Dried Plum Cultivar Development Program Update

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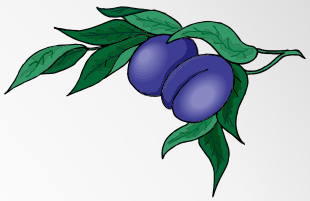
Plant Sciences

Program History



- Started by Dr. Ted DeJong and Jim Doyle in 1985
- Jim Retired
  - Carolyn Debuse took over in 2000
- Released 2 Cultivars in 2000: Tulare Giant & Sutter
  - Released pollinizer for Tulare Giant 2004: Muir Beauty
- Sarah Bradley Castro took over in 2008

Today's Presentation

- Cultivar Development Process
- Program Objectives
- Issues we avoid
- Top Item and top traits
  - Dry away
  - Pruning
  - Bloom
- Side Project: Prune sugar composition

Cultivar Development Process

Pollination produces seeds

Level 1

Seedling Block

(fruit eval. starts yr 3+)

Level 2

Selection Block (Kearney & Winters)

Level 3

Grower's Orchards

Level 4

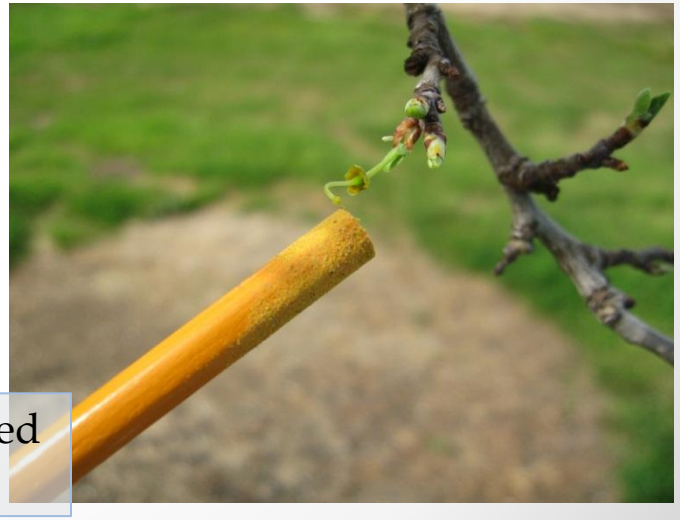
Patented or large grower plantings

Cultivar Development Process

Pollination produces seeds

Harvest Pollen

Emasculate Flowers



Apply pollen to emasculated flower (stigma)

Pictures courtesy of
- Joe Turkovich

Cultivar Development Process

Pollination produces seeds

Level 1

Seedling Block

(fruit eval. starts yr 3+)

Seedling block

- Trees take 3-5 years to come into fruit bearing
- Seedlings are evaluated for fruit characteristics
  - Fresh characteristics
  - Dried characteristics
- This year, 38 trees were selected out of the seedling block for further evaluation & breeding purposes

Cultivar Development Process

Pollination produces seeds

Level 1

Seedling Block

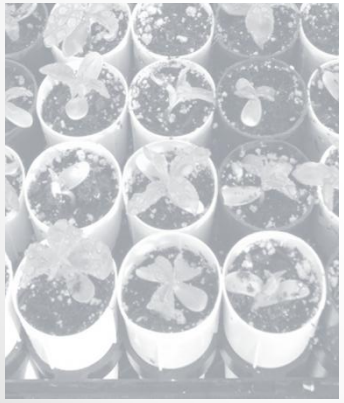
(fruit eval. starts yr 3+)

Level 2

Selection Block (Kearney & Winters)

Selection Block Evaluations

- Bloom date
- Harvest date
- Tree Structure
- Fresh Fruit Attributes
  - Sugar
    - Brix
  - Shape, Size, Pit size & Pit tightness
- Dried Attributes
  - Dry away ratio
  - Process-ability
  - Look & taste



Top Level 2

Selection	Bloom Days from French	Harvest, Days from French	Pressure	Sugar (°Brix)	Dried Ct/lb	Dry Ratio
F11S- 65	-5	-21	3.3	26.1	61.7	2.8
G12N- 51	-8	0	1.9	29.2	36.6	2.5
G31N- 27*	-5	0	3.6	24.7	52.7	2.9
G33N- 27*	-12	0	3.3	32.0	44.4	2.4
G47N- 31*	-5	-14	3.6	21.0	72.6	3.0
G47S- 49*	-6	-26	2.8	22.4	56.1	2.8
H1N- 40*	-7	-21	1.9	24.4	60.3	2.9
H1S- 31	1	-6	3.7	24.2	66.5	3.0
G36N- 65*	-8	-30	4.3	25.6	77.0	2.6
G43N- 1*	-8	-7	2.8	23.7	63.1	2.9

