Update on Trunk Injection

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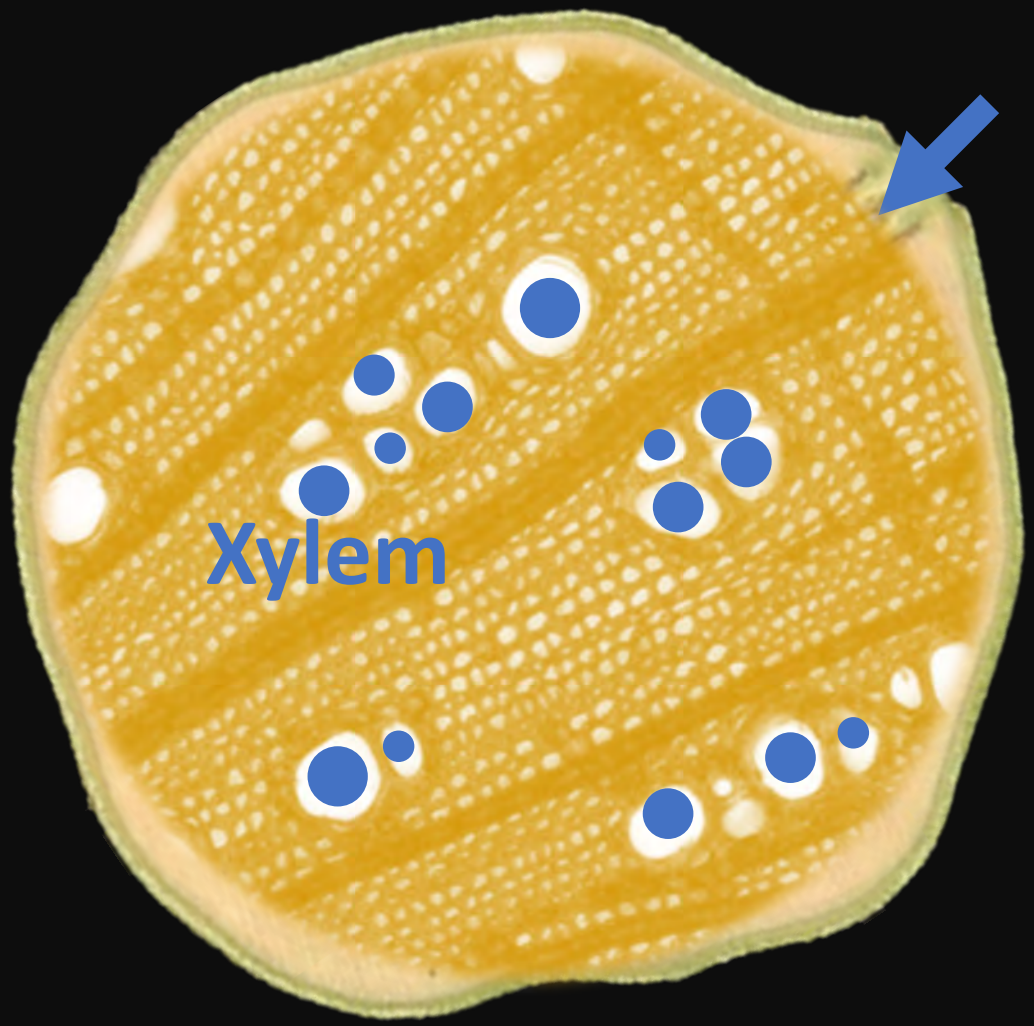
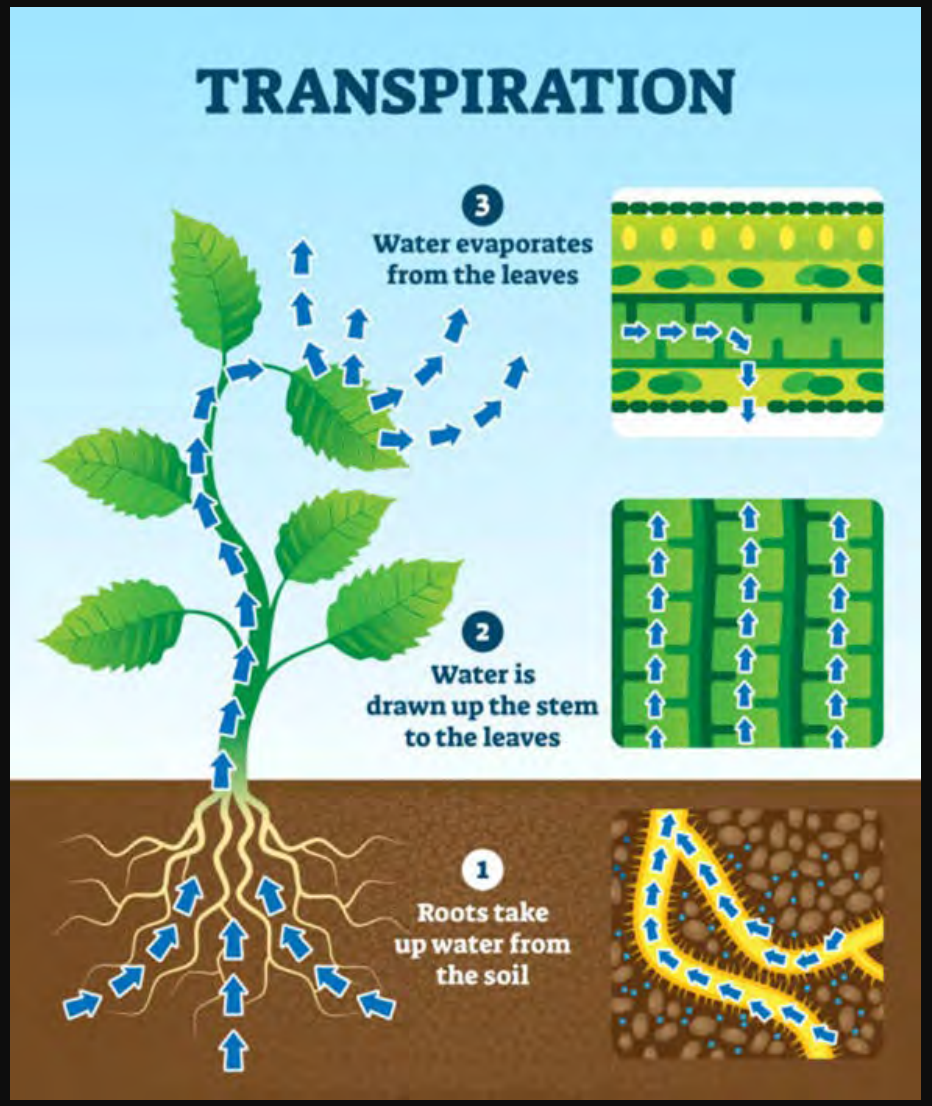
INJECTION BASICS

