

# Cold Hardy Citrus Production and Challenges

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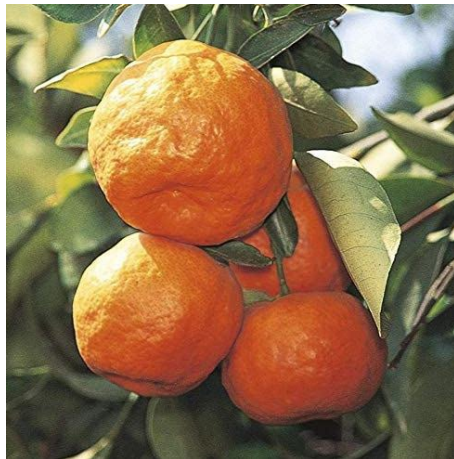


# Today's talk.....

- History
- Satsuma introduction
- Current status
- Challenges
- Recommendation and suggestions
- Research

# What is cold hardy citrus?????

- Increased frost and freeze tolerance
- Can tolerate below freezing up to 15F
- Edible - Satsuma mandarin, kumquat, Changsha mandarin etc.
- Inedible – Trifoliate orange, Ichang papeda, Citrange etc.



# Cold Hardy Citrus: History & Resurgence in US

- **1565** – sweet orange, lemon, lime and pummelo came to St. Augustine FL from Spain
- **1700s** – Jesuits introduced Satsuma in Louisiana
- **1800s** – Satsuma (Owari) was introduced from Satsuma Japan and established throughout the lower Gulf Coast States
- **1894 & 1899** – Severe freeze events eliminated citrus
- **1920s** – Satsuma acreage rebounded and Jackson county with 23,000 acres of satsuma (Sugar Sweet) was billed as “Satsuma Capital”
- **Until 1990s** – Again Satsuma industry was eliminated due to the combined effect of freezes, hurricanes, and lack of labor due to World War-II



# Cold Hardy Citrus: Current Status

- **Resurgence**
  - Mild winters during last three decades
  - Development of microsprinklers in early 1990
- **Acreage**
  - 2,500 acres (more than 16 counties)
- **Cultivars**
  - Satsuma (Owari, Brown Select, Xie Shan, Silverhill)



# Satsuma mandarin

- **Origin**

- Originated from China – reported in Japan 700 years ago
- Largest satsuma industry is located in Japan
- First recorded introduction in the United States was in Florida by George R. Hall in 1876
- The name "satsuma" is credited to the wife of a United States minister to Japan, General Van Valkenberg
- During the period 1908-1911, approximately a million 'Owari' satsuma trees were imported from Japan



# Satsuma mandarin

- **Fruit**

- Medium to small,
- Shaped as flattened sphere,
- Seedless
- Sweet in taste
- Easy to peel with 10-12 segments
- Flesh is a brilliant reddish orange, tender and melting
- Taste and color develop excellent in regions with cool winters and hot summers
- Looseness of the rind requires that fruit be clipped at harvest to avoid plugging or tearing





# Satsuma mandarin

- **Bearing season**
  - Harvesting starts from Nov-Dec,
  - Fruit hold poorly on the tree after maturity,
- **Cold tolerance**
  - Highly cold tolerant (survived minimum temperatures of 14°F to 18°F)
- **Production area**
  - Narrow strip extending along the Gulf of Mexico across North Florida, Alabama, Mississippi, and Louisiana into eastern Texas and Joaquin Valley basin of California





# Satsuma mandarin

- **Cultivars**

- Owari
- Silverhill
- Xie Shan
- Brown select
- Early St. Ann'

- **Products**



# Challenges to Cold Hardy Citrus Industry

- **Freeze and frost**
- Lack of research-based recommendations
- Saturation and short harvest window
- Pest and diseases
- Lack of trained citrus ag-agents





# Christmas & Late Freeze Events





# Christmas & Late Freeze Events



Before Freeze (December 15<sup>th</sup>, 2022)



After Freeze (January 7<sup>th</sup>, 2023)



Recovering from freeze (April 11<sup>th</sup>, 2023)