* In today's tasting

Cultivar Development Process

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Seedling Block

(fruit eval. starts yr 3+)

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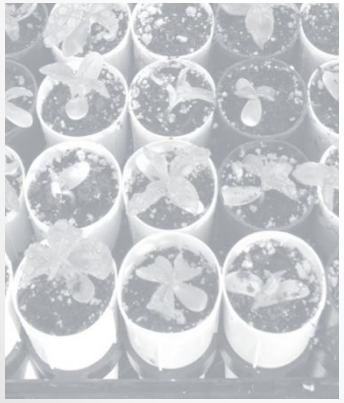
Selection Block (Kearney & Winters)

Level 3

Grower's Orchards

Level 4

Patented or large grower plantings



Top Level 3: items in grower trials

Selection	Location	Date	Bloom days from French	Harvest days from French	PSI	Sugar (Brix)	Dried Count / lbs	Dry ratio	Comments
F11S-38	Winters	7/15/13	-6	-30	3.9	33.4	63	1.7	Will dry on tree, self pollinating. Low dry away ratio
G2S- 8*	Kearney	8/30/13	-2	+16	4.9	22.3	33.2	3.0	Large yellow, wonderful dried and fresh.
	Winters	9/3/13	-5	+12	5.1	26.5	33.6	2.9	
G5N- 35	Kearney	8/22/13	3	+8	3.8	21.7	66.3	3.0	Small statured tree. Fruit very similar to French
	Winters	8/19/13	-1	0	3.2	22.8	62.4	3.0	
G16N- 19	Kearney	8/30/13	0	+16	4.5	27.8	39.3	2.8	Potential Level 4 large, round, great tasting fruit. Self pollinating
	Winters	8/26/13	-5	+6	5.1	26.9	36.4	2.8	
G39N-57*	Kearney	7/17/13	-7	-33	5.9	23.4	37.9	3.0	Early harvest, very small pit, harvest at 5-6 lbs
	Winters	7/15/13	-7	-30	6.3	24.6	47.5	2.4	

* Not in grower testing trial yet

Program Inventory

Level of Testing	Number of Items	Number of new 2013 additions
Level 1	6,393	948 (~ 2,000 seeds)
Level 2	111	24
Level 3 & 4	7	2
Fresh Items	11	2
Breeding Items	79	13
Germplasm Items	107	5

Program Objectives

- Reduce Grower operation costs by introducing a new, more efficient variety
  - Reduce pruning
  - Reduce drying costs
  - Change bloom time & harvest time

Issues we avoid

- Early drop
- Juicy fruit
- Split pits & weak pits
- Fruit defects
  - Splits
  - Cracks
  - Sunburn

Top Item: G16N-19

- Dry away ratio 2.8
- 42.6 average count per lb
- Harvests 1-2 weeks after Imp. French
- Self pollinating

Harvest date	Location	Pressure	BRIX	Weight g/fruit	count per lb.	Dry away ratio
9/7/10	Winters	6	27.9	26	44.6	2.85
9/1/10	Kearney	5.9	27.2	36.8	35.3	2.7
9/12/11	Winters	3.9	33.0	30.9	36.9	2.6
9/16/11	Kearney	5.44	29.9	32.3	36.5	2.5
8/20/12	Winters	5.65	21.3	26.7		
8/27/12		5.62	19.90	25.90		
9/4/12		4.30	21.70	26.90	59.4	3.2
9/10/12		5.20	22.30	27.00	61.2	3.2
8/29/12	Kearney	5.80	27.00	35.50		
9/7/12		4.50	25.20	32.80	38.8	2.7
8/5/13	Winters	5.2	21.9	37.7		
8/12/13		5.4	23.7	38.8		
8/26/13		5.1	26.9	32.8	36.4	2.8
8/14/13	Kearney	6.3	22.7	36.0		
8/22/13		6.1	24.3	35.3		
8/30/13		4.5	27.8	41.0	39.3	2.8