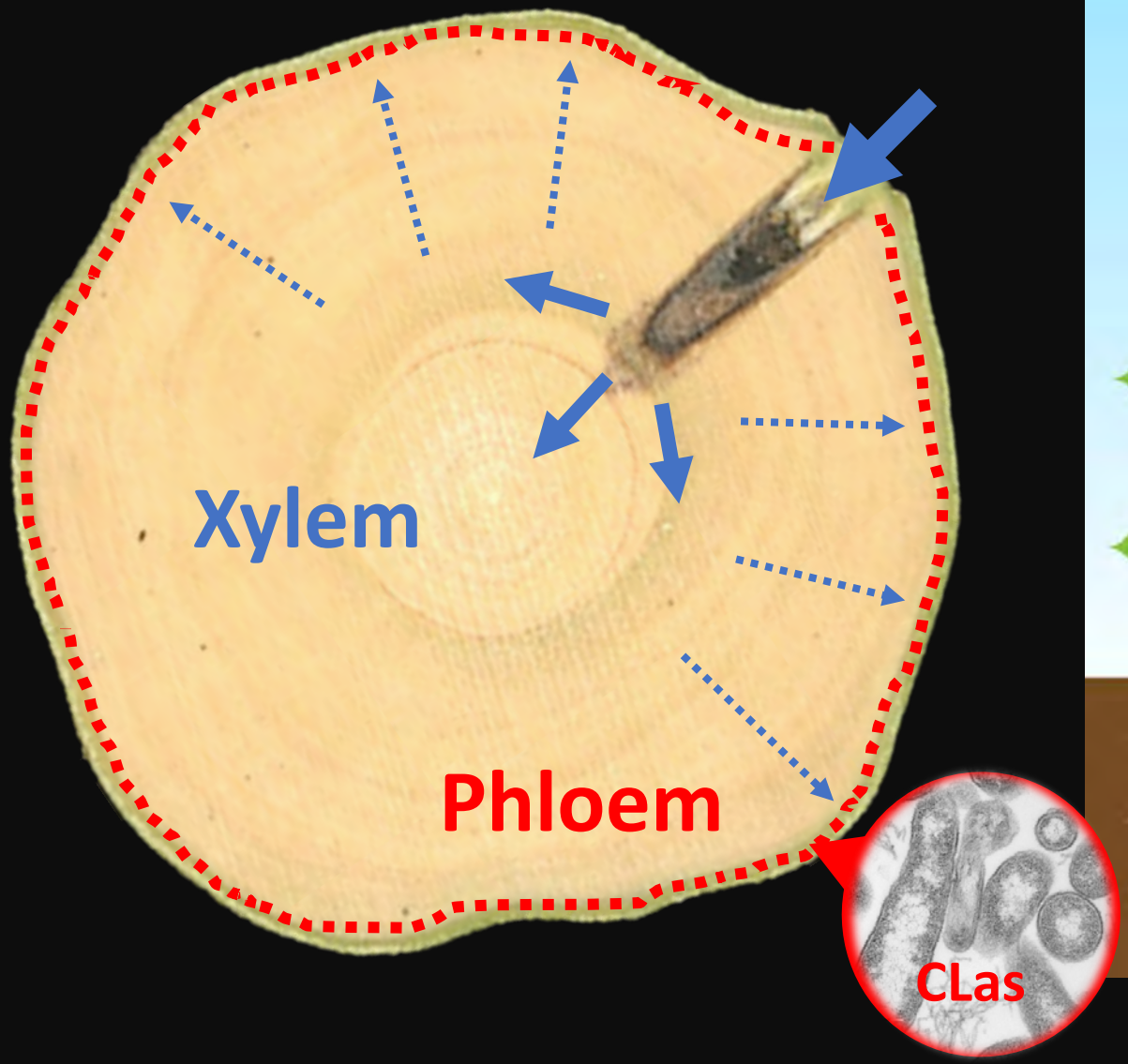
PRINCIPLE

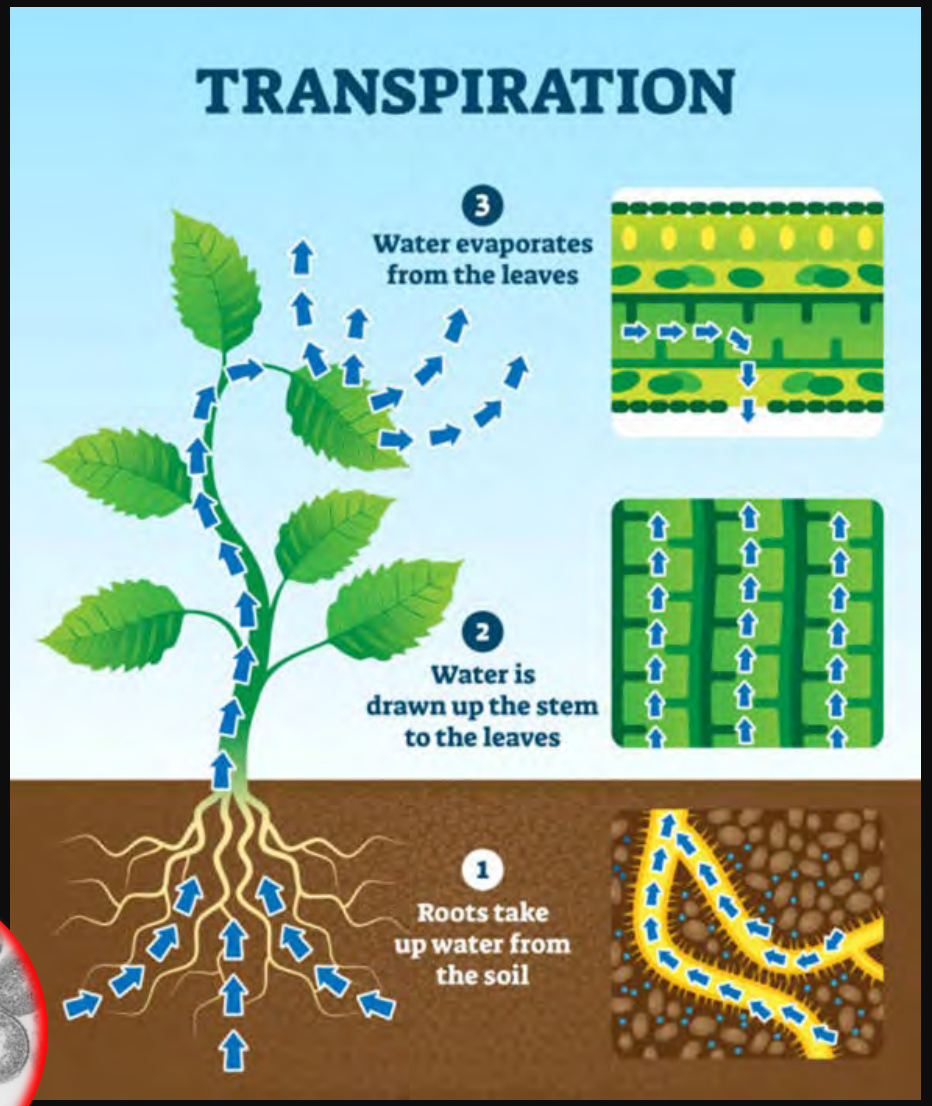




https://www.istockphoto.com/

PRINCIPLE

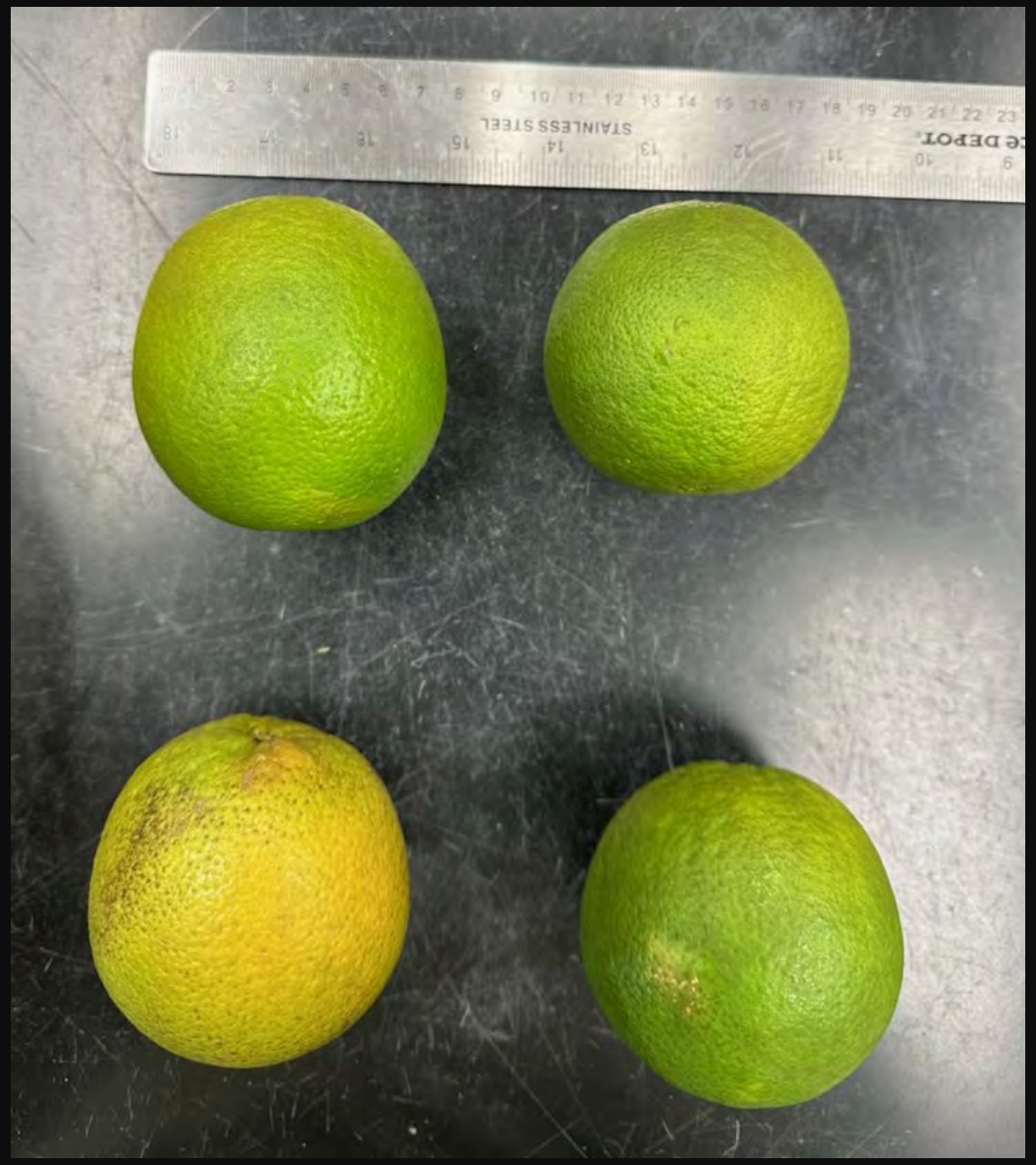




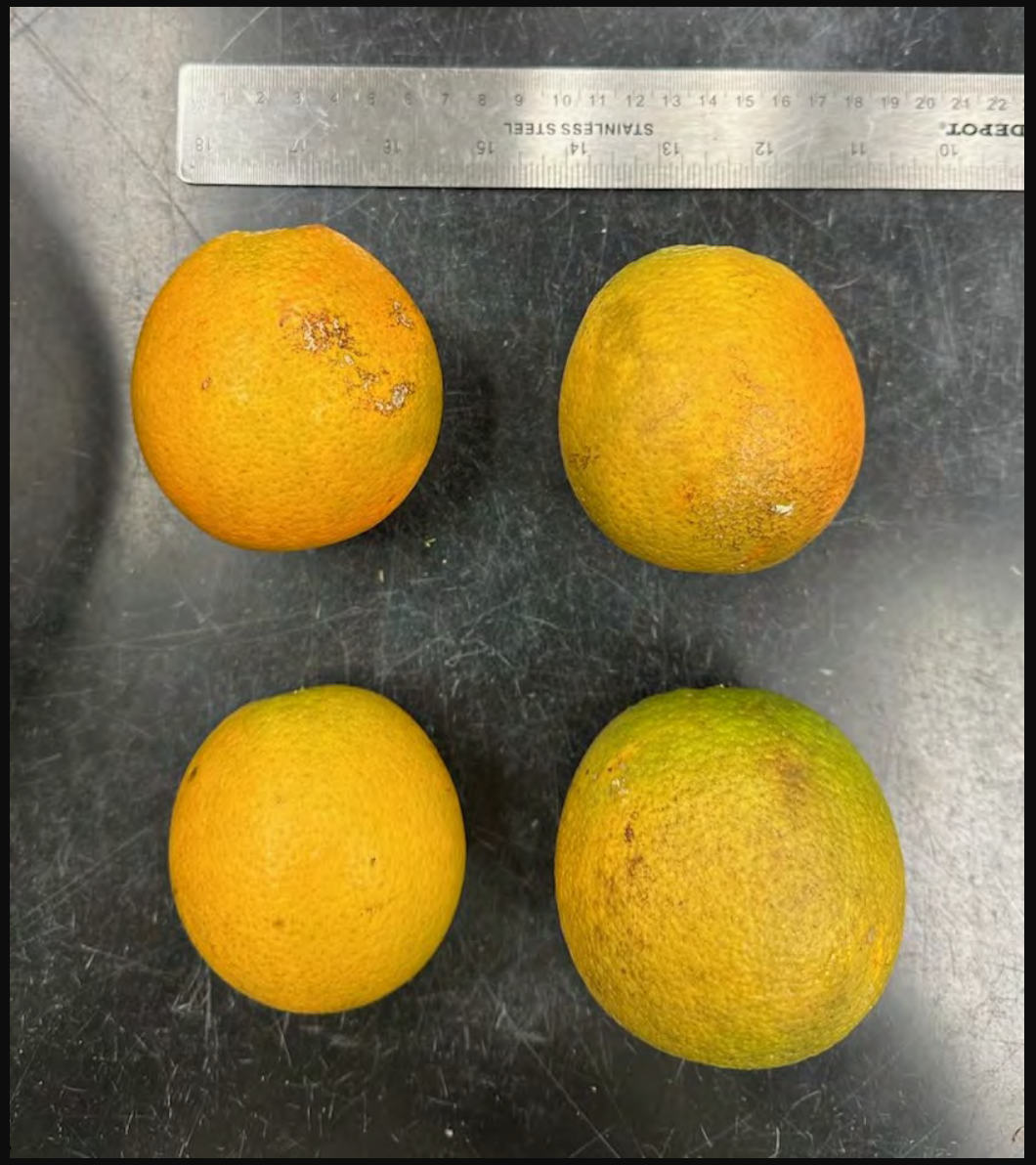
https://www.istockphoto.com/

TRUNK DISTRIBUTION

