

# Optimizing OTC Injections

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# **THE GOOD NEWS**





**OTC injections are effective!**



A photograph of a lush orange tree canopy. The tree is covered in vibrant green leaves and numerous ripe, bright orange fruits. The oranges are scattered throughout the dense foliage, some appearing more prominent than others. The background is a clear, bright blue sky, suggesting a sunny day. The overall appearance is one of a healthy and productive orchard.

**Healthier, denser canopies**



**More, and better-quality fruits and juice**





# Rootstock Trial #1

- ❖ Ridge site (~Venus)
- ❖ Planted in 2015

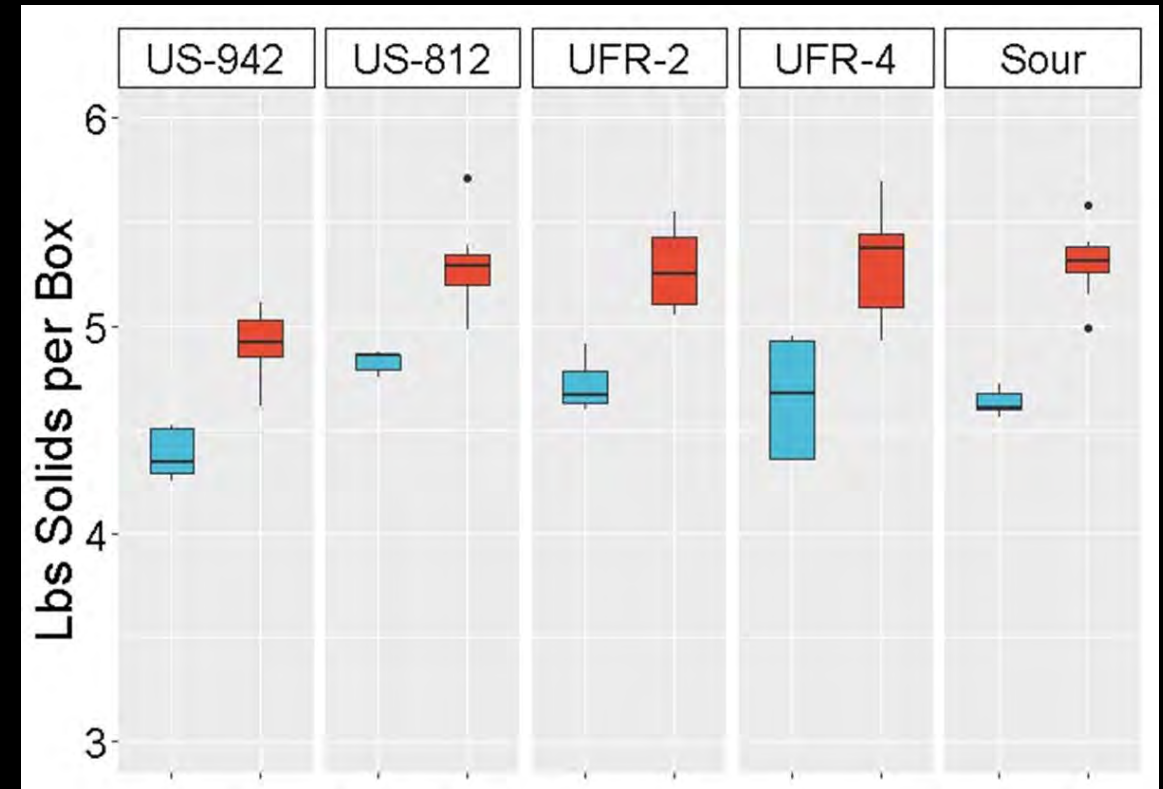
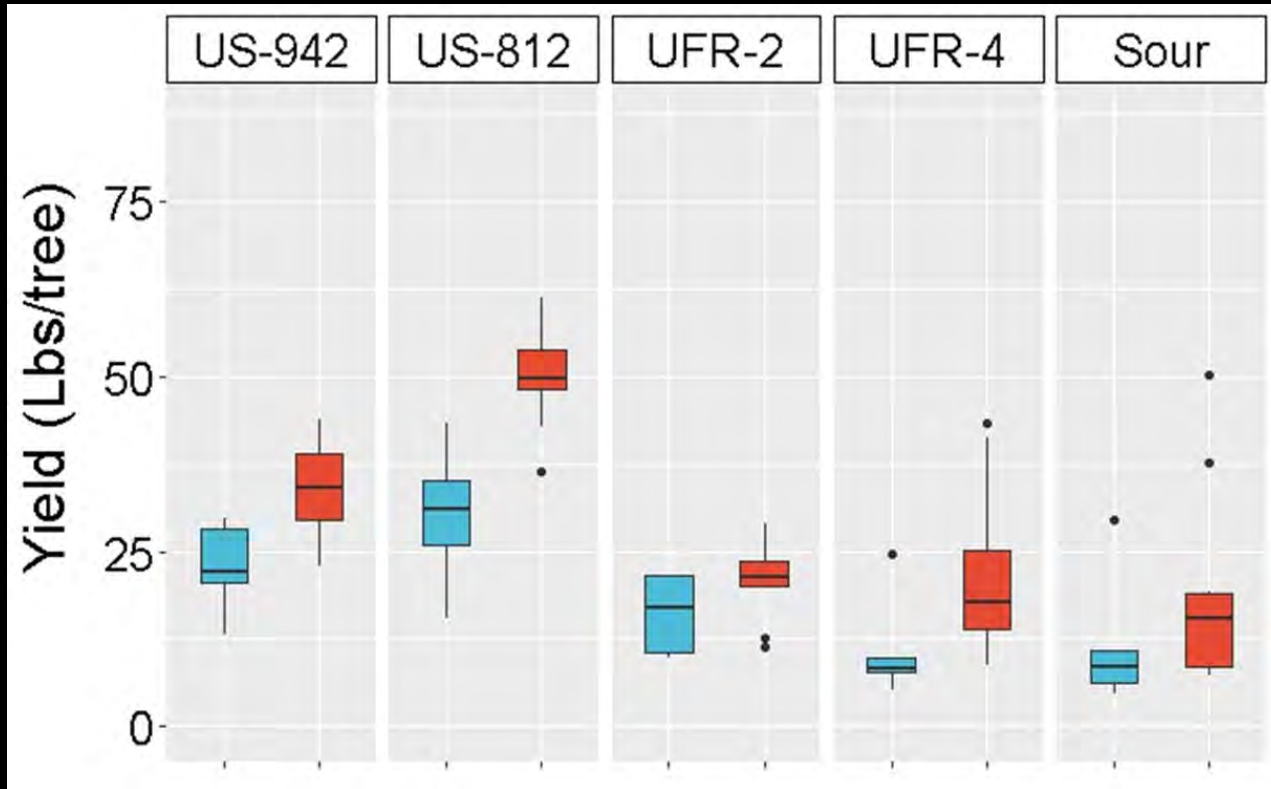
# Injection 1

- ❖ May 2023 (injection 2 completed)
- ❖ Rectify (1.1 g/tree)





