



# Growing Citrus in Difficult Times

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# Growing Citrus in Difficult Times

- Follow the fundamentals
- Types of citrus
- Citrus pests
- Exotic and invasive citrus pests
- Management strategies

**Any mention of trade and/or company names is not an endorsement**



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# Site Selection

- Well Drained
- Light shade to full sun
- Space at least 15 feet between trees
- Avoid planting next to buildings or near septic tanks and drain fields due to root invasion



# Planting

- Vigorously growing container plants
- Remove some soil from root mass to expose outer feeder roots
- Set at the same level as nursery and build water basin that will hold 5 gallons of water during establishment



# Watering

- During establishment, run a hose slowly in the basin twice a week for 10-15 min. or until full
- After establishment only run the hose when afternoon wilt is observed
- As the tree gets older, irrigation will only be required in times of excessive drought \*



# Nutrition

- During the first year, apply a complete fertilizer once every 6-8 weeks Feb.-Oct.
- Apply fertilizer evenly around the tree a distance in feet outside the dripline equal to the age of the tree
- Year 2 apply .3 lbs N in 5-6 apps.
- Yrs. 3&4 apply .8 lbs N in 3-4 apps.
- Yrs. 5+ apply 1.2 lbs. N in 3 apps.



# Macronutrient Deficiencies

- Nitrogen
- Potassium
- Magnesium





# Nitrogen



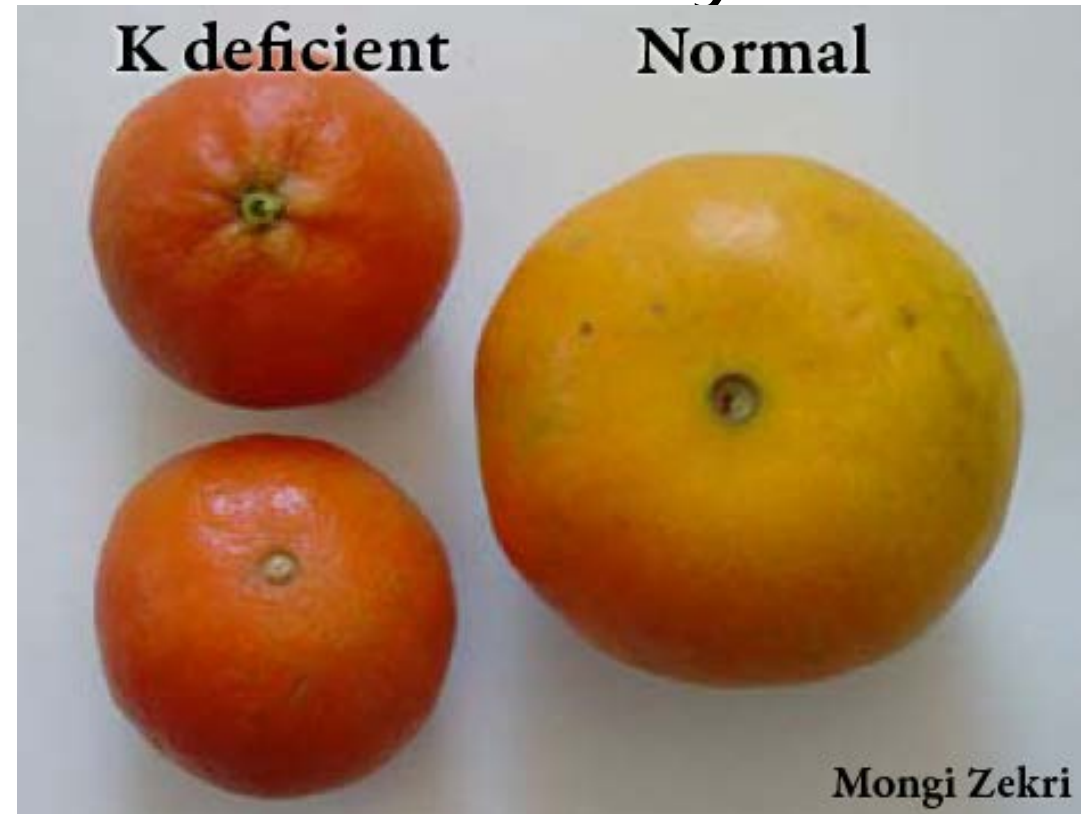
- Nitrogen deficiency-overall yellowing; sometimes main veins deeper yellow





