The California Citrus Industry

Meeting the challenges to stay competitive

Etienne Rabe

Davis: 10 December 2015

View onto the Sierra Nevada from the Valley Floor

Content

- **My Journey**
- Wonderful Citrus
- California Citrus Industry stats
- Challenges and how we deal with it
  - Consumption aspects and potential remedy
  - Invasive and other pests: HLB
  - Regulatory, food safety, market access
  - Drought/frost
  - Costs, Labor
  - Utilizing technology; irrigation management, tree phenology
  - Varieties: new trends? Branding, etc.
- Industry organizations
- The lure of agriculture

My Journey

- **From the African bush**
- To UC Riverside
- Back to Africa: Research/University [1986 to 2003]
- Consulting [1991 to 2003]
- The mandarin challenge in CA: 1998 to present

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3489 Kentucky St

Thesis

- Etiology of arginine accumulation during P deficiency
- Urea cycle: basically studied how plants get rid of unused, potentially toxic compounds, eg ammonium
- Practical application: provided basis for the technology of winter foliar applications of LBUrea in milder climatic regions to accentuate and concentrate bloom --- basically a stress-induced response

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LANDBOUWETENSKAPPE

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- Acknowledge the UCR citrus legacy

Wonderful Citrus and California: Brief Overview

- **Wonderful acreages and varieties, alliances and brands**
- CA: move to mandarins; changing face of industry
- Recent challenges: frost and drought, disease pressures, labor

Company logos/brands

Wonderful citrus™

---

the Wonderful company™

Wonderful orchards™

Wonderful pistachios & almonds™

Wonderful citrus™

Wonderful bees™

FIJI® WATER

POM WONDERFUL™

Suterra®

Company logos/brands

Wonderful citrus™

VINTAGE NURSERIES

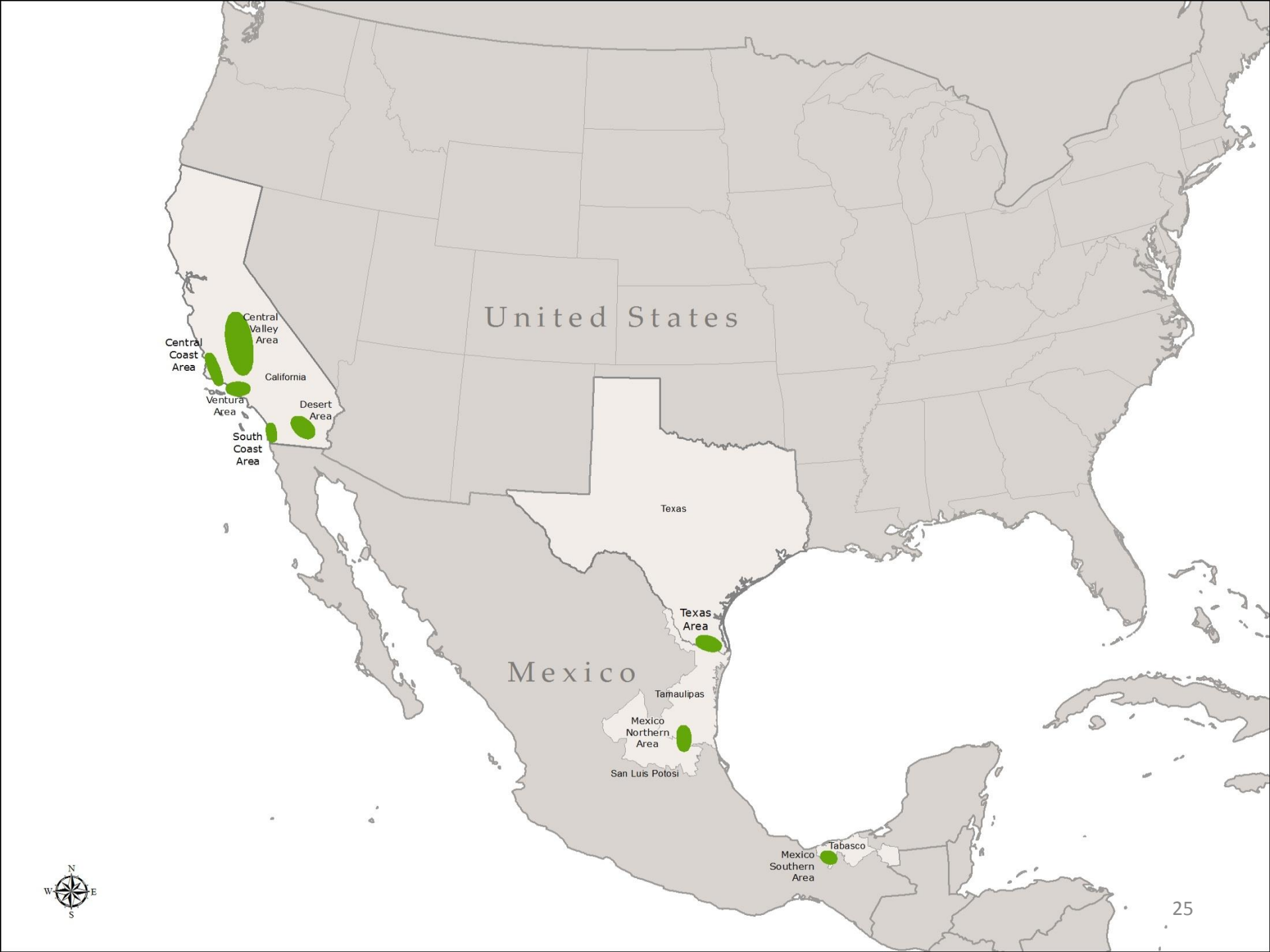
JUSTIN

Landmark Vineyards

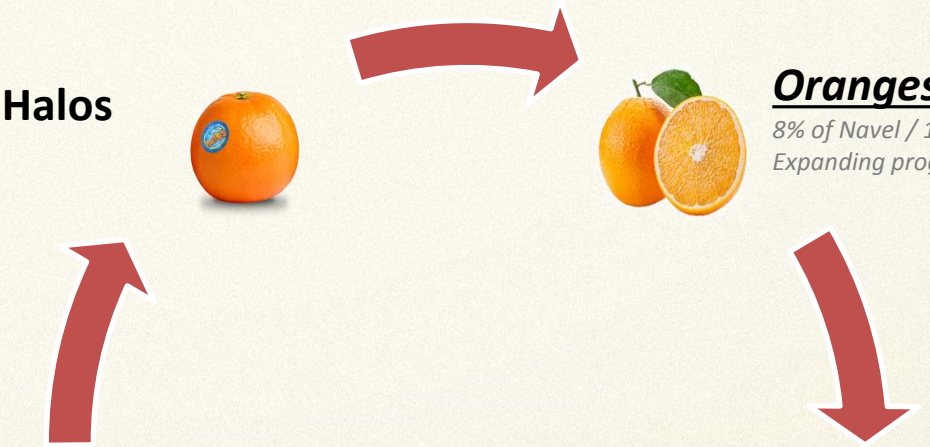
teleflora®

Wonderful education™

Wonderful sales™


United States
Central Valley Area
Central Coast Area
California
Ventura Area
Desert Area
South Coast Area
Texas
Texas Area
Mexico
Tamaulipas
Mexico Northern Area
San Luis Potosi
Tabasco
Mexico Southern Area
N
W
E
S

• Wonderful Citrus continues to grow as a one-stop shop for all major citrus varieties



Oranges

8% of Navel / 10% of Valencia volume
Expanding program through outside growers

Lemons

Largest independent lemon shipper in US
Strong summer program through Mexican lemons
Combined represents ~20% US lemon market

Persian Limes (MX)

Largest individual lime grower in Mexico
Planted 2,500 acres in 2014 alone

Texas Red Grapefruit

75% of TX grapefruit / 15% of US red grapefruit
Launched branded strategy in 2014: Sweet Scarletts

