

Flavor Quality of New Citrus Cultivars in Florida

Anne Plotto¹, Liz Baldwin¹, Jinhe Bai¹

Greg McCollum¹, Fred Gmitter², Ed Stover¹

¹U.S. Horticultural Research Laboratory, Fort Pierce, FL

²University of Florida, CREC, Lake Alfred, FL

Flavor Quality of New Citrus Cultivars in Florida

1. Flavor in a population of tangerine hybrids
 - *Dr. Fred Gmitter, UF*
2. Consumer perception of US Early Pride versus Fallglo
 - *Dr. Greg McCollum, USDA-ARS*
3. Flavor of Citrus x *Poncirus* hybrids
 - *Dr. Greg McCollum, USDA-ARS*

Tangerine Hybrids

Anne Plotto¹, Liz Baldwin¹, Jinhe Bai¹

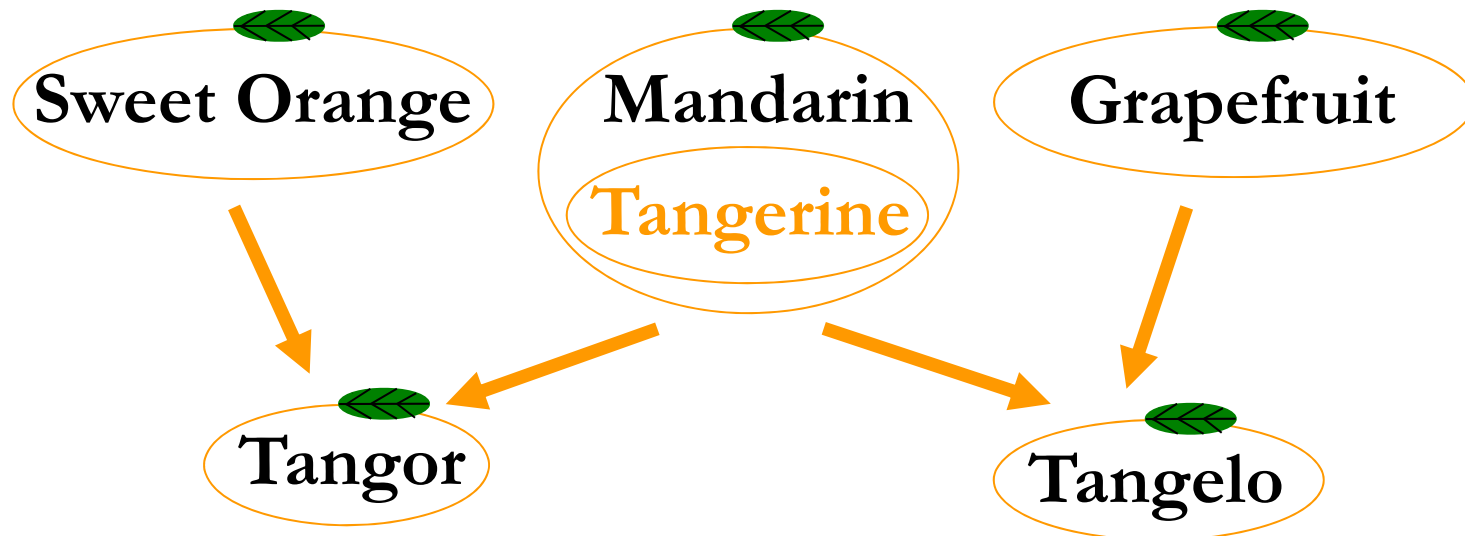
Fred Gmitter², Filomena Valim³

¹U.S. Horticultural Research Laboratory, Fort Pierce, FL

²University of Florida, CREC, Lake Alfred, FL

³ Florida Department of Citrus, Lake Alfred, FL

Tangerine (*C. reticulata* Blanco)



Example of Tangerines

- **Murcott (Honey)** = Tangor
- **Fallglo** = Bower (Clementine × Orlando) × Temple Tangor
- **Fairchild** = Clementine × Orlando Tangelo



The most phenotypically diverse group in Citrus!

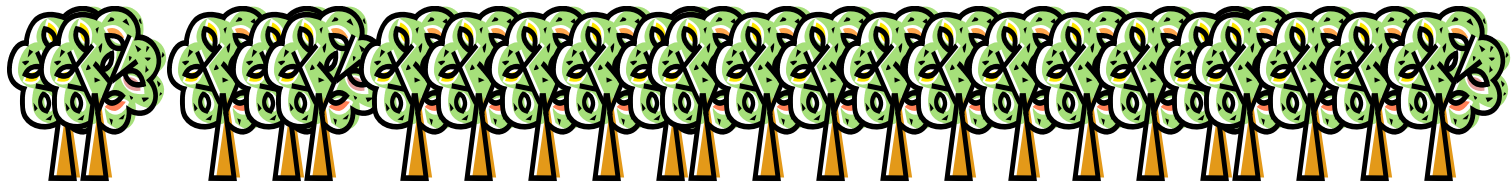


Objectives

- To identify quality attributes in a population of tangerine hybrids.
- To describe these attributes by sensory evaluation.
- To correlate tangerine sensory attributes with chemical data.
- *In the long term, to understand characteristics of “good” tangerine fruit and to find quality markers for use in Marker Assisted Breeding.*

Tangerine material

1. Identify flavor profile from hybrid population



2. Maturity of advanced selections



3. Consumer studies





Which hybrid to evaluate?

- Samples chosen because of their parentage and a preliminary flavor screening:

2006-07

42 hybrids and **13** named commercial cultivars, multiple harvests

2007-08

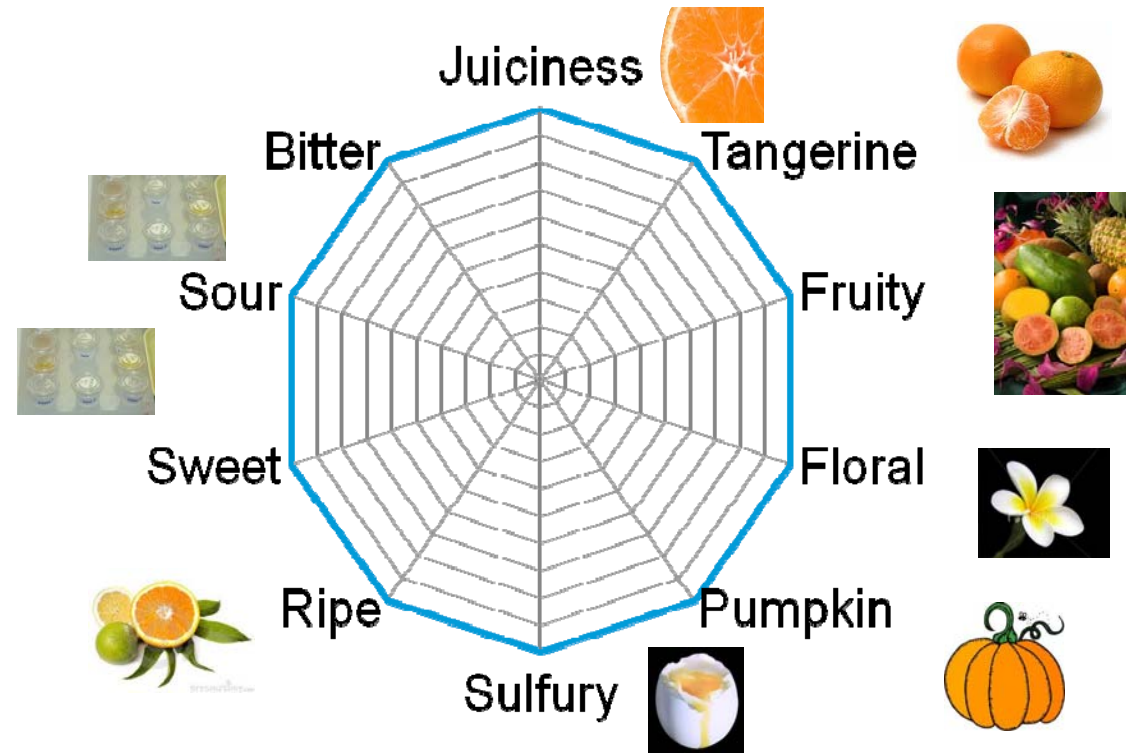
16 samples (**4** Commercial) from the previous year
9 new samples

2008-09

21 samples (**7** Commercial) from the previous years

Sensory descriptive analysis

- 10-15 panelists
- Trained each year (~ 20 hours)
- Ballot development
- Reference standards



Sensory descriptive analysis

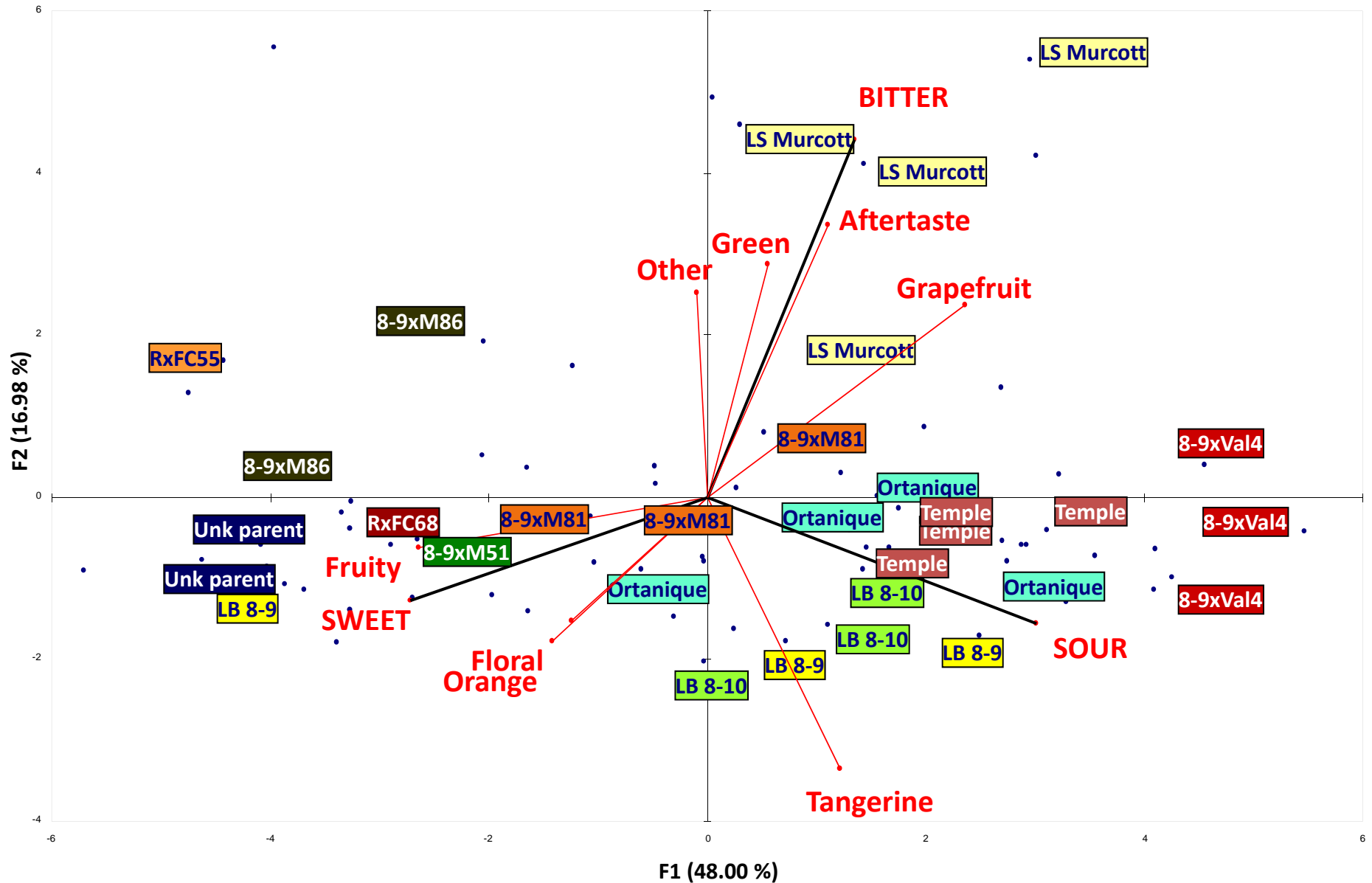


0 · 1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9 · 10 · 11 · 12 · 13 · 14 · 15
low medium high