# Potassium

- Pale yellow to bronze blotches that eventually coalesce
- Small smooth skinned fruit





# Magnesium

- Magnesium deficiency-green inverted V shape at the base of the leaf





# Micronutrient Deficiencies

- Iron
- Zinc
- Manganese



# Iron

- Iron deficiency-very fine green veins on yellow background

**Check pH**



Mongi Zekri



# Zinc

- Zinc deficiency-band along midrib green, cream colored between not defined veins

Mongi Zekri





# Manganese

- Manganese deficiency-band along midrib green, areas bet. Defined veins lt. green

**Check pH**





# Pruning

- Remove suckers/sprouts below bud union
- Prune following disease or freeze damage
- Remove vigorous vertical branches called water sprouts
- Prune to prevent crowding from buildings or other plants





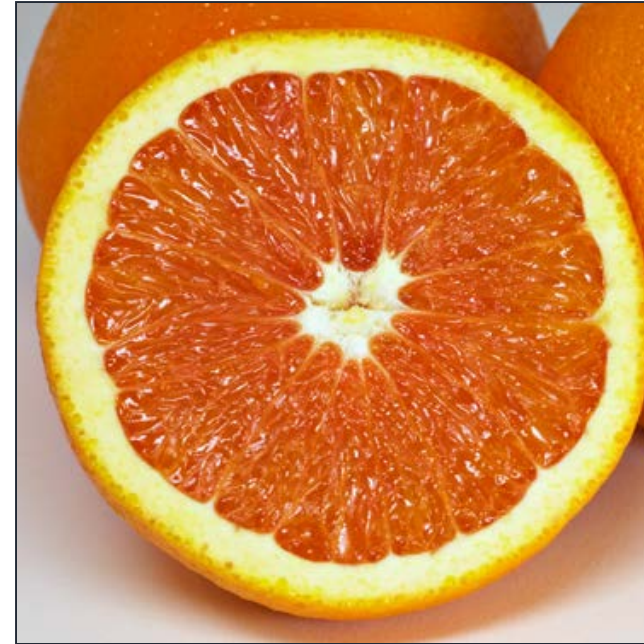
# Growing Citrus in Difficult Times

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# What is citrus?

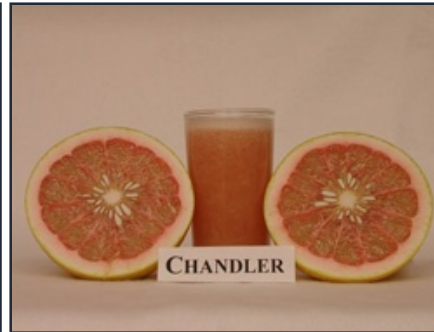
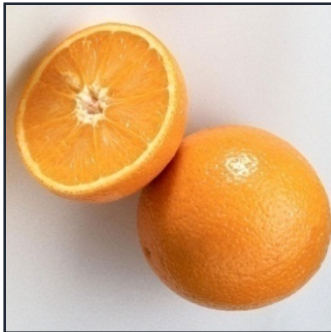
- Citrus and its relatives are members of the family Rutaceae
- Several features are characteristic of this group
  - Plants contain oil glands
  - Fruit are hesperidium (unique to this group)
    - Modified berries with tough, leathery peels with oil glands





# Citrus

- About 16 ~ 20 species recognized horticulturally – may truly be only 8 species – the problem is natural hybridization
- Four types are recognized
- Round oranges, mandarins, pummelos and grapefruit, and acid fruit (citron, lemon and lime)





# Pummelos and Grapefruit

## ■ Pummelo

- Very large fruit
- Thick rind
- Flesh is somewhat acid
- Highly fragrant
- Very common in Asian cultures



