# How Do We Obtain Well-Colored Tango and Vernia Fresh Fruit?

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# Why is Degreening Necessary?

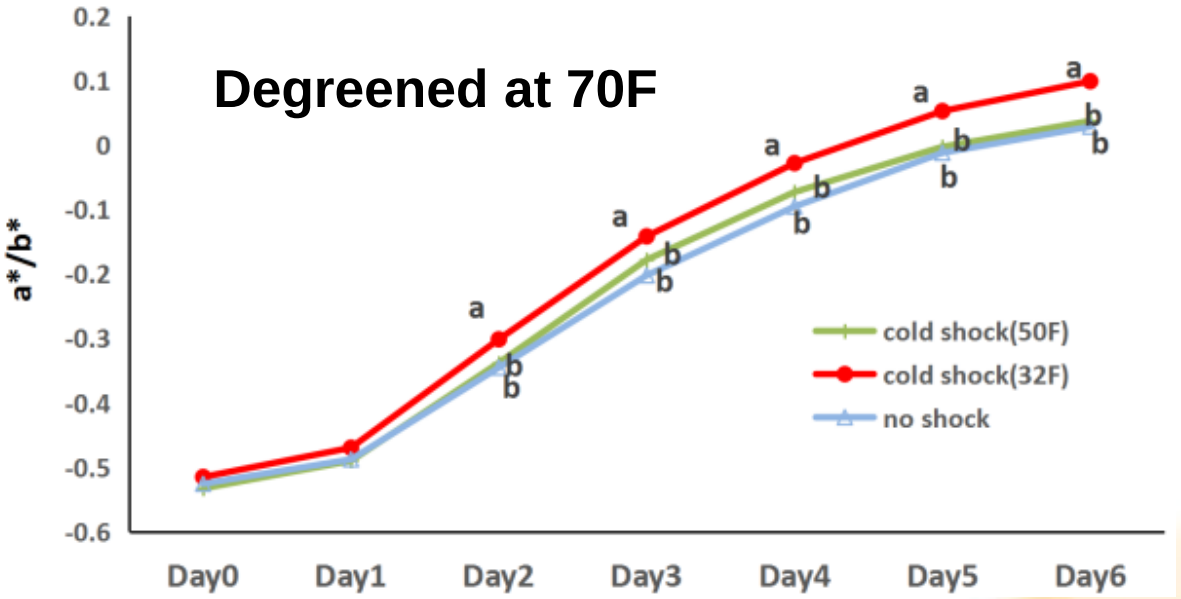
- Consumers associate green citrus fruit with immaturity (poor quality)
- Fruit color is due to the interaction of **chlorophyll (green)** and **carotenoid (red – yellow)** pigments
- Color change in the field is stimulated when nighttime temperatures drop below 55F

# Opportunities & Challenges

- New citrus varieties are critical for rebuilding and maintaining Florida's fresh citrus industry in the age of Huanglongbing
- While 'Tango' mandarin and 'Vernia' orange appear promising, their fruit peel often does not develop color well under Florida conditions

# Use of cold shock?

- Depending on citrus variety, degreening at cooler temperatures can improve final color
- A 15 hr, pre-degreening cold shock (32F) improved final peel color of ‘Vernia’
  - **Only worked when degreening at 70F, not at 85F**
  - **No benefit after natural cold temperatures in the field**
  - **Even after 6 days degreening, color was still not great**



# Preliminary Test – ‘Tango’

- ‘Tango’ on US 942 rootstock
- Three reps (trees) per treatment
- Trees sprayed until runoff with a handgun sprayer (12/14/18)
- Treatments: 100 and 300 ppm **ethephon** applied one week before harvest, plus a water control
  - **All subsequent experiments included these treatments**
- Harvested fruit (12/21) were placed at 85F (95% RH) with 5 ppm ethylene for 8 days total

# Preliminary Test – ‘Tango’

3 Day Degreening

Control 100 ppm 300 ppm

# Preliminary Test – ‘Tango’

5 Day Degreening


Control 100 ppm 300 ppm

# Expanded Second Study – ‘Tango’

- Besides water control and 100 and 300 ppm ethephon applied one week before harvest, also added a 600 ppm treatment & a treatment with two, 300 ppm sprays 1 week apart
- Flagged individual fruit on each tree to measure initial fruit color & changes in the field and after harvest
- At harvest, the stem above each of the flagged fruit were clipped and stem detachment force measured in the lab

# Expanded Second Study – ‘Tango’

1 Week after spraying

..this is the control!