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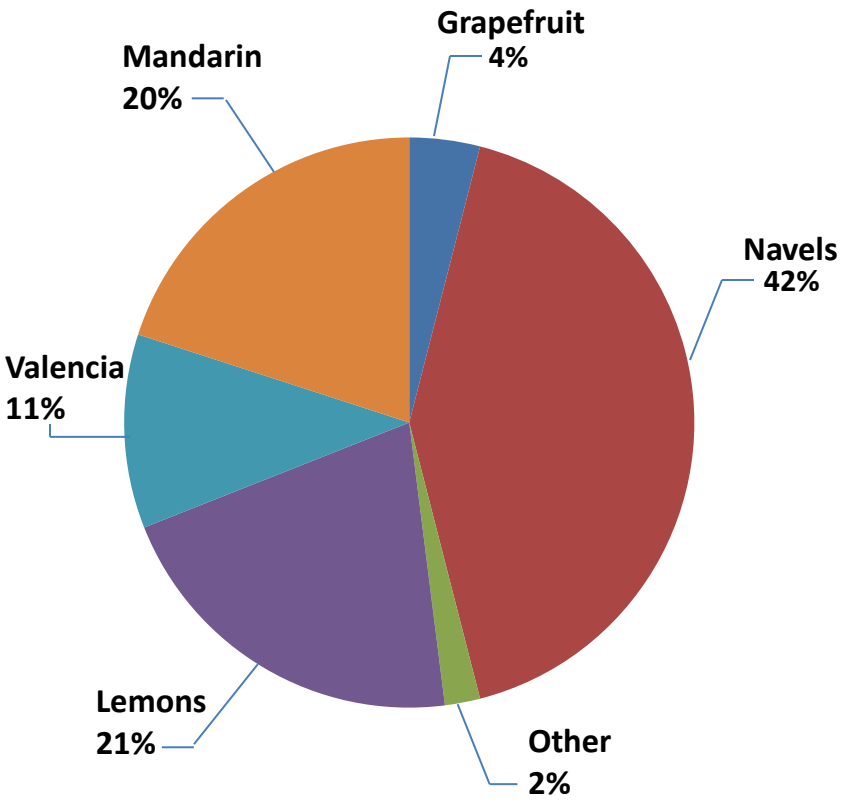
Citrus Acreage In California (2014)

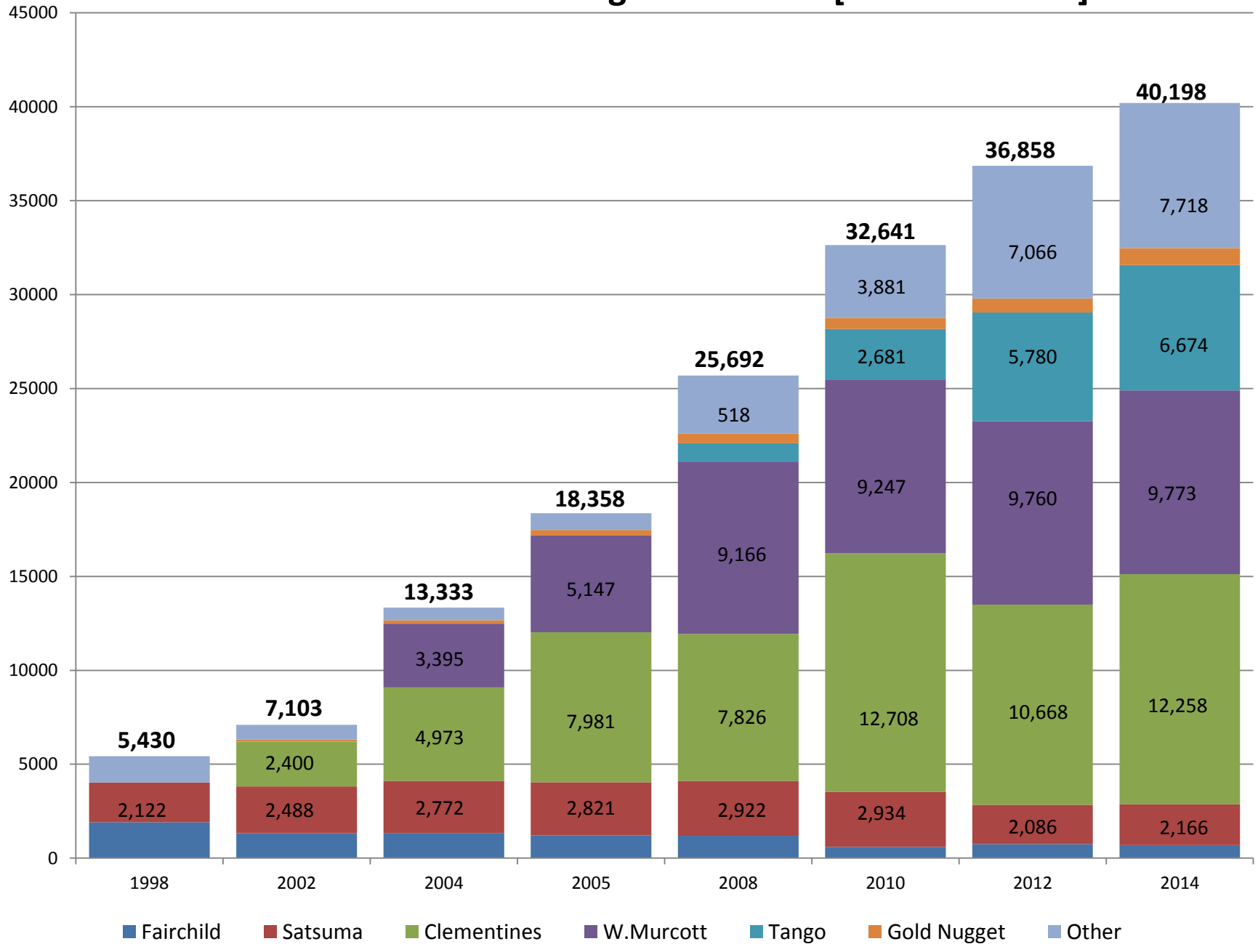


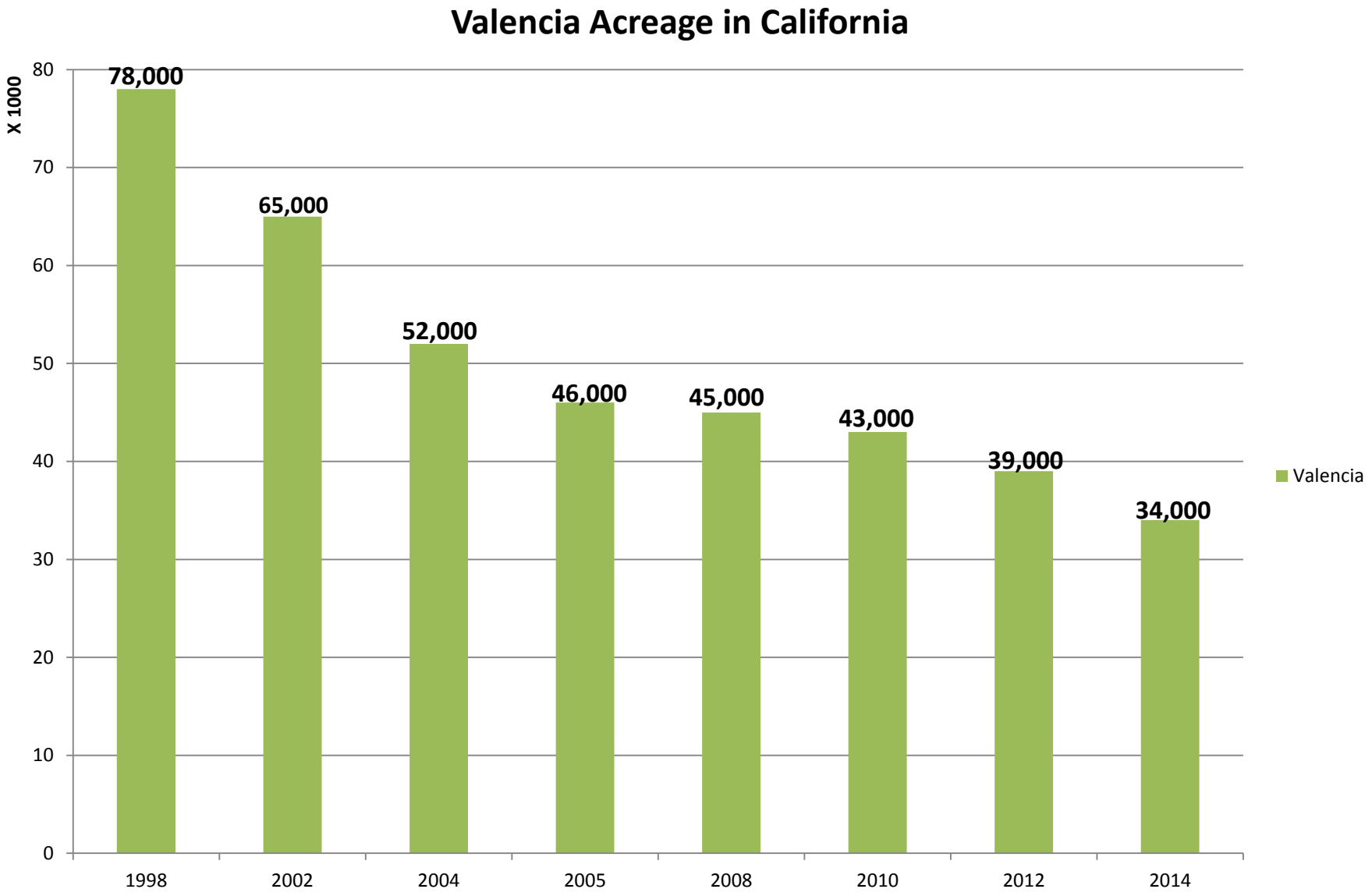
Variety	Area (ac)*
Navels	126,000
Lemons	44,000
Valencia	34,000
Mandarin	46,000
Grapefruit	9,000
Other	2,000
Total	**261,000**