## ■ Grapefruit

- Originated in the West Indies

## ■ Both are large trees

## ■ White and pink fleshed varieties of both

## ■ Seeded and seedless varieties of both



# Grapefruit Varieties

## ▪ White

- Duncan – oldest (1830s) and still the best, very seedy, matures Dec – May



- Marsh – old (1860s), nearly seedless, matures Nov – May, parent to many red grapefruit



## ▪ Red / Pink

- Foster – first pink, very seedy, matures Nov – March
- Thompson – sport of Marsh in 1920s, first seedless pink
- Ruby (Ruby Red) – a sport of Thompson in 1930s, most common variety, matures Nov ~ May
- Flame and Rio Red – very dark color, seedless, peel has pink blush, matures Nov – May





# Grapefruit General Information

- The name grapefruit refers to the fruits tendency to be borne in small clusters like grapes
- The red color in some grapefruit is due to lycopene
- Grapefruit can be stored on the tree for long periods, but if they are seeded variety the seeds may sprout inside the fruit
- Over-fertilization or severe pruning tends to lead to “sheep’ s nosing”





# Mandarins (and hybrids)

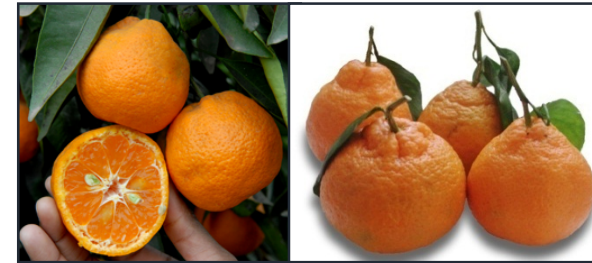
- *C. reticulata*
  - Generally smaller trees than other citrus
  - Highly pigmented flesh
  - Thin, loose peel, sometimes with easily separated segments
  - Very sweet and aromatic
  - Tend to have short harvest seasons
  - Many produce very heavy crops → alternate bearing
  - Much more cold hardy than oranges or grapefruit
  - Harvest carefully to prevent “plugging”
- Many of the varieties adapted to Florida are self-incompatible and require a pollinizer to set a good crop, but this leads to seediness





# Mandarins Varieties

- Dancy – a seedling in 1867 in Colonel Dancy's grove in Orange Mills, excellent dooryard tree, no pollinizer needed, matures Dec-Jan
  - The original Tangerine
- Satsuma – several named varieties (e.g. Owari), requires cool fall and winter temps, excellent for north Florida, matures Sept-Nov
- Ponkan – excellent dooryard tree, very loose skin, matures Dec-Jan







# Mandarins Hybrids

- Tangelos – hybrids of mandarins and grapefruit/pummelo

- Minneola (Honeybell) – Duncan × Dancy, fruit has a “neck,” hard to peel, very juicy, seedless fruit if planted alone but yields will be low, matures Dec-Feb



- Orlando – Dancy × Duncan, similar to an orange in appearance, seedless if planted alone, matures Nov-Jan



- Tangors – hybrids of mandarins and oranges

- Murcott (Honey Tangerine) – very sweet, difficult to peel, must be thinned, Jan ~ March



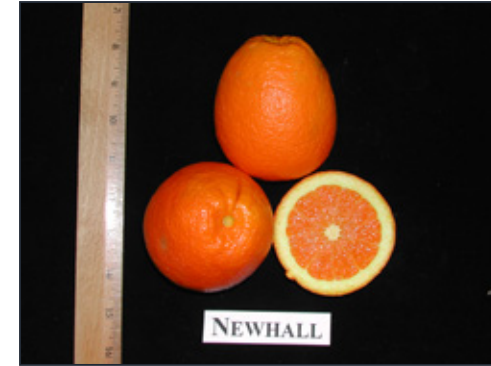
somewhat cold sensitive, peel is pebbly, thick and easy to remove, a good pollenizer variety





# Sweet Orange

- Originated in S. China / Vietnam
- Florida climate produces oranges with the highest internal quality in the world
- Florida climate produces poor external quality
- California oranges tend to have thicker peels, pebbly texture and very high external quality
- Peel color does not indicate maturity
  - Peel color change is a result of chlorophyll breakdown due to cool temperatures exposing the underlying pigments – same process that creates fall color in leaves