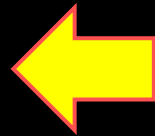
# 2024 YIELD AND POUNDS SOLIDS



**CONTROL: 18.4**

**INJECTED: 29.1**

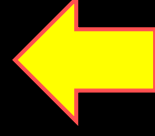
**58%↑**



**CONTROL: 4.6**

**INJECTED: 5.2**

**22%↑**



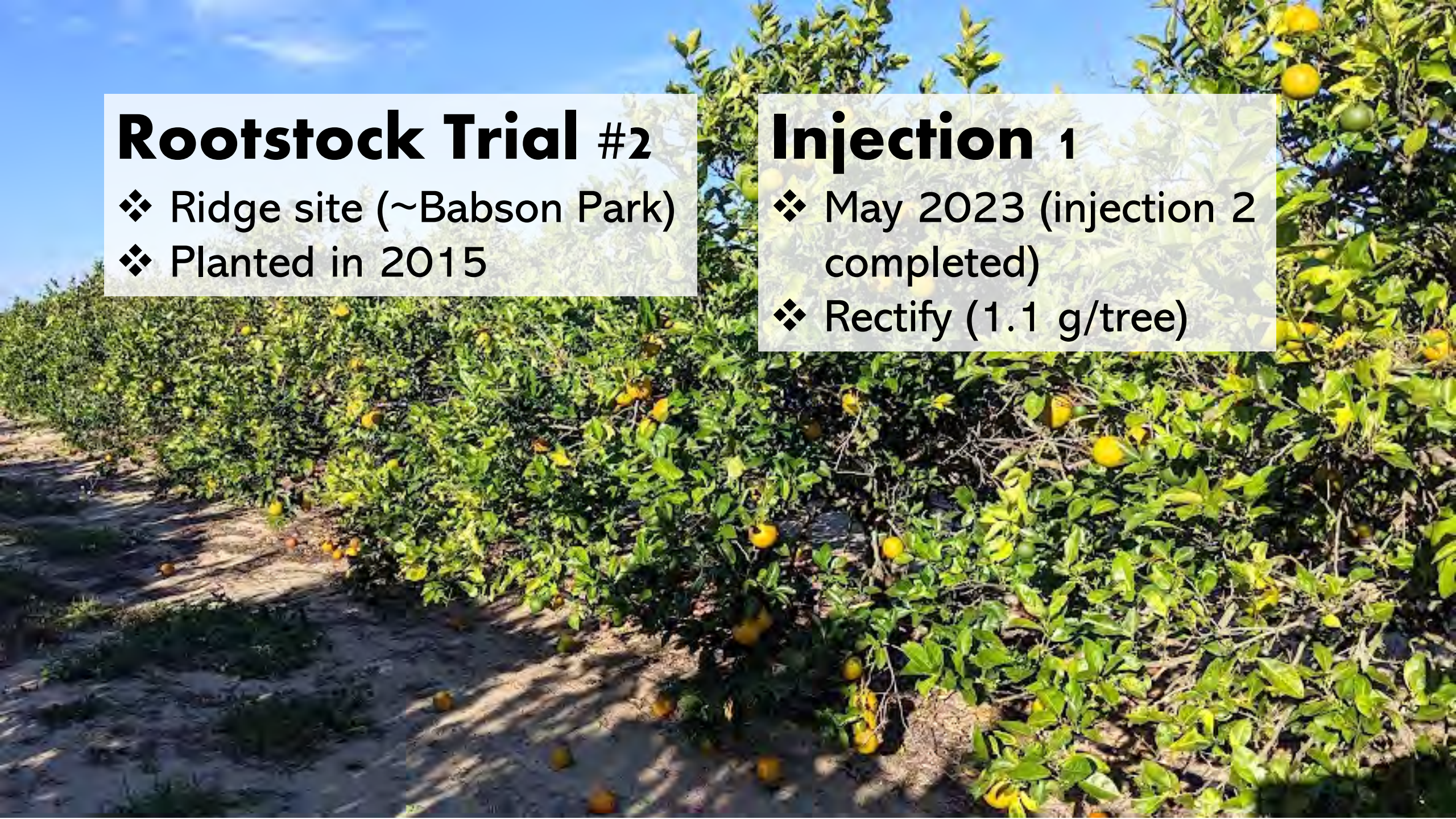


## **Rootstock Trial #2**

- ❖ Ridge site (~Babson Park)
- ❖ Planted in 2015

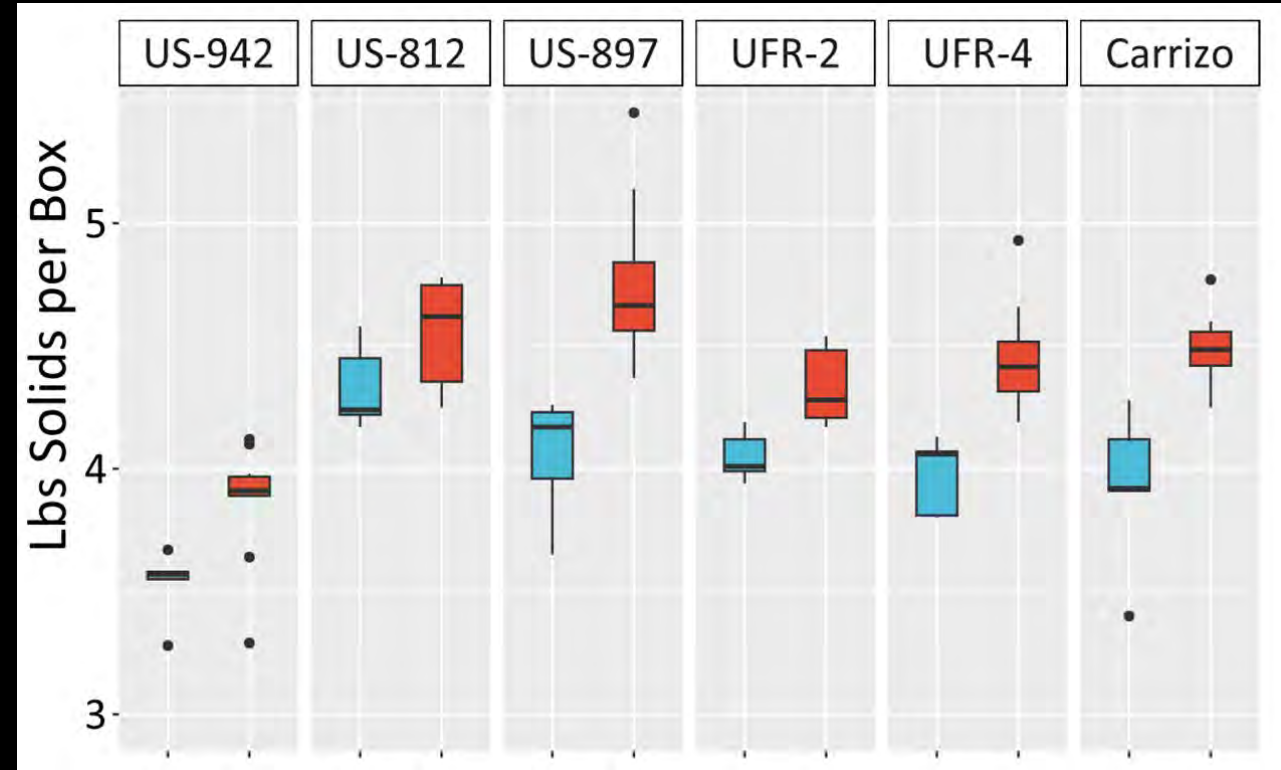
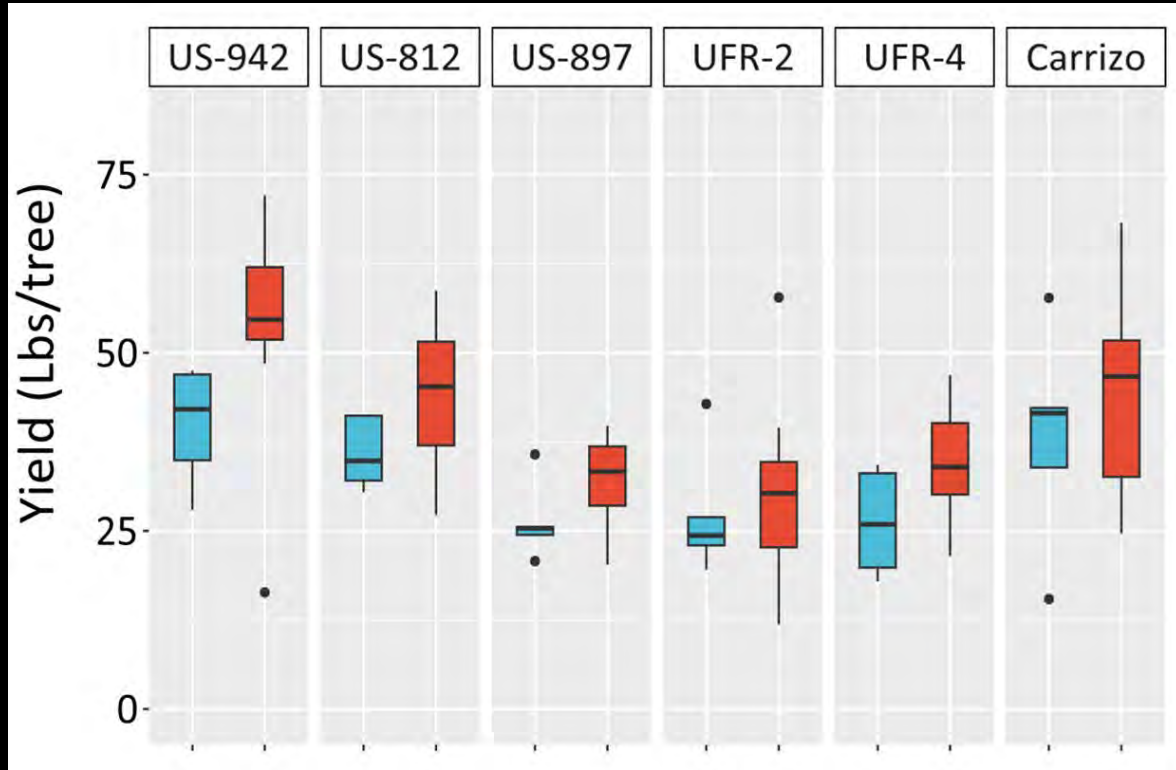
## **Injection 1**

- ❖ May 2023 (injection 2 completed)