Total Production - 3,453,000 Metric Tons

• Navels - 1,454,000	42%
•Valencias - 377,000	11%
• Lemon - 745,000	21%
• Mandarin - 673,000	20%
• Grapefruit - 131,000	4%
• Other - 72,000	2%

Mandarin Acreage 1998-2015 [CASS estimate]




Valencia Acreage in California
X 1000
80
70
60
50
40
30
20
10
0
78,000
65,000
52,000
46,000
45,000
43,000
39,000
34,000
1998
2002
2004
2005
2008
2010
2012
2014
Valencia

California Strengths

Large domestic market

Large acreages/flat land/ease of management

(economy of scale)

Deep fertile soils

Good quality water/usually abundant

Climate generally favorable/Mediterranean desert

WC Clementines in southern SJ Valley

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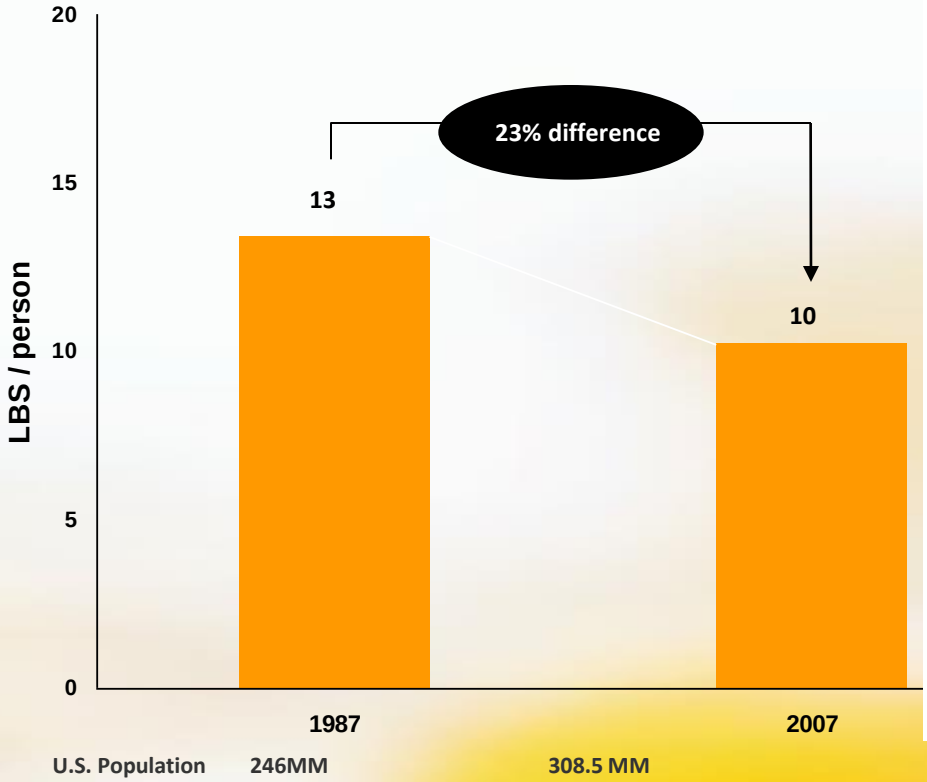
Consumers in the USA eat ~3 lbs less fresh oranges per person than twenty years ago

Changes in fresh orange consumption (lbs/person)[1]

1987 vs. 2007



Fresh orange consumption down 23% since 1987[1]

- Total ~3 billion lbs sold in 2007
- Missed opportunity of ~ 900MM lbs (equiv. of ~3lbs per person)

Not all citrus *(i.e. mandarins)* is in decline

- Other citrus consumption (e.g. mandarins, tangelos, limes) is increasing ~2% per year[3] (see appendix slide 17)

1.ERS/USDA total per capita consumption of fresh, processed and juice fruit; 2. FAO; 3.ERS/USDA total per capita consumption of fresh, processed and juice fruit; 4. Based on USDA/ERS per capita data and FAO population data

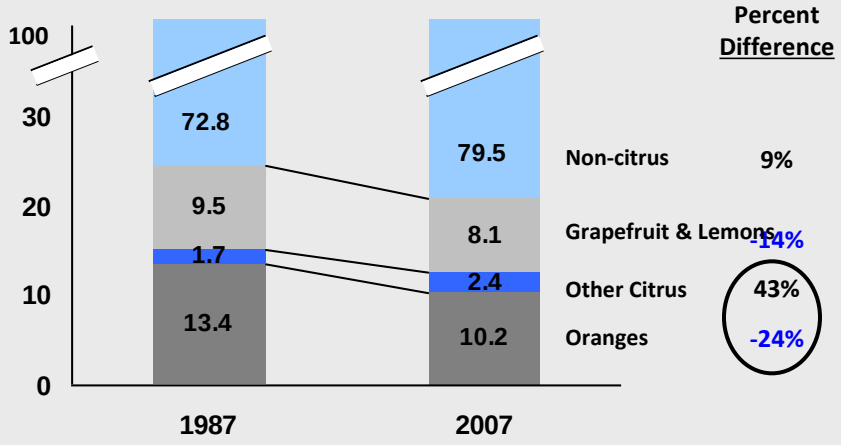
Overall fresh fruit consumption increasing as consumers are faced with more produce options than ever before

Overall fresh fruit consumption has increased ~3lbs per capita since 1987[1]

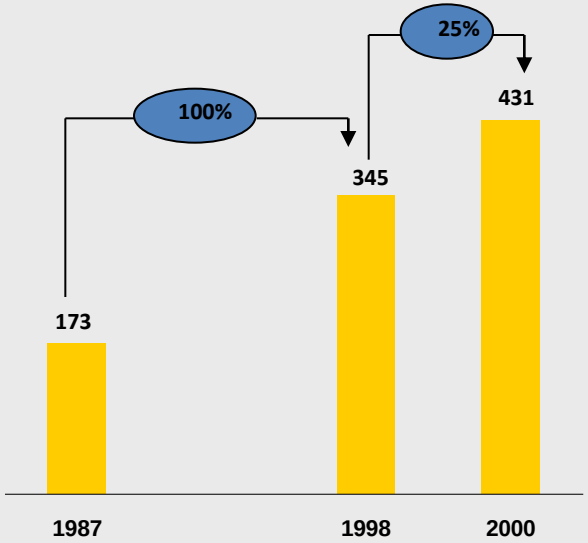
- Average number of options in the produce department more than doubled since 1987
- Fresh fruit imports have doubled in the last ten years[2]

Consumption of Fresh Fruit[1]

(Lbs per person)



Average # of items in the produce dept.[3]



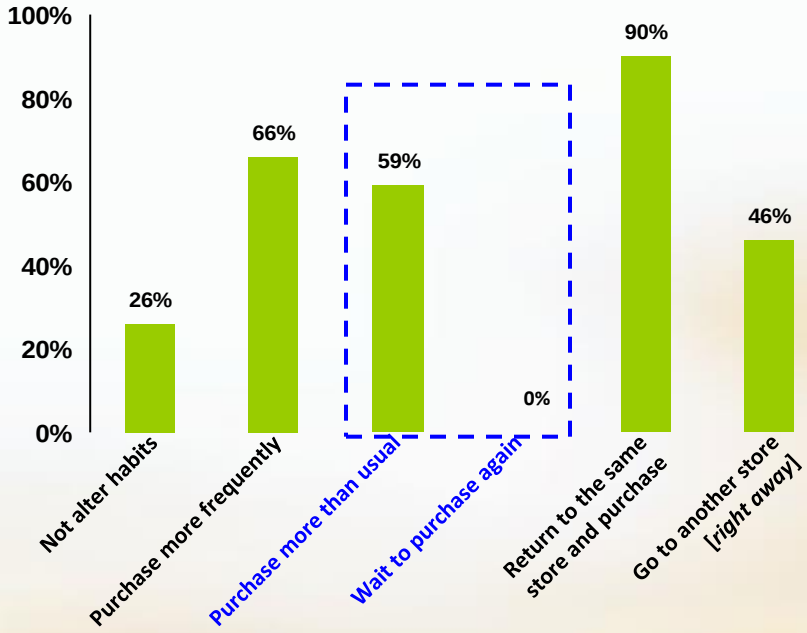
Increases in imports are affecting consumer fresh fruit purchases