Non-injected side



Injected side

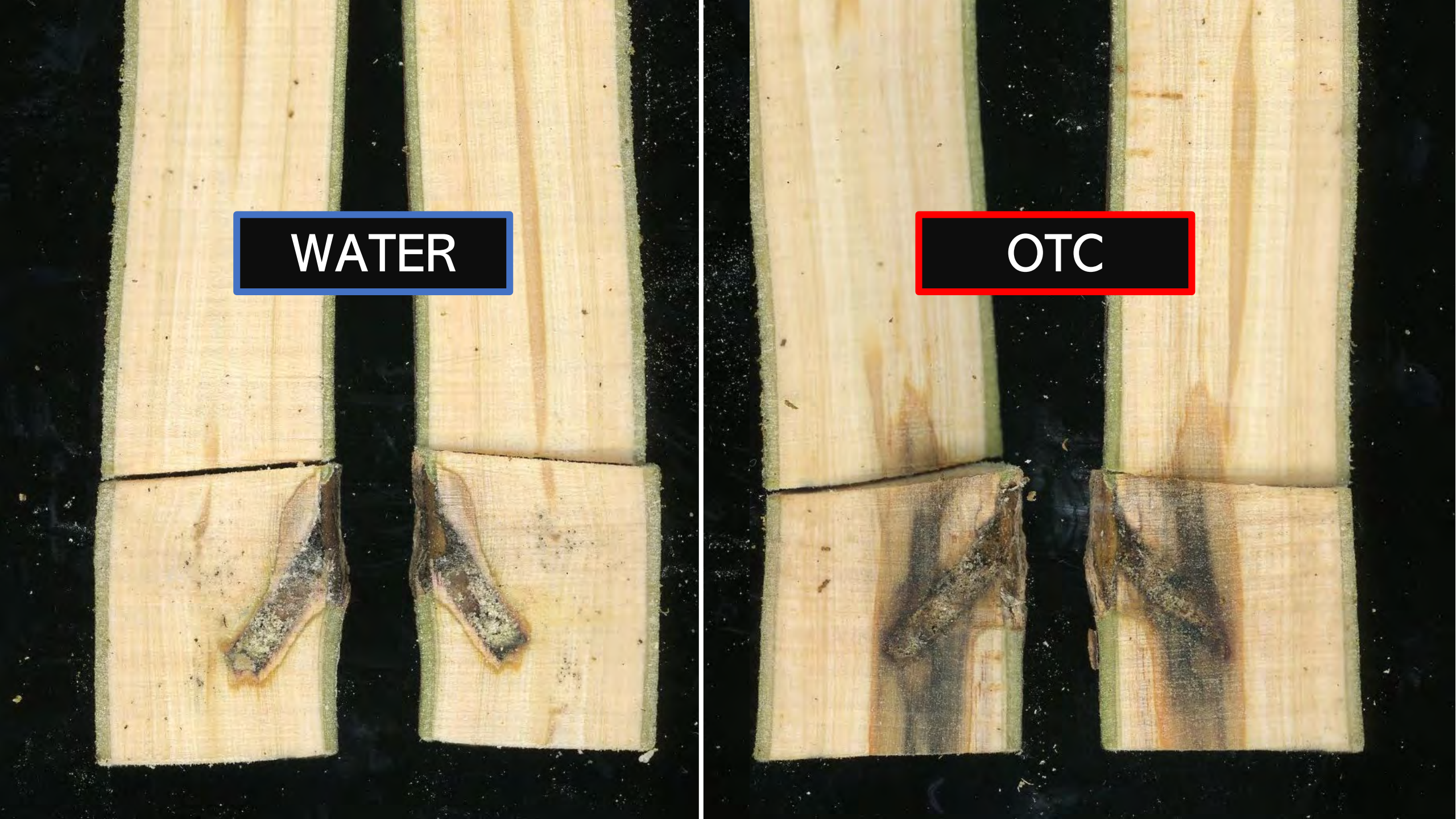


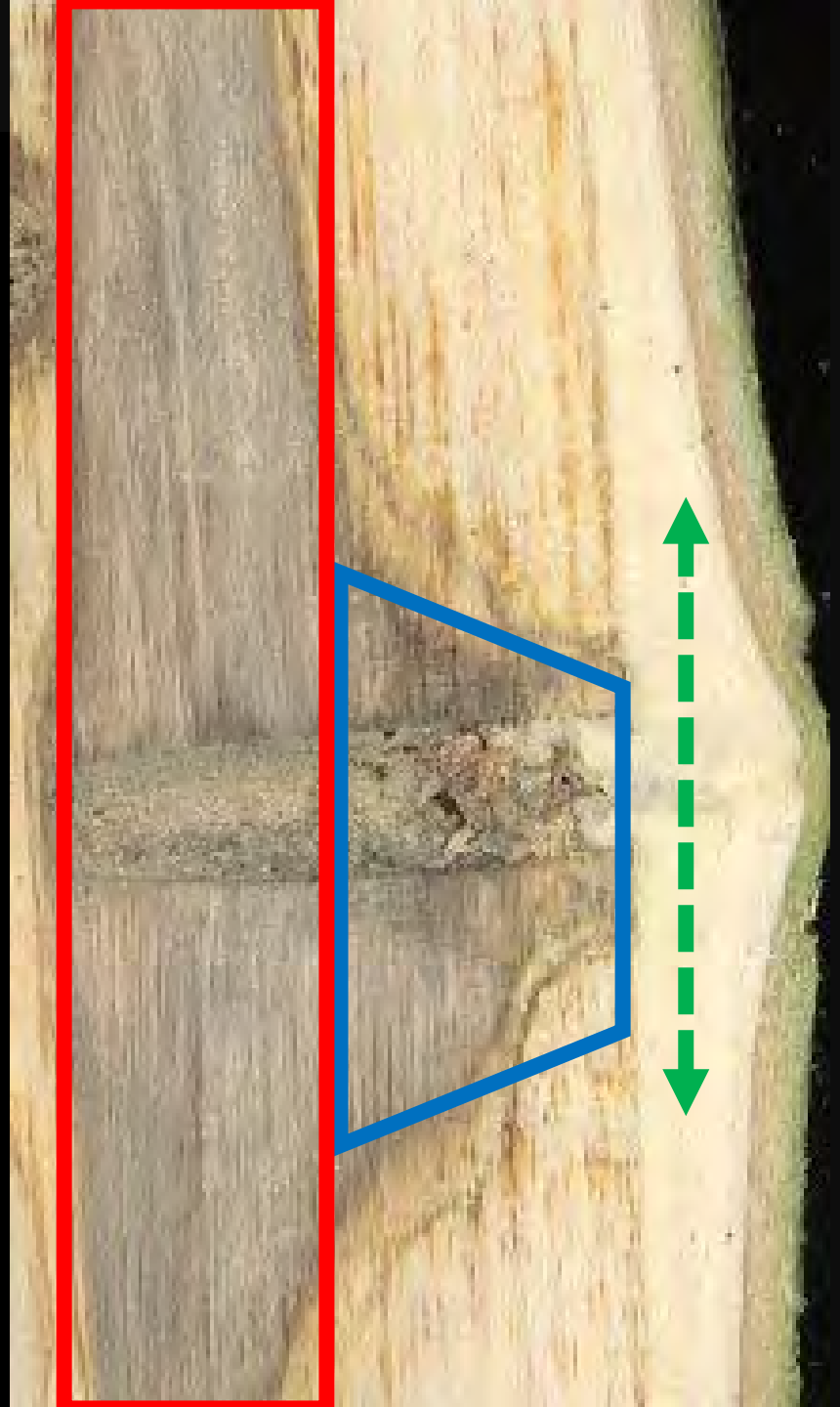

SECTORING

SEASONALITY OF WOUND CLOSURE

Month	Compound	4 MAI	8 MAI	12 MAI
June	Water	100%	100%	100%
October	Water	25%	58%	100%
June	OTC	0%	36%	83%
October	OTC	0%	0%	58%