- ❖ Rectify (1.1 g/tree)





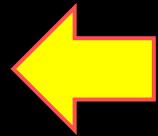
# 2024 YIELD AND POUNDS SOLIDS



**CONTROL: 32.4**

**INJECTED: 40.1**

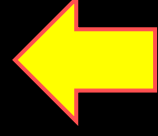
**24%↑**



**CONTROL: 4.0**

**INJECTED: 4.4**

**11%↑**









# Rootstock Trial #3

- ❖ Flatwoods site (Ft Pierce)
- ❖ Planted in 2014

# Injection 1

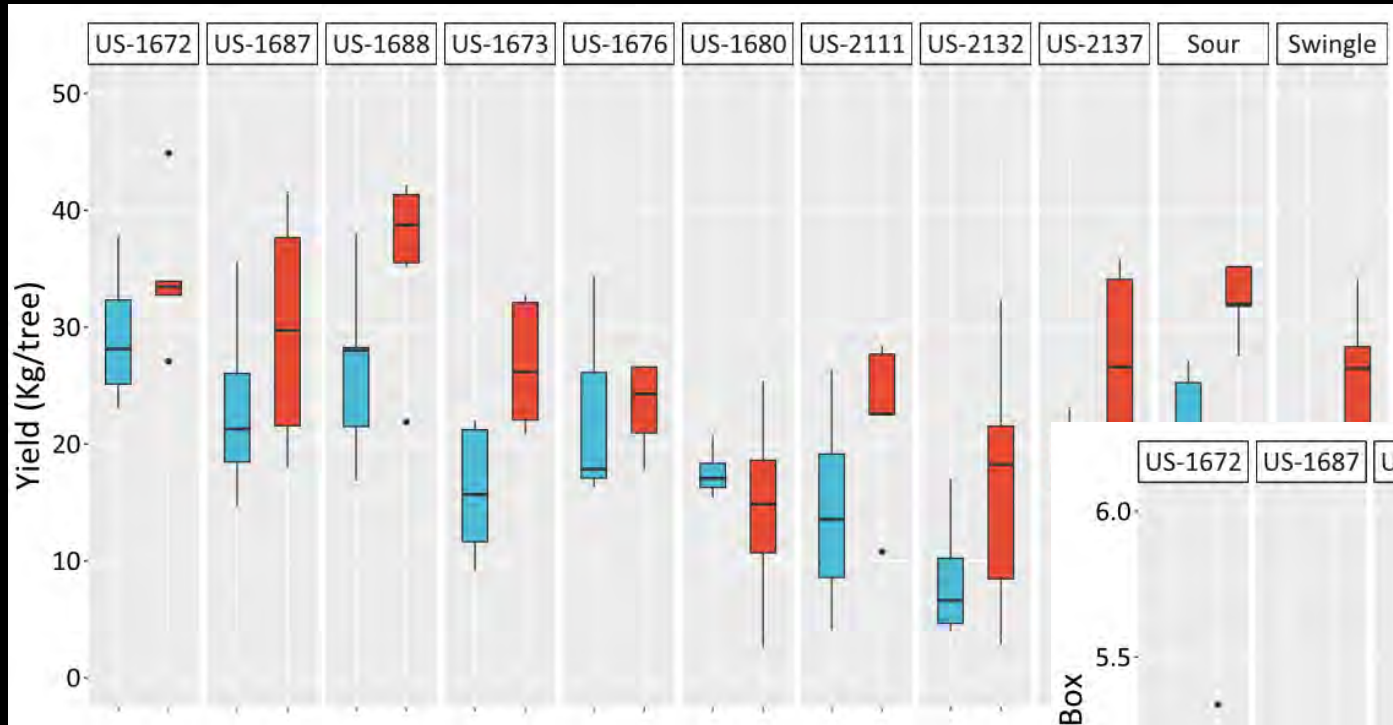
- ❖ July 2023 (injection 2 completed)
- ❖ ReMedium (0.75 g/tree)