1. ERS/USDA; 2. U.S. Dept. of Commerce Foreign Trade Statistics (mixed quantities); 3.. Postharvest Technology of Horticultural Crops, Ed. Adel A. Kaded, 2002

Over 65% of consumers say they would purchase oranges more frequently if they ate a delicious orange[1]

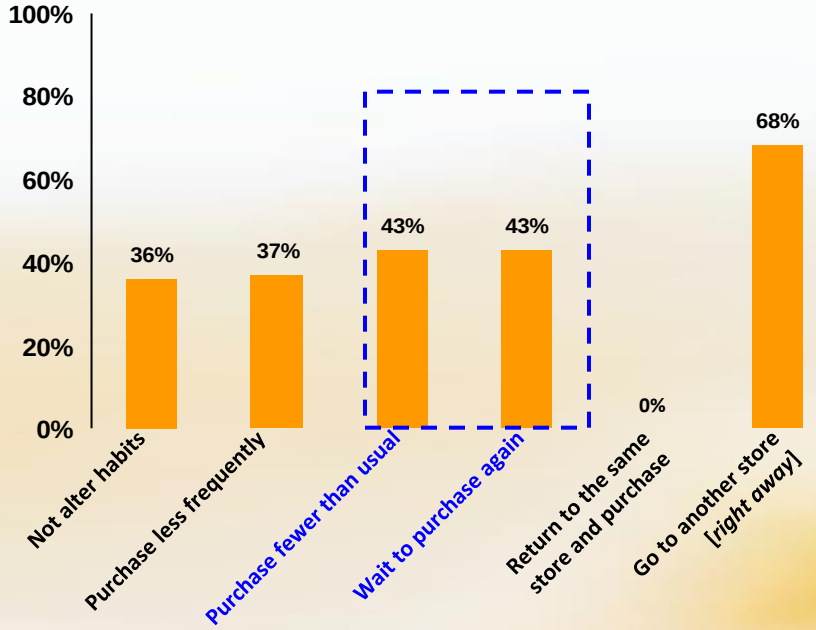
Changes to Behavior After Positive Eating Experiences

(Percent of respondents)



Changes to Behavior After Negative Eating Experiences

(Percent of respondents)



A positive eating experience with an orange may initiate additional purchases . . .

. . . while negative experiences either reduce quantities purchased or send consumers searching for better oranges

Consumer eating experiences (of oranges) directly affect repeat purchases

1. 2008 Tragon Study

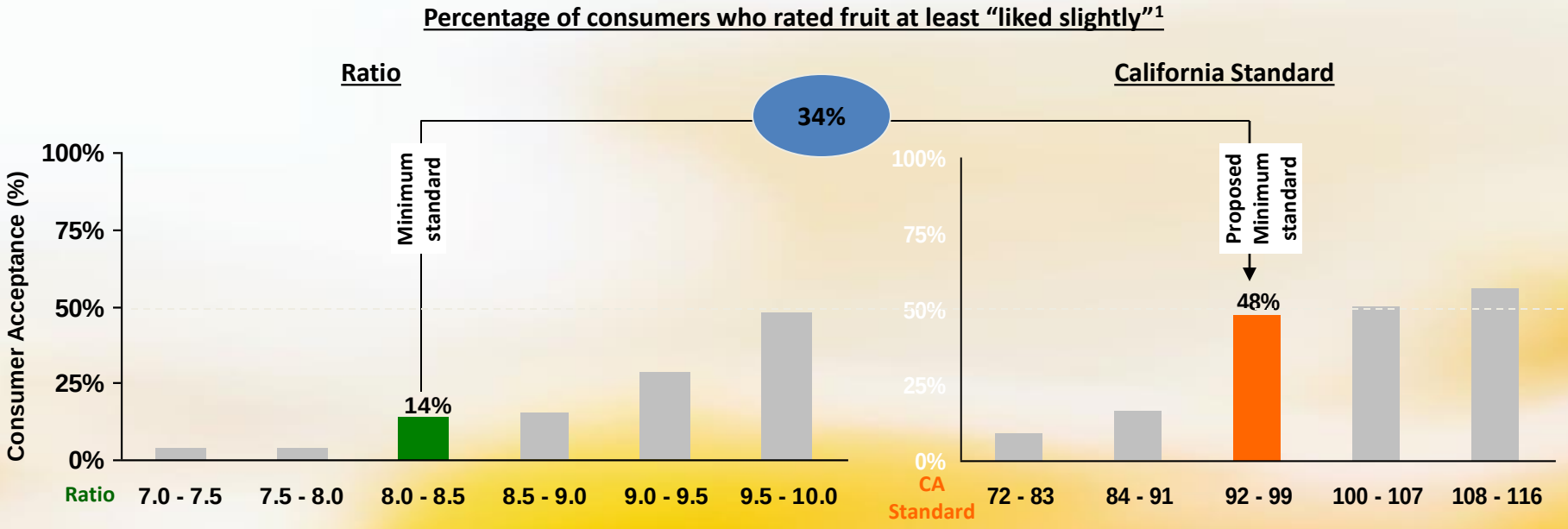
Making Citrus Sexy Again

- Branding
- New varieties
- Quality standards
- California Standard

The minimum standard used less likely to guarantee consumers a positive eating experience

The California (CA) Standard of 90 replaces ~35% of fruit deemed unacceptable with acceptable fruit

- Currently there is low (less than 15%) consumer satisfaction of early season oranges (ratio 8:1 to 9:1)[1]
- In order to achieve the ~50% acceptability of the CA Standard minimum, would need at least a 9.5 Ratio

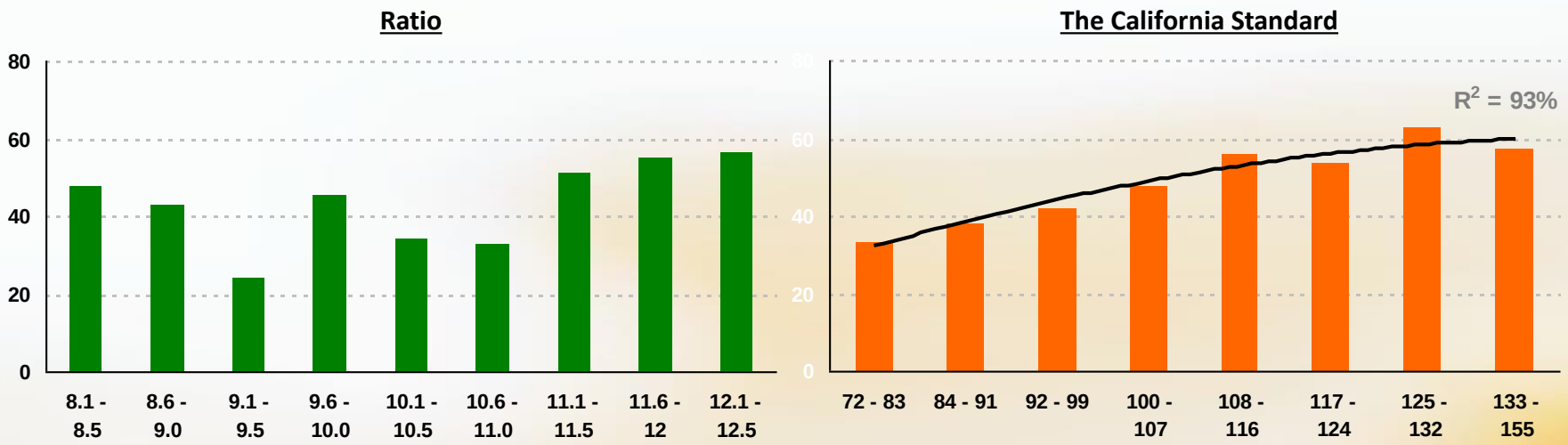


The California Standard more likely to supply consumers with acceptable fruit

1. 2009 Tragon Study

The CA standard shows a predictable linear progression – as the score improves so does consumer acceptance

Percentage of consumers who "would purchase"[1]



Ratio is not predictable (exhibits no logical pattern) in determining purchase intent . . .