Fall /winter injections delay wound closure


WATER
OTC

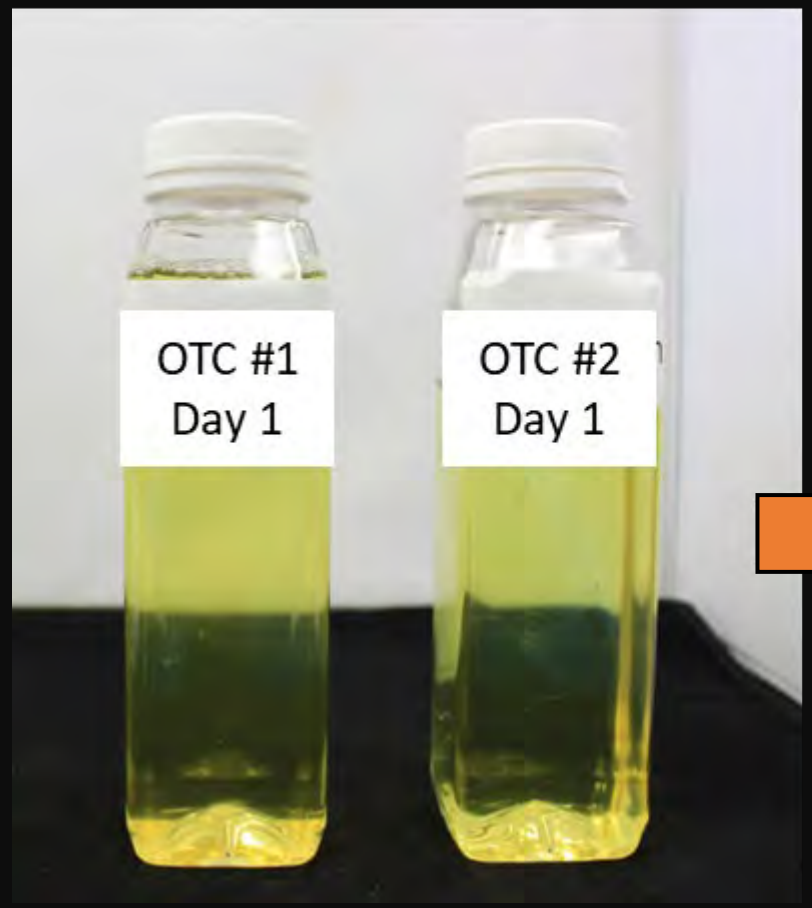


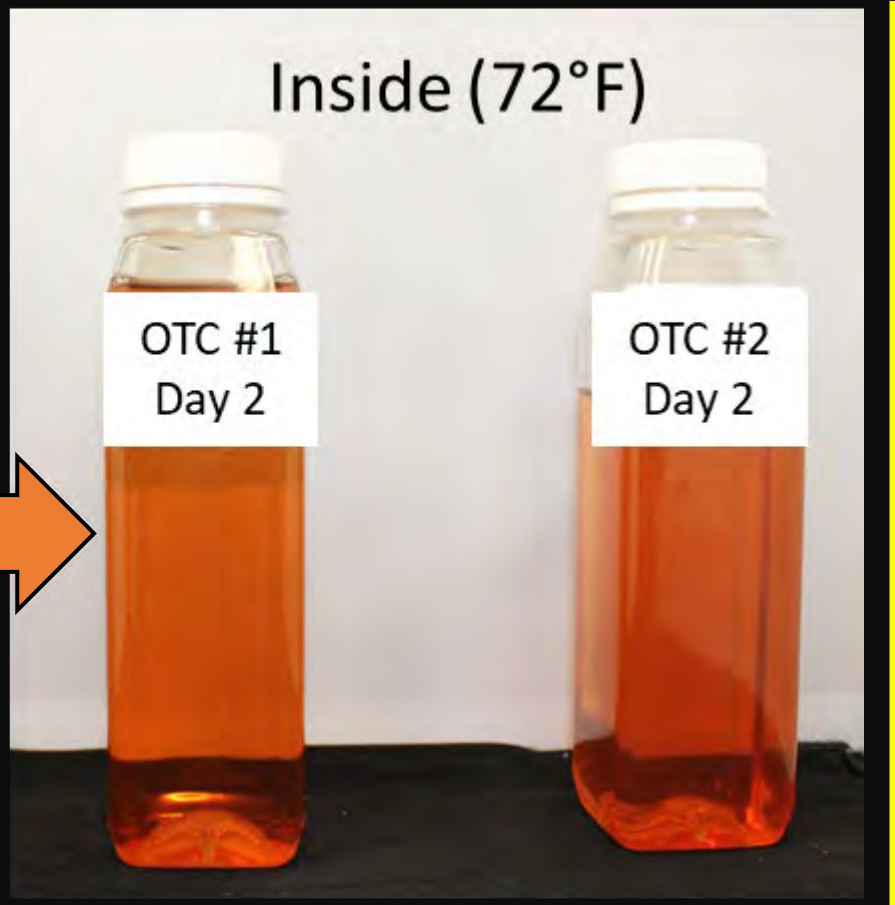
INJECTION DEPTH

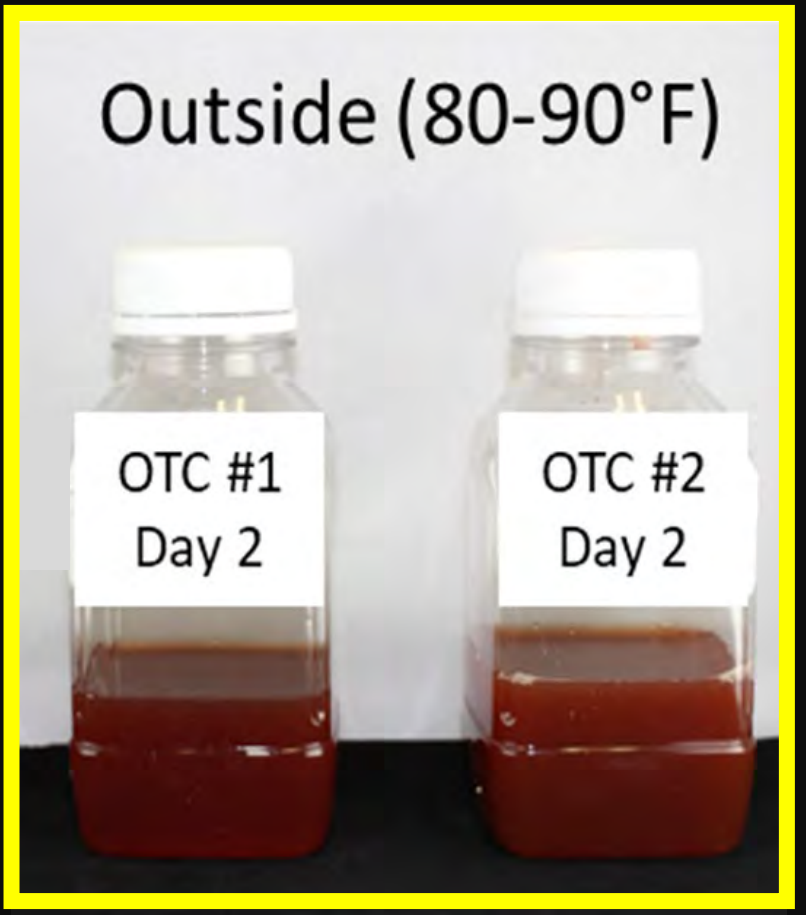
Younger wood is metabolically more active than older wood

Less discoloration in the younger wood compared with the older wood

FORMULATION STORAGE

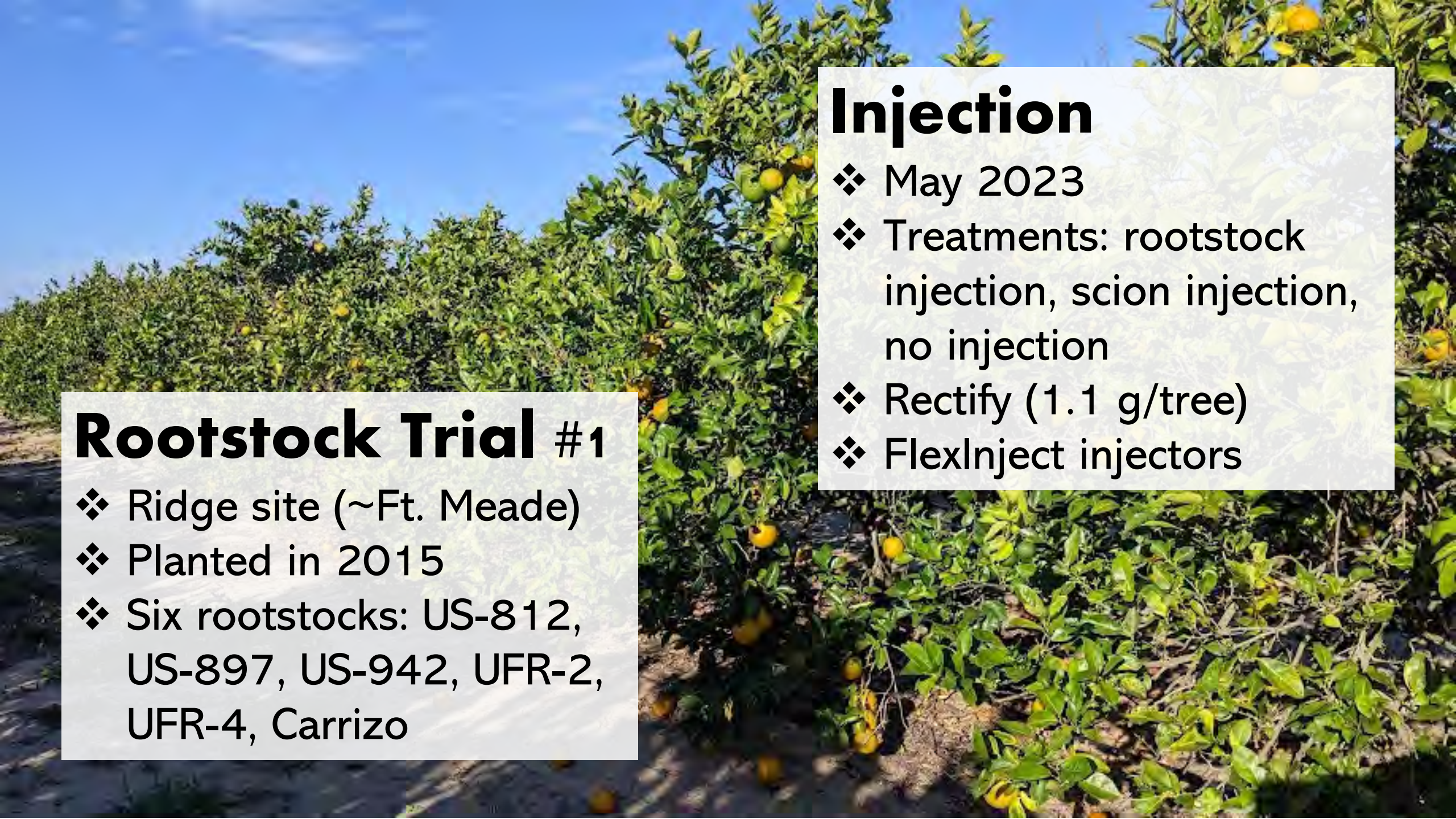






Use only freshly prepared OTC solution!