# Sweet Orange (fresh)

## ▪ Navel

- Most common variety is ‘Washington’
- A fruit within a fruit
- Sweet, distinctive flavor, easy to peel
- Used only for fresh fruit
- Very unstable and tend to mutate frequently
- Sensitive to environmental stresses, require careful management
- Matures Oct-Jan

## ▪ Cara (Red Navel)

- A mutant of ‘Washington’ navel with red flesh (due to lycopene)
- Found at Hacienda Cara , Venezuela
- Flesh color develops in warm weather
- Matures Oct-Jan

## ▪ Blood Oranges

- Many different varieties
- Red pigmented flesh due to anthocyanins
- Pigment requires cool temperatures to develop
- Color is poor, except north Florida





# Sweet Orange (processing)

## ■ Hamlin

- Seedling found in 1879 near Deland
- Most commonly grown early-season orange in Florida
- Primarily grown for juice, tends to produce small fruit
- Has good flavor, but poor juice color, needs to be blended
- Matures Oct-Jan



## ■ Valencia

- Old variety probably from Spain, introduced to US in 1870
- Most widely grown orange in the world
- Primarily grown for juice in FL, but is an excellent fresh fruit as well
- Late-season maturity can leave it susceptible to freezes, fruit may re-green in spring
- Matures March-June (old and new crops on the tree)





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- **Citrus pests**
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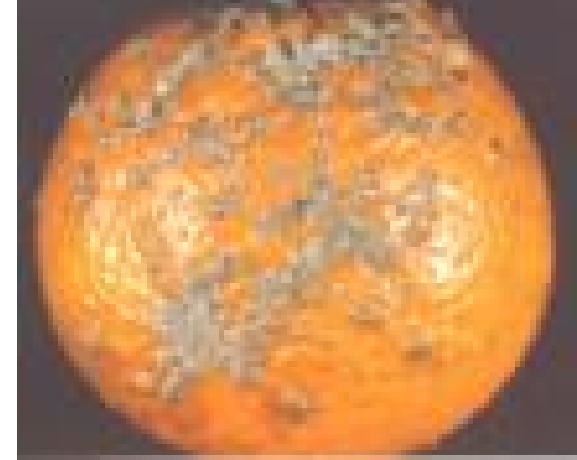


# Common Citrus Diseases

- Citrus Scab
- Greasy Spot
- Melanose
- Alternaria
- Foot Rot
- Postbloom Fruit Drop



## Citrus Scab



- Scabs or warts on leaves
- Conical growth/depression on leaves
- Pale to dark corky, scab like growth
- Lemmon, Temple, Minneola, Murcot and Page (Interior quality not affected)
- Dispose of infected material
- Apply Cu 2-3 times after petal fall



## Greasy Spot



- Old engine oil beneath leaf surface
- Leaf drop = loss of vigor
- Fruit blotch on lemons, grapefruit and tangelos
- Pin point blotch that does not cover oil glands on fruit surface
- Remove infected leaves (oil & copper)







## Melanose



- Small dark brown raised lesions (rough like sandpaper)
- Tear streaking symptom on fruit
- Many lesions on fruit form mudcake
- Remove dead twigs & branches
- Avoid overhead irrigation
- Apply Cu 2-3 weeks after petal fall (2x)





## Alternaria



- Sunken lesions on Dancy and Minneola can cause fruit drop
- Foliar lesions can cause leaf drop
- Apply Copper early (sometimes several)



# Foot Rot

- Decomposition of fine feeder roots near soil surface
- Leathery brown rot fruit (white fungus with moisture) – Usually early maturity
- Bud union 4-6 in. abv. soil; watch mulch
- Do anything to enhance air circulation

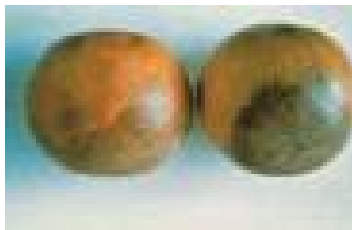




## Foot Rot



- Resistant root stocks ( Swingle, C. macrophylla, Trifoliate Orange)
- Tolerant (Sour Orange & Carizzo)
- Sweet Orange most susceptible scion
- Copper paint; systemic fungicides