. . . while the CA Standard exhibits 90%+ accuracy in determining purchase intent

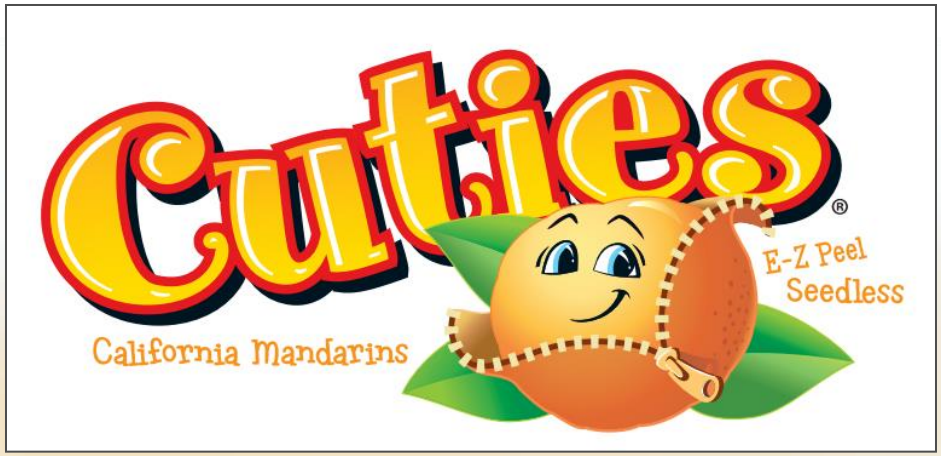
The California Standard more accurately predicts purchase intent

1. 2009 Tragon Study

Branding/Trade Marking

- Emulate **Pink Lady model** with novel selections
- **“Clemengold”** launch around a variety (internal quality, color, seed levels, etc)
- **“Halos” and “Cutie”**: brands for a range of mandarins with minimum internal quality standards, low or no seed content, ease of peeling (no oiliness)

Cuties: Established In 2004



Halos: Launched in Nov 2013

Wonderful™ halos™


SWEET
Scarletts
TEXAS RED GRAPEFRUIT
PARAMOUNT
CITRUS
Wonderful
halos
TEXAS GROWN
CITRUS
16
17
18
19
20
21
22
23
24
25
26
27
28

What Does It Take To Be a Halo?

- Easy to peel
- Seedless
- Eating quality [min. brix and max. acid; “California Standard” scale]

Implications of seedless promise

- Self-incompatible but cross-compatible and cross-pollination lead to seediness (bee pollination)
- Need for netting during flowering period to prevent bees from reaching the flowers; cost increases
- Premium on sterile varieties
- Fruit size compromise

Net Application

Final Product

The Drivers For Change

- Financial: cultural costs
- Southern hemisphere pressure
- Consumer preference: convenience fruit -- witnessing a sea change!
- Non-citrus competition – quality fruit on the shelves (apples, berries, etc.)

Halos is focused on growing market demand and is committed to spending $100MM on advertising

Digital

FSIS

PR

In-store

Print

New

OOH/ Radio

TV

$20MM

81% brand awareness

More buyers

29% of US: 45% more than Cuties

More valuable buyers

9.7 lbs/buyer: 21% more valuable than Cuties

- **Wonderful merchandising force brings Halos to the forefront in stores**

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• Halos facility continues to expand in capacity ahead of the 2015 season

Packinghouse Stats

+ 640,000 sf – largest citrus packinghouse in US
+ 300,000 sf – facility Fowler Packing
+ Forward distribution location in Chicago

Packinghouse Enhancements

+ Doubling of presort capacity to 7,000 bins/day
+ 30% increase in bagging capability
+ Installation of automatic case packers

Where to from here?

- Oranges likely further cannibalized by mandarins
- Volume growth of mandarins in short term will be absorbed by aggressive advertising
- Some sectors of the industry think a smash on the way and they may have missed the boat
- Consumption growth still possible in the US as compared to other countries
- SH volumes into NH summer?

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Invasive Pests/Disease

- Top of the agenda: Huanglongbing (HLB)
- Non-culturable bacteria transmitted by Asian Citrus Psyllid (ACP)
- Florida being devastated
- Certain regions of Mexico as well
- Texas: fast spread
- California next in line: more of a fighting chance

Citrus infected with Huanglongbing (HLB) have reduced productivity and ultimately die from the disease

- Leaves have mottled appearance
- Symptoms can look like nutrient deficiency

- Fruit of infected plants remain partially green and fall off the tree easily and prematurely

- Fruit of infected plants are small, misshapen/deformed with thicker rind and dark, aborted seeds
- There is no known cure or natural resistance to HLB

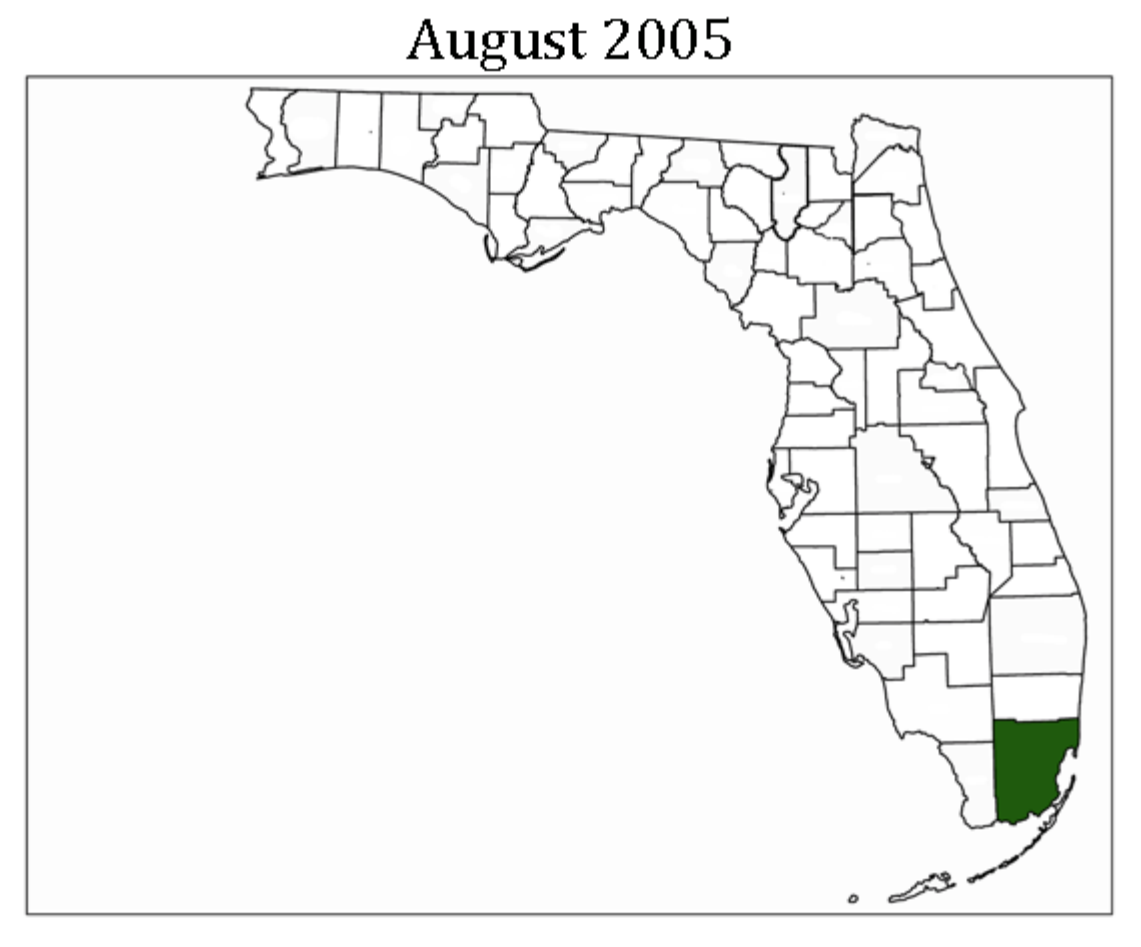
Huang Long Bing (HLB) is a citrus disease caused by a bacterium but transmitted by the Asian Citrus Psyllid (ACP)

- Enlarged view of Asian Citrus Psyllid
- 1/8 – 1/6 inch (3 – 4 mm) in length[1]
- Live 1 to 2 months[1]