TRIAL UPDATES



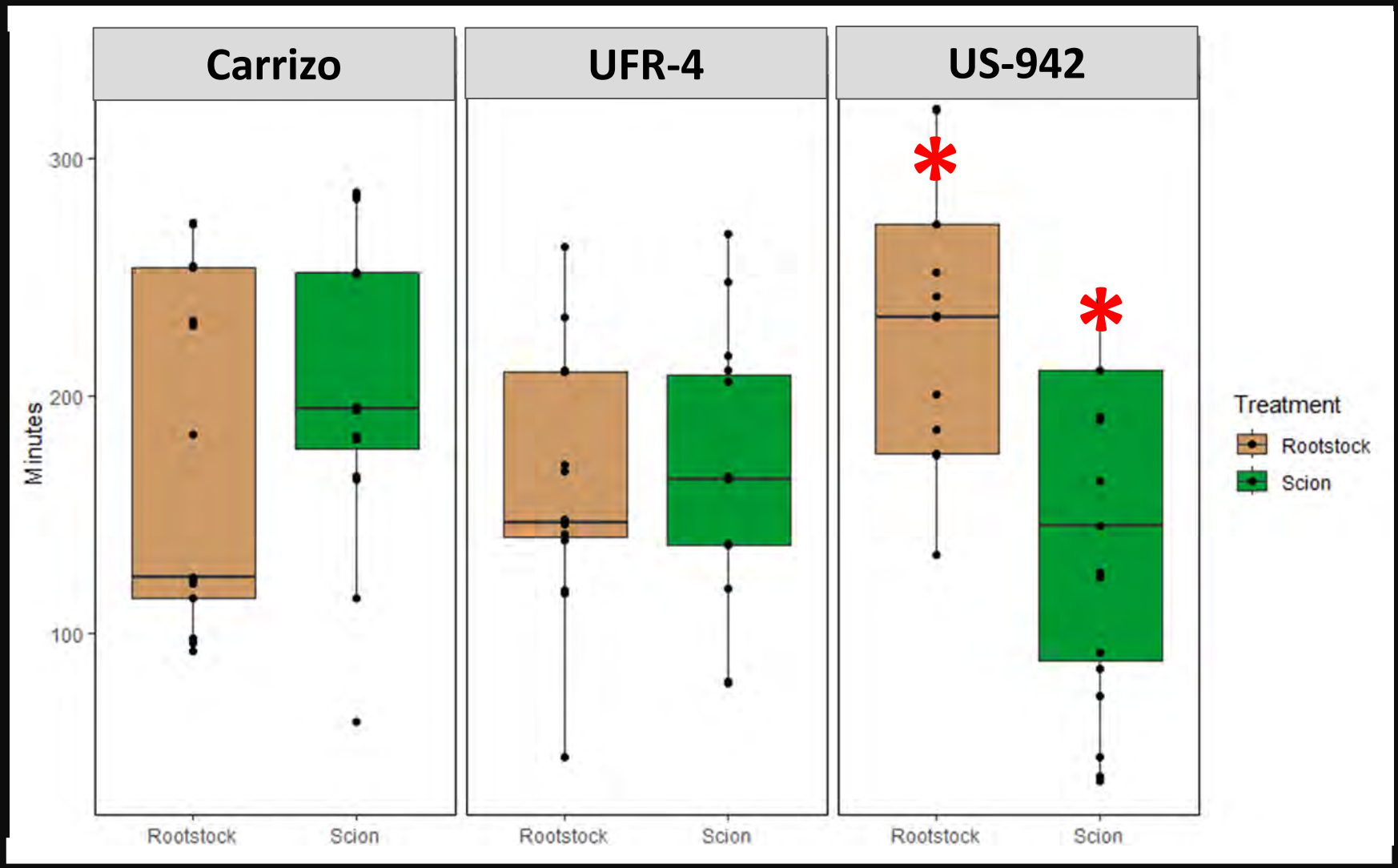
Rootstock Trial #1

- Ridge site (~Ft. Meade)
- Planted in 2015
- Six rootstocks: US-812, US-897, US-942, UFR-2, UFR-4, Carrizo

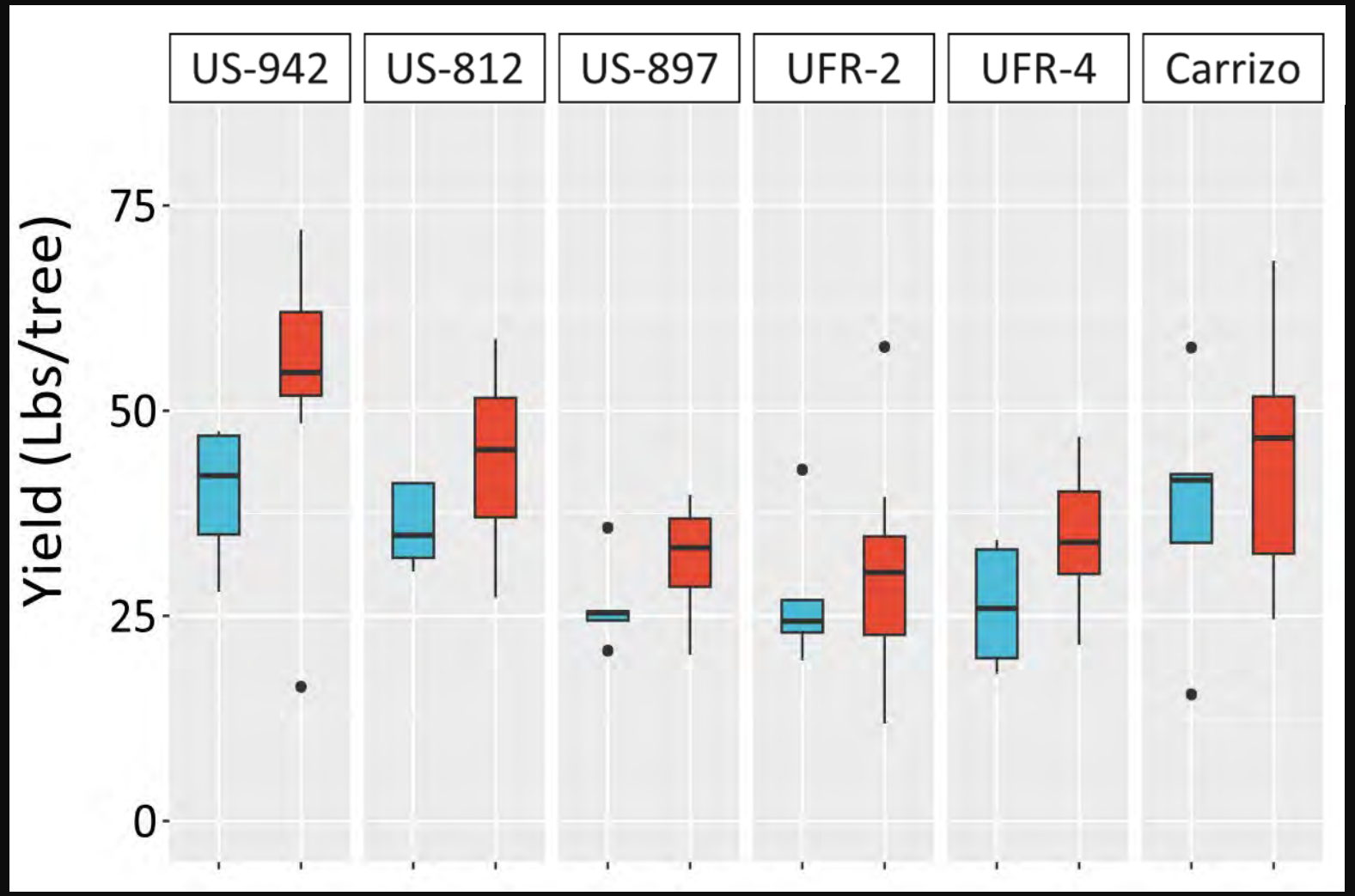
Injection

- May 2023
- Treatments: rootstock injection, scion injection, no injection
- Rectify (1.1 g/tree)
- FlexInject injectors

OTC UPTAKE RATE



ROOTSTOCK TRIAL 1 – YIELD (14 Feb 2024)



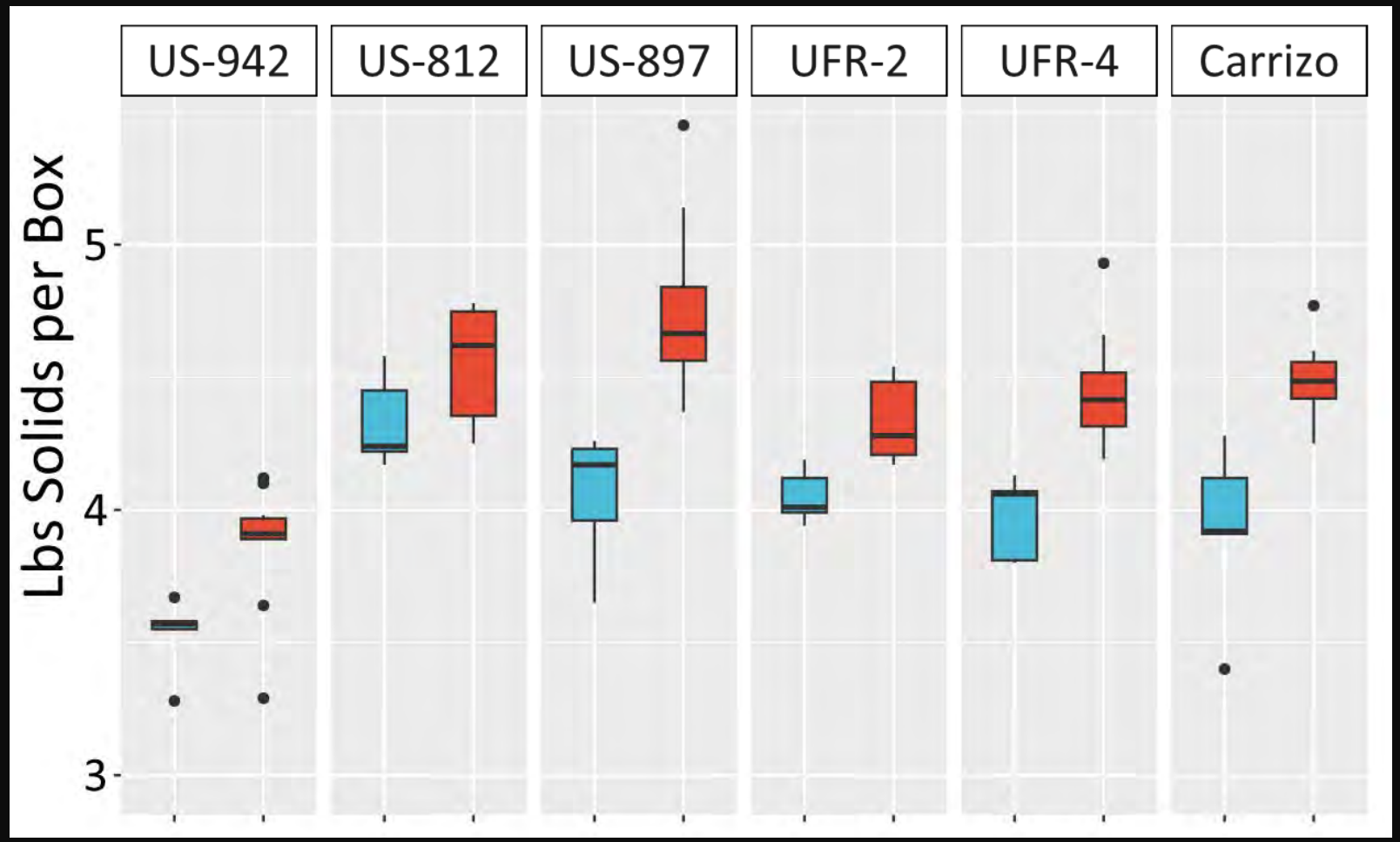
CONTROL: 32.4

INJECTED: 40.1

24%↑

- Significant rootstock differences
- Slightly higher yield with scion injection

ROOTSTOCK TRIAL 1 – SOLIDS (14 Feb 2024)