Collaborator: Kim Bowman (USDA)





# 2024 YIELD AND POUNDS SOLIDS



**CONTROL: 19.4 (42.7 lbs)**

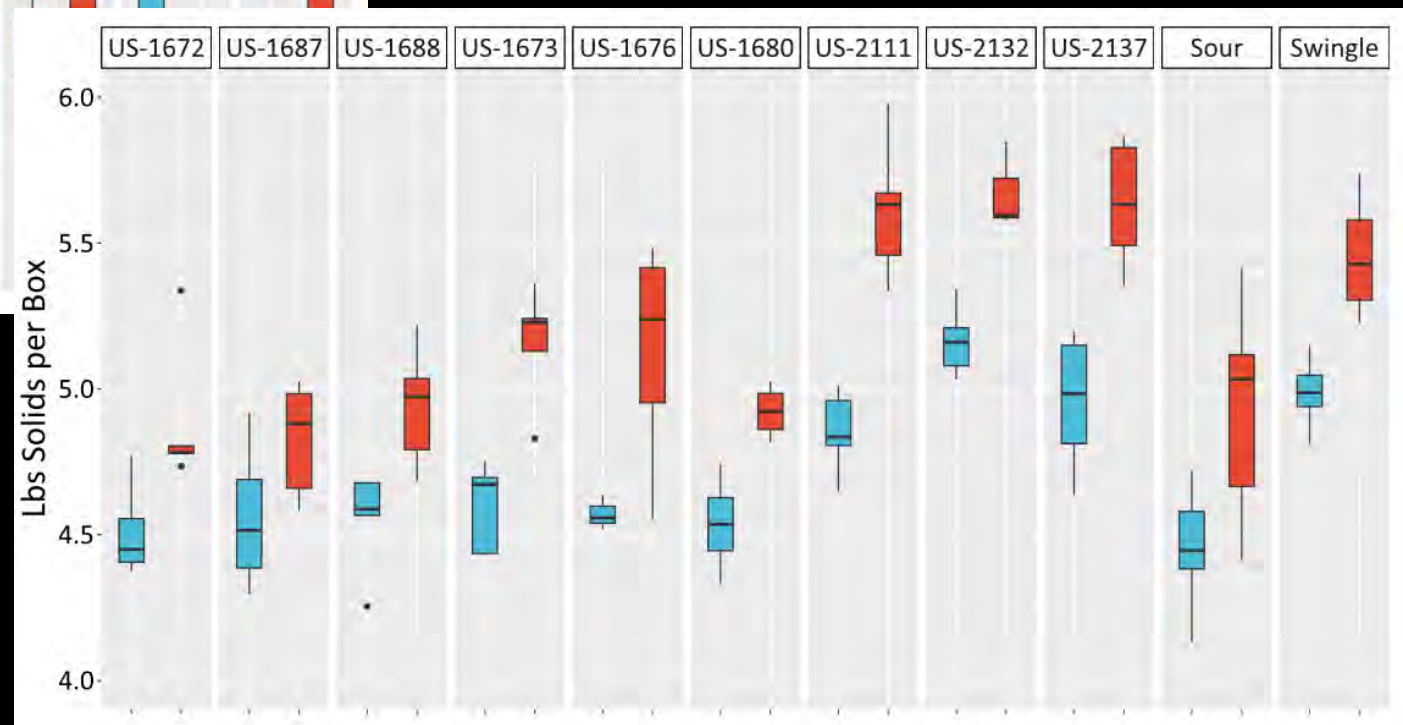
**INJECTED: 26.3 (58.0 lbs)**

**36%↑**

**CONTROL: 4.7**

**INJECTED: 5.2**

**11.5%↑**





# Two-year Trial

- ❖ Flatwoods site (near Ft Pierce)
- ❖ Planted in 2013
- ❖ Valencia/sour orange

# Injection

- ❖ June 2023
- ❖ June 2024
- ❖ ReMedium and Arbor-OTC  
(0.55 g and 1.1 g/tree)





# TWO-YEAR TRIAL (trees planted in 2013)

Cumulative  
improvements  
after two  
consecutive  
years of  
injection

OTC rate	Boxes/ acre	Lbs solids/ acre
<b>YEAR 1 (2023)</b>		
Non-injected	57 b	274 b
0.55 g/tree	75 a	408 a
1.1 g/tree	95 a	543 a
<b>YEAR 2 (2024)</b>		
Non-injected	101 b	541 b
0.55 g/tree	173 a	1066 a
1.1 g/tree	223 a	1385 a

