Sweet Oranges from the UF/IFAS Citrus Breeding Team

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UF/IFAS Plant Breeding

* The University of Florida has a history of improving several crop plant species for Florida's stakeholders

* Current activities range from conventionally breeding to importing germplasm from other countries to editing and transforming plants (CRISPR and transgenics), among other methods (somatic hybridization, somaclonal selection, etc.)

UF/IFAS Plant Breeding

* The UF/IFAS citrus breeders have released many cultivars and developed technology to improve sweet orange
* Some selections are sweet orange-like and may serve the industry in the near future
* Some material appears somewhat HLB tolerant; other material is highly susceptible

What is HLB tolerance?

* Ability of the tree to continue to produce commercial yields and quality despite being infected with HLB
* A trait that plants possess when they exhibit minimal disease damage despite substantial pathogen levels
* Tolerance promotes host health while having a neutral to positive impact of pathogen fitness

Purpose of this talk

* The take-home message is that there exists material that appears to be more tolerant than conventional standards

* Research is underway to determine the healthiest combinations and whether these selections will produce the yields and pounds solids required for profitability

* Whether the level of tolerance available translates into a sustainable enterprise with optimal caretaking and environment is unknown

UF Sweet Oranges Released

Where did they come from? Not from crosses!

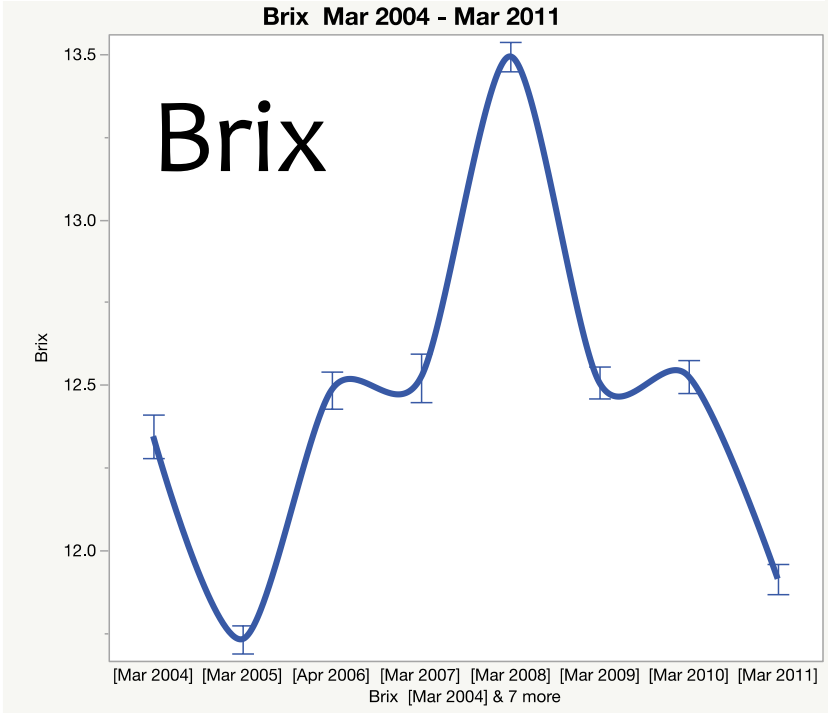
CREC Released Sweet oranges	Source
• B9-65 Valencia	organogenesis, adventive shoot
• OLL-4	somatic embryogenesis from callus
• OLL-8	somatic embryogenesis from callus
• N7-3 'Valenfresh'	somatic embryogenesis from protoplasts
• SF14W-62 Valquarius	somatic embryogenesis from protoplasts
• SF11-1-24 MidSweet	budwood irradiation
• N13-32 Hamlin	somatic embryogenesis from protoplasts
• EV-1 Early Valencia	organogenesis, adventive shoot
• EV-2 Early Valencia	somatic embryogenesis from protoplasts

2021 CREC Release	
• OLL-20	somatic embryogenesis from callus

Vernia was a CREC discovery (Dr. Bill Castle)

HLB tolerant Juice Oranges

* **B-9-65 Valencia** (marginal);
* **N13-32 Hamlin** (seems more than marginal; variable)
* OLL line releases: **OLL-4, OLL-8, OLL-20** (8 seems best)
  Unreleased: OLL-10 (seems healthy) and the DC line
* Sweet orange-like hybrids, but they are not technically sweet orange; **'Sugar Belle'** seems to be "tolerant"