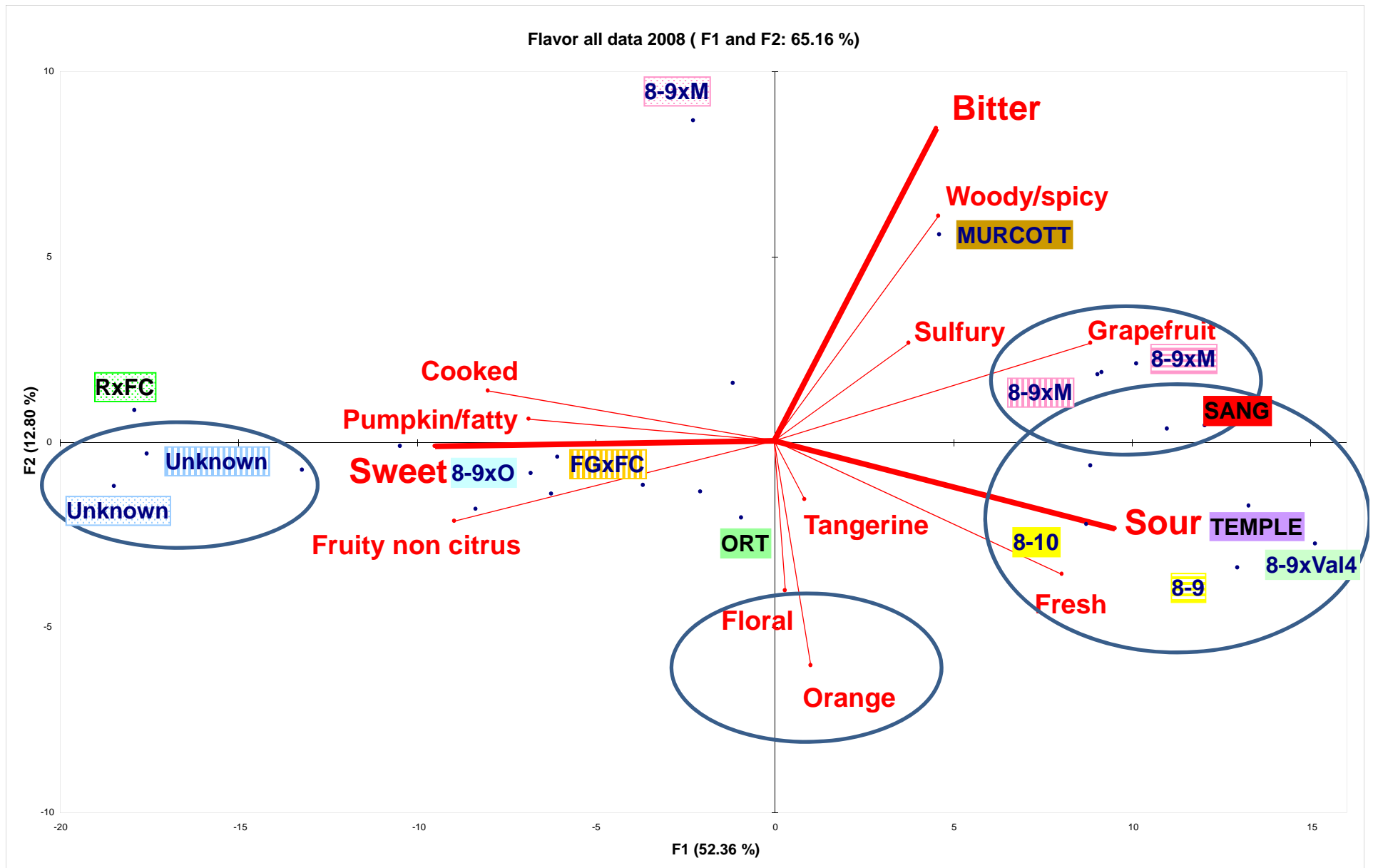
Flavor descriptors

2006-07	2007-08 & 2008-09
Sweet	Sweet
Sour	Sour
Bitter	Bitter
Tangerine	Tangerine
Orange	Orange
Grapefruit	Grapefruit
Floral	Floral
Fruity	Fruity non citrus
Green	Fresh
Other	Cooked
Aftertaste	Pumpkin / Fatty
	Sulfury
11	12

Tangerine Flavor Map 2006-07



Tangerine Flavor Map 2007-08





Suggested sample description

- ✓ ***Clementine x Minneola 8-9 and 8-10***: typical tangerine flavor if harvested at the correct maturity.
- ✓ ***8-9 x Murcott hybrids***: sweet, fruity, some orange and floral flavor if harvested ripe. Otherwise, can be sour with grapefruit and sulfury notes.
- ✓ ***LS Murcott***: bitter, fatty, sulfury. These characteristics are brought upon by juicing and freezing, and are enhanced in unripe fruit.
- ✓ ***Robinson x Fairchild 68***: sweet, balanced in fruity and citrus flavors.
- ✓ ***Unknown parents***: typical pumpkin flavor, very sweet, fruity-non-citrus flavor.
- ✓ ***Sanguinelli, Temple, Ortanique, 8-9 x Val4X***: orange and floral flavor, may be sour with some grapefruit note.



Conclusion 3 seasons 2006-2008

- Wide distribution in aroma and taste attributes of tangerine hybrids.
- Sensory descriptive analysis provides the breeder with specific qualifiers about the hybrids.
- Harvesting at the optimum maturity is a challenge.
- Correlate sensory with instrument.
- Need to complement descriptive panels with consumer acceptance surveys before releasing cultivars.



Comparison of 'Fallglo' and its seedless mutation 'US Early Pride'

Alice Biotteau & Clotilde Leclair

Anne Plotto & Greg McCollum

U.S. Horticultural Research Laboratory, Fort Pierce, FL

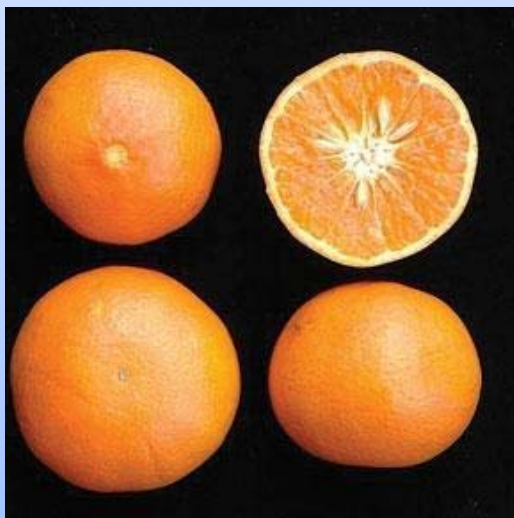


'Fallglo' and 'US Early Pride'

'FALLGLO'

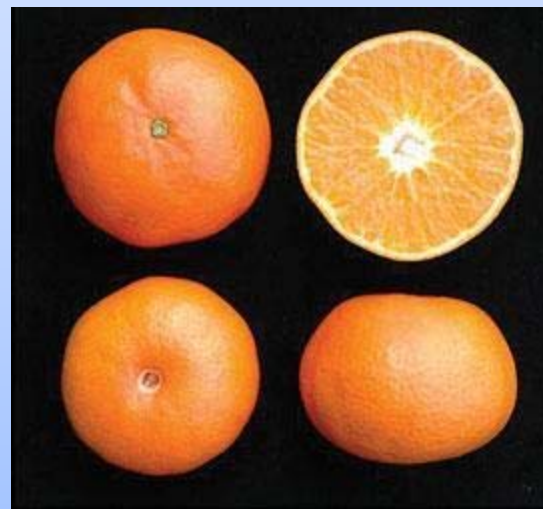
'Bower' [*Citrus reticulata* Blanco × (*C. paradisi* Macf. × *Citrus reticulata*) × 'Temple']

Released in 1987



'US EARLY PRIDE'

