Improved sweet orange cultivars for processing and the fresh market

ICC - 2016

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Jude Grosser & Fred Gmitter

UF-CREC Citrus Genetic Improvement Team
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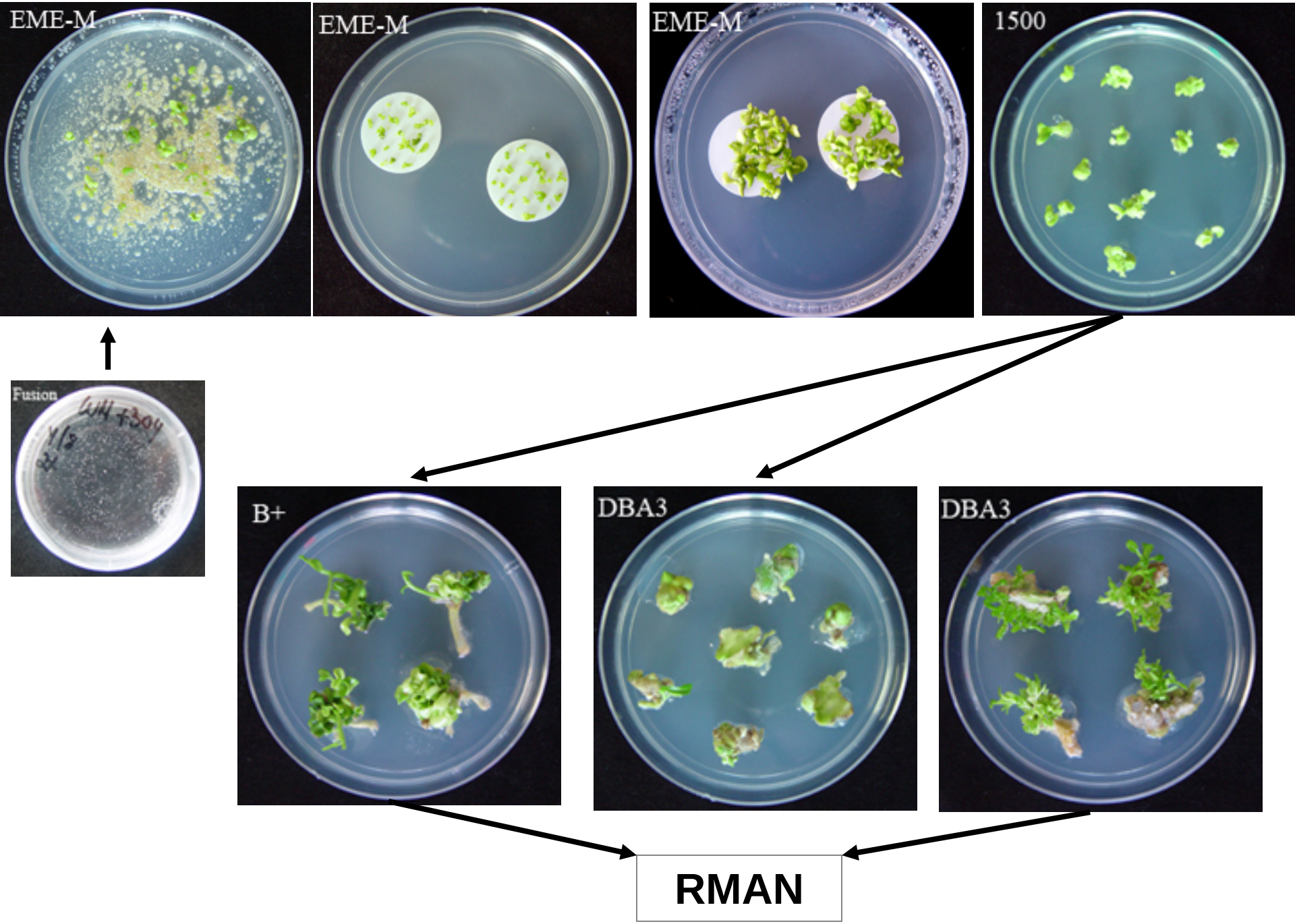
Somaclonal Variation

Somaclonal variation is defined as variability in plants regenerated from tissue culture that is either induced or uncovered by a tissue culture process. Most somaclonal variation is negative, but if enough plants are examined, positive changes can usually be recovered (Larkin and Skowkroft, 1981). Somaclonal variation has been a primary source of genetic variation in sweet orange exploited in our citrus improvement program.