G16N- 19

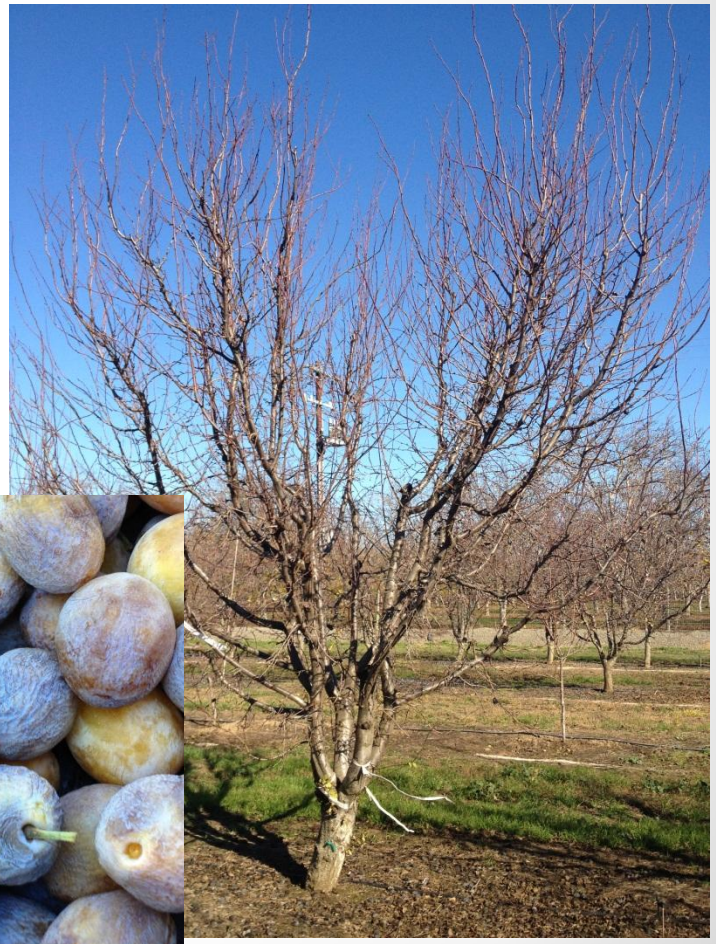
Top Item, possible Level 4

Parents: 3-9E-49 x 4-7E-35

G16N- 19 Fruit

Reduce Drying Costs: F11S- 38

- Tree provides low dry away ratio: 1.7-2.5 dry away ratio
- Round, yellow fruit where some fruit dry on the tree
- Spread Harvest/Bloom
  - Harvests 1 month before Imp. French
  - Blooms 6-29 days before Imp. French



- Leafy healthy tree
- More research needed:
  - Drying times need to be tested, will likely need less drying time

Reduce Pruning Costs: G5N- 35

- Small tree with short internodes
- Spread Harvest/Bloom Time
  - Blooms two day after Imp. French
  - Harvests a few days after Imp. French
- Will use for breeding a French look-a-like, non-pruning tree