Irradiation induced mutation of Fallglo with very low seed count



Sensory evaluation

55 to 62 consumers staff of the USDA and UF

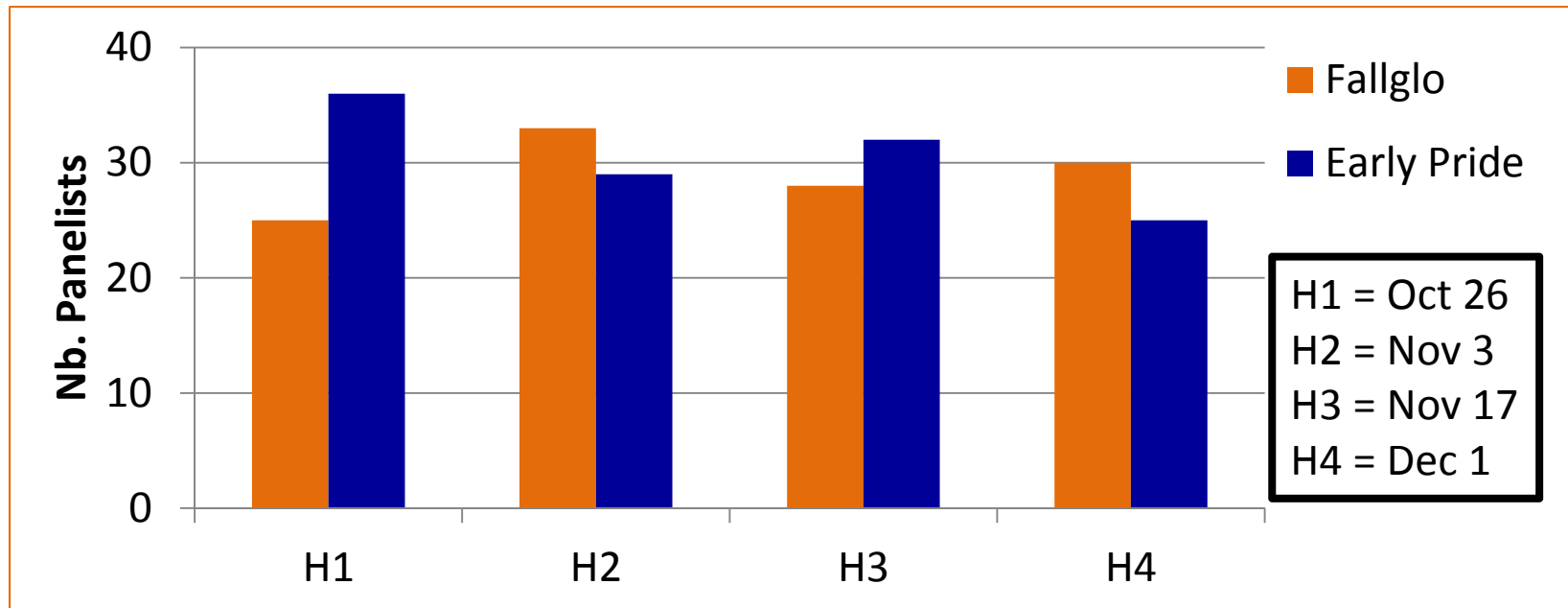


1. Which sample do you prefer?
2. Select the reason of your choice
 - Sweeter
 - Less sweet
 - More flavor
 - Less flavor
 - ...
 - More seeds
 - Less seeds

H1 = Oct 26
H2 = Nov 3
H3 = Nov 17
H4 = Dec 1



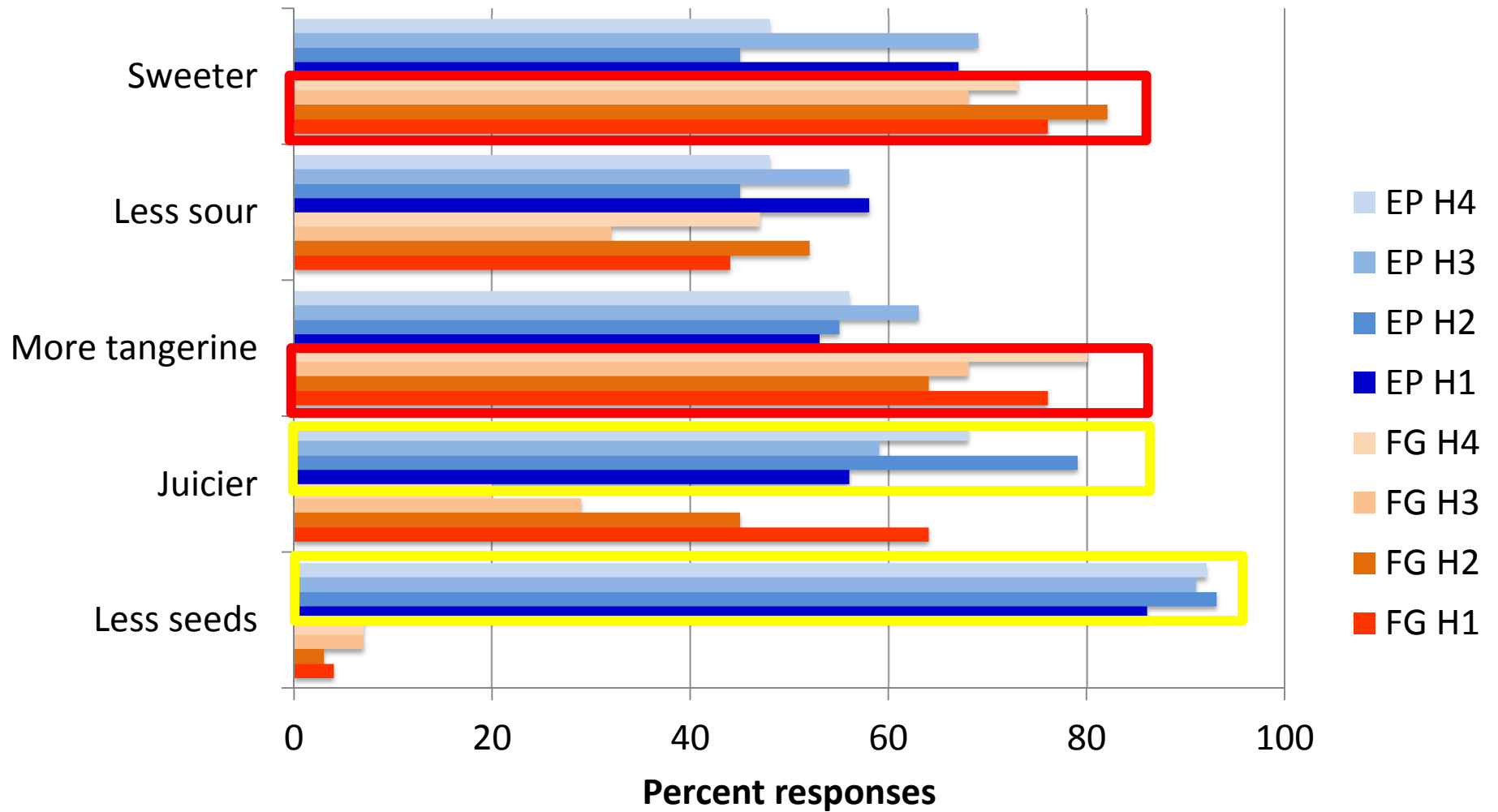
Preference 'Fallglo' vs 'Early Pride'