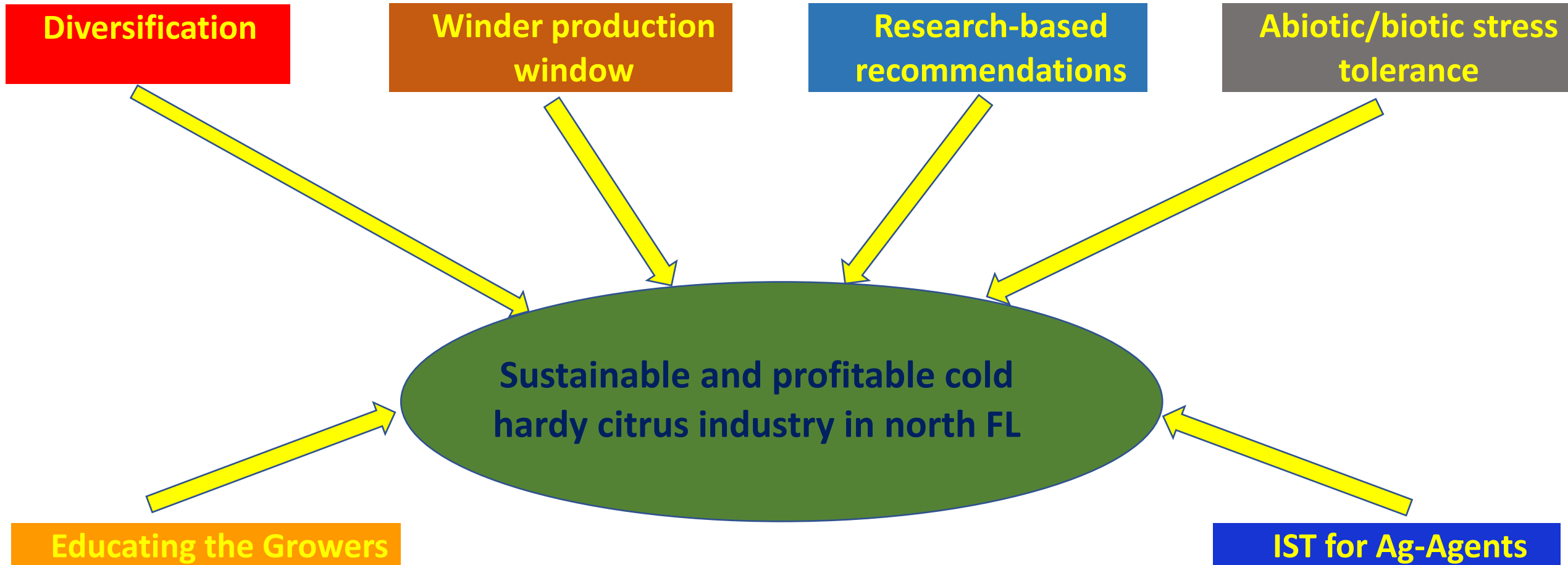
# Christmas & Late Freeze Events



Late freeze event on March 22<sup>nd</sup>, 2023



# What we need to need to do????



# Diversification

- Florida Foundation Seed Producers Inc.,
- 30 scion cultivars and 20 rootstocks

Gator bites Dec-Jan	N11-7 Oct-Feb	Lisbon lemon seedless (Aug-Dec)	18-A-4-35 Oct-Nov	RBB7-34 Dec-Jan
RES-19-56 Oct-Nov	1859 Nov-Jan	Limon hybrid Sep-Dec	KE-3-15 Sep-Oct	C-7-12-9 Mid Sep-Oct
1924 Nov-Feb	C2-5-3 Mid Sep-Oct	950 Nov-Jan	Greenie Oct-Nov	Sugar belle Mid Nov-Late Dec

# Research-based Recommendations: Nutrients, Irrigation, Plant Care

- **Nutrient Management**

- Efficacy of different N and P sources
- Application rate
- Application time
- Slow-release vs conventional fertilizer
- Biostimulants





# Research-based Recommendations: Nutrients, Irrigation, Plant Care

- **Water Management**

- Effective and efficient irrigation for getting optimum yield





# Standardization of Freeze Protection Techniques





# Improving Cold Tolerance through Exogenous Application of Growth Hormones/Regulators

- Silicon
- K
- ABA
- Methyl Jasmonate
- Brassinosteroids





# New Production Systems

- High density plantation
- Good strategy to increase per acre yield
- Currently we have 116-145 tree/acre





# Educating the Growers and Ag-Agents





# Cold Hardy Citrus Website

## COLD HARDY CITRUS

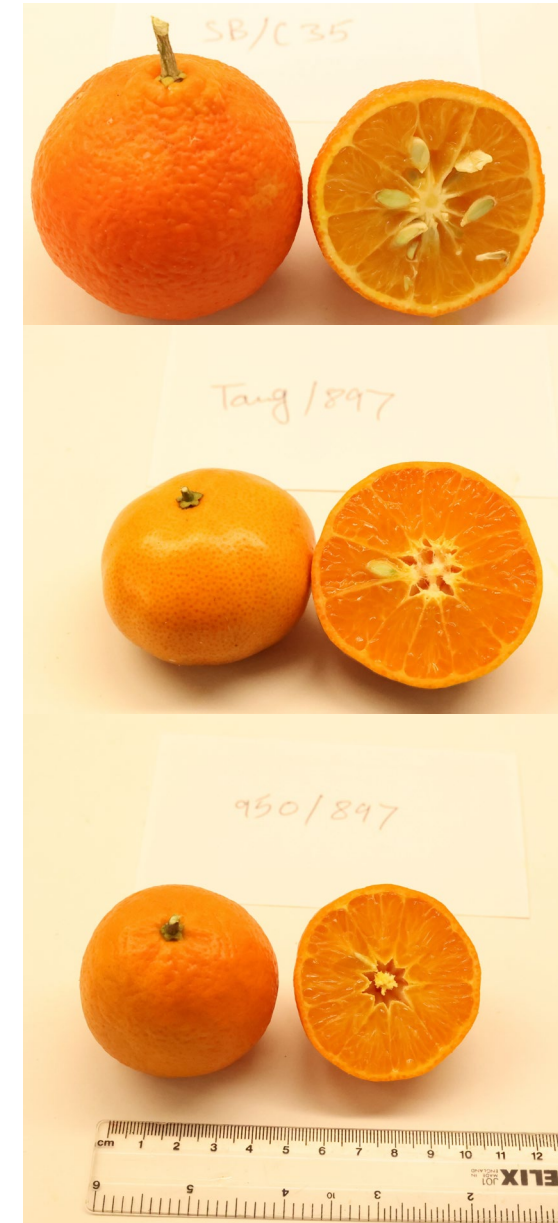


# COLD HARDY CITRUS



# Recommendations for Sustainable Cold Hardy Citrus Production

- **Rootstock**
  - Swingle, Rubidoux, US942, Rich-16-6, Flying dragon, UFR897
- **Scion**
  - Satsuma – Brown select, Xie Shan, Owari
  - Mandarin – Bingo, UF-950, UFGlo, Sugar belle, Tango
- **Planting time**
  - April-May
- **Fertilizer**
  - 170-30-170 lb N-P-K with micros per acre
  - Split application with first application in mid-Mar or early April
  - No fertilizer after August



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- My lab
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- UF/IFAS citrus breeding program
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- Citrus Growers





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