Brix Mar 2004 - Mar 2011
Brix
13.5
13.0
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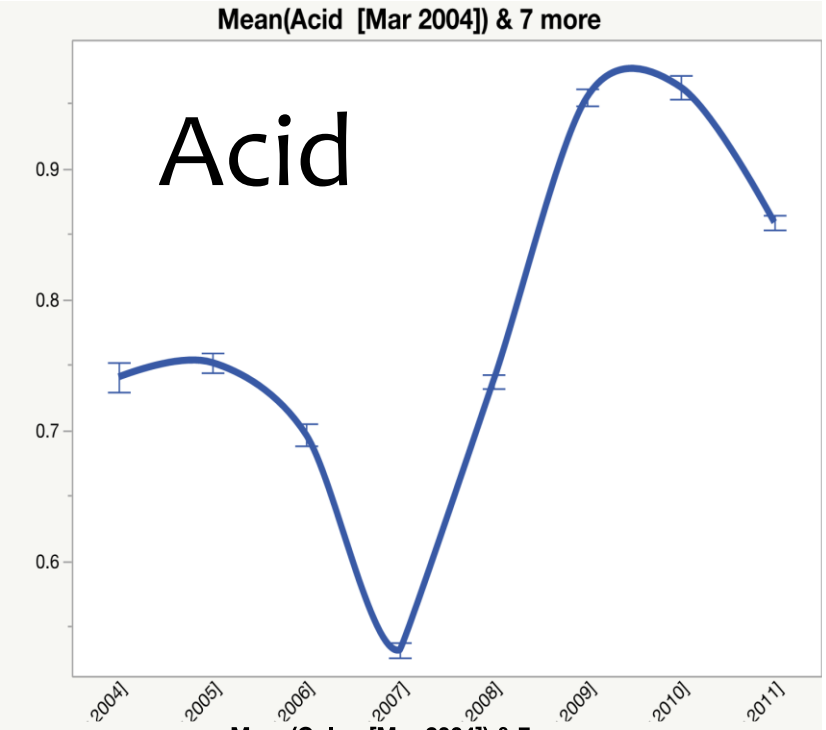
[Mar 2004] [Mar 2005] [Apr 2006] [Mar 2007] [Mar 2008] [Mar 2009] [Mar 2010] [Mar 2011]
Brix [Mar 2004] & 7 more