49%

98%

97%

156%

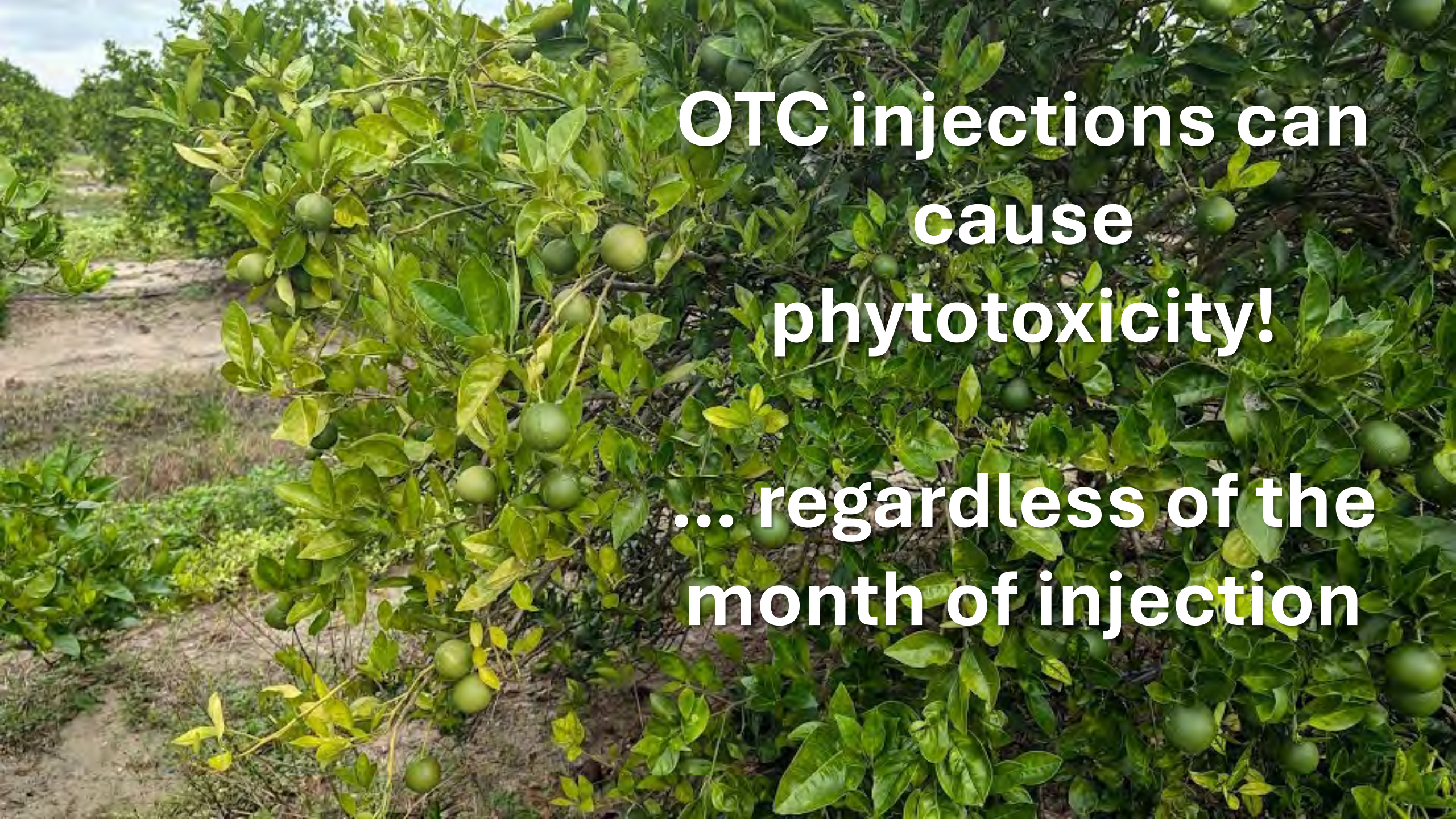
290 trees /acre





# **THE BAD NEWS**



An orange tree in a field, showing signs of phytotoxicity. The leaves are mostly green but have significant yellowing and chlorosis, particularly on the lower and outer branches. The fruit is green and unripe. The background shows a dirt path and other trees under a cloudy sky.

**OTC injections can  
cause  
phytotoxicity!**

**... regardless of the  
month of injection**





**Yellowing**





**Bronzing**





**Narrow leaves**







**Sectoring**







**Sectoring**





**Brix:  
9.3**

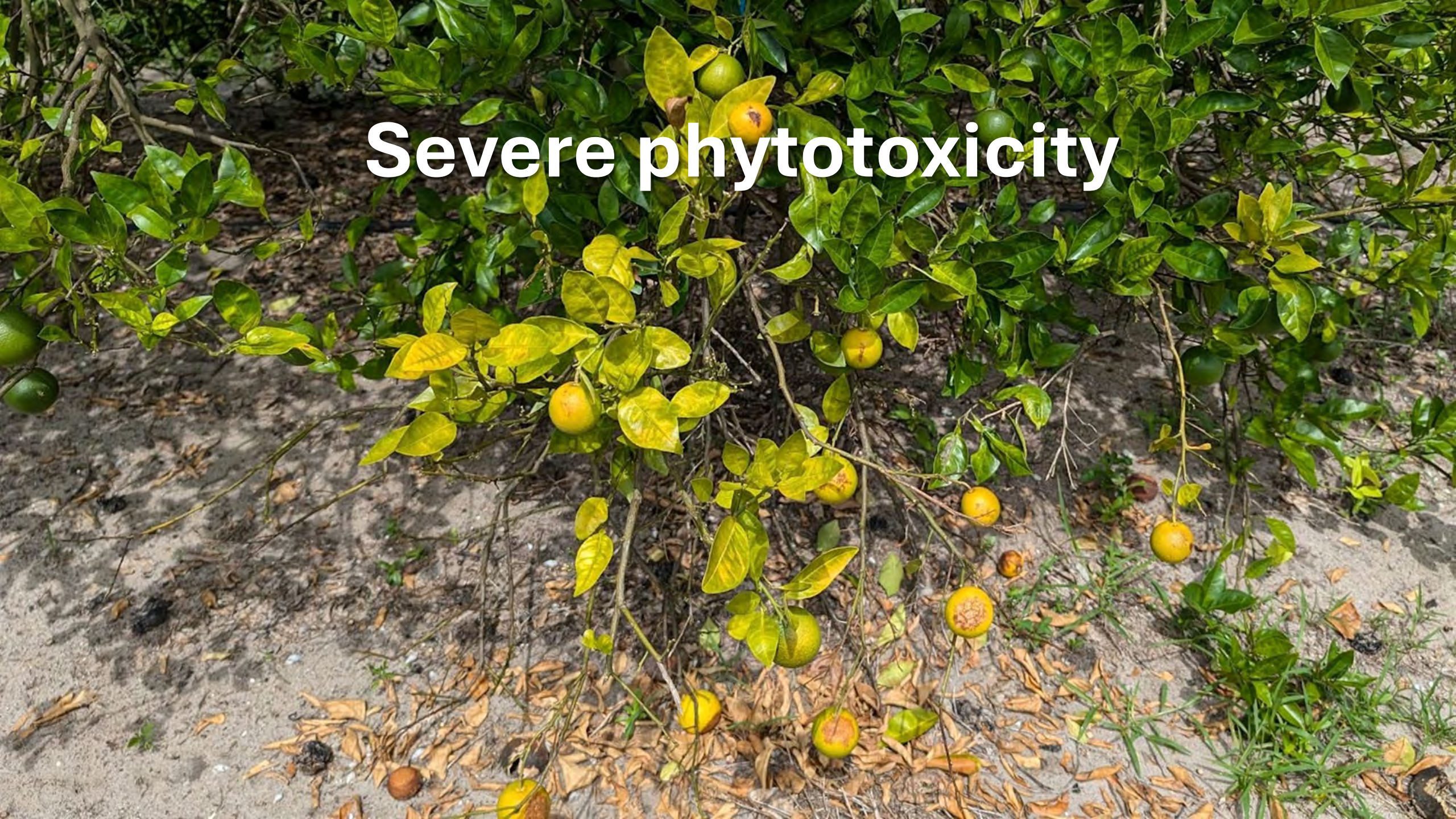


**Brix:  
11.2**





**Severe phytotoxicity**







**Die-back**



**... usually, localized**





FIFRA Section 24(c)  
Special Local Need Label

KW 10/28/2022

ReMedium TI®

For distribution and use only within Florida.

ReMedium TI® is a systemic injectable antimicrobial for the control or suppression of Huanglongbing (HLB, Citrus Greening) for Citrus Group 10-10.

OXYTETRACYCLINE GROUP 41 FUNGICIDE/BACTERICIDE

Active Ingredient

Oxytetracycline Hydrochloride\* .....95.0%  
Other Ingredients .....5.0%  
Total ..... 100.00%

\*Equivalent to 87.9% Oxytetracycline

KEEP OUT OF REACH OF CHILDREN

CAUTION

See inside booklet for Additional Precautionary Statements,  
Directions for Use and Restrictions.

Si usted no entiende la etiqueta, busque a alguien para que se la  
explique a usted en detalle.

(If you do not understand the label, find someone to explain it to you in detail.)

Sec 24(c) Registrant:  
EPA SLN FL220005  
Exp. 12/4/2025  
Net Contents: 165 Grams

Produced for:  
TJ BioTech LLC  
PO Box 21  
Buffalo, SD 57720

EPA Est. No. 100305-IND-1  
Lot No. XXXX

FIFRA Section 24(c)  
Special Local Need Label

RECTIFY™

1/30/2023

For distribution and use only within Florida

This labeling must be in the possession of the user at the time of the pesticide application

Rectify™ is a systemic injectable bactericide for the control of *Candidatus Liberibacter asiaticus* (CLas) or suppression of Huanglongbing (HLB, Citrus Greening) for Citrus Group 10-10.