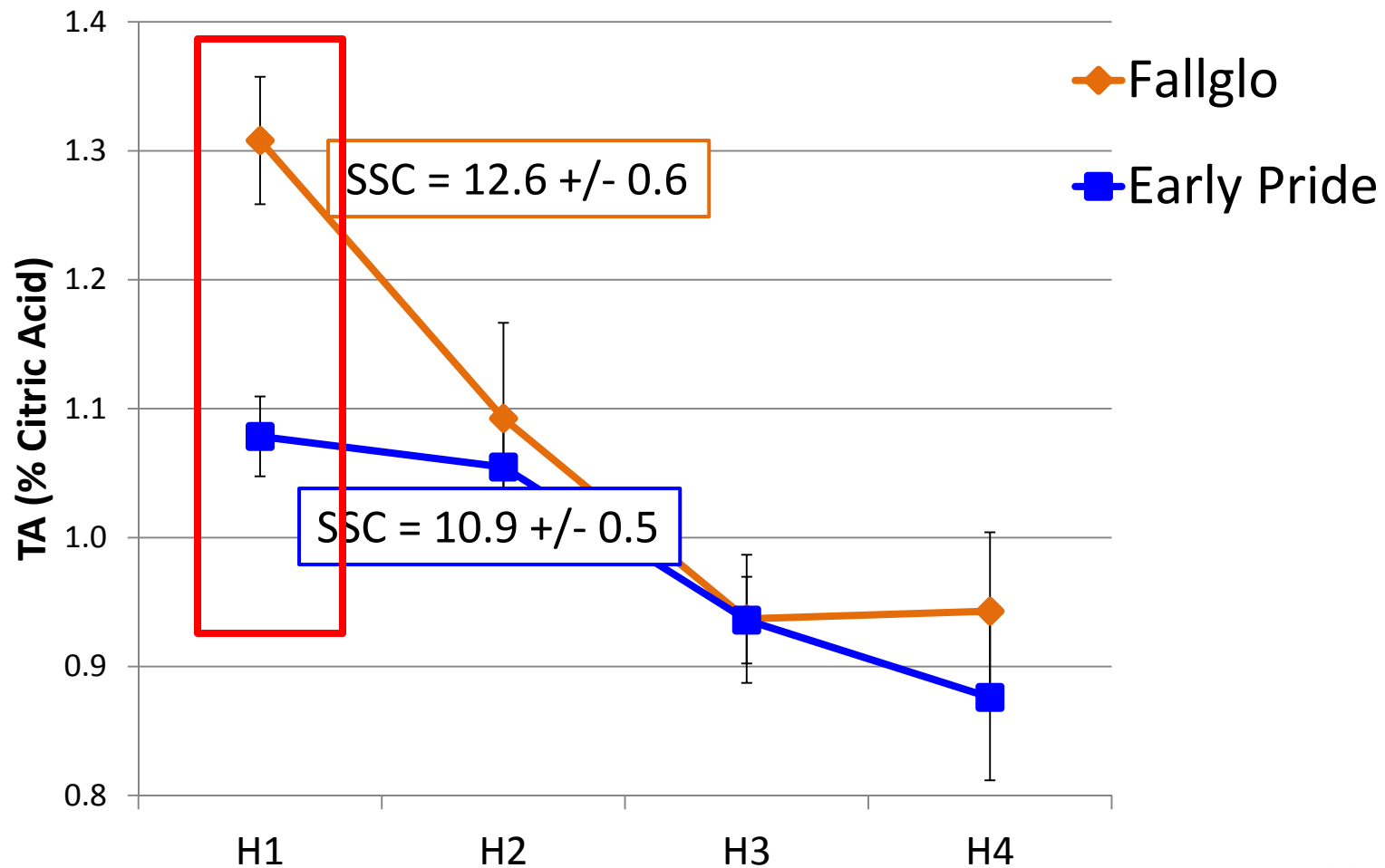
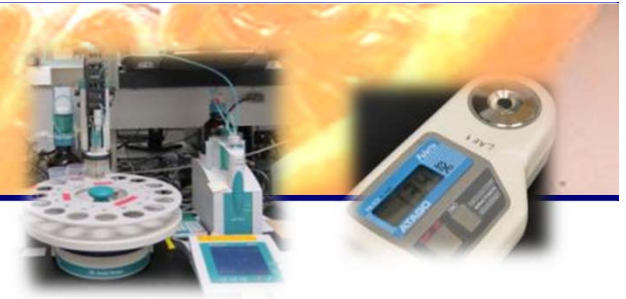
Harvest	Prefer Fallglo	Prefer Early Pride	Total panelists	Minimum for 5% sign.
H1				39
H2				40
H3				39
H4	30	25	55	36

Not Significant!!!