Mean(Acid [Mar 2004]) & 7 more
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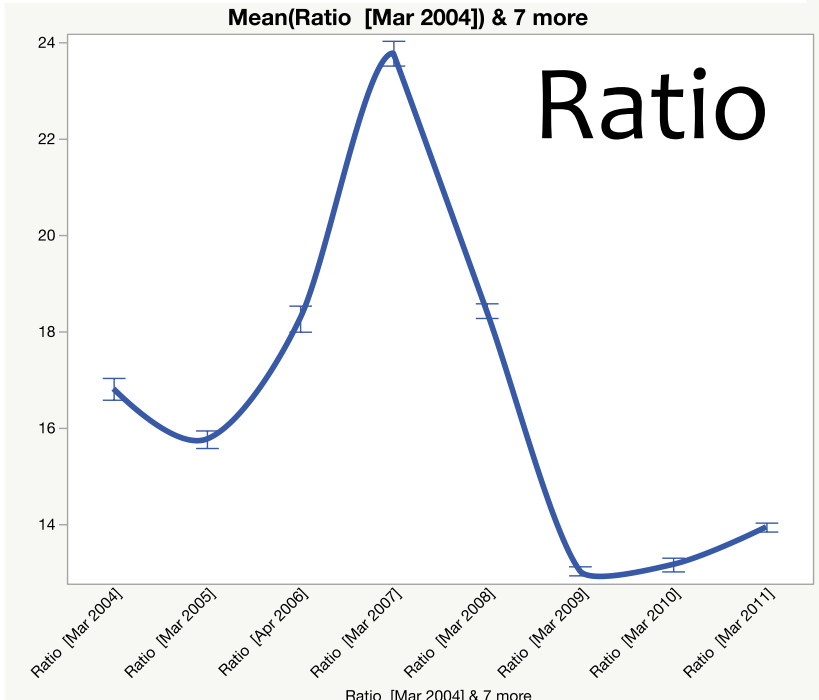
Mean(Ratio [Mar 2004]) & 7 more
Ratio
24
22
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Ratio [Mar 2004]
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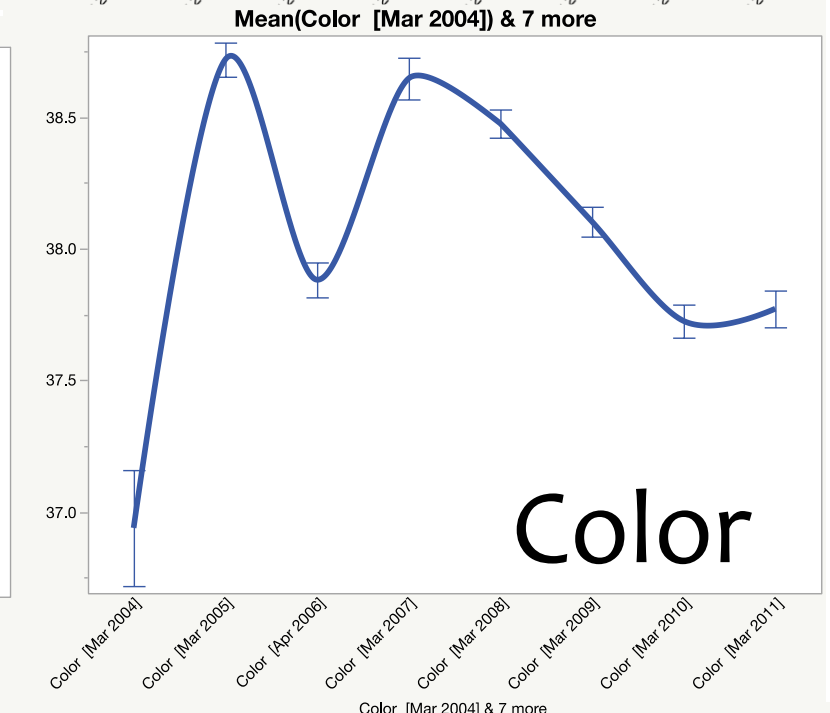
Mean(Color [Mar 2004]) & 7 more
Color
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37.5