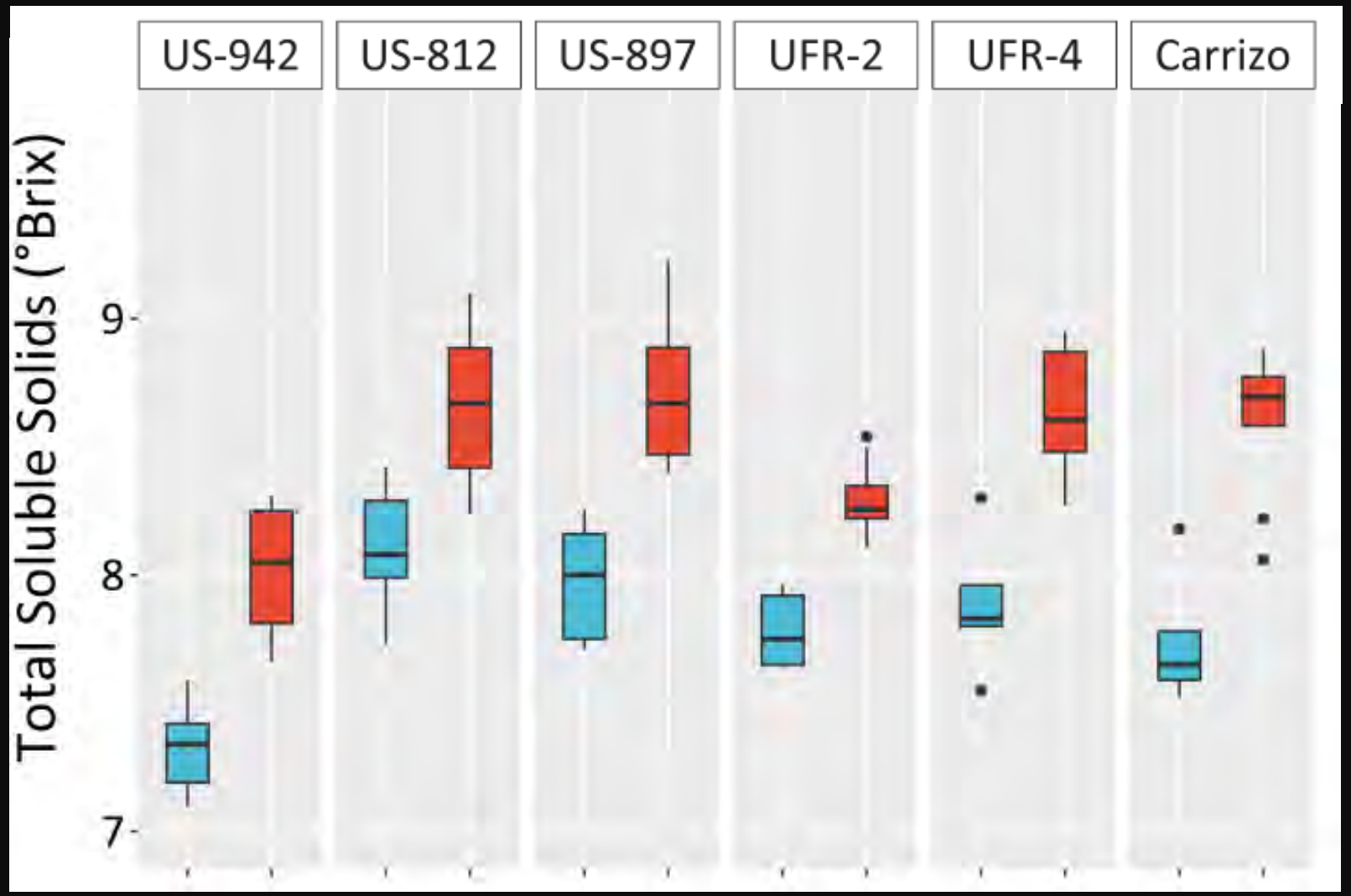
CONTROL: 4.0

INJECTED: 4.4

11%↑

- Significant rootstock differences
- No difference between scion and rootstock injection

ROOTSTOCK TRIAL 1 – BRIX (14 Feb 2024)



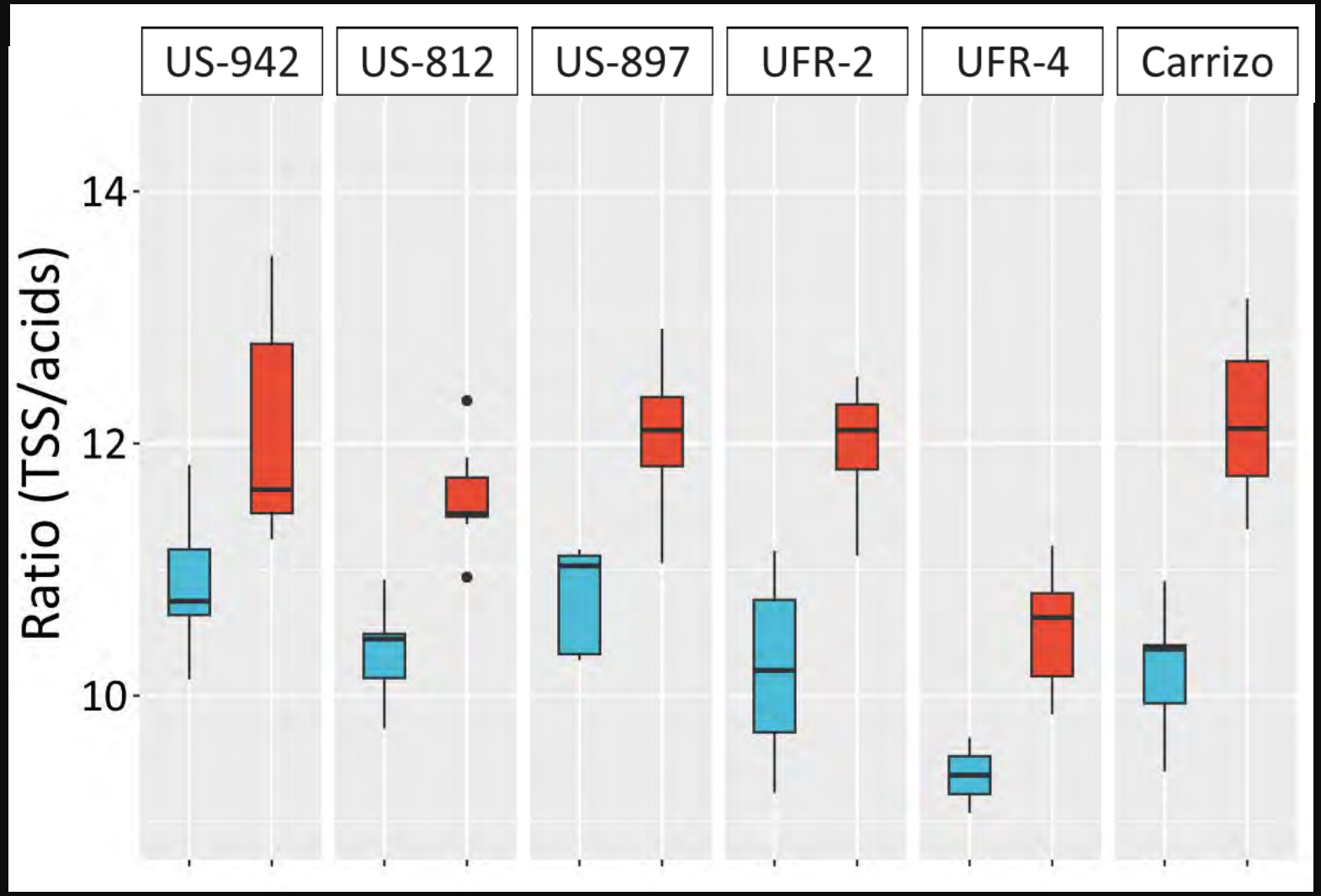
CONTROL: 7.8

INJECTED: 8.5

9%↑

- Significant rootstock differences
- No difference between scion and rootstock injection

ROOTSTOCK TRIAL 1 – RATIO (14 Feb 2024)