OXYTETRACYCLINE GROUP 41 FUNGICIDE/BACTERICIDE

Active Ingredient:

Oxytetracycline Hydrochloride\* ..... 95.0%  
• Other Ingredients ..... 5.0%  
Total ..... 100.0%

\*Equivalent to minimum 88.0% Oxytetracycline

KEEP OUT OF REACH OF CHILDREN

CAUTION

See inside booklet for Additional Precautionary Statements,  
Directions for Use and Restrictions.

Si usted no entiende la etiqueta, busque a alguien para que se la  
explique a usted en detalle.

(If you do not understand the label, find someone to explain it to you in detail.)

Sec 24(c) Registrant:  
AgroSource, Inc.  
PO Box 3091  
Tequesta, FL 33469

EPA SLNFL230001  
Expires 12/04/2025  
Net Contents:  
2.75 lbs. (1248 grams)

EPA Est. No. 65387-AR-2  
Lot No. XXXX



# FORMULATION EFFICACY

Valencia/X639, planted in 2017

	Boxes/ acre	Fruit wt (g)	Brix	Brix/ Acid
OTC #1	52.6 a	190 a	10.1 a	17.4 a
OTC #2	56.6 a	195 a	10.2 a	16.9 a
No injection	24.3 b	171 b	8.5 b	13.4 b
	***	***	***	***