# Postbloom Fruit Drop

- Brown lesions on petals
- Moisture (rainfall, fog & dew)
- Avoid overhead irrigation during flowering
- Most cultivars (Navel)





# Common Insects and Mites

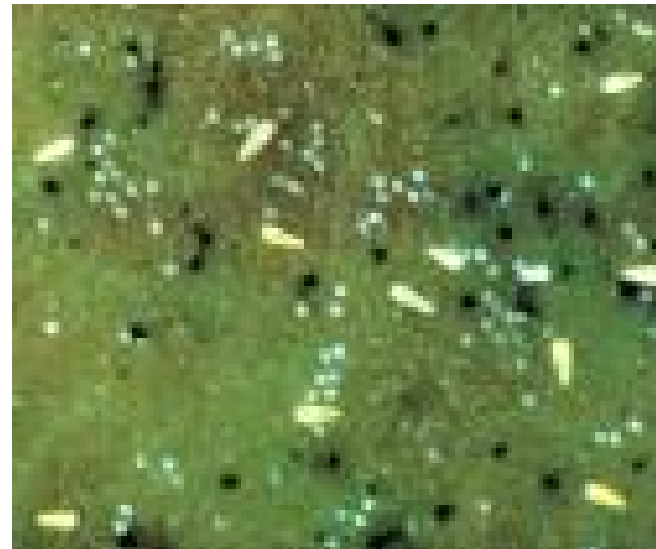
- Citrus Rust Mite
- Scale Insects
- Chewing Insects
- Citrus Leafminer



## Citrus Rust Mite



- Can use a hand lens to observe very tiny mites during periods of warm weather
- Usually at boundary of shade and sun on fruit
- Above damage occurred months earlier
- Oil
- Hirsutella





# Scale Insects



Caribbean Black Scale

Snow Scale

Cottony Cushiony scale

Sooty mold

Beneficials/Oil (crawlers)

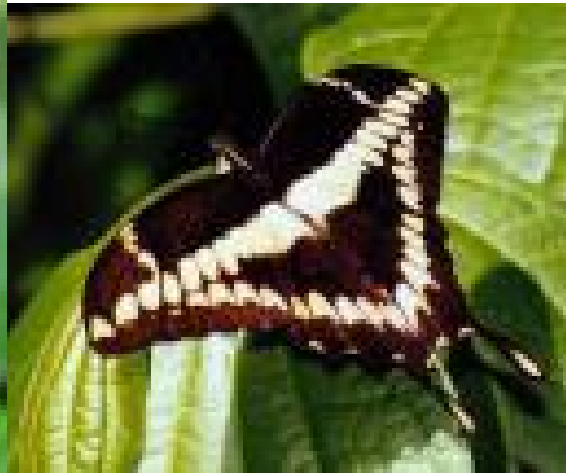
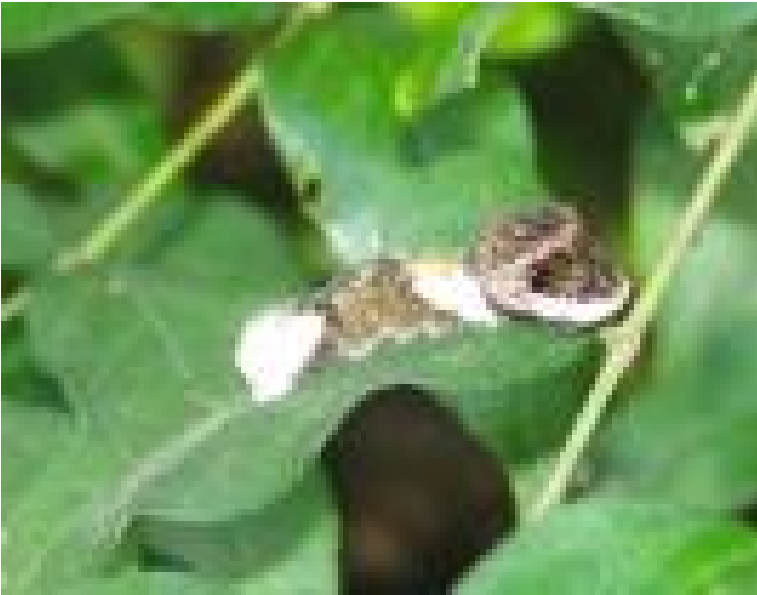
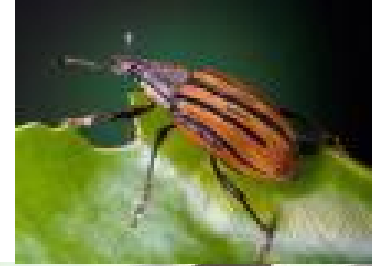






