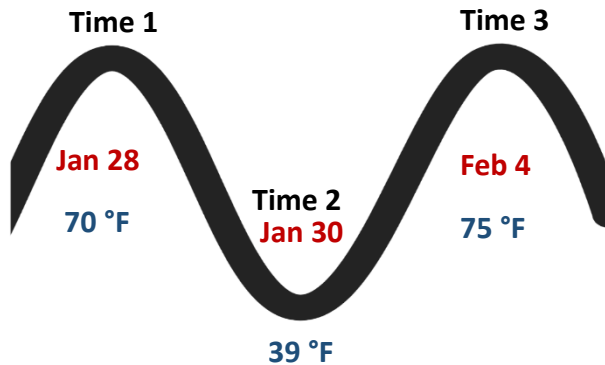
FIELD PERFORMANCE

The performance of the UF RedLime and UF SunLime trees was studied before and after a rare 2022 hard freeze.

Time 1 : Day 0 at 70 °F (21 °C),

Time 2 : Day 2 at 39 °F (3.5 °C) and

Time 3 : Day 6 at 75 °F (24 °C)



wind chills ranged from 21 to 32 degrees F (-6 °C to 0 °C)

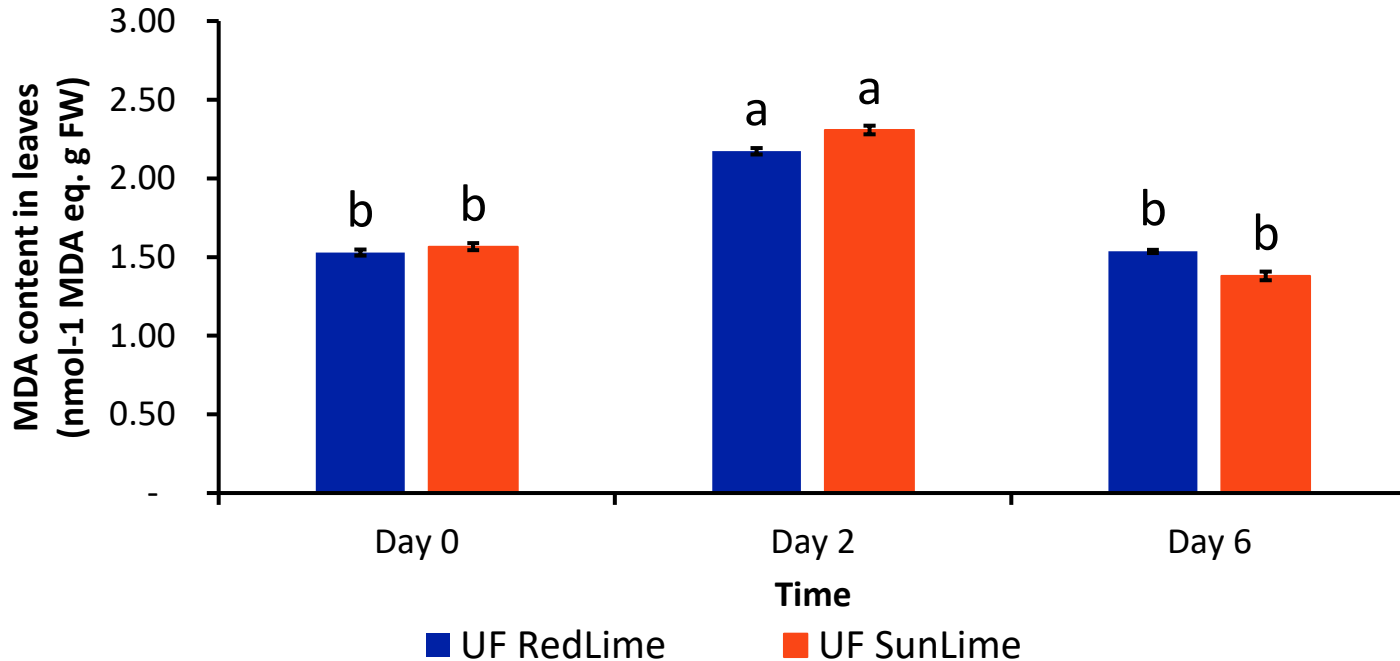
LIPID PEROXIDATION

 Time 1
70° F

 Time 2
39° F

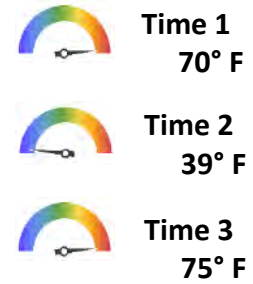
 Time 3
75° F

- There was an increase in malondialdehyde (MDA) during the low temperature weather.
- A decreased MDA content was recorded after the cold wave.