No differences between OTC formulations





**No differences between OTC formulations**

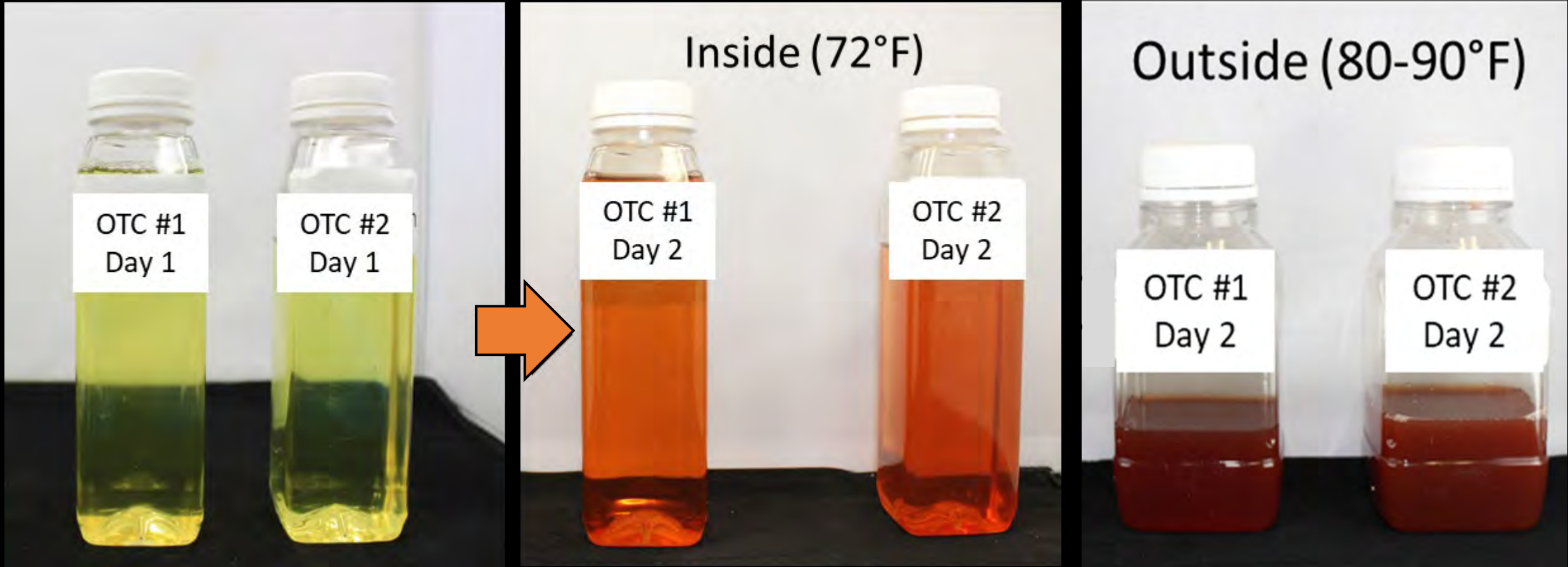




**HOW TO IMPROVE  
INJECTIONS?**



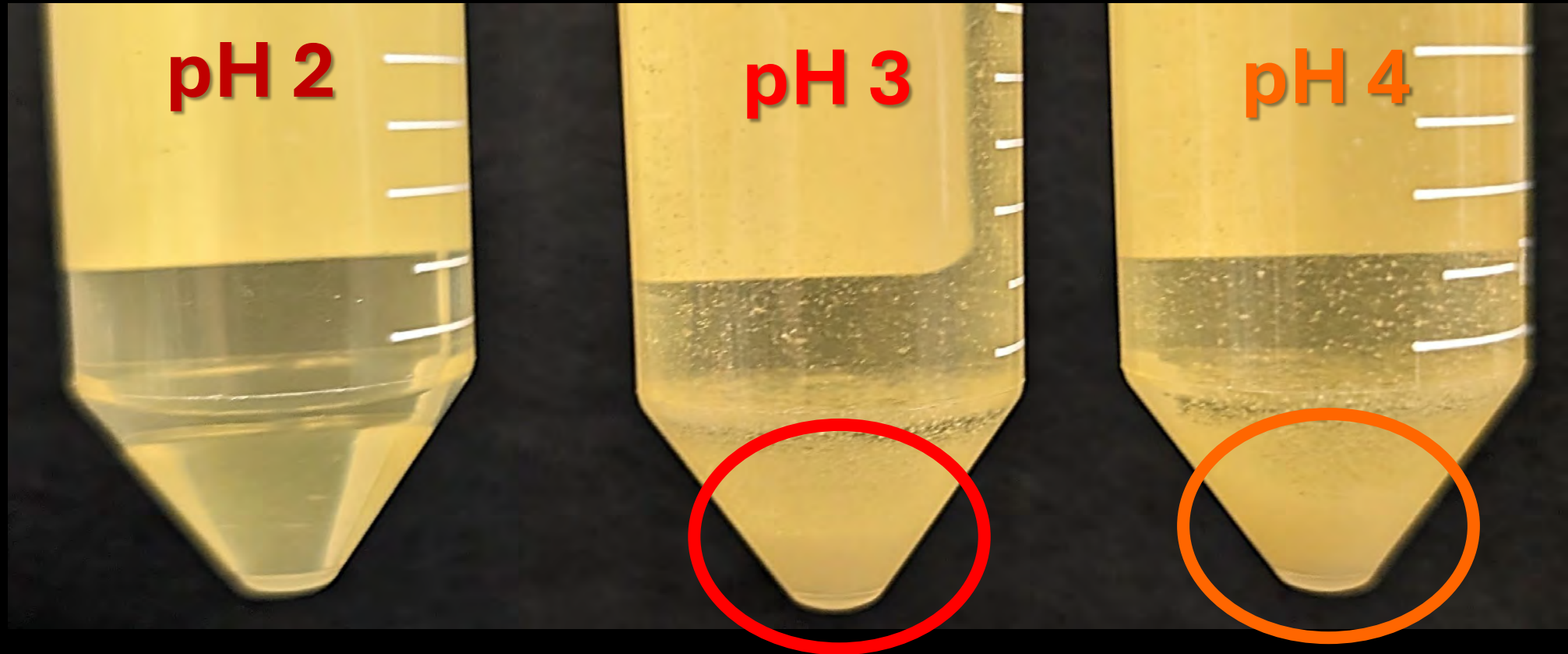
# FORMULATION STORAGE



**Use only freshly prepared OTC solution!**



# OTC SOLUBILITY



**pH matters!**



**Any chemicals can be phytotoxic, regardless of pH !**



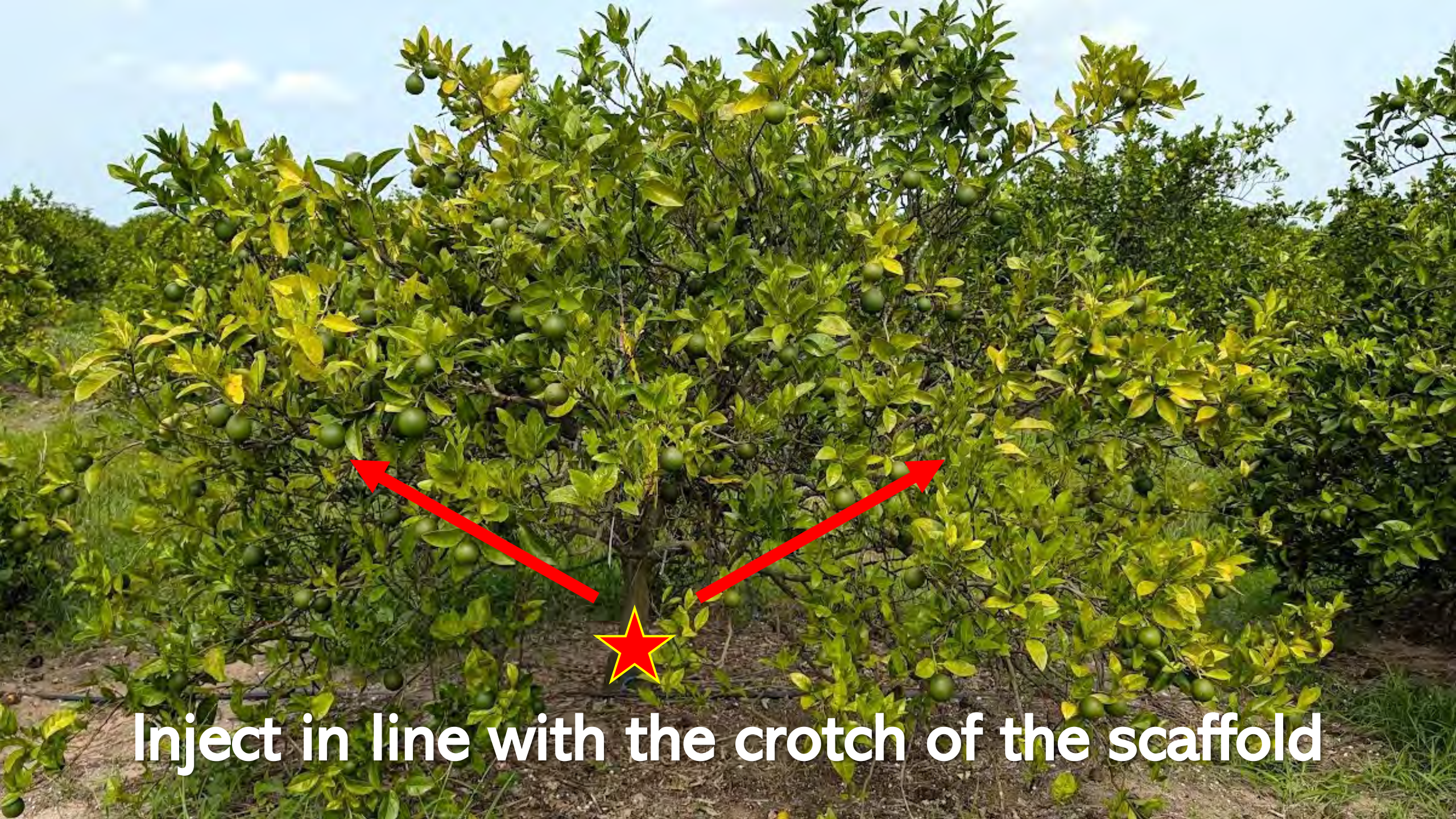
**pH 7 - NOT OTC !**



An orange tree in a field, showing signs of phytotoxicity. The leaves are yellowed and sparse, and the fruit is green. A semi-transparent white box with black text is overlaid on the center of the image.