# Chewing Insects

- Lubber grasshopper
- Root weevil
- Katydid
- Orange Dog Fall





# Citrus Leafminer

- Very small lepidoptera that lives within the leaf tissue
- Access for citrus canker
- Horticultural oil in new flush





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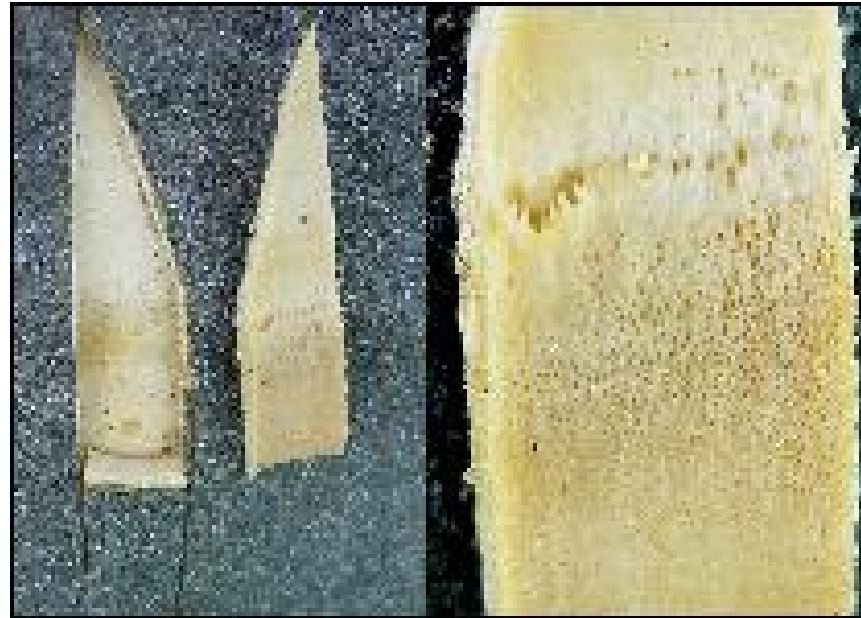
# Threatening Disorders

- Tristeza
- Citrus back spot
- Citrus Canker
- Citrus Greening (Huanglongbing – HLB)
- Leprosis



# Tristeza

- Virus that does not allow food to get from the leaves to the roots, thus starving them



- Sour orange rootstock



# Citrus Black Spot

- Causal agent: *Guignardia citricarpa*
- Symptomatic: Sweet oranges, mandarins and tangerines, lemons
- Unusual to see symptoms more than 1 – 1.5 months before maturity
- Warm temps (~ 81F; 27C) also increase disease
- Symptoms generally occur on the 'sunny side of trees'



# Hard Spot



Photos: Dr. Megan Dewdney



# Citrus Canker







# Citrus Canker Pathogen

- Citrus canker (CC) is caused by the bacterial pathogen *Xanthomonas axonopodis* pv. *citri*. The pathogen enters host tissues through wounds and natural openings called stomata. It is a serious disease of all citrus and some citrus relatives.