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Color [Mar 2004]
Color [Mar 2005]
Color [Apr 2006]
Color [Mar 2007]
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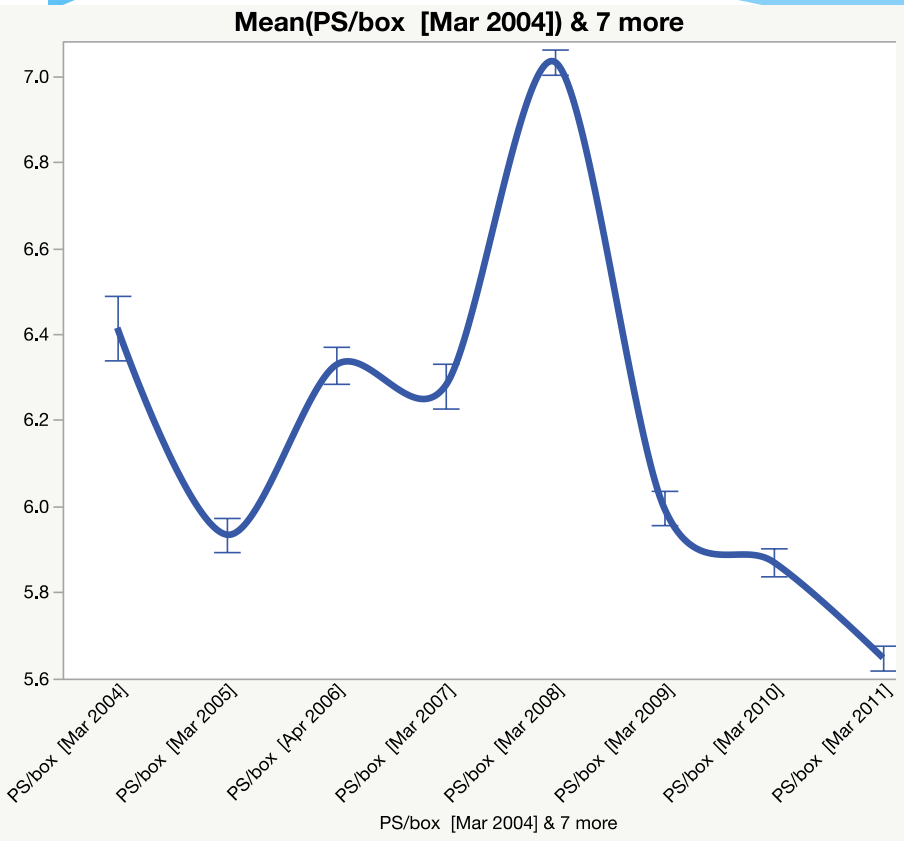
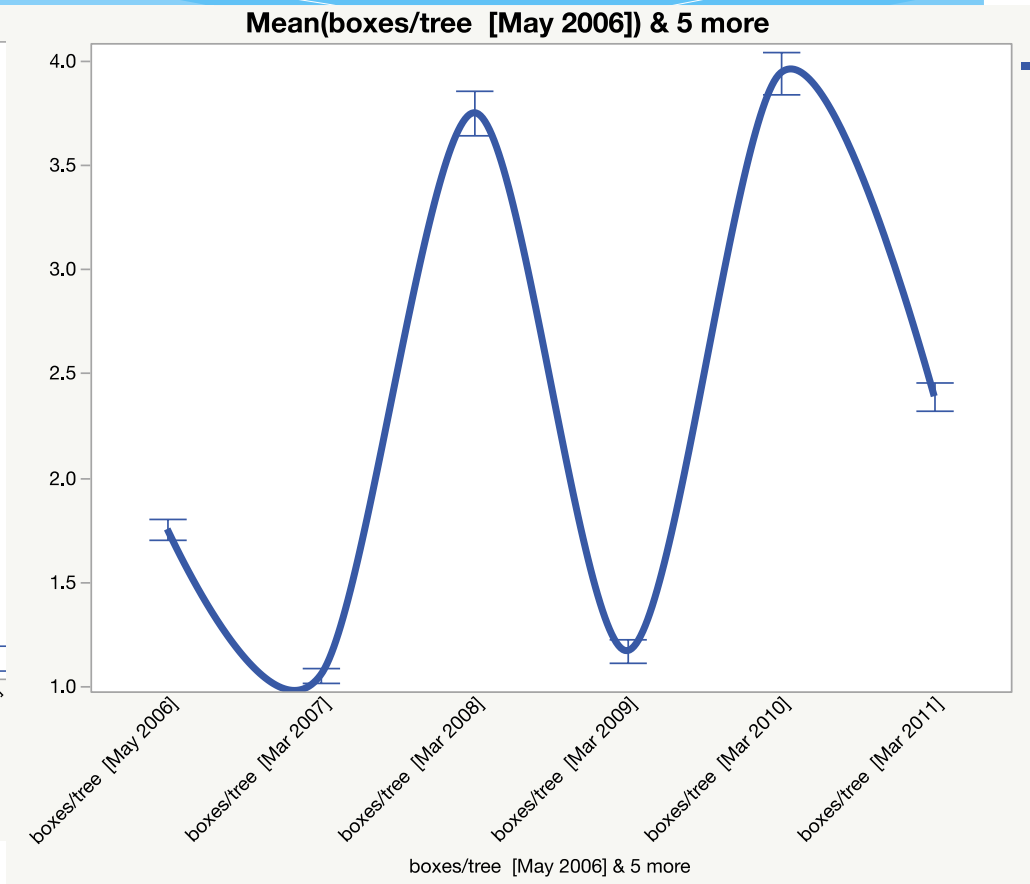
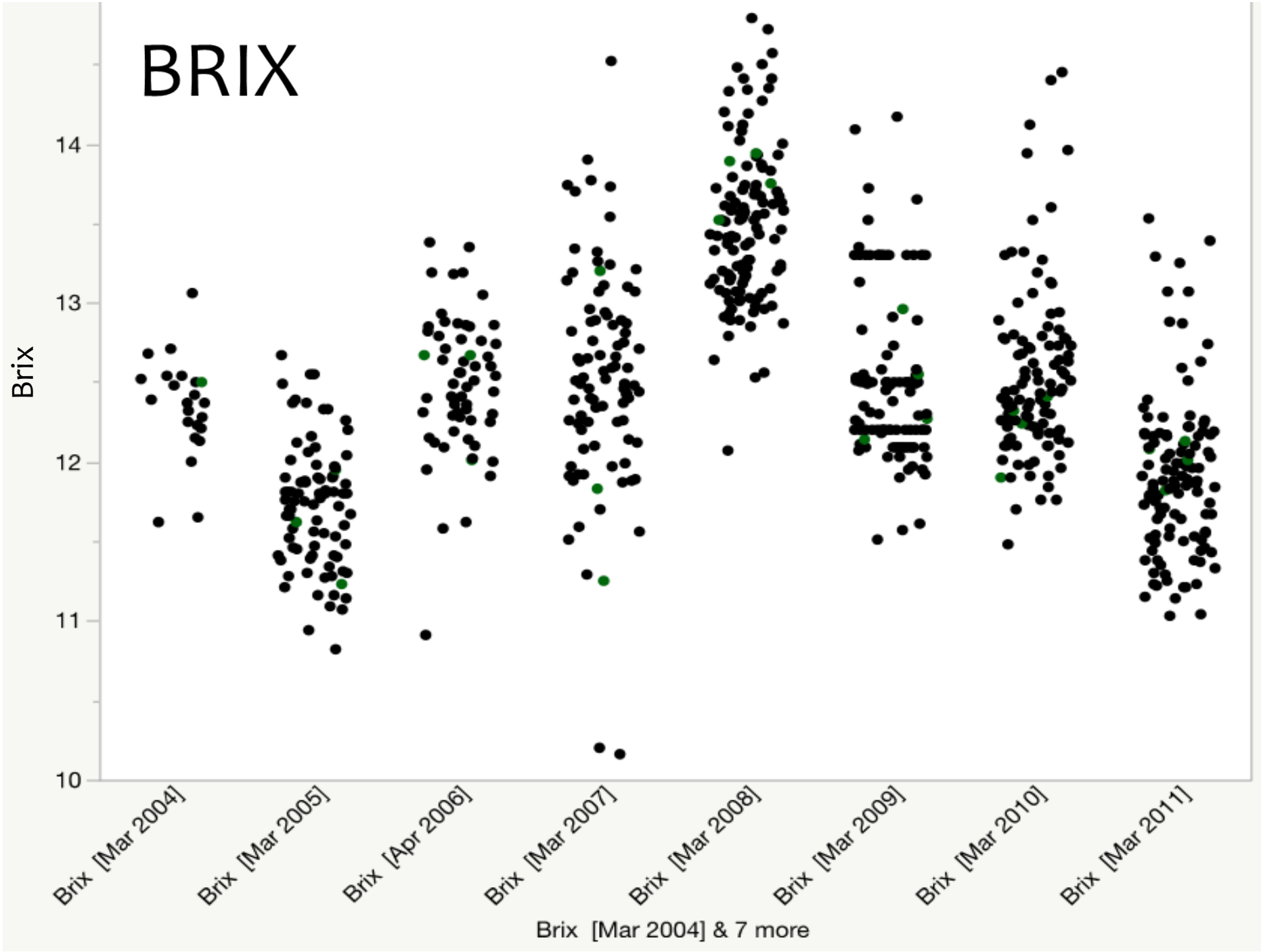
Color [Mar 2009]
Color [Mar 2010]
Color [Mar 2011]
Color [Mar 2004] & 7 more