Pruning

Precocious trees limit ability for long pruning

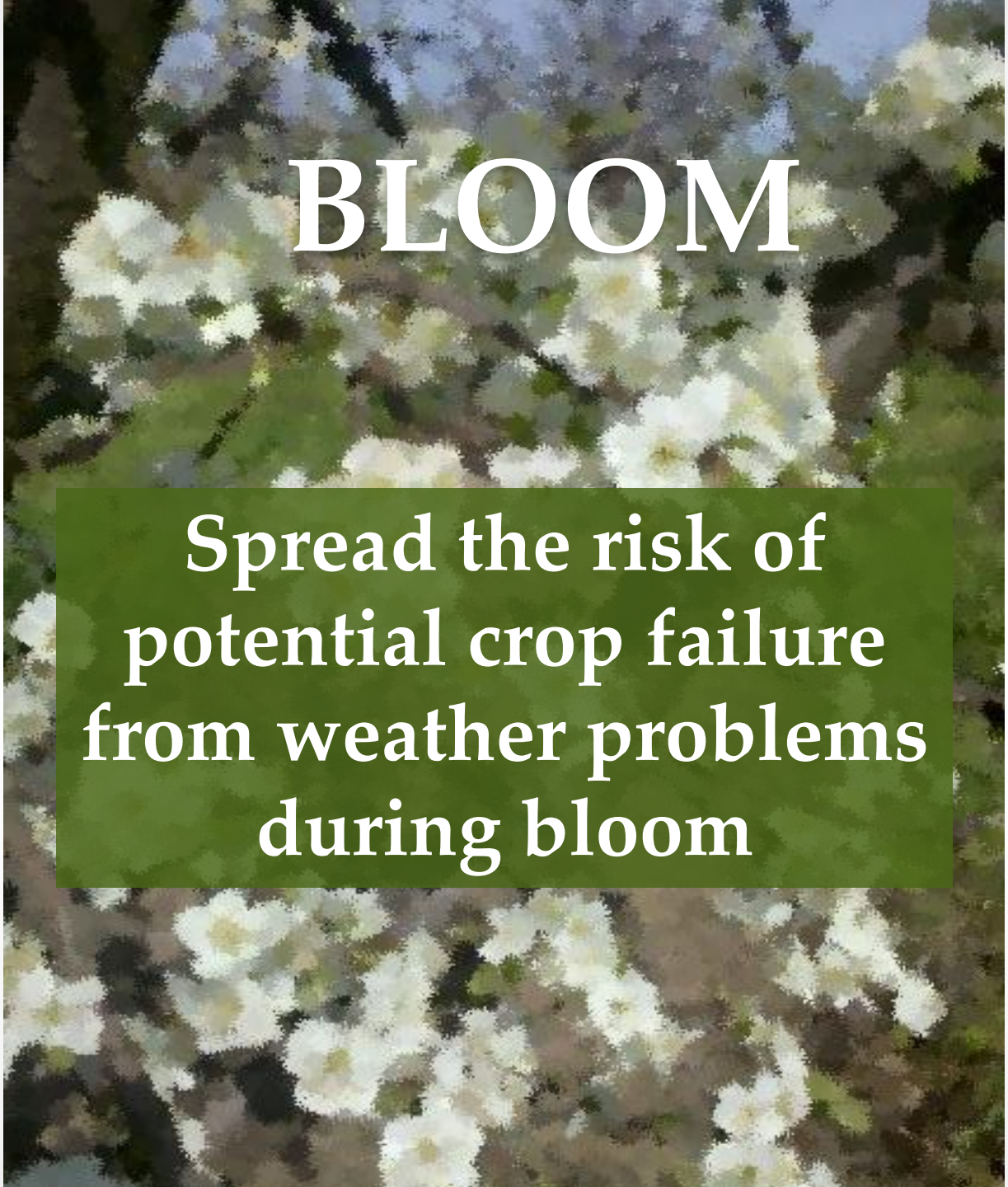
Heat at Bloom

"Excessive heat at bloom is linked to significantly reduced prune production in key California growing regions in three of the last ten crop years (2004, 2005, and 2007). Total grower economic losses in Sutter and Yuba Counties …were in the range of $240 million"

-"Managing Heat at Prune Bloom 'French' Prune"