EME-M
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1500
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RMAN

Hamlin Somaclone N13-32 (PP27,145) - a new and distinct early season clone of Hamlin sweet orange improved juice color and typical or better soluble solids for processing.

Hamlin Somaclones – Advanced Selections

ANALYSIS DATE	Hamlin Clone ID		BRIX	ACID %	RATIO		Color	
1/3/12	T8-40		11.65	0.51	22.84		33.92	
1/3/12	N16-23		13.84	0.69	20.06		32.51	
1/3/12	N13-32		11.01	0.60	18.35		36.14	
1/3/12	N14-10		11.64	0.57	20.42		32.95	
1/3/12	Standard Hamlin		11.86	0.53	22.38		32.81	

Valquarius ™ processing sweet orange, an early-maturing selection of Valencia that can be harvested mid-January through February, with typical Valencia quality. Amenable to mechanical harvesting! RELEASED and available through NVDMC!

Fruit of Valencia somaclone SF14W-62

Juice Data from Valencia Somaclone SF14W-62 'Valquarius'						
Date	Orange	Brix	Acid	Ratio	lb solids	Color
1st Generation Tree (Original, location: Venus, Florida, Southern Farms Ltd., Carrizo rootstock)						
1/28/2000	SF14W-62	11.0	0.75	14.7	4.85	38.0
	Valencia	10.1	0.94	10.8	5.87	37.6
2/6/2001	SF14W-62	12.8	0.81	15.8	7.04	38.0
	Valencia	11.7	1.00	10.3	5.88	37.5
1/15/2002	SF14W-62	11.8	0.86	13.8	n.d.	37.6
	Midsweet	12.0	0.90	13.4	n.d.	36.4
2/6/2003	SF14W-62	10.7	0.64	16.7	5.38	37.6
	Valencia	11.7	0.97	12.0	6.15	37.9
1/16/2004	SF14W-62	11.8	0.77	15.3	n.d.	38.7
	Valencia	11.1	1.10	9.7	n.d.	38.0

Juice Data from Valencia Somaclone SF14W-62 'Valquarius'						
Date	Orange	Brix	Acid	Ratio	lb solids	Color
2nd Generation Trees – Alligator Grove, east of St. Cloud (Control trees – mature budwood)						
1/26/2006	SF14W-62	10.6	0.84	12.6	n.d.	39.1
	Vernia	13.4	1.00	13.6	n.d.	38.5
	Midsweet	13.2	1.13	11.9	n.d.	37.7
1/23/2007	SF14W-62	10.9	0.76	14.3	n.d.	39.2
	Vernia	11.3	0.67	17.1	n.d.	39.5
	Valencia	11.1	1.14	9.7	5.88	37.5
4/11/2007	SF14W-62	12.6	0.57	22.0	6.19	39.0
	Valencia	14.1	0.83	17.0	7.76	39.8
1/17/2008	SF14W-62	11.1	0.76	14.6	5.90	38.2
	Vernia	12.4	0.97	12.8	6.40	38.5
2/25/2008	SF14W-62	10.8	0.70	15.6	n.d.	40.9
	Vernia	11.0	0.64	17.4	n.d.	40.3
	Valencia	11.7	1.4	8.6	n.d.	38.5
1/14/2009	SF14W-62	10.9	0.81	13.6	5.68	38.2
	Valencia	11.1	1.14	9.7	5.88	37.5

7-year old reset of SF14W62 on rough lemon, showing yield potential.

Valenfresh ™ sweet orange, a seedless selection of Valencia for fresh market or processing, late maturing and holds quality into June! Approved for release by IFAS Cultivar Release Committee.