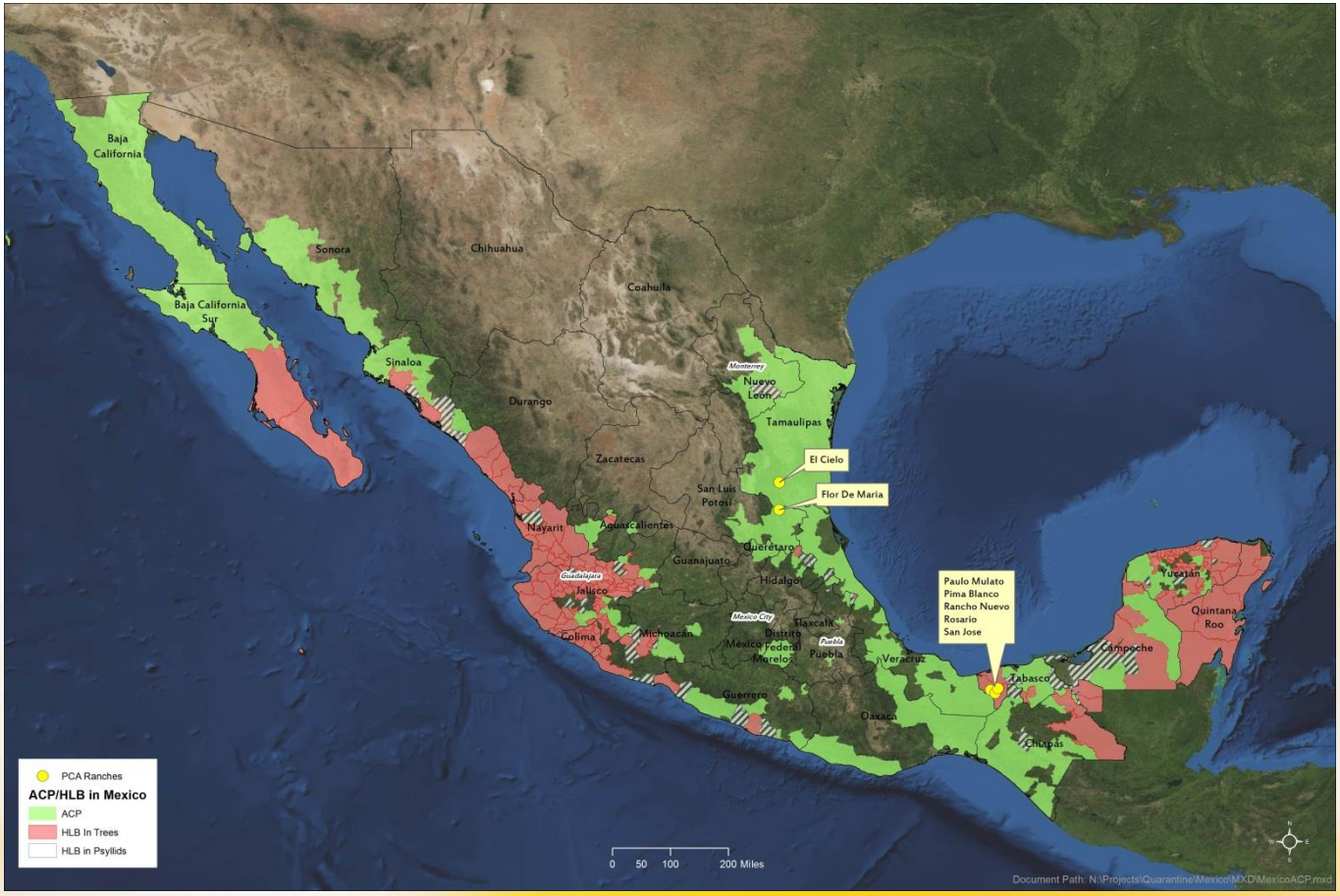
- Image of many ACP on citrus leaf

Source: [1]UC ANR Publication 8205

HLB Spread Throughout Florida Within Four Years of Initial Detection



Wonderful ranches in the north and south of Mexico are in or near territories where HLB has been detected



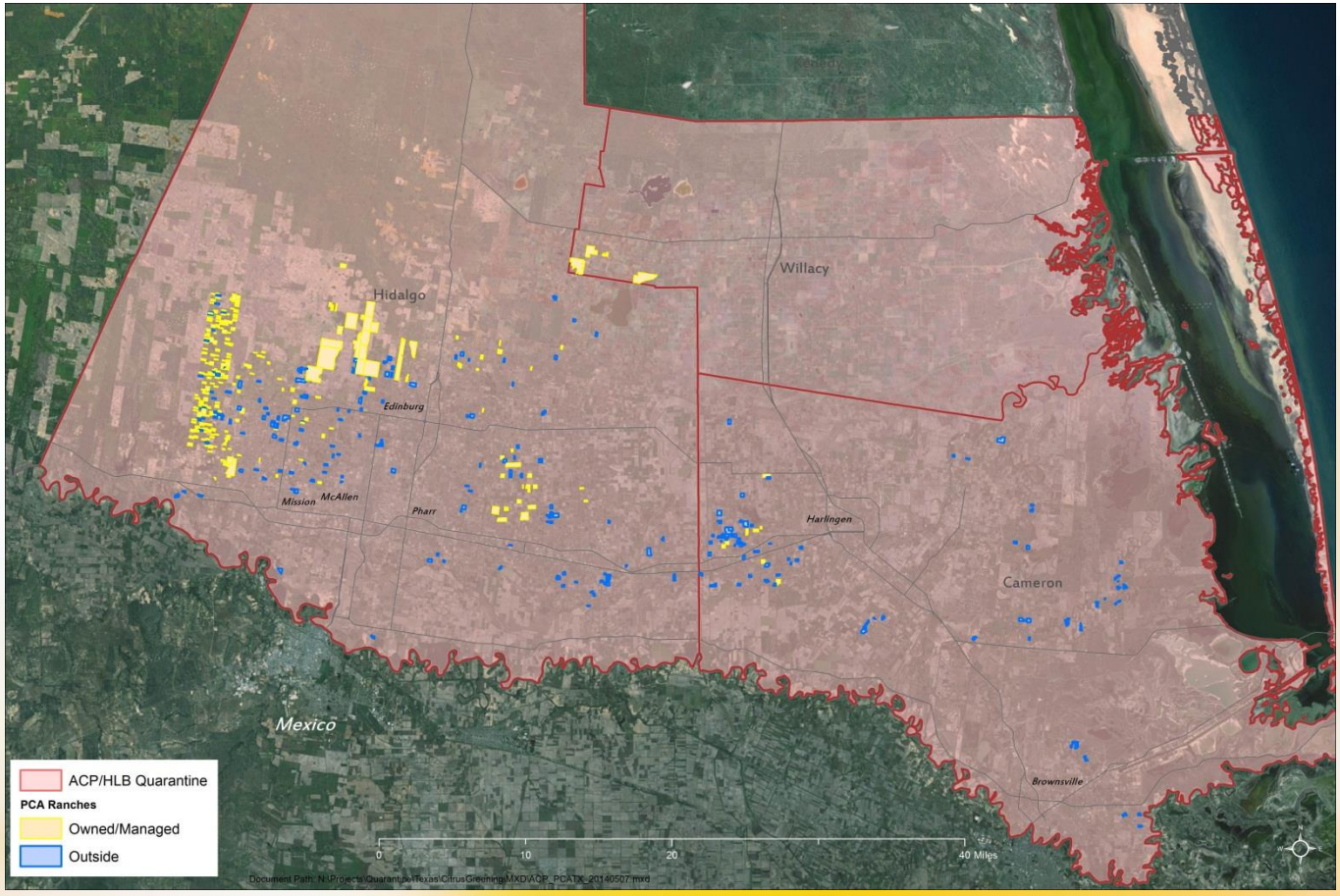
North (Flor and Cielo)

- Relatively isolated; Flor totally; can "protect" ourselves
- Currently aggressive ACP program, resulting in other pest flare-ups