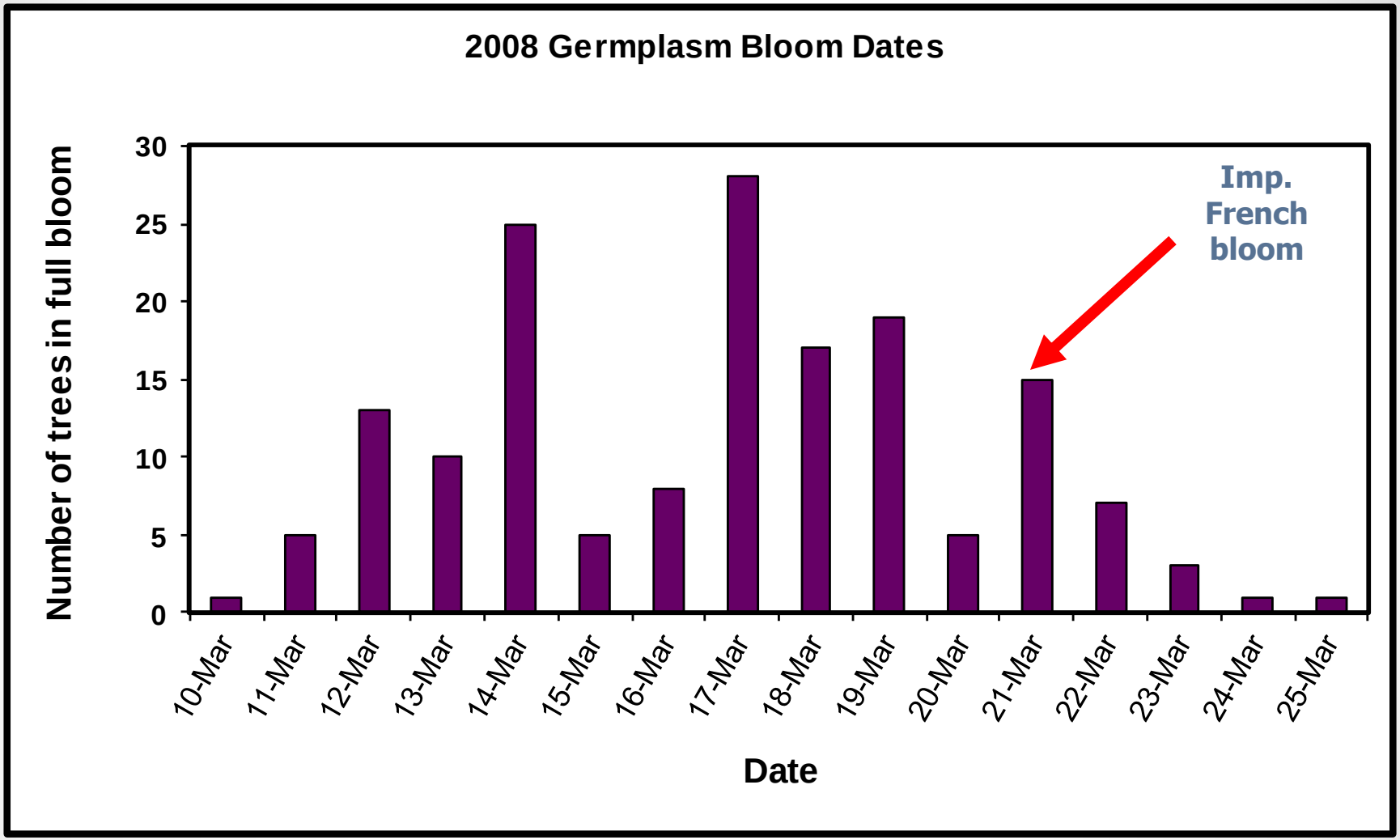
By Niederholzer, Buchner & Johnson

CDPB Research Report 2013


BLOOM
Spread the risk of potential crop failure from weather problems during bloom

Bloom Data

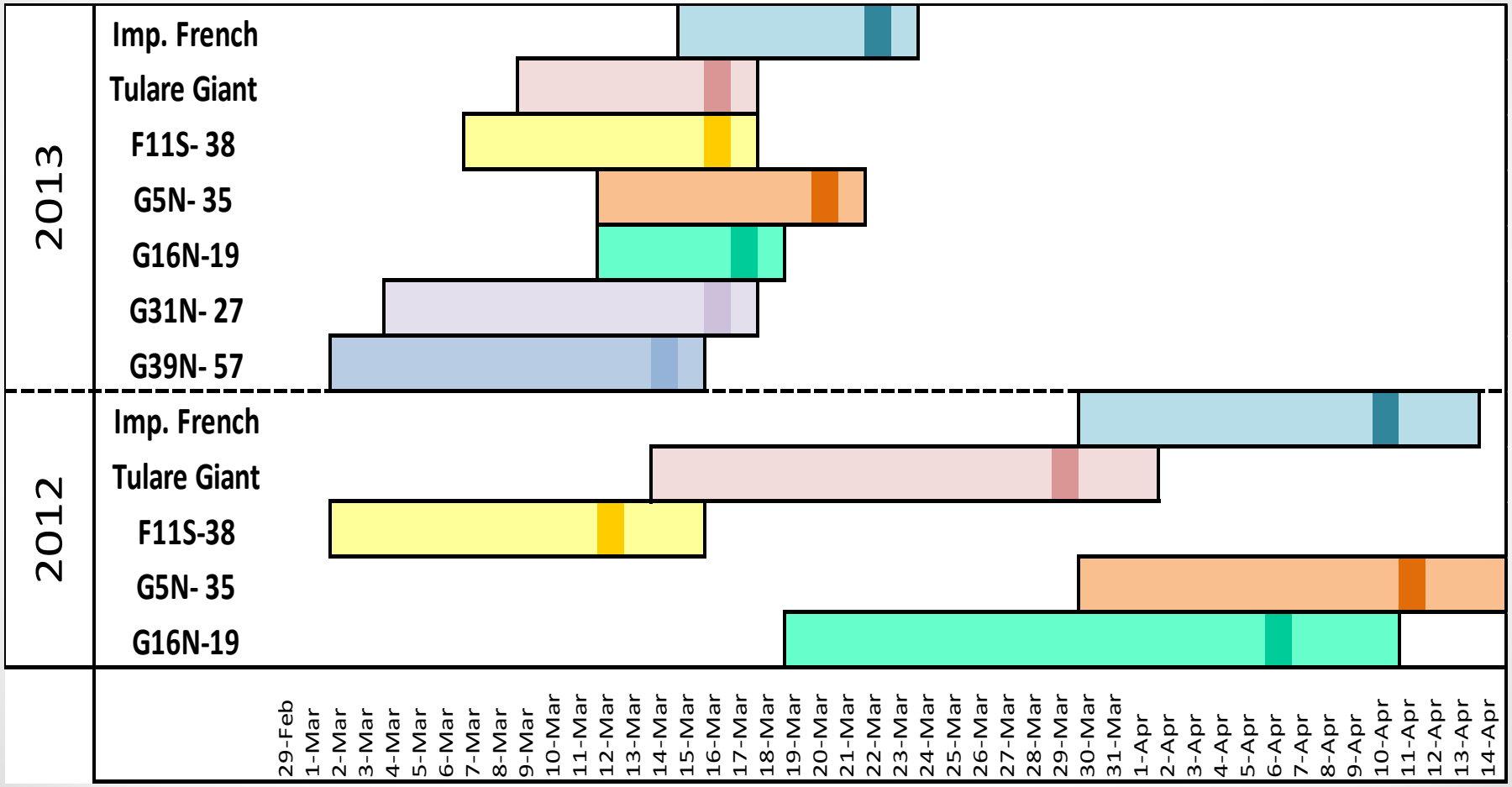
Cultivar	Full Bloom Date (90%)	Days in Bloom 2013	Days from French 2013
G33N- 27	10-Mar	9	-12
G43N- 1	15-Mar	6	-7
G39N- 57	15-Mar	10	-7
Tulare Giant	16-Mar	7	-6
G39N- 34	16-Mar	8	-6
F11S-38	16-Mar	9	-6
G31N- 27	17-Mar	13	-5
G16N-19	17-Mar	5	-5
G5N- 35	21-Mar	9	-1
Imp. French	22-Mar	8	--



The various bloom dates that our diverse trees have.