# Expanded Third Study – ‘Vernia’

- Treatments: water control and 100 and 300 ppm ethephon applied one week before harvest
- Flagged 30 individual fruit on each tree to measure initial fruit color & changes in the field and after harvest
- At harvest, branches above each of the flagged fruit were clipped and stem detachment force measured in the lab
- Degreened (70F) half the fruit from each replicate

# Expanded Third Study – ‘Vernia’

| | Individually flagged fruit | | | | Remaining fruit on tree |
|---|---|---|---|---|---|
| **Ethephon** | **Mean detached force (g)** | | **Drop fruit (%)** | | **Yield/Tree (kg)** |
| **Control** | 891.38 | A | 4.44 | B | 30.05 |
| **100 ppm** | 907.3 | A | 8.89 | AB | 28.08 |
| **300 ppm** | **711.01** | **B** | **18.89** | **A** | 26.43 |
| **P Values** | 0.0315 | | 0.0434 | | 0.6073 |

| Date | Treatment | Degreening | a*/b* | | Hue | | Chroma | |
|---|---|---|---|---|---|---|---|---|
| Feb 27, 2019 (before degreening) | Control | Non | -0.25 | B | 103.76 | A | 48.44 | B |
| | 100 ppm | Non | -0.23 | B | 102.87 | A | 48.78 | B |
| | **300 ppm** | **Non** | **-0.16** | **A** | **98.99** | **B** | **51.56** | **A** |
| | P Values | | <.0001 | | <.0001 | | 0.0002 | |
| March 2, 2019 (2 days degreening) | Control | yes | -0.11 | B | 96.21 | C | 51.50 | AB |
| | 100 ppm | yes | -0.08 | AB | 94.31 | CD | 52.78 | AB |
| | **300 ppm** | **yes** | **-0.03** | **A** | **91.84** | **D** | 53.25 | A |
| | Control | Non | -0.26 | D | 104.16 | A | 47.69 | C |
| | 100 ppm | Non | -0.23 | D | 102.85 | A | 48.63 | C |
| | **300 ppm** | **Non** | **-0.17** | **C** | **99.29** | **B** | **50.77** | **B** |
| | P Values | | <.0001 | | <.0001 | | <.0001 | |
| March 07, 2019 (7 days degreening) | Control | yes | 0.06 | B | 86.46 | C | 56.93 | A |
| | 100 ppm | yes | 0.08 | AB | 85.48 | CD | 57.41 | A |
| | **300 ppm** | **yes** | **0.11** | **A** | **83.71** | **D** | 58.54 | A |
| | Control | Non | -0.20 | D | 101.37 | A | 46.96 | BC |
| | 100 ppm | Non | -0.22 | D | 102.22 | A | 46.24 | C |
| | **300 ppm** | **Non** | **-0.13** | **C** | **97.03** | **B** | **48.80** | **B** |
| | P Values | | <.0001 | | <.0001 | | <.0001 | |