# Citrus Canker

- Moved by wind blown rain
- Physical movement
  - Equipment
  - Clothing
- Decontamination
- Copper sprays can protect developing leaves and fruit
- Wind breaks



# Huanglongbing (Citrus Greening)



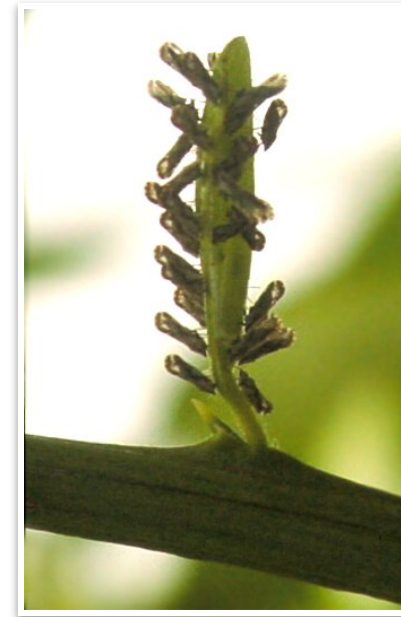


# Citrus Greening (HLB)





# Vector-Asian Citrus Psyllid





# Citrus Greening (HLB)

- Vector present through growing season
  - Dormant sprays
- Symptoms August to February
- Enhanced nutrition
- <http://www.mycitrustree.com/>



# Managing greening in the landscape





- Beneficial insects
  - Lady beetle
  - Wasp
- Alternate hosts
  - *Murraya paniculata*
  - *Severinia buxifolia*



Figure 11. Orange jasmine (*Murraya paniculata*). (Photo: Forest & Kim Starr. <http://www.hear.org/starr/>)



Figure 10. Orange boxwood (*Severinia buxifolia*). (Photo: <http://www.hktree.com>)





## • Pesticides

- Horticultural oil
- Malathion
- Sevin
- Imidacloprid
- Neem???





# Nutritionals for infected trees????





# SEASON-LONG ACP CONTROL ON YOUNG TREES

Tree size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reset (<3')	P		A	A		B	B		A	A		P
1-2 yr (3-5')	P		A	B		B	B		B	A		P
3-5 yr (5-9') <sup>1</sup> bearing				P		A	B		A	B		



# Citrus Leprosis





# Citrus Leprosis

- Non-systemic virus disease found primarily on sweet orange.
- Chlorotic lesions on leaves and fruit.
- Symptoms only spread by several species of false spider mites.
- Reported in Florida 50 years ago; not believed to be in state now.



# Growing Citrus in Difficult Times

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# Management strategies

- **Don't Plant Citrus!**
- Maintain tree health (The Fundamentals)
- Tolerant rootstocks/cultivars?
- Avoidance?



# Alternative Fruit Crops

- Already being produced
  - Muscadine
  - Blueberry
  - Stone fruit (Peaches)
  - Blackberry
- Possibly
  - Persimmon
  - Pomegranate
  - Pecan
- Olives???





# Maintain tree health (The Fundamentals)

- Site Selection
- Planting
- Watering
  - \* • Frequent light irrigation assists trees affected by HLB in commercial groves; consider micro irrigation
  - During high stress as root mass declines and crop load increases in late summer
- Nutrition
  - Frequent light applications, foliar applications of micros to flush



# Controlled release fertilizer with enhanced micronutrients



# 12-3-8

**Batch #: 1406-1122**

## FERTILIZER ~ CREC Mix with Tiger micros

### GUARANTEED ANALYSIS

* Total Nitrogen (N).....	12.0000%
6.8800% Nitrate Nitrogen	
4.5200% Ammoniacal Nitrogen	
0.6000% Urea Nitrogen	
** Available Phosphate (P2O5).....	3.0000%
*** Soluble Potash (K2O).....	8.0000%
Calcium (Ca) .....	4.5270%
Magnesium (Mg) .....	0.9850%
0.9850% Water Soluble Magnesium (Mg)	
Boron (B) .....	0.0240%
Copper (Cu) .....	0.0400%
0.0400% Water Soluble Copper (Cu)	
Iron (Fe) .....	1.0980%
0.1100% Water Soluble Iron (Fe)	
0.2200% Chelated Iron (Fe)	
Manganese (Mn) .....	0.9160%
0.0690% Water Soluble Manganese (Mn)	
Molybdenum (Mo) .....	0.0060%
Zinc (Zn) .....	0.7150%
0.0400% Water Soluble Zinc (Zn)	