(Dates taken from Winters, 2008)

2012-2013 Days in Bloom



Pollination Cages

Items caged	Compatibility
G16N-19	Yes, self compatible
G39N- 57	Yes, self compatible
G5N- 35	Yes, self compatible
G40N- 34	No, not self compatible

Items to cage next year: G43N- 1, H1N- 40, G33N- 27 & G31N- 27

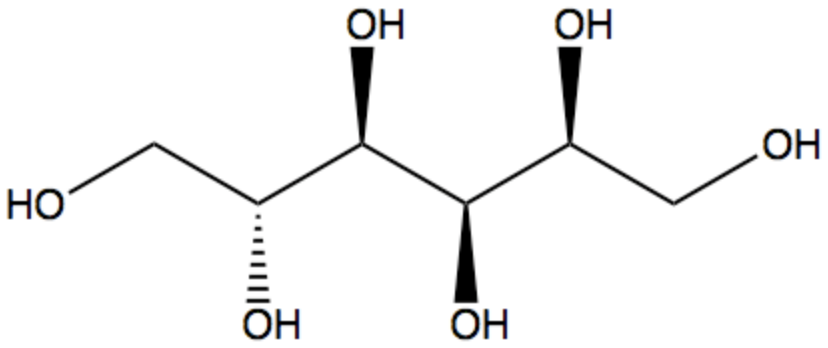
Grower Meeting

Held annually ~3 weeks before harvest at Wolfskill Experimental Station in Winters, CA

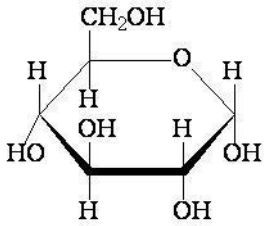
Side Project on Sugar Composition

- Compared sugar ratios of dried fruit at different fruit sizes
- Compared process-ability of top breeding items to their sugar ratios
- Analyzed changes in sugar ratios from fresh to dried to processed
  - Determined if Sorbitol protected sugars from degrading

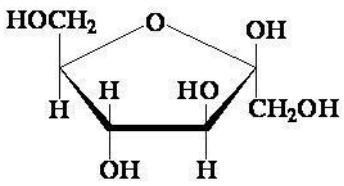
Sugar Structures



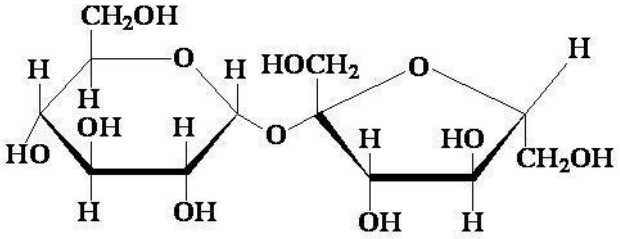
Sorbitol
(Sugar Alcohol)



glucose



fructose



sucrose

http://cdavies.wordpress.com

http://www.kasel.at/kasel-chemicals

Sugar Sweetness Ratings

- Specific Sugars in question:
  - Glucose- most prevalent in prunes tested
  - Sucrose- (Glucose+Fructose, table sugar)
  - Fructose- makes fruit taste sweeter
  - Sorbitol- sugar alcohol, acts as a preservative, digestive value