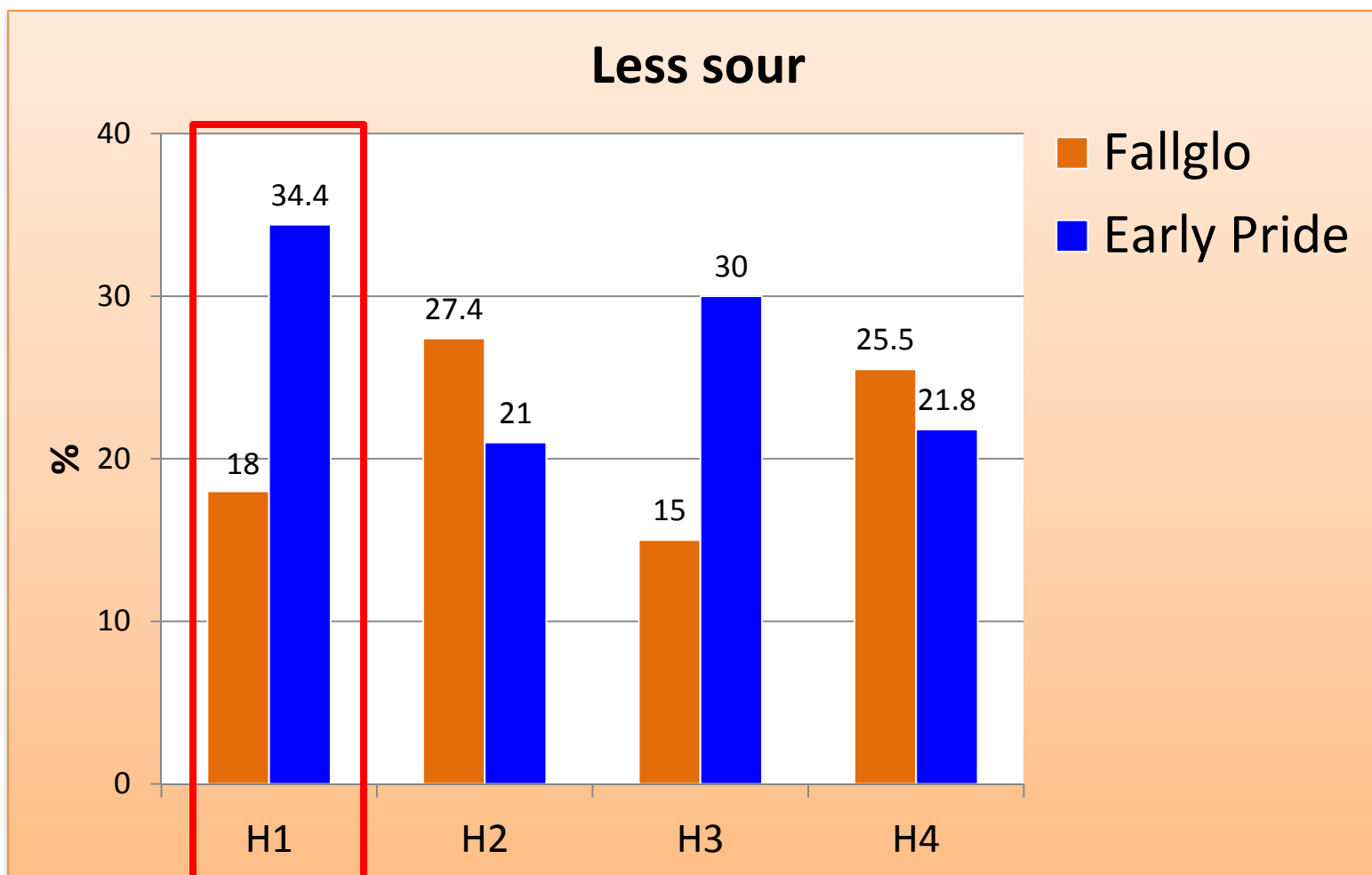
Reasons for preference



SSC and TA over time



Percent responses “less sour”



SSC/TA & BrimA

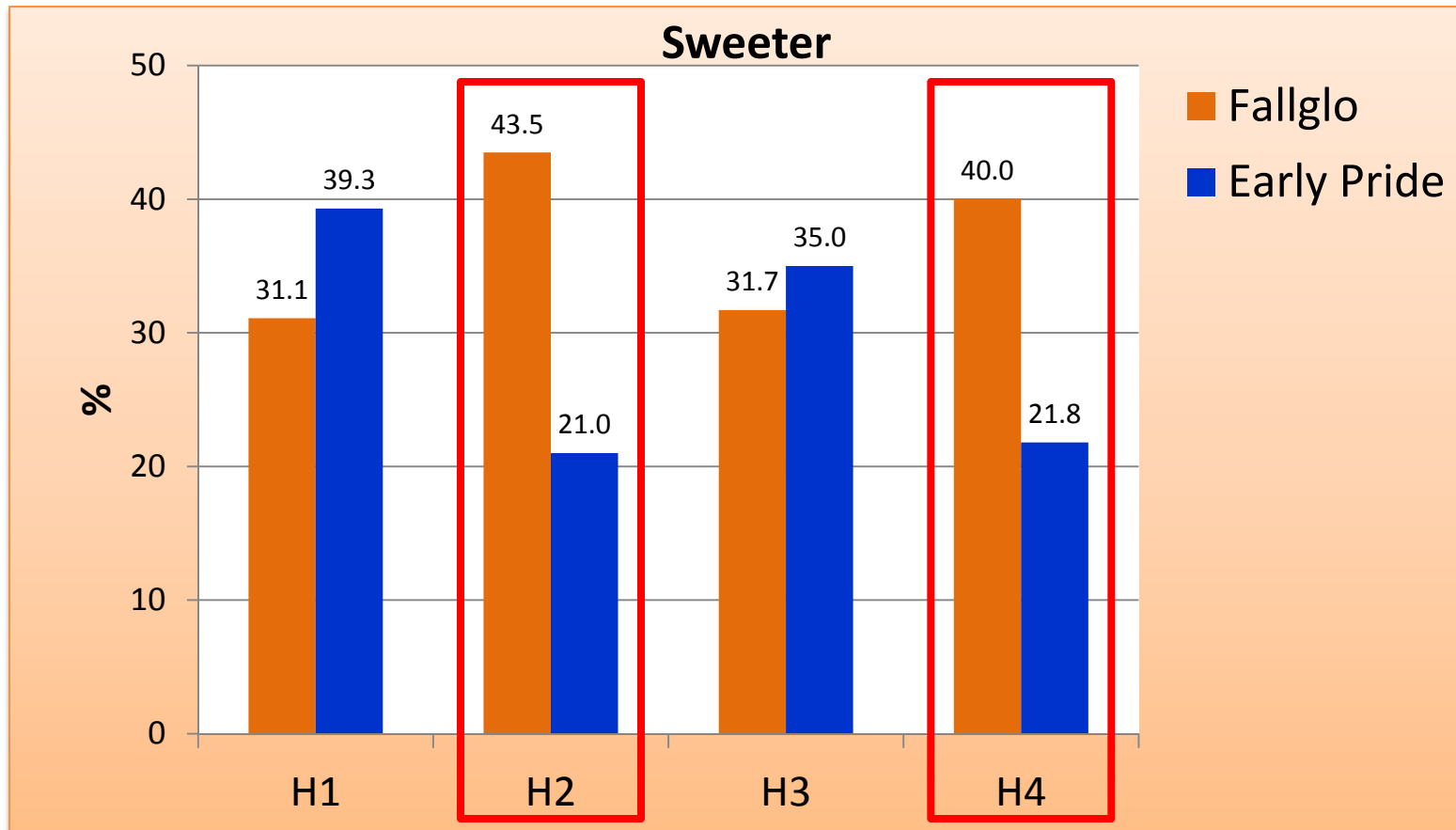
SSC/TA

	H1	H2	H3	H4
Fallglo	10.01 A	11.05 A	12.98 A	13.95 A
Early Pride	9.65 A	9.87 B	12.21 A	12.84 A

BrimA= SSC-5TA

	H1	H2	H3	H4
Fallglo	6.54 A	6.59 A	7.42 A	8.39 A
Early Pride	5.01 B	5.15 B	6.75 A	6.82 B

Sweetness perception vs SSC & TA



	H1	H2	H3	H4
Fallglo	6.54 A	6.59 A	7.42 A	8.39 A
Early Pride	5.01 B	5.15 B	6.75 A	6.82 B

BrimA= SSC-5TA

Summary

- TA was higher in 'Fallglo' on the first harvest (Oct. 26)
- SSC tended to be higher for 'Fallglo', but not significant except H1
- BrimA was a better predictor than SSC/TA for the perception of sweetness





Summary

- Untrained panelists could perceive differences between 'Fallglo' and its seedless mutation 'US Early Pride'
- However, results showed **NO PREFERENCE** for either strain
- Panelists who preferred '**Fallglo**' indicated it was for its sweetness and tangerine flavor
- Panelists who preferred '**US Early Pride**' indicated it was for its juiciness and seedlessness