‘Valenfresh’ seedless Valencia on WGFT+50-7 somatic hybrid rootstock

Juice Data from Valencia Somaclone N7-3 'Valenfresh'						
Date	Orange	Brix	Acid	Ratio	lb solids	Color
(Location: CREC North-40 Grove, Lake Alfred, Florida, Swingle citrumelo rootstock)						
5/14/1998	N7-3	12.18	0.70	17.40	6.35	37.9
	Valencia	13.44	0.57	23.58	7.21	37.7
2/19/1999	N7-3	11.43	1.16	9.85	6.54	36.9
	Valencia	10.93	0.83	13.17	5.44	36.8
6/19/2000	N7-3	11.57	0.62	18.7	5.25	39.1
	Valencia	12.81	0.51	25.1	6.44	39.0
5/15/2001	N7-3	10.82	0.79	13.7	4.98	37.9
	Valencia	10.86	0.58	18.7	6.43	39.3
3/14/2003	N7-3	11.72	0.91	12.88	6.32	37.8
	Valencia	12.46	0.90	13.84	6.54	38.2
2/28/2006	N7-3	12.30	1.33	9.25	6.11	n.d.
	Valencia	12.69	1.15	11.03	6.67	n.d.
4/10/2007	N7-3	11.86	0.80	14.83	6.00	39.2
	Valencia	12.96	0.75	17.28	6.71	39.9

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.

Table1. Yield Boxes / tree of Late Season sweet orange selections (somaclones, seedling introductions and controls) on Carrizo citrange rootstock planted 15' x25' at Water Conserv II, Winter Garden, FL, planted March, 2000.

Late season selections	2005-06	2006-07	2007-08	2008-09	2009-10	Cumulative Yield	Cumulative Rank
B-9-65	2.21	1.28	5.38	1.4	4.8	15.06	1
Appleby	2.46	0.98	4.61	1.82	4.91	14.78	2
T-4-43	1.8	1.02	4.4	0.73	5.81	13.76	3
T-2-25	2.08	1.27	4.15	1.08	4.68	13.26	4
S441-54-3 (Juv. 10-12-7)	2.27	1.24	4.4	0.83	4.38	13.13	5
T-3-62	1.59	1.58	3.8	1.21	4.52	12.7	6
S822-111-5 (Mat.10-12-7)	1.94	1.53	3.13	2.31	3.72	12.62	7
B-8-66	2.03	1.18	3.88	1.23	4.25	12.58	8
B-10-81	1.89	1.29	4.25	1.18	3.94	12.56	9
B-6-68	2.13	1.11	4.21	1	4.1	12.53	10
B-12-71	2.25	0.75	4.19	1.13	4.2	12.52	11
Jenner	2.08	1.18	4.52	1.18	3.48	12.44	12
Natal	1.48	1.46	4.07	1.04	4.27	12.32	13
Smith	2.11	0.99	3.93	1.01	4.26	12.3	14
T-1-13	2.35	0.84	4.28	0.91	3.8	12.18	15
T-1-23	1.82	0.7	4.07	1.42	4.18	12.18	16
T-2-62	1.8	1.06	3.82	1.22	4.18	12.08	17
Frost	2.14	0.79	4.52	0.84	3.77	12.06	18
B-8-76	1.84	0.89	4.43	0.66	4.13	11.96	19
T-1-25	1.61	0.69	4.61	0.43	4.38	11.72	20
T-1-26	1.66	0.72	4.29	0.81	4.22	11.7	21
T-1-33	1.62	0.67	3.75	0.77	4.47	11.27	22
Rohde Red Valencia	1.51	1.49	3.47	1.57	3.19	11.22	23
Valencia SF8-2-35	1.72	1.19	3.11	1.88	3.31	11.21	24
B-10-68	1.82	0.96	4.12	1.07	3.2	11.16	25
Vernia	1.35	1.34	3.18	1.29	3.12	10.28	26
Valencia SF11-1-69	1.54	1.17	2.06	1.47	3.4	9.64	27
B-10-62	0.99	0.74	2.58	1.25	2.27	7.82	28
Valencia SF9-1-86	0.93	0.73	2.04	1.05	2.83	7.58	29
B-6-66 (seedless, dwarfing)	0.82	1.06	1.48	1.03	2.38	6.77	30