Derived From: Polymer Coated Ammonium Nitrate, Polymer Coated Calcium Nitrate, Polymer Coated Copper Sulfate, Polymer Coated Iron EDTA, Polymer Coated Magnesium Sulfate, Polymer Coated Manganese Sulfate, Polymer Coated Monoammonium Phosphate, Polymer Coated Sodium Molybdate, Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia, Polymer Coated Urea, Polymer Coated Zinc Sulfate, Elemental Sulfur, Ferrous Sulfate, Iron EDTA, Iron Humate, Iron Oxide, Iron Sucrate, Manganese Oxide, Sodium and Calcium Borate, Zinc Oxide



# Tolerant rootstocks/cultivars?

## Rootstocks

- X-639
- Cleopatra Mandarin
- US 802
- US 942
- **Sour Orange**
- US 897<sup>GKE</sup>

## Cultivars

- Sugar Belle
- Fallglo tangerine
- Navel
- Grapefruit
- Lemon
- **Parson Brown**



# Avoidance

- Preventing the Asian citrus psyllid from infesting the citrus canopy



# Kaolin for Pest Control

- **Clay-based (alluminosilicate mineral)**
- **Leaves a white residue on treated plant surfaces**
- **Demonstrated to deter some insect pest infestations and feeding**



Dr. Michael Rogers

**UF** UNIVERSITY of FLORIDA  
IFAS  
Citrus Research and Education Center



# Company develops tree cover for young citrus trees

Betsy Jibben, Ag Day TV National  
Reporter

March 8, 2016 06:32 AM





# Citrus under protective structures (CUPS)



Credit: Arnold W. Schumann, UF/IFAS



Dr. Arnold Schumann

**Figure 6.** View of the CUPS screen house at the CREC, showing trellised container hydroponics-grown Cara Cara navel orange trees at 871 trees/acre planting density.





# South Georgia farmers hope Satsuma oranges produce sweet results

Clint Thompson/UGA College of Agricultural and Environmental Sciences  
CNHI

Jul 24, 2014



**160 Acres of  
Tangerines slated  
to be planted on a  
farm in Hastings,  
FL beginning in  
2018**



**For Homeowners**

## Heat treatment

- Heat treatment can eliminate greening for 2 years
- 48 hours at 105° F
- Grower treating 5 trees at a time for about a week

Apply Heat and Wait





# Thermotherapy

## Tents



Summer: 2-3 days;  
temperatures 120-130 F highs

## Steam





## References

- **Your Florida Dooryard Citrus Guide - Common Pests, Diseases, and Disorders of Dooryard Citrus** This document is HS 890
- **Field Diagnosis of Citrus Tristeza Virus**  
This document is HS996
- **Citrus Fertility** This document is SL 253
- **Citrus Culture In The Home Landscape**  
This document is a Fact sheet HS-867



# Resources

- Identifying canker and greening in your grove by Jamie Burrow
- Growing Citrus in the Florida Dooryard by Jamie Burrow
- Greening and canker training for Master Gardeners by Tim Spann and Ryan Atwood
- Dooryard citrus production: citrus greening HS1131



mycitrustree.com

How-to Tutorials

Hot Topics for Dooryard Citrus

Feed Your Fruit

GrowScripts

UF/IFAS RESOURCES

# YOUR SOURCE FOR DOORYARD CITRUS GROWING...

TIPS AND TRICKS FOR SUCCESS IN GROWING CITRUS IN THE BACKYARD AND CONTAINER. PLUS ANSWERS TO COMMON CITRUS GROWING QUESTIONS.

READ OUR HOT TOPICS

VISIT OUR HOW-TO TUTORIALS

Follow Us

10% OFF ONLINE ORDERS

Get your trees ready by "Feeding the Top" essential

mycitrustree.com/my-citrus-tree/uf-ifas-resources.html

Most Read Content

- Lemons & Limes
- Fertilizing a Citrus Tree
- Orange Varieties
- Water a Citrus Tree
- Planting a Citrus Tree

<http://mycitrustree.com/>



# Thanks!

[gke@ufl.edu](mailto:gke@ufl.edu)

# Revisiting the Parson Brown Sweet Orange

Gary K. England and Dr. Ron Brlansky  
UF/IFAS Extension – Lake County  
UF/IFAS CREC - Retired