Δ 0.09

Δ 0.08

Δ 0.05

Individually flagged fruit

# Fruit quality – ‘Vernia’

Individually flagged fruit – measured after 7 days degreening + 7 days storage

| Treatment | Degreening | TSS | TA | TSS/TA | PPR ( Kg) | |
|---|---|---|---|---|---|---|
| **Control** | yes | 10.57 | 0.66 | 16.16 | 1.82 | AB |
| **100 ppm** | yes | 10.97 | 0.69 | 16.10 | 1.83 | AB |
| **300 ppm** | yes | 10.80 | 0.68 | 16.00 | **1.67** | **C** |
| **Control** | Non | 9.70 | 0.61 | 15.86 | 1.83 | AB |
| **100 ppm** | Non | 10.63 | 0.67 | 15.94 | 1.85 | A |
| **300 ppm** | Non | 10.57 | 0.59 | 18.07 | 1.76 | B |
| **P Values** | | 0.2786 | 0.4096 | 0.627 | <.0001 | |

# Fruit quality – ‘Vernia’

Remaining fruit on tree – measured after 7 days degreening + 7 days storage

| Treatment | Degreening | Healthy (%) | | Decay (%) | SERB (%) | |
|---|---|---|---|---|---|---|
| **Control** | yes | 85.0 | B | 3.3 | 10.0 | B |
| **100 ppm** | yes | 78.3 | B | 0.0 | **21.7** | **A** |
| **300 ppm** | yes | 83.3 | B | 5.0 | **13.3** | **B** |
| **Control** | Non | 95.0 | A | 3.3 | 1.7 | C |
| **100 ppm** | Non | 96.7 | A | 0.0 | 3.3 | C |
| **300 ppm** | Non | 96.7 | A | 0.0 | 3.3 | C |
| **P Values** | | 0.0018 | | 0.4363 | <.0001 | |

# Conclusions

- 300 ppm ethephon applied 1 week before harvest improved peel color at harvest, which maintained during degreening
- Ethephon decreased stem detachment force & increased preharvest fruit drop
  - **Marginal impact on yield**
  - **Quality of fruit that abscised is not know**
- Ethephon had …
  - **no effect on internal fruit quality and decay**
  - **A little effect on PPR  and SERB after degreening**

# Plan for 2019-20 Season

- Evaluate effect of Ethephon concentration applied at different times before harvest
- Pursue Ethephon registration for FL citrus
  - **Working with Mike Aerts (FFVA), Janine Spies (UF IR-4 Southern Region Field Coordinator, and Rodney Akers (UPL-Ethephon registrant)**
  - **Ethephon received a ranking of an “A” priority during the IR-4 southern region prioritization session**
  - **End of September, we will seek a national “A” priority ranking to obtain the residue data needed to register Ethephon for citrus**

# MRLs

- For the most current changes, see https://irrec.ifas.ufl.edu/postharvest/index/pesticides.shtml
- Things to note:

| Chemical Name | Trade Names (Examples only, not inclusive) | U.S. Citrus | Canada Citrus | CODEX Citrus | EU (G & O only) | Japan (G & O only) | Taiwan (G & O only) | Korea (G & O only) |
|---|---|---|---|---|---|---|---|---|
| Carbaryl | Sevin | 10 | 10 | 15 | 0.01 | 7 (proposed elimination for G & O) | 1 | 0.5 (G), 7 (O) |
| Cryolite | Kryocide | 7 | 0.1 | | 0.01 | 0.01 | 7 | 0.01 |
| Dimethoate | Dimethoate, Cygon | 2 | 1.5 | 5 | 0.01 | 2 | 2 | 2 |
| Fenbutatin Oxide | Vendex | 20 | 2 | 5 | 0.01 | 5 | 2 | 5 |
| Pyridaben | Nexter | 0.9 | 0.9 | | 0.5 (0.3 proposed) | 1 | 2 | 0.01 |
| Sethoxydim | Poast Plus | 0.5 | 0.1 | | 0.1 | 1 (proposed elimination) | 0.01 | 1 |
| Thiabendazole (TBZ) | Freshgard 598, Alumni, DECCO Salt No. 19 | 10 | 10 | 7 | 7 | 10 | 10 | 10 (7 proposed) |

# Thank You!

- For more information,
  visit the UF Postharvest Website

  http://irrec.ifas.ufl.edu/postharvest/