OLL (Orie Lee Late) Series of Somaclones

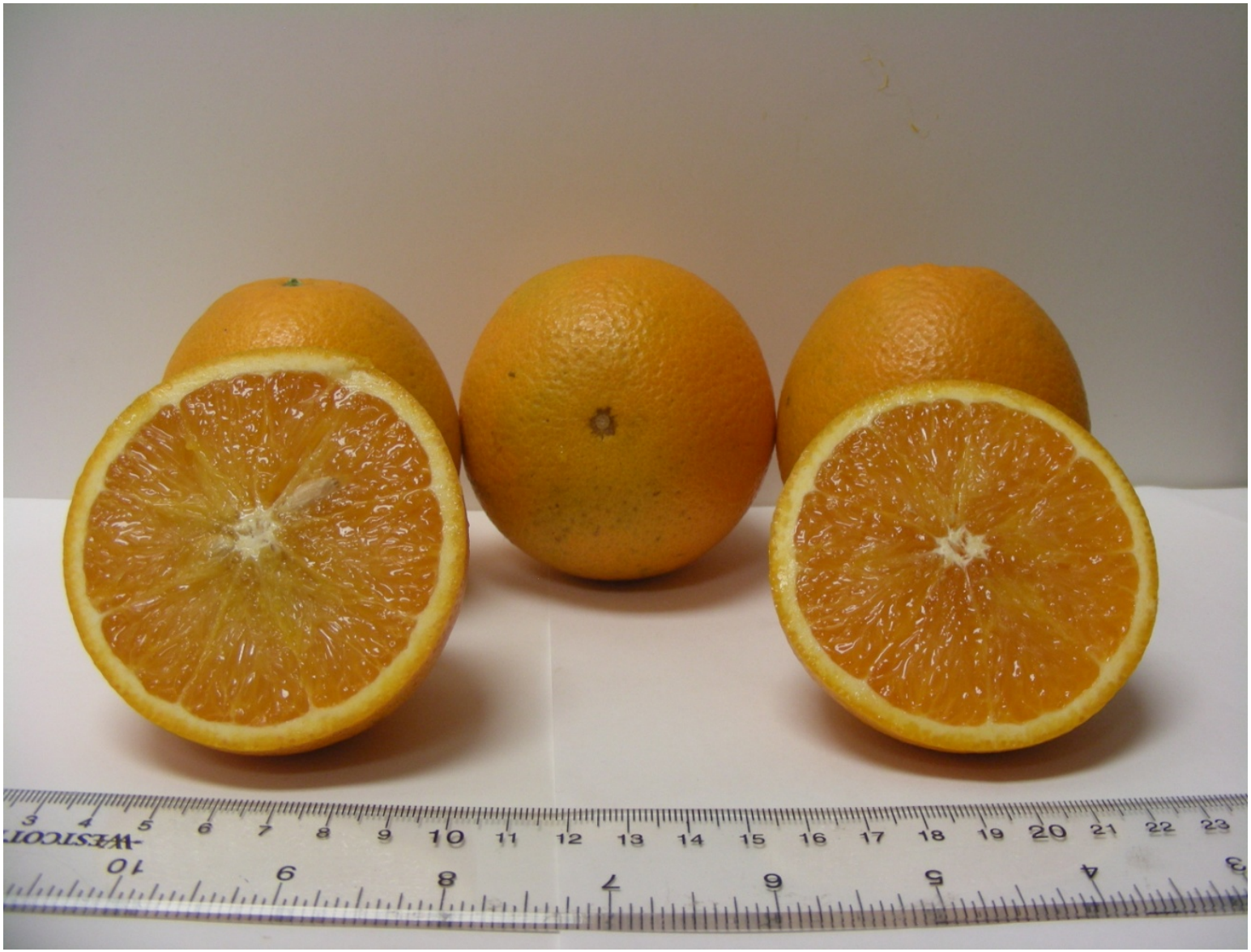
• Original tree was unselected from USDA trial on Mr. Lee's property (abandoned >50 years ago) designed to generate a seedless 'Pineapple' sweet orange using irradiation. Mr. Lee selected the original OLL tree because it never dropped fruit (unlike 'Pineapple), and held quality into the summer, with exceptional juice color.