PS/Box and Boxes/tree





‘Valencia’ alternate bearing: the power of long-term field research


BRIX
Brix
14
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Brix [Mar 2004]
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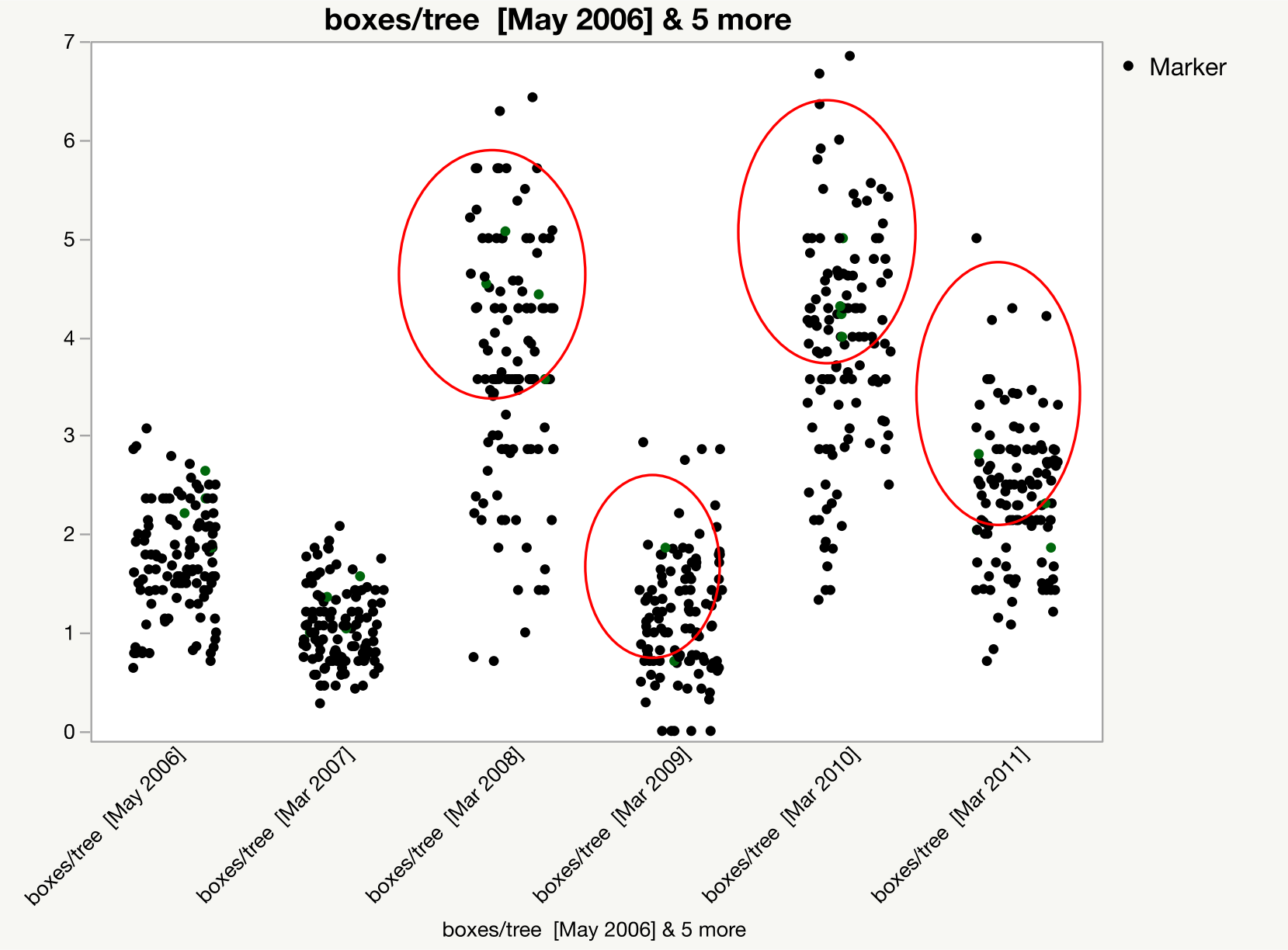
Brix [Mar 2007]
Brix [Mar 2008]
Brix [Mar 2009]
Brix [Mar 2010]
Brix [Mar 2011]
Brix [Mar 2004] & 7 more

Are these the ones that matter?