Sensory & chemical evaluation of Citrus x *Poncirus trifoliata* hybrids

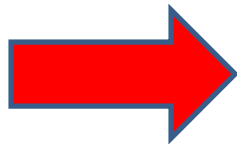
**Sophie Deterre, Greg McCollum, Jinhe Bai, John
Manthey, Liz Baldwin, Anne Plotto**

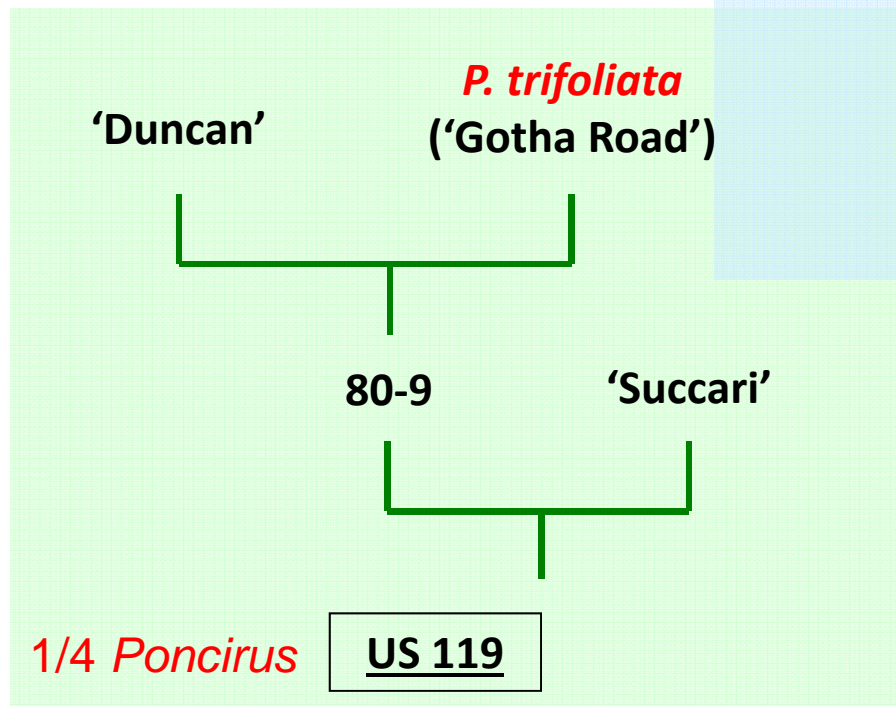
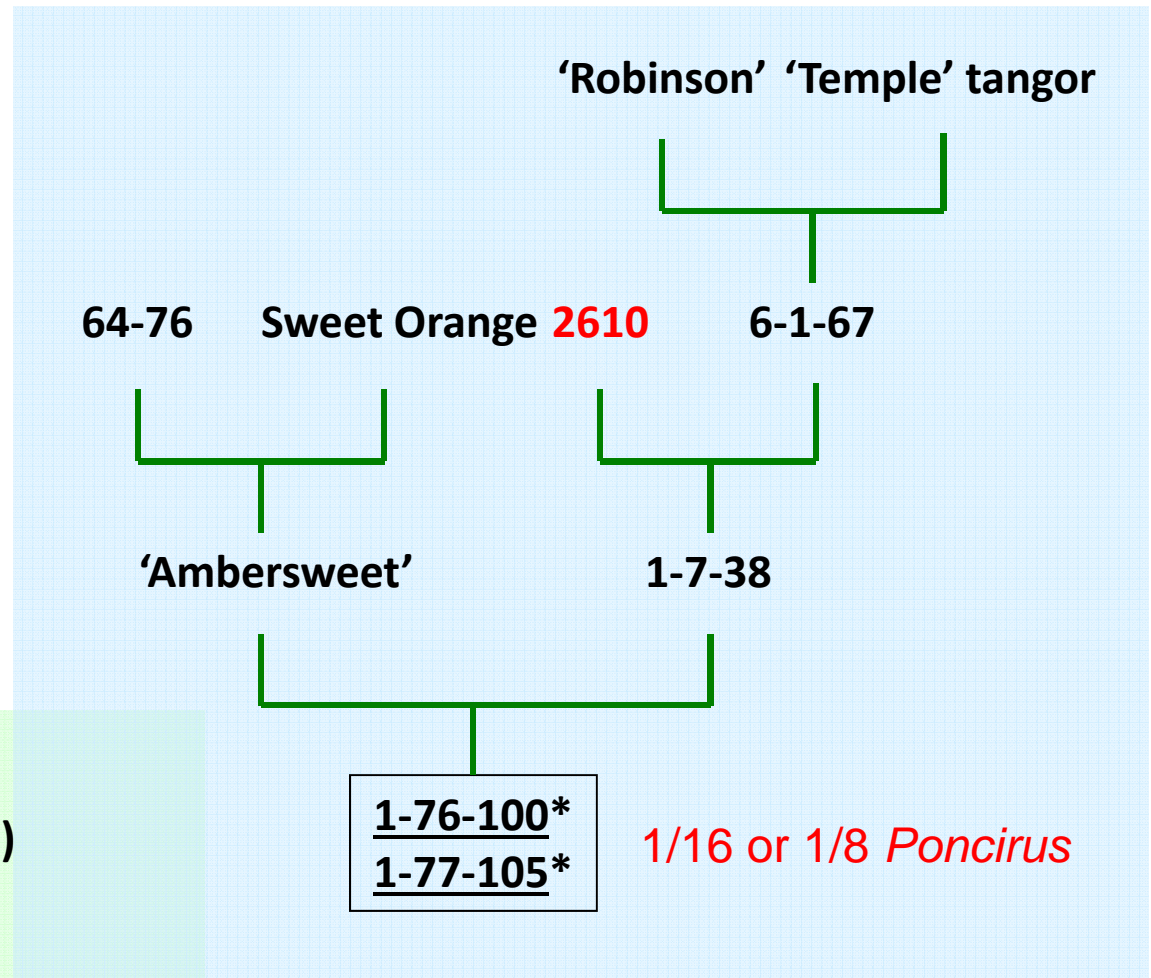
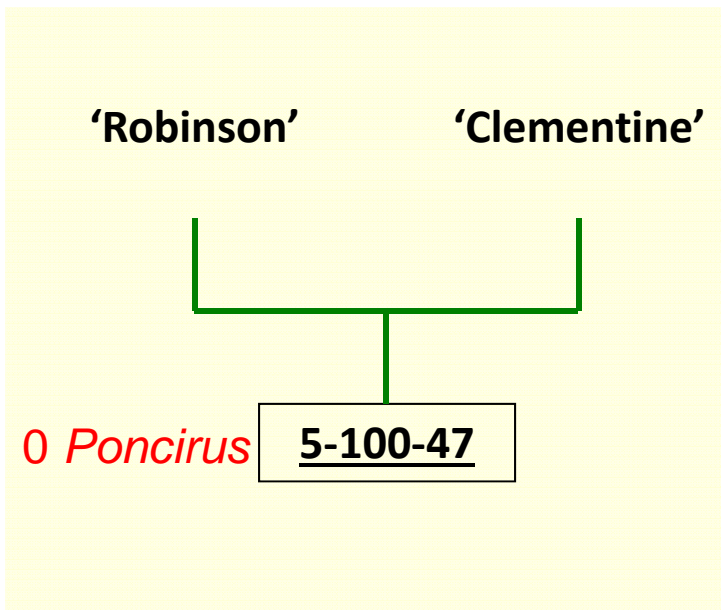
U.S. Horticultural Research Laboratory, Fort Pierce, FL