CONTROL: 10.2

INJECTED: 11.8

15%↑

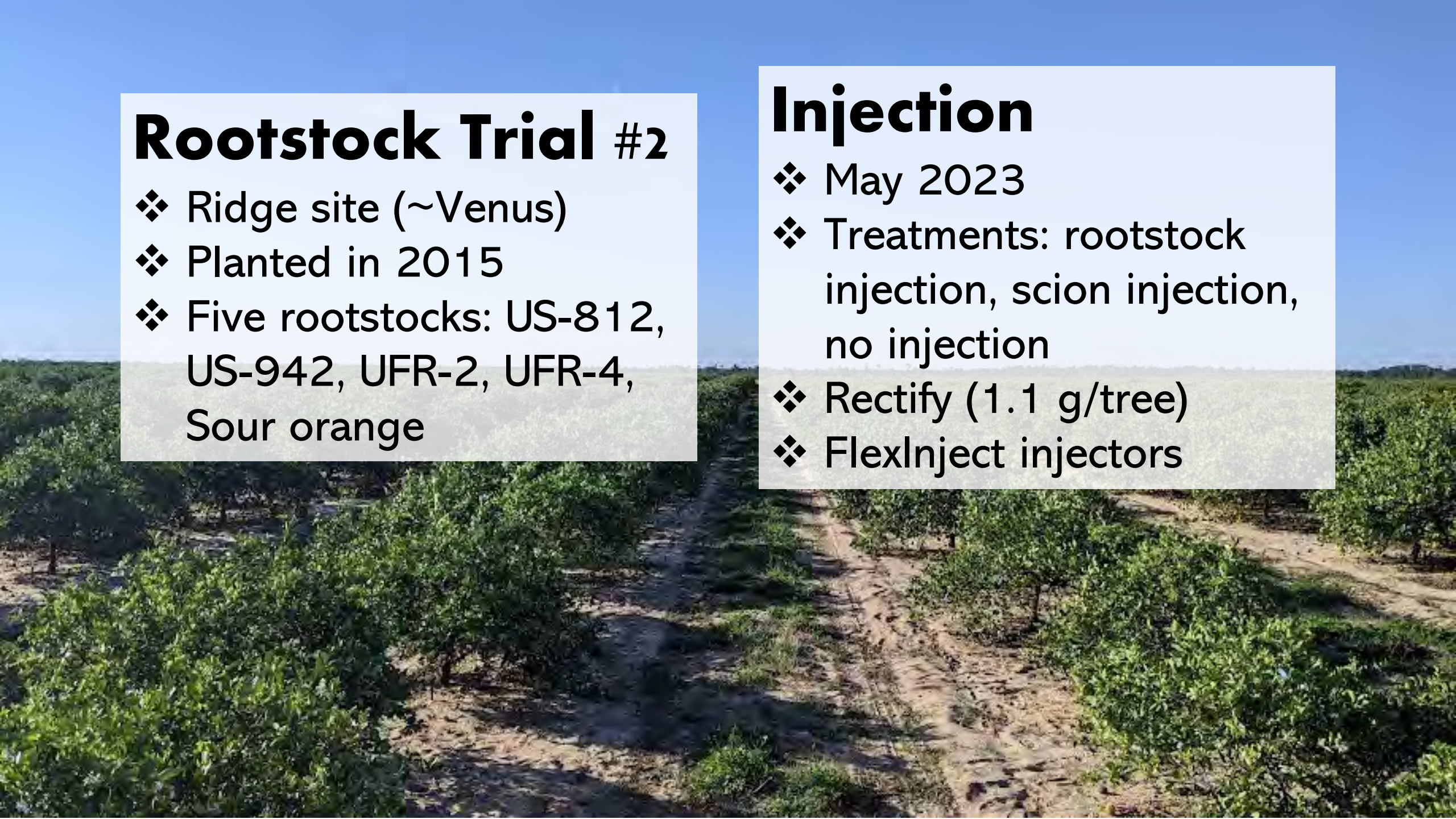
- Significant rootstock differences
- No difference between scion and rootstock injection

YIELD NEEDED TO OFFSET COSTS OF INJECTIONS

Percent Increase Relative to 100 Boxes/ Acre	Percent Increase Relative to 150 Boxes/Acre
16.7%	11.1%
17.1%	11.4%
17.9%	11.9%
18.7%	12.5%

	Boxes/acre (Valencia)		
	Control	Injected	% Increase
US-942	134	182	36
Carrizo	129	150	16
US-812	121	148	22
UFR-2	92	103	12
US-897	89	108	22
UFR-4	88	117	32
Avg.	**109**	**135**	**24**

Ariel Singerman, UF/IFAS, CREC
https://citrusindustry.net/2023/10/25/how-much-yield-is-needed-to-offset-the-cost-of-injecting-trees-with-oxytetracycline/



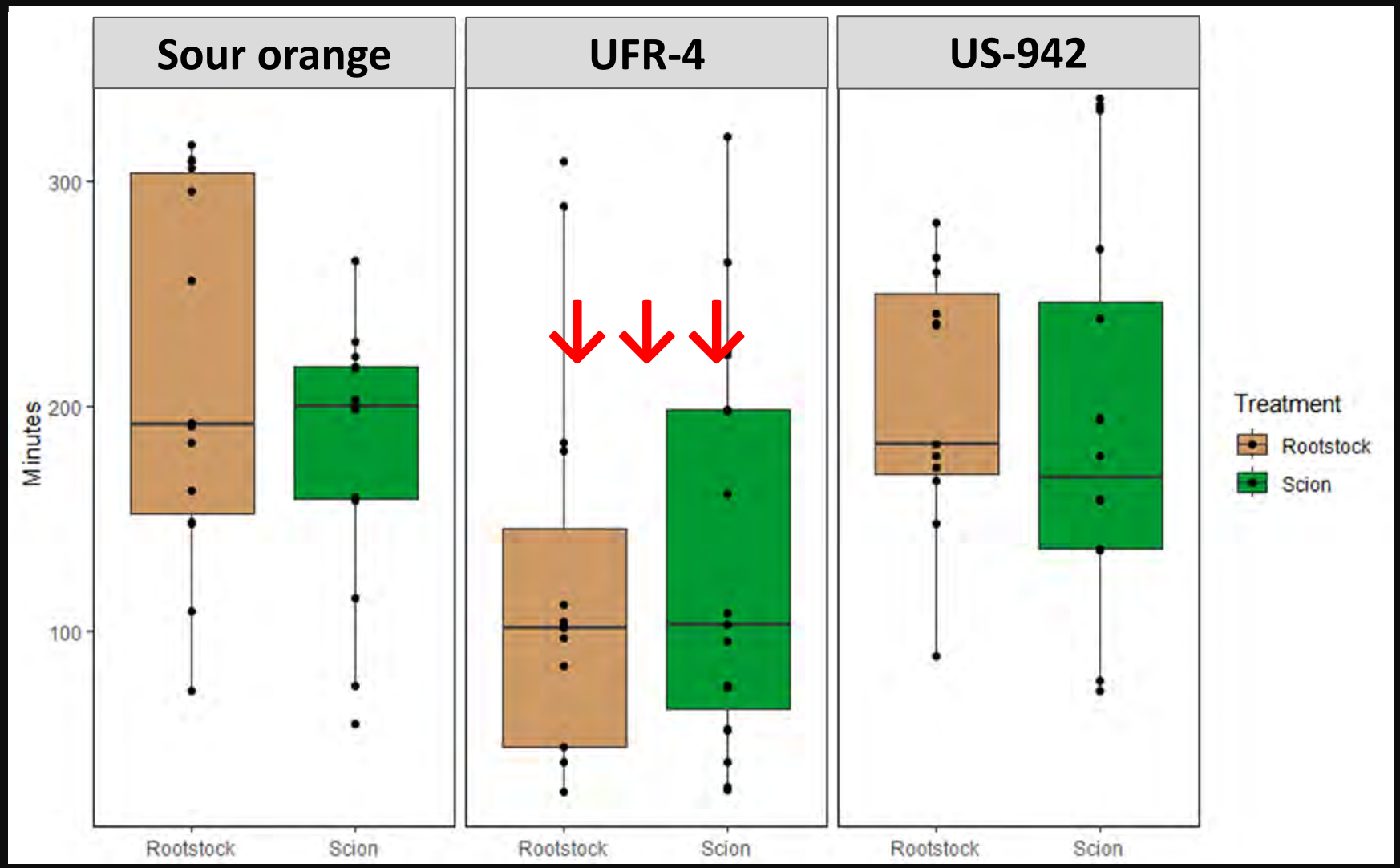
Rootstock Trial #2

- Ridge site (~Venus)
- Planted in 2015
- Five rootstocks: US-812, US-942, UFR-2, UFR-4, Sour orange

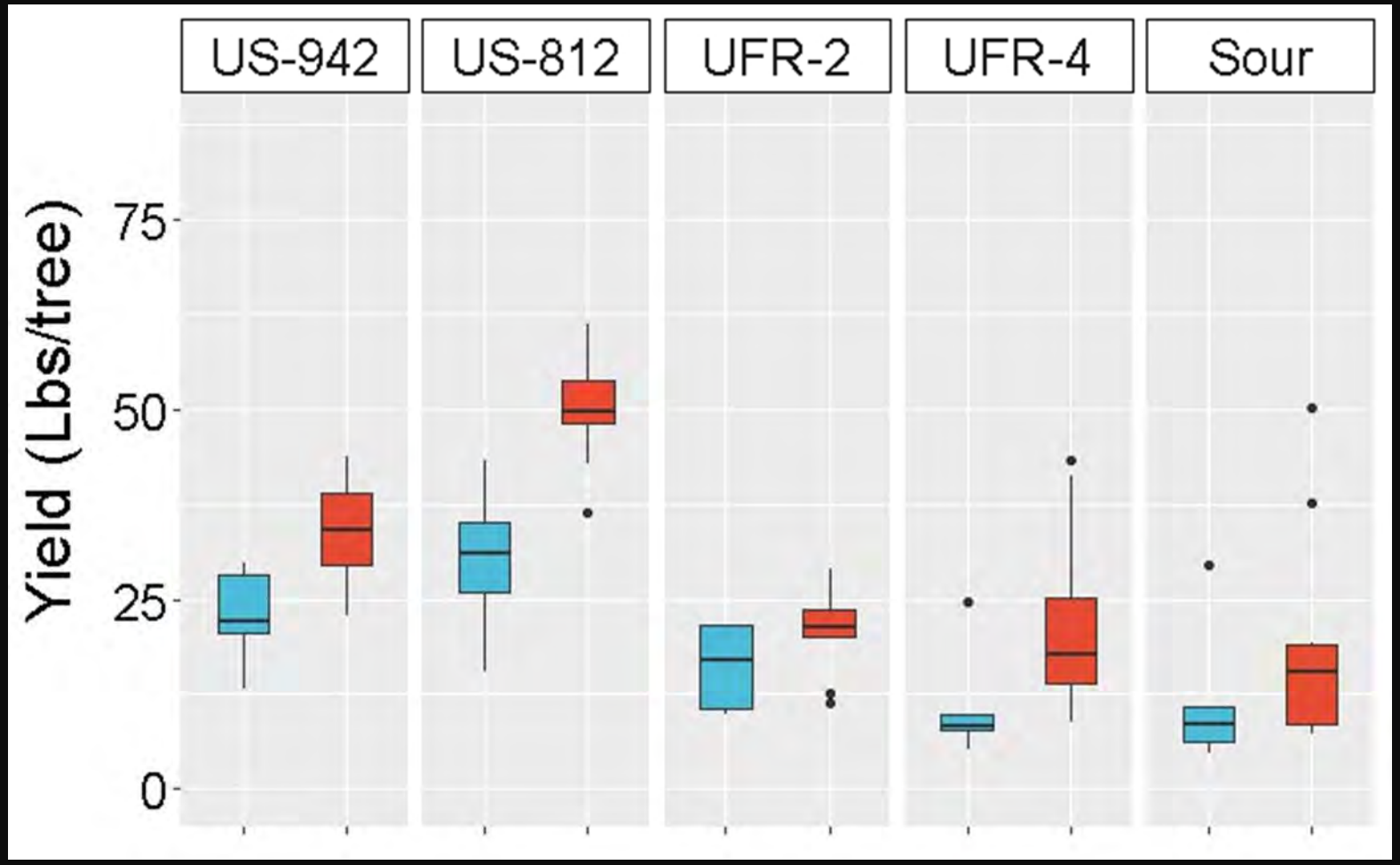
Injection

- May 2023
- Treatments: rootstock injection, scion injection, no injection
- Rectify (1.1 g/tree)
- FlexInject injectors