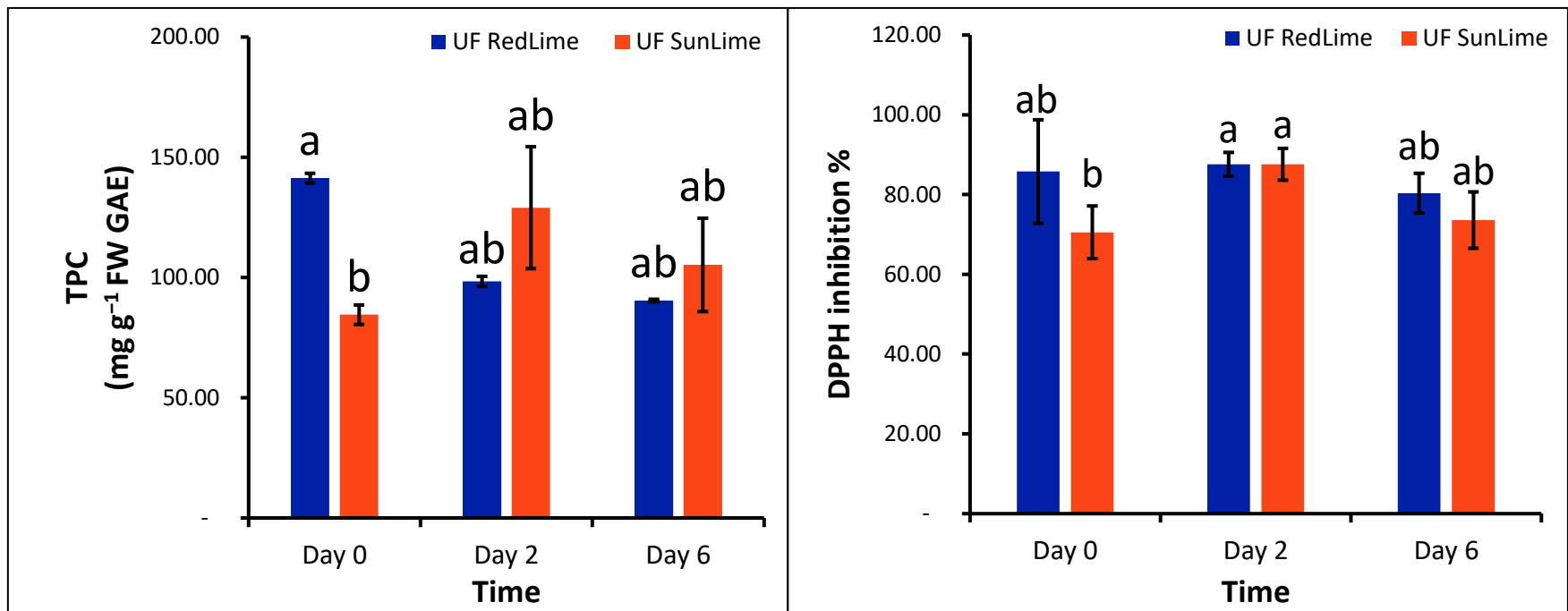


Following the hard freeze, Finger lime cultivars had increased MDA content. This is due to the production of free oxygen radicals that could break the membrane structure of cells and induce membranous lipid peroxidation. A recovery took place within a week of warmer weather.

TOTAL PHENOLIC COMPOUNDS, DPPH ANALYSES



Slight difference was recorded in TPC and DPPH inhibition % in Finger Lime cultivars in the field study.



Field study



CONCLUSIONS

- Both UF SUNLIME and UF REDLIME have done well under Central and South Florida conditions.
- Trees are fast growing in South Florida
 - REDLIME trees can grow to be 8 feet in height after 2 years in the field.
 - SUNLIME trees remain relatively dwarfed even in South Florida.
- Trees have performed well following occasional freezes in Central Florida.
- No data for North Florida and at this time is not recommended for outdoor cultivation in areas where temperatures $< 32^{\circ}\text{F}$ (0°C) for extended periods of time.

Finger lime trees from the UF releases can be ordered in Florida from:

- Phillip Rucks Citrus Nursery (<https://ruckscitrusnursery.com/>)
- Southern Citrus Nursery
- Brite Leaf Nursery (<https://www.briteleaf.com/>)



ACKNOWLEDGEMENTS



Florida Department of Agriculture and Consumer Services

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PLANT
BREEDING

THANK YOU