•Standard propagations of 'OLL' were unstable – possibly due to transposon movement

•OLL somaclone population was produced from embryogenic callus produced from 'OLL' – trees show considerable variation

•OLL somaclones appear to be more tolerant of cold and drought than standard Valencia – could enhance productivity and survivability in HLB world

•Juice flavor profile of OLL somaclones rated as 'good' by Tropicana and Florida's Natural.



Fruit of Sweet orange OLL-8, Approved for Release by IFAS Cultivar Release Committee

Scion/Rootstock interaction – Synergy against HLB
– 7-year old OLL-8 trees on rough lemon (Lee Alligator Grove, St. Cloud). 100% HLB, 6.65 lbs. solids this year – performing much better than Vernia, Valquarius and Valencia!

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Fruit of Sweet orange OLL-4

Unique Characteristics of Sweet Orange OLL-4

- Somaclone regenerated from unstable OLL (Orie Lee Late) parent, developed in collaboration with Orie Lee

- Late maturity comparable to Valencia, fruit holds very well on the tree, into the summer (although earlier and with better ratio than Valencia in 2014)

- Excellent internal and external quality, exceptional juice color (even better than Rhode Red Valencia), juice content, and soluble solids; easier to peel than Valencia, thus better fresh-fruit potential.

- Although yield data is limited, the original tree of OLL-4 has been the highest yielding tree among the OLL somaclones

- Juice flavor profile rated as good or better than Valencia by Tropicana, very high interest in this clone from Tropicana for use in NFC juice

Yield data from original OLL somaclone trees – Alligator Grove – Trees on Swingle citrumelo planted in 2001 (90 lb. boxes).

	2012 BOXES	2013 BOXES	2014 BOXES	TOTAL BOXES	AVG. BOXES
OLL-1	4.00	4.75	3.88	12.63	4.21
OLL-2	3.00	3.75	2.34	9.09	3.03
OLL-3	2.75	4.75	4.13	11.63	3.88
OLL-4	5.75	5.25	6.13	17.13	5.71
OLL-5	4.75	3.75	3.38	11.88	3.96
OLL-6	2.75	2.75	5.88	11.38	3.79
OLL-7	2.75	4.25	3.88	10.88	3.63
OLL-8	1.75	0.00	0.00	1.75	0.58
OLL-9	4.25	4.00	3.13	11.38	3.79
OLL-10	5.00	5.75	5.38	16.13	5.38
OLL-11	1.00	1.50	1.38	3.88	1.29
OLL-15	2.00	2.75	2.88	7.63	2.54
OLL-16	3.00	3.75	2.63	9.38	3.13
OLL-19	4.00	5.00	3.88	12.88	4.29
OLL-20	2.00	5.25	4.13	11.38	3.79
OLL-21	3.75	4.75	4.13	12.63	4.21
OLL-22	5.25	4.50	3.38	13.13	4.38
OLL-23	3.75	6.75	3.88	14.38	4.79
OLL-25	3.25	3.75	2.38	9.38	3.13
OLL-27	4.25	4.50	5.38	14.13	4.71

Please note that the viewer should disregard the yield data for OLL#8 on slide 21 in the sweet orange PP, as this data was taken just before the tree died from a tractor-wound (Phytophthora)