Results: Brix and PS/acre

	Mean						Cumulative
Selection	Brix*	Acid*	Ratio*	PS/box*	Boxes/tree**	PS/acre***	PS/acre ***
V-B-9-65	12.4	0.82	15.8	6.3	2.9	2,117	11,420
Appleby Val/J	12.2	0.84	15.2	6.2	2.9	2,113	11,038
V-10-12-7/M	12.5	0.79	16.5	6.2	2.7	1,935	10,194
V-T-4-43	12.2	0.82	15.6	6.1	2.6	1,809	10,047
V-10-12-7/J	12.4	0.81	15.9	6.3	2.6	1,871	9,852

- V-B-9-65 was the best performing scion in the trial (released by IFAS).
- Appleby (juvenile) was a close second, but the processors did not like the flavor (oil is different).
- Industry standard ranked far behind in 3rd place.

B9-65 Valencia (PP27,144) for processing

- A high yield, high solids selection with typical Valencia maturity, best of 30 selections for yield and soluble solids in trial at Conserve II.

B9-65 Valencia

* In the 2021/2022 budwood report, Valencia UF B9-65 had 11,794 propagations (2020/2021: 25,716)

* In my experience, B9-65 can have marginally better or equal health compared to conventional Valencia

* From what I have seen so far, B9-65 is not the answer to HLB, but may have better health compared to standards; consider some rows of B9-65 for comparisons

The OLL line

* Developed by Jude Grosser using somaclone methods.
* Tree health seems to be superior to Hamlin and Valencia under HLB conditions
* Several lines under evaluation
* Releases: OLL-4, OLL-8, and OLL-20

OLL Sweet Orange

OLL Sweet Orange

OLL Sweet Orange

OLL tolerance

OLL-8 (New data)

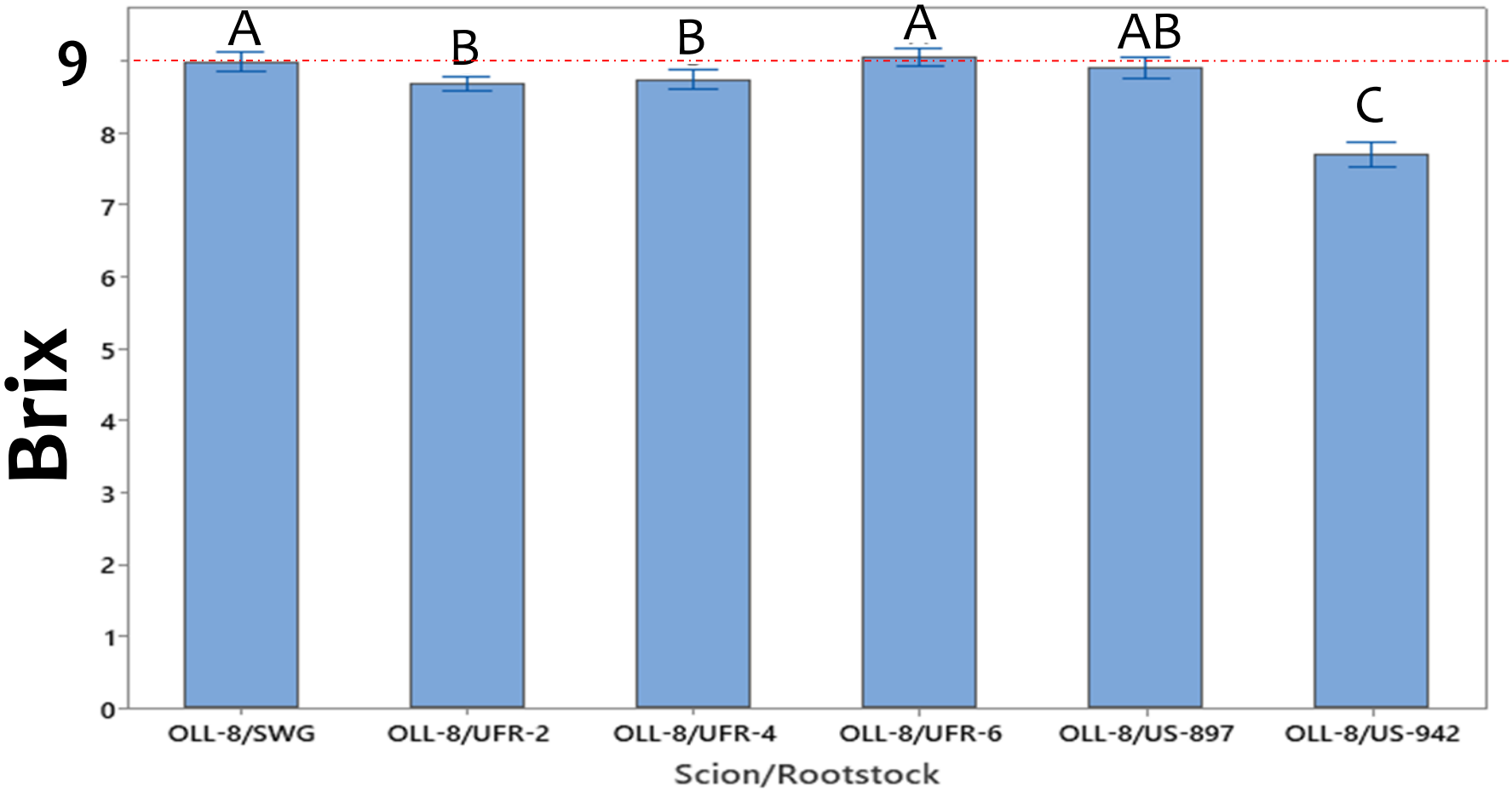


Figure 2. Average Brix across three sampling dates . Letters above bars indicate significant differences among treatment groups.