OTC UPTAKE RATE



ROOTSTOCK TRIAL 2 – YIELD (11 Mar 2024)



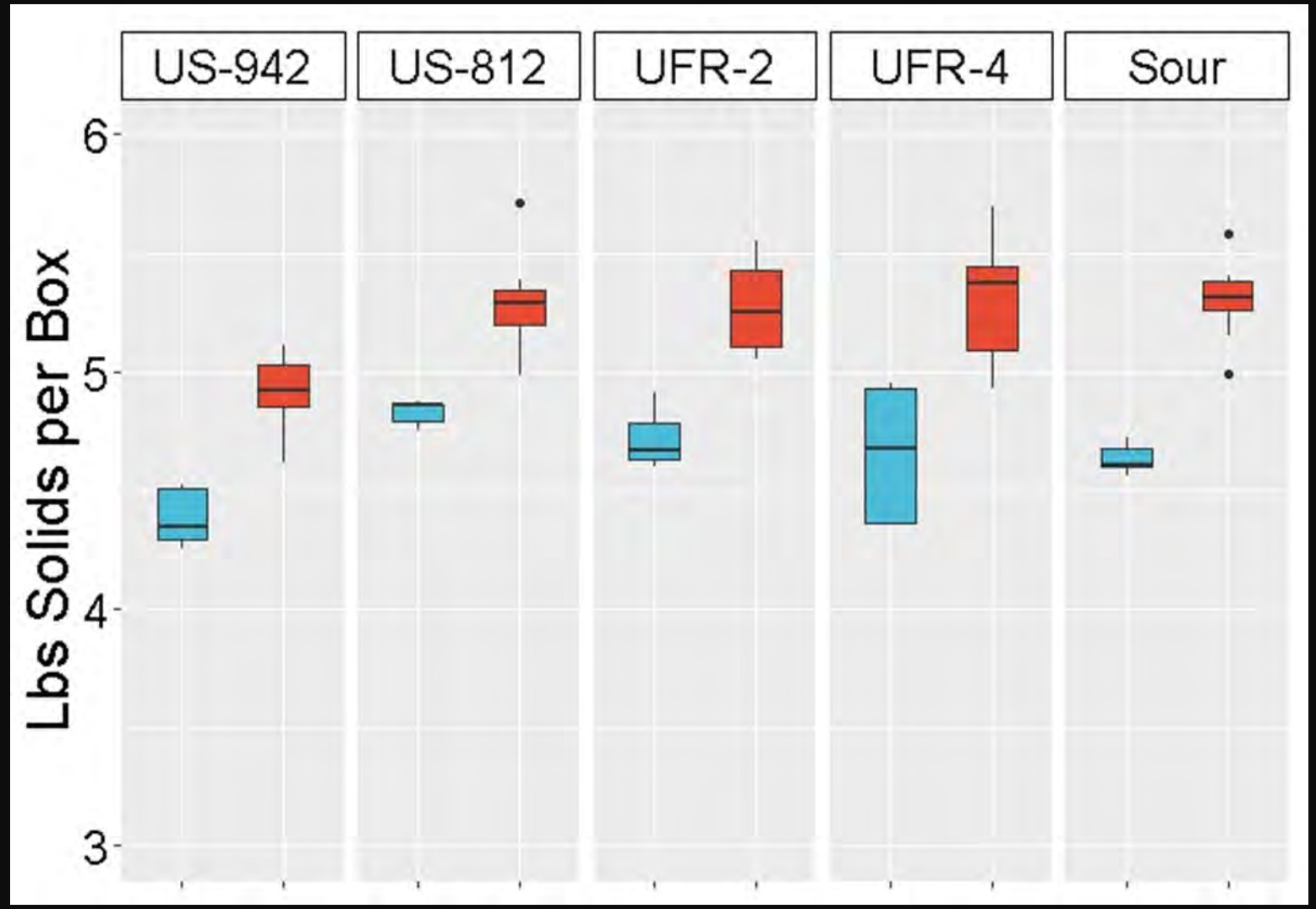
CONTROL: 18.4

INJECTED: 29.1

58%↑

- Significant rootstock differences
- No difference between scion and rootstock injection

ROOTSTOCK TRIAL 2 – SOLIDS (11 Mar 2024)



CONTROL: 4.6

INJECTED: 5.2

22%↑

- Significant rootstock differences
- No difference between scion and rootstock injection

YIELD NEEDED TO OFFSET COSTS OF INJECTIONS

Percent Increase Relative to Florida's 2022–23 Average Valencia Yield (51 Boxes/Acre)
32.8%
33.6%
35.1%
36.7%

	Boxes/acre (Valencia)		
	Control	Injected	% Increase
US-812	80	133	66
US-942	61	89	47
UFR-2	43	56	31
Sour or.	32	51	59
UFR-4	30	58	97
Avg.	**49**	**77**	**60**

Ariel Singerman, UF/IFAS, CREC
https://citrusindustry.net/2023/10/25/how-much-yield-is-needed-to-offset-the-cost-of-injecting-trees-with-oxytetracycline/

Injections

- June or Sep 2023
- Scion injection
- Rectify
- OTC (g/tree):
  - ✓ 0.55*
  - ✓ 0.825*
  - ✓ 1.1*
  - ✓ 1.65** (two-sided)
- FlexInject injectors

Valencia/Swingle

- Ridge site (~Ft. Meade)
- Planted in 2005

VALENCIA/SWINGLE TRIAL – YIELD (21 Mar 2024)

OTC rate	Lbs. fruit/tree	
Control	73	b
0.55 g/tree*	92	a
0.825 g/tree*	99	a
1.1 g/tree*	93	a
1.62 g/tree**	108	a
P-value	*0.0002*	

- Average yield increase of 34%
- No difference between low and high OTC rates!
- No differences between June and September injection

Control:
73 lbs/tree

Injected:
108 lbs/tree
48%↑

VALENCIA/SWINGLE TRIAL – JUICE QUALITY (21 Mar 2024)

OTC rate	Juice color	Brix	Brix/ acid	Lbs. solid /box
Control	36.8 b	8.4 c	11.4 c	4.4 c
0.55 g/tree*	37.1 ab	9.0 b	12.5 b	4.7 b
0.825 g/tree*	37.1 ab	9.2 b	13.0 b	4.8 b
1.1 g/tree*	37.1 ab	9.2 b	13.1 b	4.8 b
1.62 g/tree**	37.3 a	9.8 a	14.1 a	5.1 a
P-value	*0.0011*	*<0.0001*	*<0.0001*	*<0.0001*

VALENCIA/SWINGLE TRIAL – YIELD (21 Mar 2024)

Month	Lbs. fruit per tree	Brix	Lbs. solids/box	Juice color
June	101	9.1	4.79	37.06
September	95	9.5	4.97	37.24
P-value	*0.0735*	*<0.0001*	*<0.0001*	*0.0009*

Later injections can improve juice quality

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Suggested Use Pattern of Injectable Antimicrobials for Huanglongbing (HLB) Management (April 2024)

U. Albrecht, O. Batuman, and M.M. Dewdney[1]

This document is a suggested use pattern of injectable antimicrobials in Florida citrus. This is not an official University of Florida recommendation. Information is based on FIFRA Section 24(c) Special Local Need Label for ReMedium TI ®(10/28/2022) and Rectify™ (01/30/2023).

Antibacterial Product Application Schedule

The application schedule should be adjusted based on expected harv[illegible] and flowering. The [illegible]boxes indicate the possible timing of injection. Only one application per year is allowed for bearing trees, but non-bearing trees can be injected twice annually with a 4[illegible]th interval.

Citrus Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Early Season Varieties (Ex. Hamlin, Navel, Fallglo)												
Mid Season Varieties (Ex. Murcott, Pineapple, Midswee[illegible]												
Late Season Varieties (Ex. Valencia)												
Grapefruit (Ex. Ray Ruby, Flame, Ruby Red)												

The latest possible injection application should be determined [illegible]d on the 180-day PHI from the expected harvest date.
The color scale indicates the most desirable (dark red) to least desira[illegible]ht red) injection time.

Application

- DO NOT apply during bloom.
- DO NOT apply during leaf flushing.
- Recommended to apply when leaves are fully expanded for efficient uptake and distribution.
- Trees should be well-watered before and at the time of application.
- DO NOT apply during drought conditions.
- Leaf yellowing (phytotoxicity) may occur on the side of injection.
- ONLY inject once the product is fully dissolved.
- ONLY use freshly prepared solution.

Injection Sites

- Do not re-use injection sites.
- The rootstock is the recommended location for injection, but scion injections are also effective.
- Subsequent injections should be above or below the initial site by 2 inches and on the opposite side, or to the right or left by 2 to 3 inches.
- Do **NOT** use any post-wounding treatments as these may interfere with wound healing.

Other considerations

- Injection into the trunk can cause significant damage to the tree.
- Trees with a trunk diameter of less than 2.5 inches are prone to more damage.
- Minimizing the hole size will minimize tree damage.

THE LABEL IS THE LAW!
Refer to the label for additional information. This guide does not supersede the label.

ANTIBACTERIAL PROGRAMS DO NOT REPLACE ASIAN CITRUS PSYLLID MANAGEMENT PROGRAMS.

1. U. Albrecht, associate professor, Department of Horticultural Sciences, Southwest Florida Research and Education Center, O. Batuman, associate professor, Department of Plant Pathology, Southwest Florida REC, and Megan M. Dewdney, associate professor, Department of Plant Pathology, Citrus REC; UF/IFAS Extension; Gainesville, FL 32611.

Take Home Messages

- Field trials consistently demonstrate increases in yield and soluble solids after trunk injection of OTC when injections are performed properly
- Responses vary based on tree age, disease state, scion/rootstock combination, and other factors

“Each tree appears to be a law unto itself”

against parasitic attacks'. In his 1906 paper Bolley stated his belief that individual unhealthy trees could be saved by injection, and he mentioned using solutions of formaldehyde (½ to 2 parts per thousand), copper sulphate, and ferrous sulphate, which hastened recovery of apple-trees from sun-scald and checked development of Exoascus. He concluded by saying: 'Plum- and apple-trees when fed have produced more and better fruit, larger growth and sturdier foliage, than checked trees. The chief difficulty in the way of this work becoming practical seems to be that each tree appears to be a law unto itself.'

W.A. Roach (1939)

Plant Injection as a Physiological Method, Ann. Bot. 3(9):155-226

Thank You

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

Grower Collaborators


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