Juice Quality Data from OLL-Series Somaclones

Data 3-2-2012

Variety	Lbs. Juice Per Box	Acid	Total Brix	Ratio	Lbs. Solids Per Box	Color
Valencia Control	54.41	1.00	12.03	12.03	6.55	38.60
OLL 20	53.23	0.84	12.10	14.40	6.44	40.50
OLL 27	54.99	0.84	12.34	14.69	6.79	39.80
OLL 25	57.58	0.79	12.81	16.22	7.38	40.20
OLL 9	56.30	0.94	12.97	13.80	7.30	39.90
OLL 15	49.48	0.99	14.56	14.71	7.20	39.50
OLL 2	51.55	0.77	12.77	16.58	6.58	41.00
OLL 3	54.52	0.98	12.92	13.18	7.04	40.30
OLL 4	55.52	0.92	12.60	13.70	7.00	40.70
OLL 7	57.51	0.94	13.20	14.04	7.59	41.20
Valencia control/SW	48.46	0.79	12.91	16.34	6.26	39.10
OLL 21	58.20	0.77	12.38	16.08	7.20	40.30
OLL 10	55.55	0.82	12.42	15.15	6.90	40.60
OLL 5	53.92	0.93	13.13	14.12	7.08	40.10
OLL 23	57.21	0.81	12.12	14.96	6.93	39.90
OLL 19	54.02	0.84	12.32	14.67	6.65	40.90
OLL 1	55.10	0.90	12.90	14.33	7.11	41.50
OLL 6	58.19	0.96	12.85	13.39	7.48	40.80
OLL 3-10 dwarf	53.80	0.80	12.51	15.64	6.73	41.20
OLL 8	56.43	0.77	11.99	15.57	6.77	40.70