The OLLs (new data)

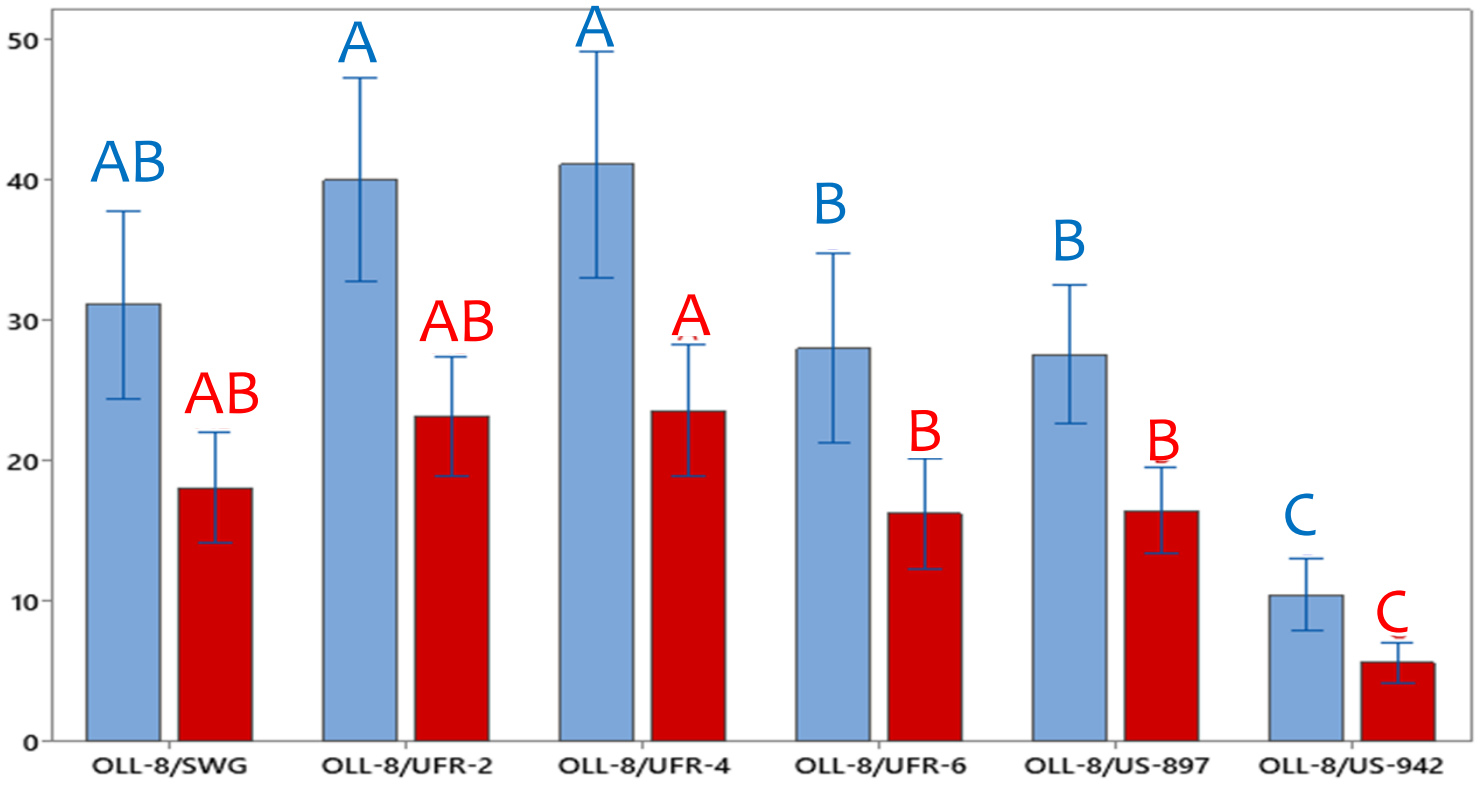


Figure 5. Average yield and juice weight per tree. Letters above bars indicate significant differences among treatment groups. Separate ANOVAs and post hoc tests were run for yield (blue) and juice weight (red).