<u>Sugar type's sweetness relative to Fructose:</u>

Fructose is 3 times sweeter than Sorbitol

Fructose is 2.3 times sweeter than Glucose

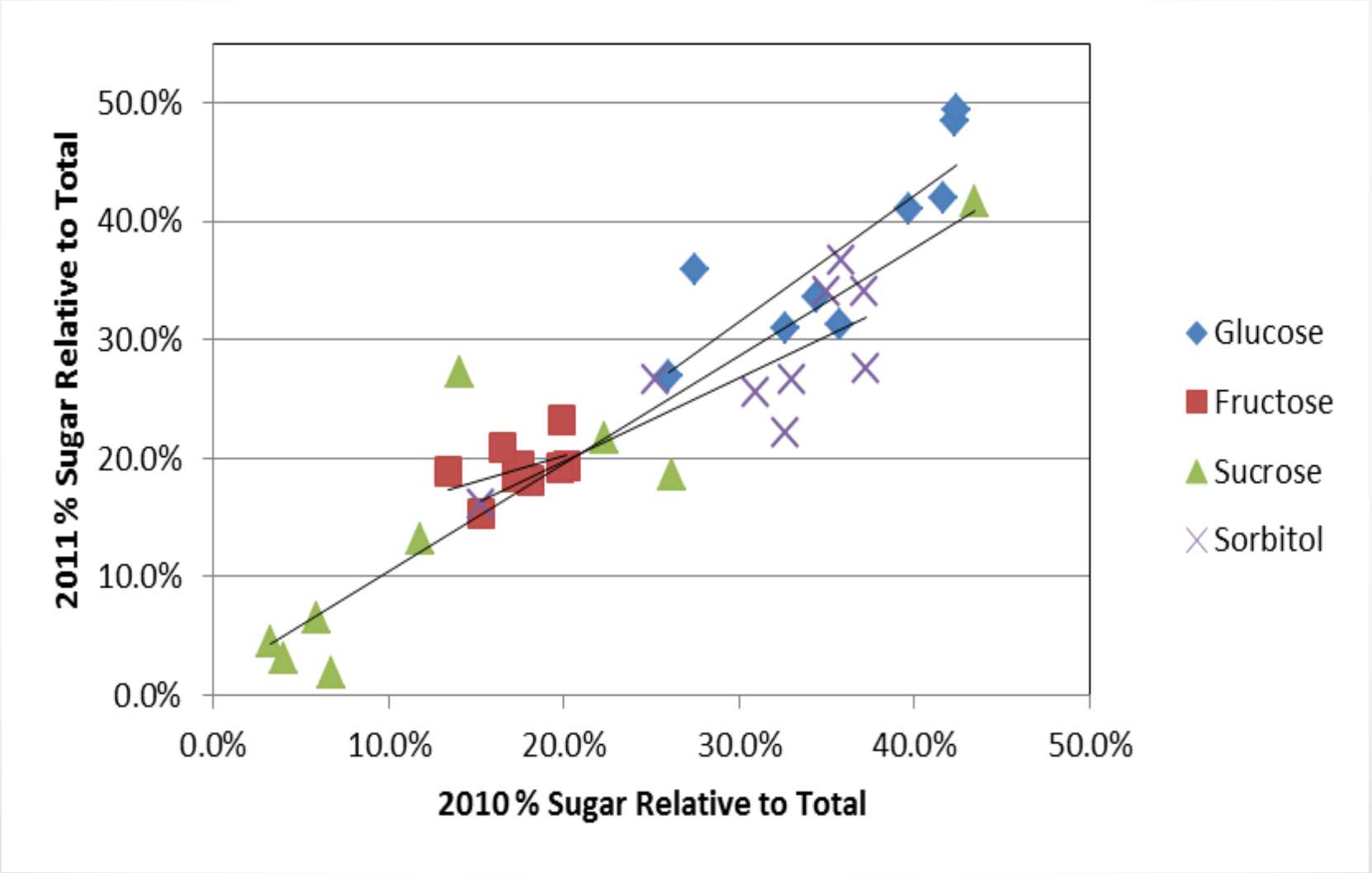
Fructose is 1.7 times sweeter than Sucrose