# HOW TO PREVENT PHYTOTOXICITY?





**Inject in line with the crotch of the scaffold**



# TWO-SIDED INJECTION...

**½ of full  
dose**



**½ of full  
dose**

... reduces phytotoxicity and sectoring

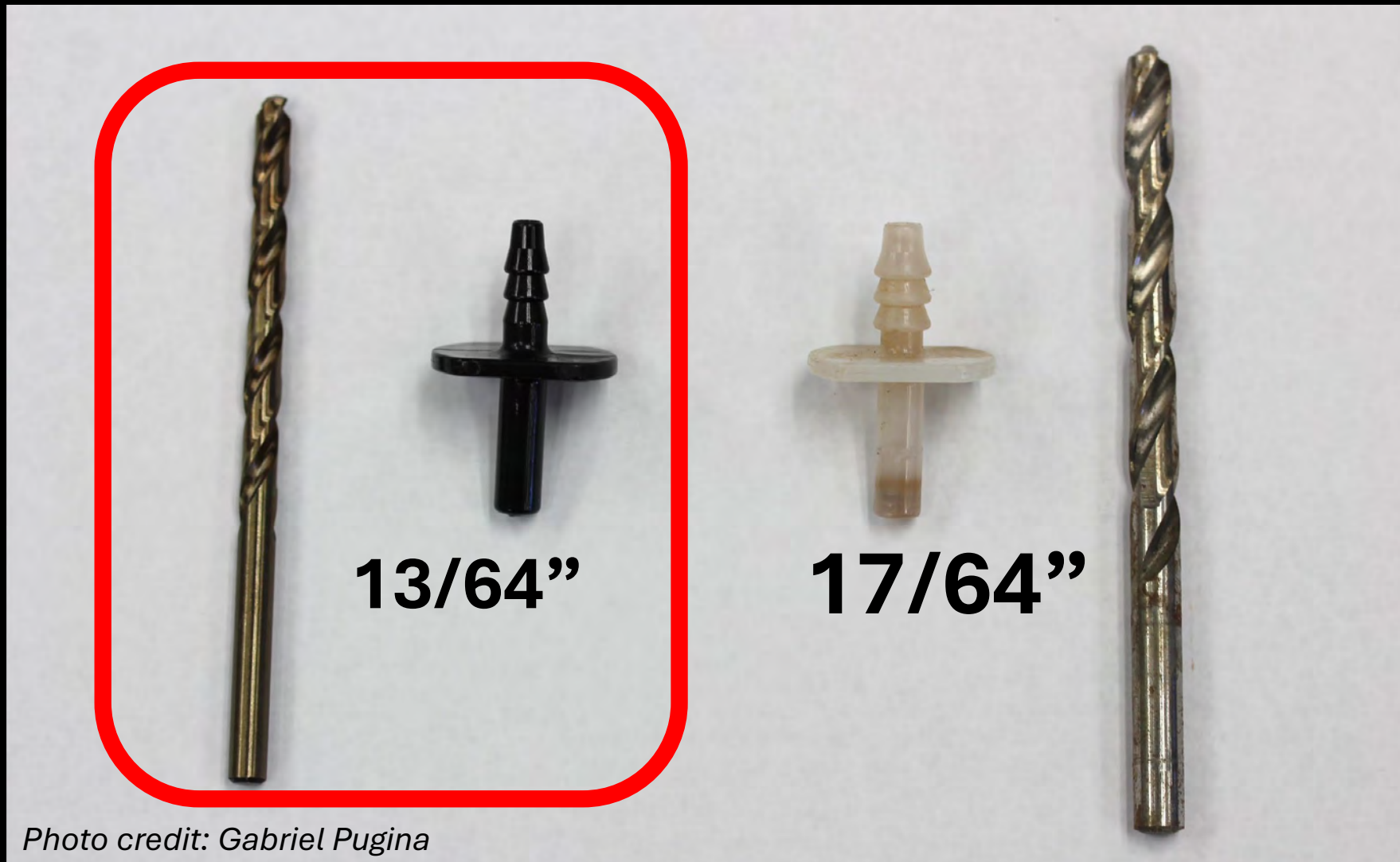


# Study: More injection sites are more effective than a higher OTC dose





# Exchange 17/64" tips with 13/64" tips



*Photo credit: Gabriel Pugina*



**Chemjets:  
1 1/64"**

**Max. volume:  
20 ml**

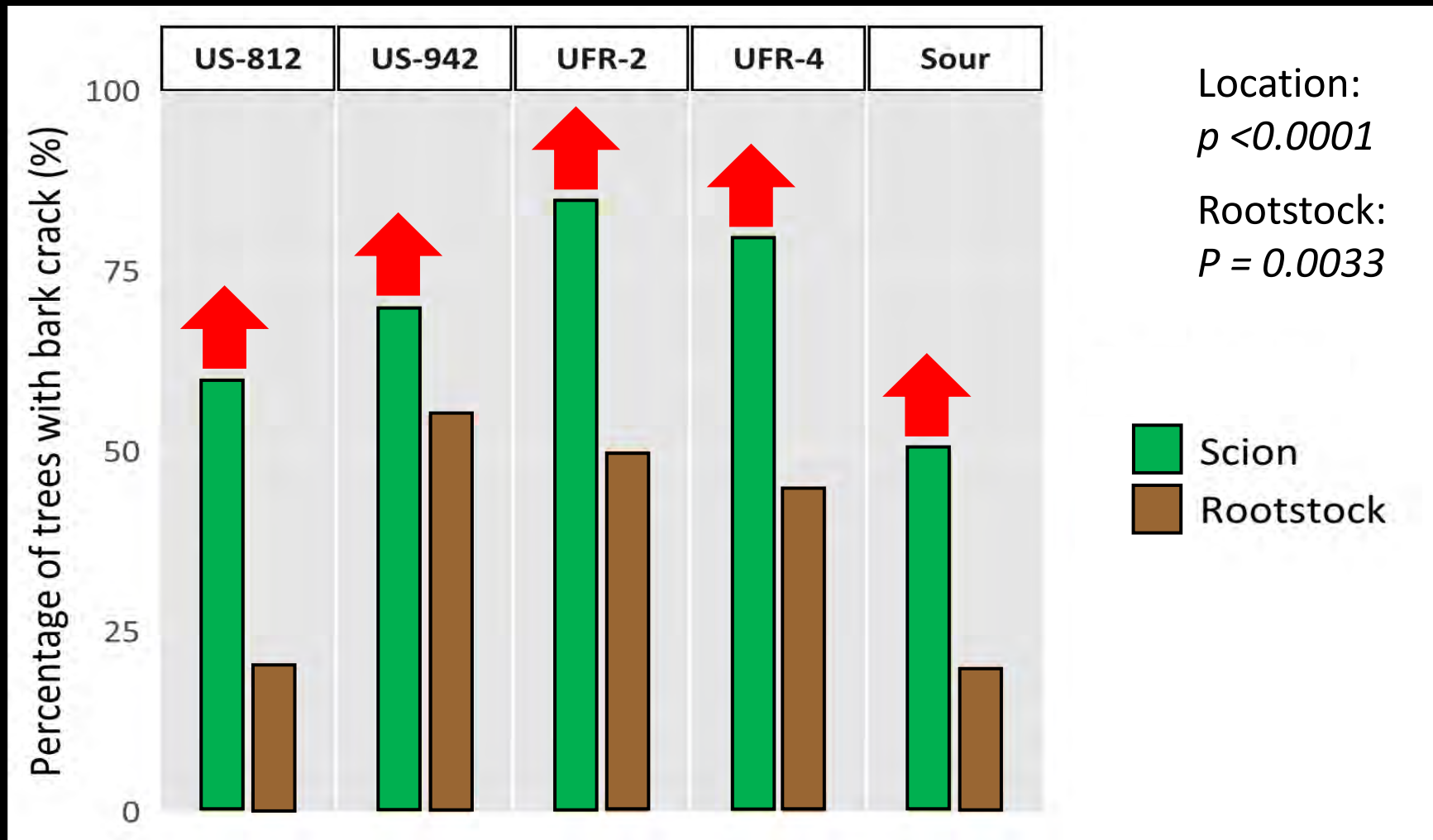








# BARK CRACKING – May 2024 INJECTIONS



Higher occurrence of bark cracking after scion injection




# OTC RESIDUES

(whole fruits)

## Hamlin

OTC rate	PPB
0.55 g/tree	2.2
0.825 g/tree	5.5
1.1 g/tree	6.9



Injection: May 2023  
Harvest: December 2023

## Valencia

OTC rate	PPB
0.55 g/tree	1.3
0.825 g/tree	2.3
1.1 g/tree	2.5

Injection: June 2023  
Harvest: March 2023

**Allowed maximum: 10 ppb (0.01 ppm)**





## HOW TO MOVE FORWARD?

- ✓ Optimize injections
- ✓ Integrate OTC injections with other best practices: IPCs, PGRs, psyllid management (!)
- ✓ Continue with good grove care: good nutrition, irrigation, etc.



Thank You



USDA-NIFA 2019-70016-29096  
USDA-NIFA 2021-70029-36056  
CRDF 22-001, 23-002, 23-005,  
23-006, 23-018



Grower Collaborators







Igor Rodrigues, Caroline Tardivo, Franco Gustave, Gerardo Moreno, Ankit Pokhrel, Larissa Nunes, Jasmine Freitas, Gabriel Pugina