Poncirus trifoliata x *Citrus* hybrids

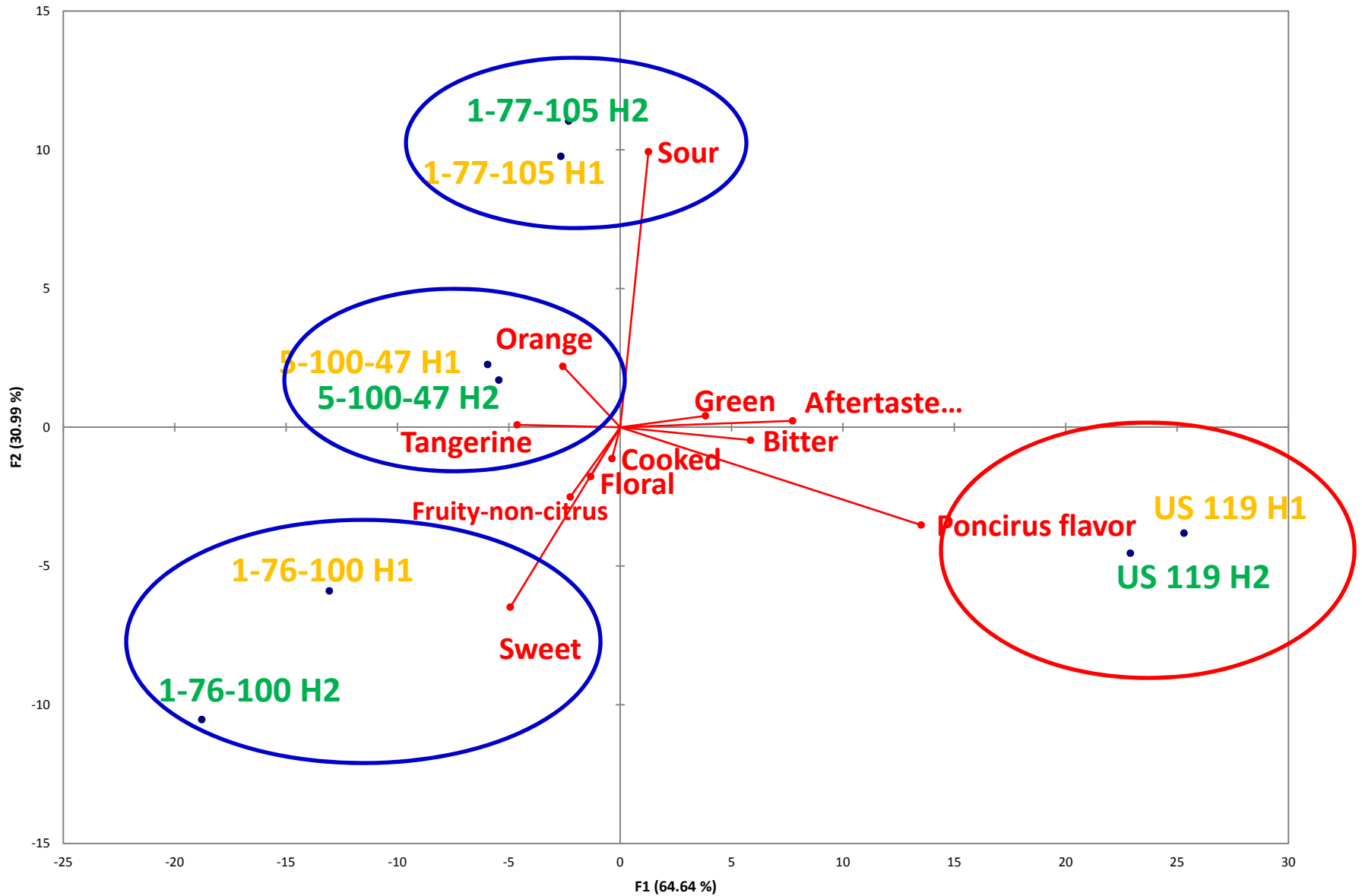
- *Poncirus trifoliata* is cold hardy and resistant to diseases
- Hybrids with *P.* in their background appear to be tolerant of Huanglongbing disease
- Fruit of *P. trifoliata* are inedible
- What about the hybrids? How many generations does it take to be acceptable???





Sensory Profiles (PCA)

Biplot (axes F1 and F2: 95.63 %)



Volatiles

(relative peak area)

Hybrid	Monoterpene hydrocarbons	Sesquiterpene hydrocarbons	Aldehydes	Total alcohols	Esters	Ketones
5-100-47	2.595	0.001	0.026	0.151	0.001	0.013
1-76-100	13.550	1.127	0.247	0.081	0.009	0.025
1-77-105	7.915	0.518	0.290	0.518	0.027	0.013
US 119	6.885	6.040	0.277	0.258	0.048	0.075

Esters:

- Ethyl acetate & octyl acetate in hybrids
- 24 different esters in Poncirus!!!

Sesquiterpenes much more abundant in Poncirus

Limonoids & Flavonoids ($\mu\text{g/g}$ of juice)

Bitter



Bitter



Sample	limonin	nomilin	deacyl nomilin acid glucoside	limonin glucoside	nomilin acid glucoside	naringin	poncirin	narirutin	isosakurane tin rutinoside	hesperidin
5-100-47	0.8	1.0	2.0	14.8	29.6			18.5	6.1	302.2
1-76-100	2.8	1.4	1.7	66.6	267.1			10.3	9.6	231.9
1-77-105	0.9	1.0	2.0	19.5	98.4			10.0	23.1	195.3
US-119	0.8	1.2	9.9	50.2	112.5			173.7	243.0	10.4
Poncirus	10.8	1.3	16.1	17.4	1.4	115.9	50.2	22.4	38.8	17.0

Poncirus trifoliata x *Citrus* hybrids

- Correlate sensory descriptors with instrumental data
- Different inheritance mechanism between flavonoids/limonoids and volatiles
- Commercial potential of these hybrids



© Jeff McMillian

Overall Summary

- Sensory evaluation helped characterize new tangerine hybrids.
- Consumer panels with US and ARS employees did not reveal preference for 'Fallglo' or 'US Early Pride', but could distinguish among preference types.
- More research is needed to evaluate Citrus x Poncirus hybrids prior to commercialization.





Questions?