Nearly Seedless Midsweet Selection UF 11-1-24, from budwood irradiation

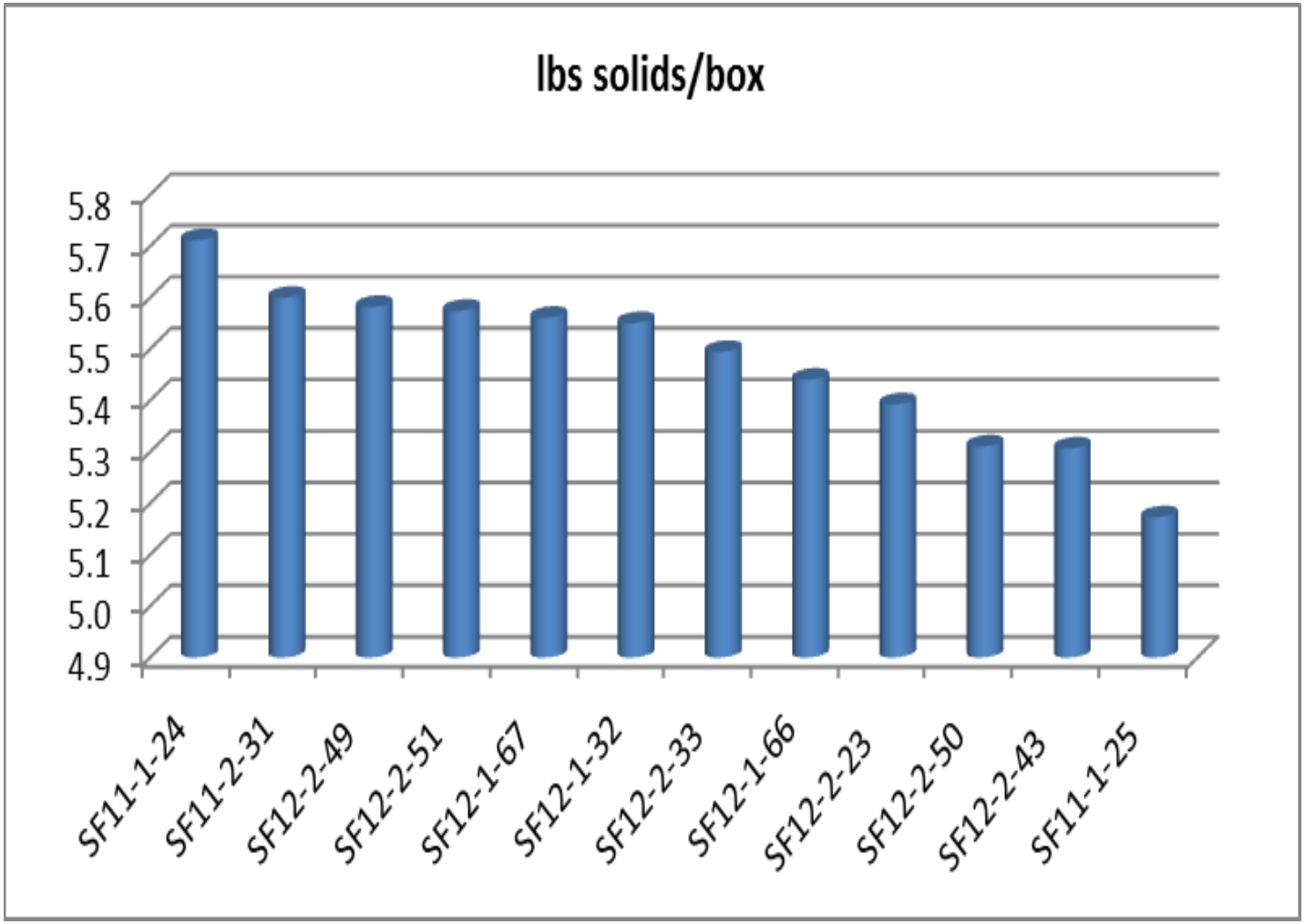

Figure 4. Mean pounds solids/box across five seasons (2007-2011). Fruit harvest dates varied from year to year, based on availability of commercial harvesting crews, but they were always sometime in the month of January.

WHY PLANT HAMLIN?

New early-maturing Valencia somaclones EV-1 and EV-2 released in 2016 have matured during the Hamlin harvest period the past 3 years – with higher solids, juice color and ratio than Hamlin on December 1.

One of the best ways to counter declining orange juice sales is to offer a higher quality product. Replacing Hamlin with early-maturing Valencia clones will increase juice quality (flavor and color) in both NFC and frozen concentrate juice products!

Since the release, 20 Florida nurseries have received budwood increase trees propagated at UF/CREC

Juice Quality Data from Two New Early-Maturing Valencia Somaclones. Data from fruit harvested first week of December, 2014, 6-year old trees on rough lemon rootstock, Alligator Grove, St. Cloud, Florida.

Variety	Lbs. Juice Per Box	Acid	Total Brix	Ratio	Fruit Ct	Lbs. Solids Per Box	Lbs. Solids Per Box	juice color
Vernia	53.906	0.87	11.04	12.69	78	5.9512	5.95	35.3
EV-1 (B7-70)	50.913	0.71	11.30	15.92	61	5.7532	5.75	36
Hamlin	52.914	0.94	11.17	11.88	64	5.9105	5.91	34.5
Valuarius	50.728	0.84	9.87	11.75	55	5.0069	5.01	35.7
EV-2 (SF14W-65	50.299	0.67	11.06	16.51	63	5.5631	5.56	36
Valencia	53.443	0.98	9.53	9.72	58	5.0931	5.09	35.4

EV-1: Early-maturing Valencia somaclone B7-70: photo Dec. 1, 2014. EV-1 and EV-2 have potential to replace Hamlin with higher quality fruit; potentially less fruit drop!

EV-2: Early-maturing Valencia somaclone SF14W-65: photo Dec. 1, 2014. EV-1 and EV-2 have potential to replace Hamlin with higher quality fruit; potentially less fruit drop!

EV-1: Valencia Somaclone (formerly B7-70) fruits hanging on the tree in early winter. Lee-Alligator Grove, St. Cloud FL. December, 2014 photo.

EV-2: Valencia Somaclone (formerly SF14W-65) fruits hanging on the tree in early winter. Lee-Alligator Grove, St. Cloud FL. December, 2014 photo.

THANKS!

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