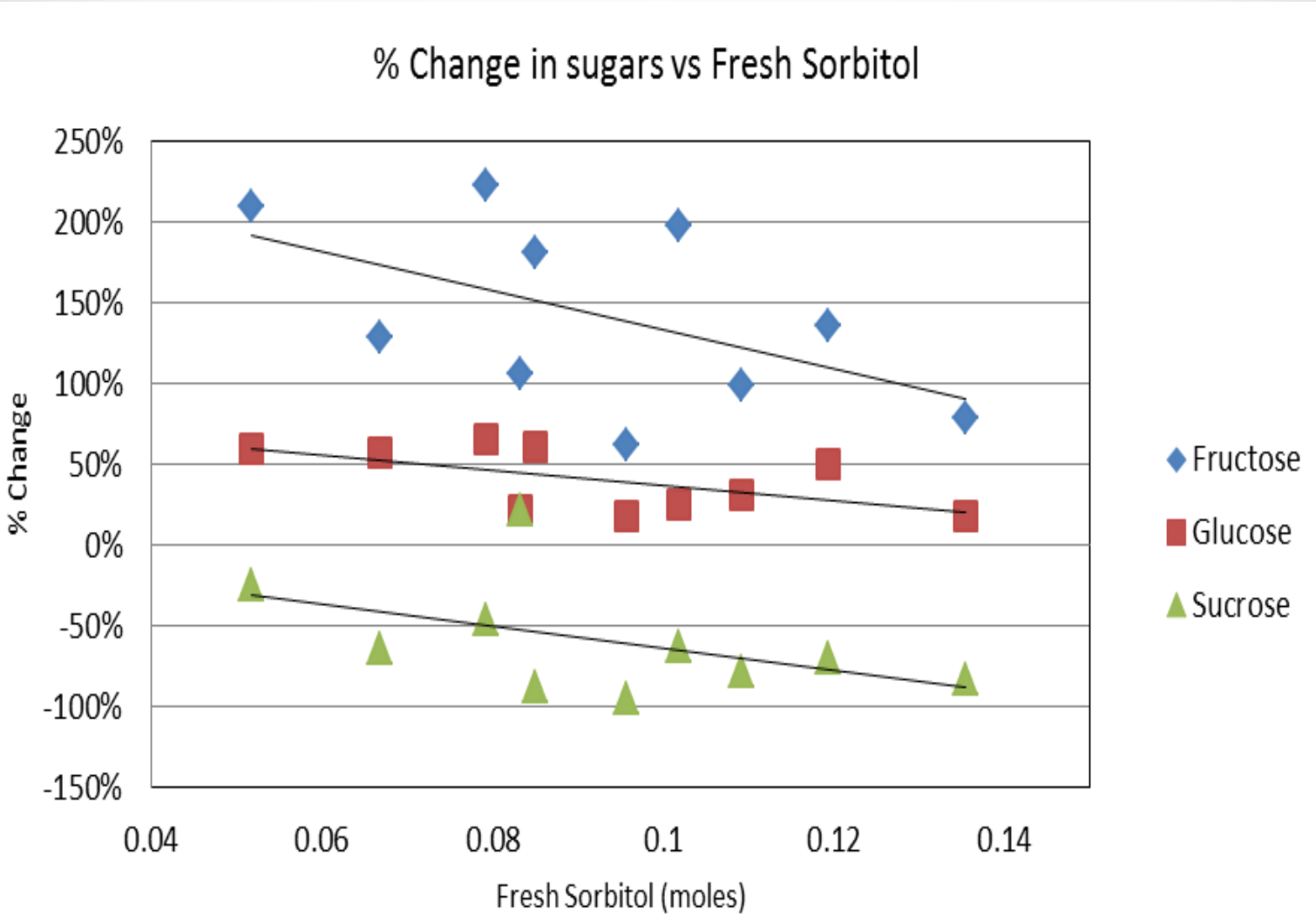
Size Evaluation: No significant difference between totals

Item	Size	Glucose	Fructose	Sucrose	Sorbitol	Sum
French	A	23.1	10.3	3.3*	24.0	60.7
	B	21.7	10.1	5.3*	23.7	60.8
	C	20.7	11.0	4.9	24.3	60.8
D6N-103	A	23.9	12.6	4.3	17.7	58.6
	B	24.8	12.1	3.9	19.4	60.1
	C	23.5	11.6	2.6	15.2	52.9
F9N-21	A	24.3	12.6	2.0	22.5	61.4
	B	26.4	12.7	1.8	22.0	62.9
	C	26.7	11.4	1.4	21.0	60.4
F2N-32	A	22.3	11.4	8.1	14.9*	56.8
	B	23.6	13.7	10.8	18.4	66.4
	C	23.9	11.2	9.1	20.4*	64.6
Sugar	A	24.9*	13.1	0.4	18.6	57.0
	B	26.9	12.5	0.6*	20.3	60.3
	C	28.8*	13.6	0.2*	17.4	60.0

* LCD test shows significant differences between other size

Sugar Ratios remain consistent from year to year despite total sugar differences





Sorbitol content does not influence other sugars during dehydration and processing

Summary

- Objectives: to save growers money through a new cultivar that reduces pruning and/or reduces dry away ratio
- Traits being aggressively pursued are low pruning, low dry away ratio, diversifying bloom time, precocity (early bearing)

Thank You!

- Duarte Nursery
  - Nursery care of seedlings
- Pacific Western Container
  - Donation of tree protectors
- All participants of the test group

Wilford, L.G.; Sabarez, H.; & Price, W.E. "Kinetics of carbohydrate change during dehydration of d'Agen prunes" 1997. *Food Chemistry*. 59: 149-155

Thank you for your attention! Question? Comments?

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In house tasting

- Select items
  - Low dry away ratios
  - Thick skin
  - Thick flesh
  - Small, free pit
- Most common discards
  - Weak skin
  - Gooey fruit / Slabbing
  - Items that dry on the tree, but taste horrible
  - Weak pits

Tasting

- Taste 13 different selections
- Please give feedback on your evaluation sheets
- We will taste, evaluate, then see data on individual fruit

Rootstock compatibility:

G16N- 19 on Marianna 2624: Rootstock 2yrs old / graft 1 year old

Other trees (not pictured) grafted on 29c & Nemaguard