South

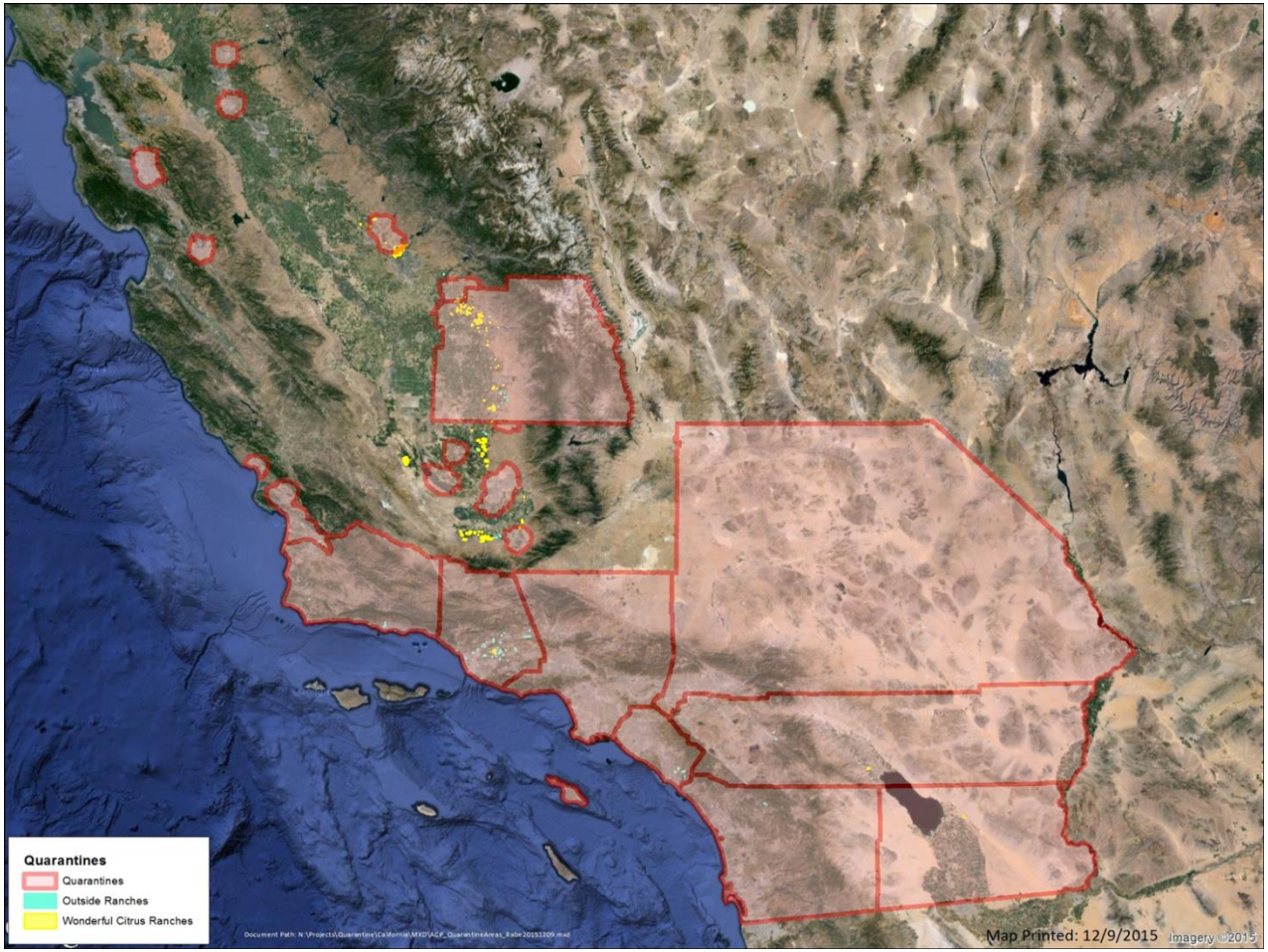
- Surrounded by neglected orchards
- Historically no ACP control; being instituted now with program to minimize other pest flare-ups
- Young, new plantings aggressively treated but older plantings without irrigation and with low tree population less aggressive

The entire citrus region of Texas is now in an HLB quarantine zone



- All citrus ranches and packinghouses now located inside HLB quarantine zone
- Industry working with Texas Dept. of Ag. to relax rules regarding tarping of trucks, notification of harvest, pre-harvest inspections, and psyllid traps
- Many trees in zone propagated outside of insect resistant screen structure – these trees have a higher risk of HLB infection

California ACP Q's: 12/2015



With no cure for HLB, the research landscape for treatments can be divided into near and mid term activities, that reduce disease effects and long term solutions

Research areas	Activities
Near term	
1 Nutritional research (fertigation combinations/spraying beneficial compounds)	• Delay disease through nutritional treatment
2 "Early" (pre-symptomatic) HLB detection through VOC / metabolites / Airborne imaging	• HLB detection and tree removal (PCR assay/scouts)
3 Spray-delivered treatments to modify metabolism or treat psyllid	• Area-wide psyllid management
4 Biological control of ACP	• Natural predator to control ACP population; scale up in residential areas of So. California and Texas
Mid term	
5 Thermal therapy	• Reduce HLB bacterial count by heating the trees using plastic covering (solar heating)
6 Antimicrobial treatment	• Control or eliminate HLB bacterium using compounds injected into trees
7 Odor-based lures & trapping	• Develop an effective ACP trap; develop an attract & kill platform
Long term	
8 Genetically modified (GM) citrus immune to HLB	• Create citrus immune to HLB
9 RNA interference (RNAi) insecticide against psyllids	• Release modified psyllids that do not vector HLB
10 Breed new rootstock varieties	• Breed new rootstocks that confer immunity or suppress disease symptoms

Prognosis for HLB Is Highly Regionally Dependent

California

- Fighting chance in most climatic regions due to lack of humidity, more defined flushing of trees, cold winters in the Central Valley; Ventura, Orange, and San Diego plus western Riverside and San Bernardino counties are much more at risk due to mild climate
- HLB survey is crucial
- ACP monitoring in Central Valley, Ventura and desert must continue
- Research activities to focus on include:
  - Area-wide management (insecticides; lures – attract and kill type)
  - Early diagnosis and detection of HLB
  - Antimicrobials and thermal therapy
  - Genetic tolerance and/or resistance through breeding and genetic modification (rootstocks and scions)

Texas

- Higher temperatures and lower humidity relative to Florida will allow for better disease management, although, it will be likely worse than regions in California
- Climate conditions in Texas lead to different tree phenology than in Florida, which should help reduce spread of HLB
- Texas is mainly a fresh industry that treats plants more frequently than Florida, this should also help slow the spread of the disease due to lower overall psyllid populations
- Close interface of residential and commercial properties poses a high risk to commercial growers as it is difficult to control psyllid populations in residential areas

Mexico and Florida

- Mexico is the most difficult to assess currently: it is anticipated that the eastern, high rainfall regions (Vera Cruz and Tabasco) will be greatly affected; the northern regions by contrast, are drier and ranches are more isolated, providing for greater success in managing HLB
- Main challenge in regions where HLB will take hold is to get young trees into production: this will require higher density plantings per acre, in order to compensate for declining trees – currently there is a trial in California using 700 trees/acre (12 ft x 5 ft) that uses different machinery, etc. to test production methods
- For PCA, it is fortunate that the varieties grown in Mexico are naturally sour/acidic

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Regulatory, Food Safety, Market Access

- Regulatory: cost of doing business; air quality regs
- Food safety/traceability: plethora of audits, each varying minutely
- Market access issues: phytosanitary barriers, some imagined
- Environmentalists/sustainability:

  -- fruit farming by definition sustainable

  -- activists: goal posts keep moving so they can remain activist!
- Citrus industry on board for safe food but sometimes burdens seem very onerous

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View Onto The Sierra Nevada From The Valley Floor

Drought

- Snowpack low
- No or very little allocations from State and Federal projects
- Solely rely on groundwater pumping: dangerous situation and not sustainable
- Some citrus regions no wells!
- Partially man-made: lack of pumping to re-charge aquifers in high rain years

Ice After Frost Night

Severe Frost Damage

12/2014

Fruit Drop Due To Frost

(no juice value)
12/2014

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Make Technology Work For Us

- **Water**: irrigation management
- **Nutrition**: soil and foliar
- **Light**: pruning – optimal photosynthesis

IRRIGATION SYSTEMS

Water (Coverage)	Nutrition	Irrigation
Sprinkler – 100%	1 x Season	1 x 2 –3 week
Micro – 80%	2 x Season	1 x 10 Days
Micro – 50%	3 x Season	1 x Week
Drip – 20%	1 x Week	Daily/5 x Week
OHS – 3%	Daily	Daily