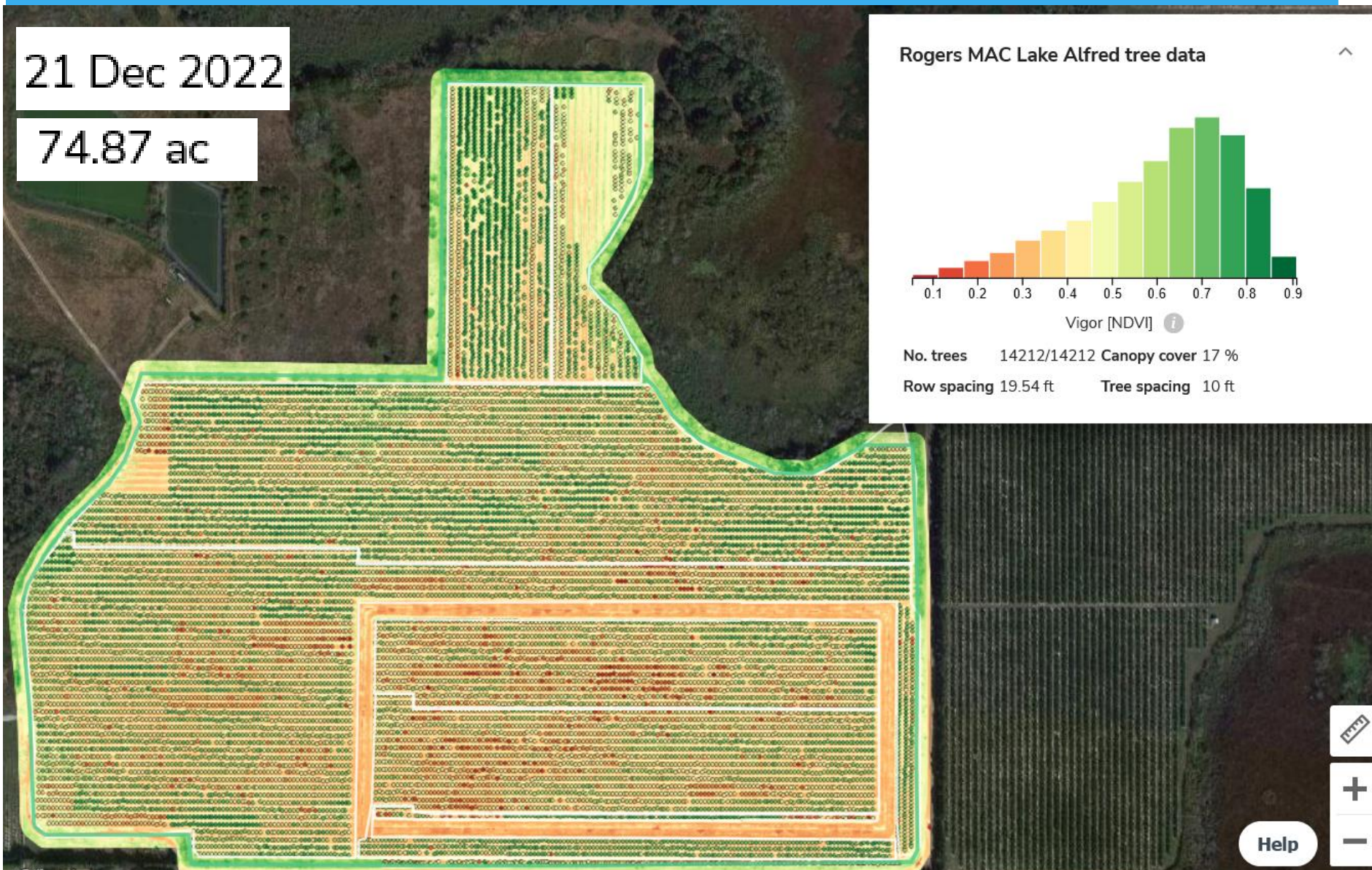
OLL propagations

* Sweet Orange UF OLL-8: 27,418 propagations in 2021/2022 report (37,235 in 2020/2021)
* Sweet Orange UF OLL-4: 7,824 propagations in 2021/2022 report (1,598 in 2020/2021)
* Valencia Mid UF OLL-20: 1,898 propagations in 2021/2022 (2,236 in 2020/2021)

N13-32 Hamlin

N13-32 on UFR-4

Polk County Trial A



N13-32 Hamlin

Hamlin 13-32

* Hamlin UF N13-32: 23,739 propagations in 2021-2022 report (about 8% of the early oranges, doubled from previous year)
* UFR-4 seems to be a good rootstock for this selection, although other rootstocks seem to work as well
* DNA sampling underway to identify best clones

Good Hybrid Juice
December color for blending

Several sweet orange-like hybrids have been selected for OJ improvement and entered into the PTP; some with better HLB tolerance

ie. 1859
3-3-52
KE-6-3
C4-15-50
C7-11-7

UF 1859 Hybrid

- Original tree has good HLB tolerance
- High Brix, tropical flavor notes
- Attractive fruit for fresh market
- Juice processing characteristics TBD
- Included in MAC, topworking, and nursery trials

18 year old tree in 2021

Conclusions

* UF/IFAS has material that seems to be tolerant to HLB. We also have seemingly resistant rootstock material under evaluation
* Whether planting solid blocks of this material will result in a sustainable enterprise is under investigation
* Several growers are trying UF/IFAS material; if you have interest in seeing or trialing UF/IFAS sweet oranges, fresh fruit, or lemons, contact me

We work for you

* UF/IFAS will continue to work hard on a solution for this vital industry

* Thank you for staying in the battle against HLB

Thank you, CRDF!

* Questions? Feedback? Leads?

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