Fertigation

Drip: single or double line

IMG_1889

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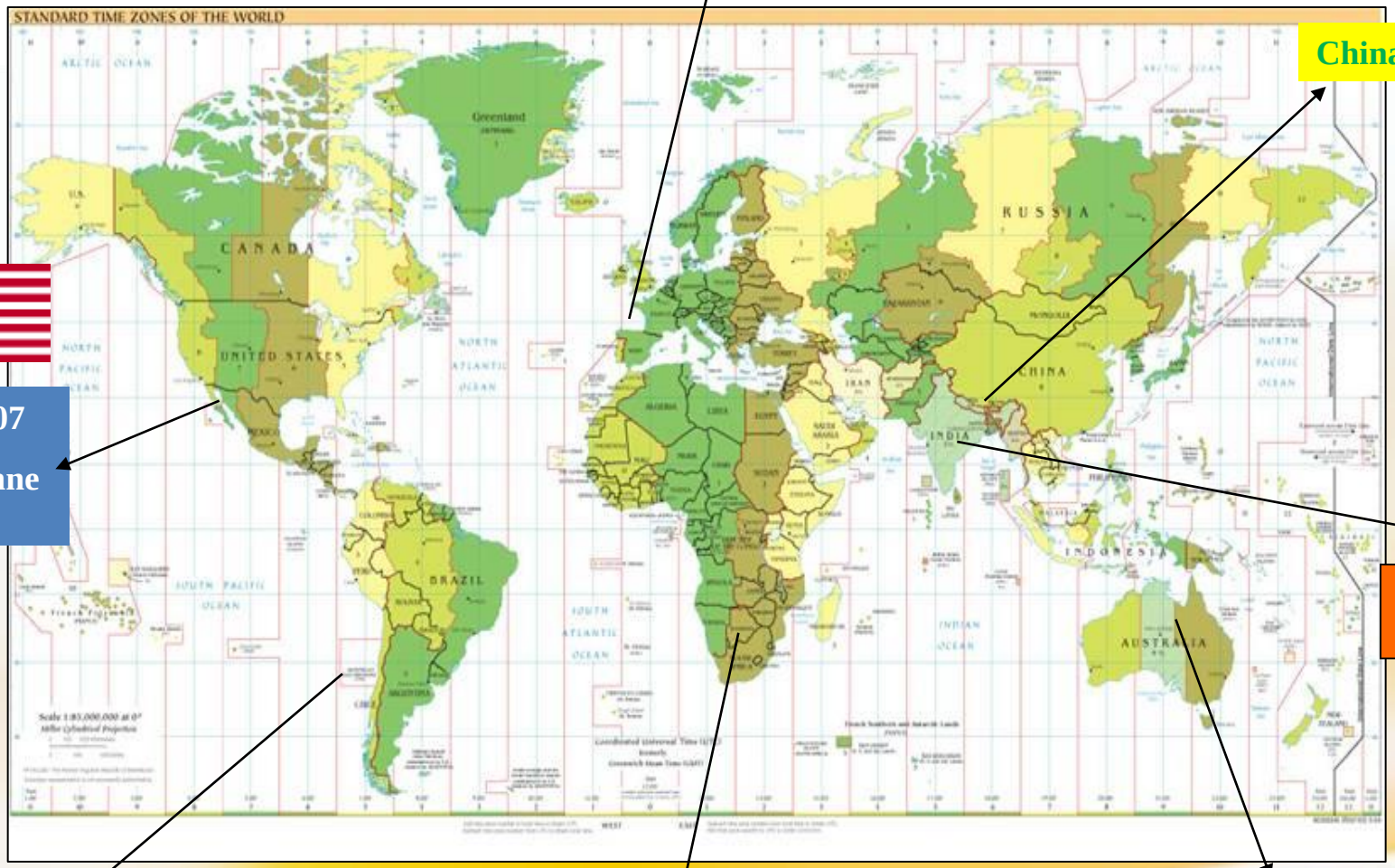
BIOGOLD Network



EU, 2008/9

China,2007

USA,2007

Dr Etienne Rabe

India, 2007

Chile,2006

Rodrigo Cruzat

Africa,1997

Bruce Cook

Australia,2005

Wayne Parr

Navel: M7 Early

M7 vs. Navelina 7.5, 27 Abril 2007

M7 - Navel

Eureka Seedless

ESL 2

ESL 2

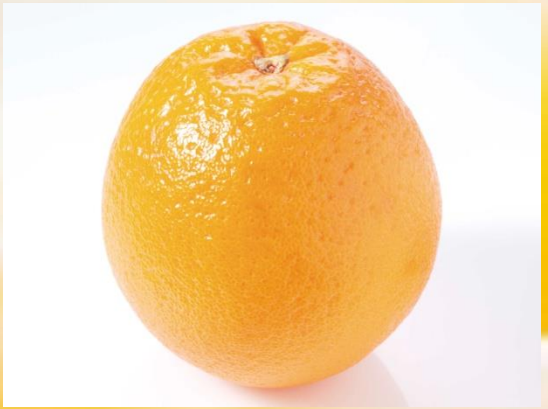
RHM

LNR

High internal quality; very low seeded, large fruit. Maturity in May/June (SH)

Ruby Valencia

- Late maturing
- Deep red pigment (lycopene)
- Fruit size medium(68 – 78mm)
- Juice content > 55%



Kiwi SORELI

ANGEL RED Pomegranate

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- Wonderful Citrus
- California Citrus Industry stats
- Challenges and how we deal with it
  - Consumption aspects and potential remedy
  - Invasive and other pests: HLB
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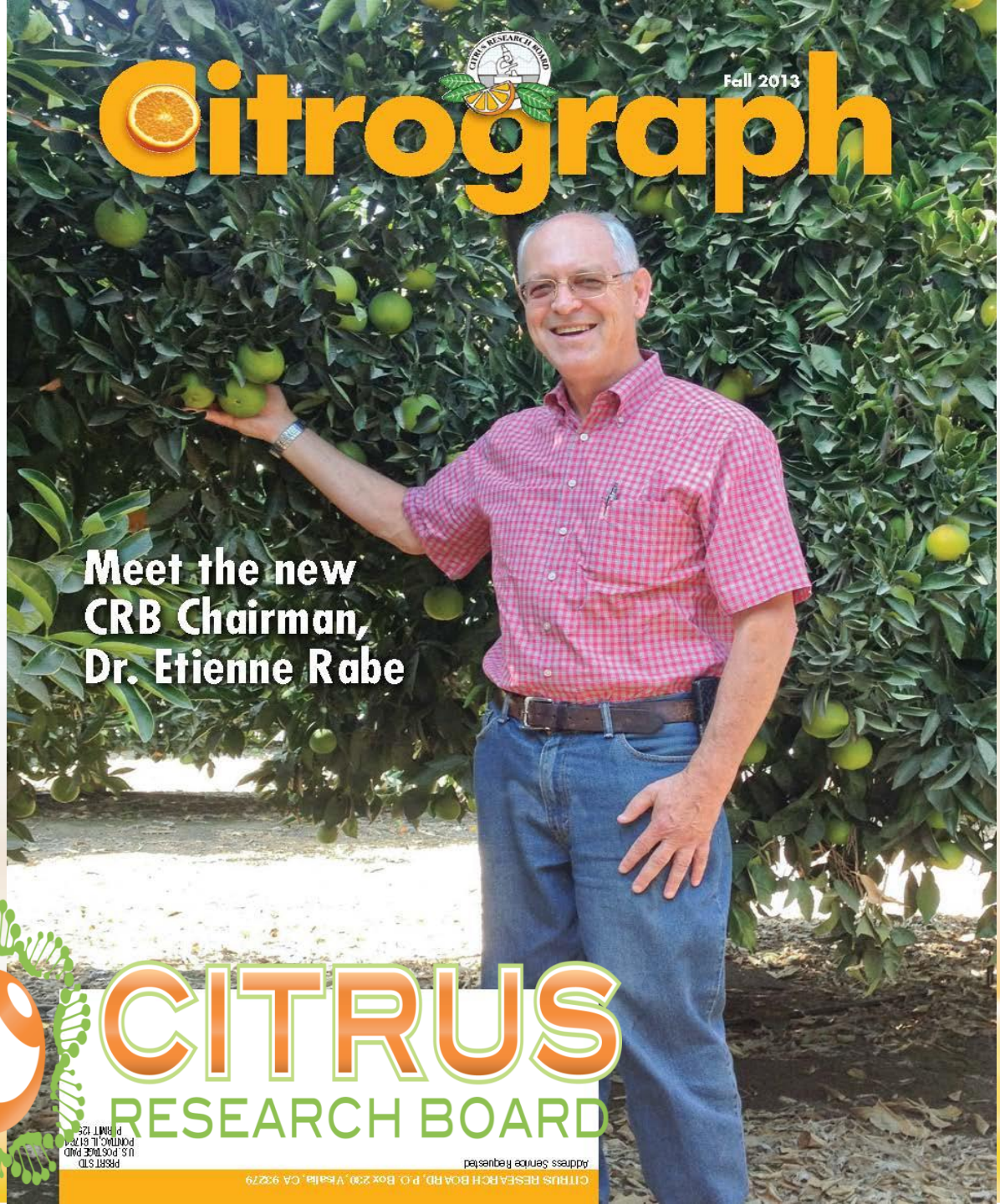
  - Drought/frost
  - Costs, Labor
  - Utilizing technology; irrigation management, tree phenology
  - Varieties: new trends? Branding, etc.
- **Industry organizations**

Industry Bodies

- CRB: research
- CCQC: market access
- CCM: political issues
- CPDPP: new disease management entity
- CCAC: maturity committee
- NAREEE Citrus Disease Subcomittee


CITRUS
RESEARCH BOARD


Citrograph
Fall 2013
Meet the new
CRB Chairman,
Dr. Etienne Rabe
CITRUS
RESEARCH BOARD

High cost environments

- Increased pressure to produce higher value products --- cannot compete with commodities from low cost regions

Everyday driving motto

- **RESPECT the CONSUMER!!!**

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- Industry organizations
- **Join us in these exciting times!**

THANK YOU

etienne.rabe@wonderful.com