

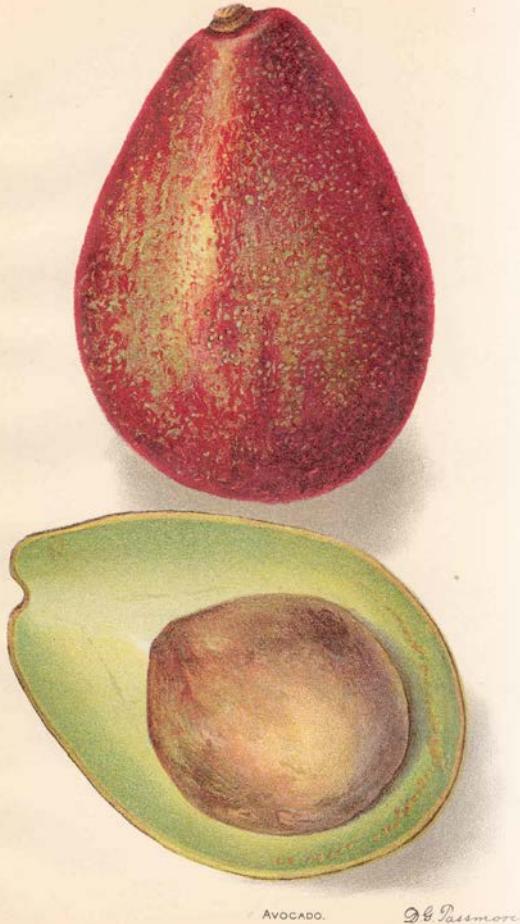


INDEX FRESH[®]
SEMINAR
— SERIES —



California Avocado Varieties: *Past, Present and Future (?)*

Mary Lu Arpaia
University of California, Riverside



A member of the Laurel family (Lauraceae) which is mainly tropical evergreen trees composed of ~50 genera and >3000 species

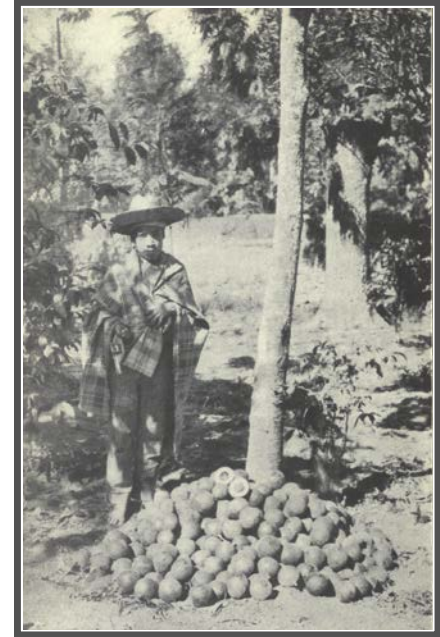
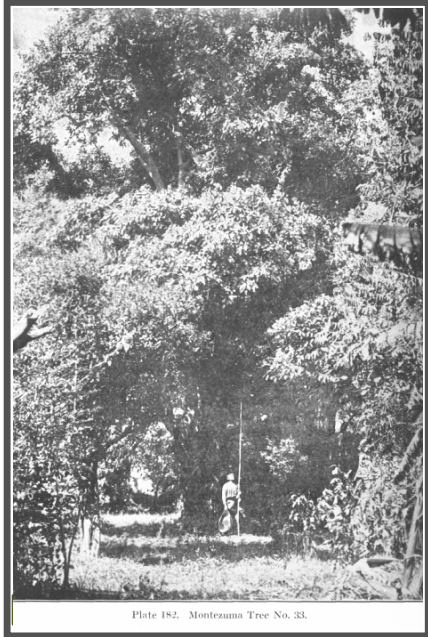
Family includes Cinnamon, Bay Laurel, CA Bay tree, Red Bay Laurel and sassafras and numerous other *Persea* species found in SE USA and throughout Central America



Aztec man with guacamole;
avocados on the tree
(Florentine Codex, 1500s AD)



- Seeds found in Archeological Record showing long history of cultivation
- Derived from Spanish Ahaucate (aguacate) which is derived from the Aztec word – Ahuacatl
- Also known as “Palta” in Chile, Alligator Pear in Africa



- Relatively “new” crop to domestication
- Highly diverse
- Retains the traits that are adapted to its native neotropical rainforest habitat
- The physiology of the tree is poorly understood

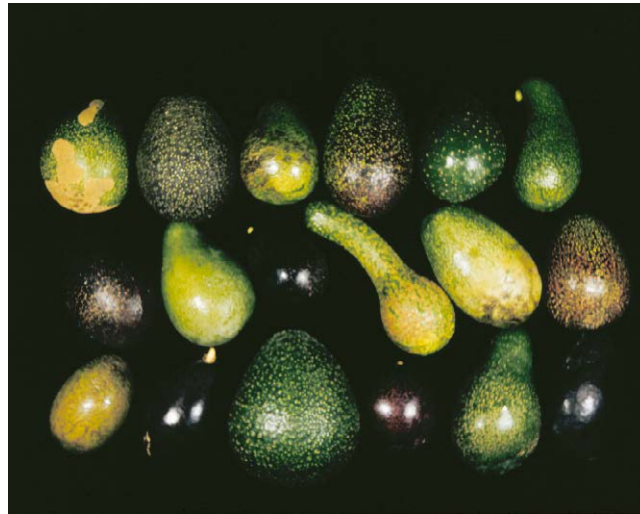


Persea americana Mill.

Family: Lauraceae

3 horticultural races

- Mexican
- Guatemalan
- West Indian (Antillean)



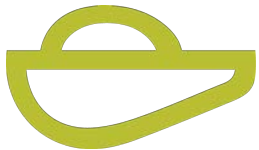
INDEX FRESH®



THE TERTO AVOCADO, ONE OF THE LARGEST GUATEMALAN VARIETIES.

The fruits here shown are not yet fully grown. Good specimens of this variety weigh 3 pounds and are of excellent quality, the flesh being rich yellow in color, free from all discoloration, and of nutty flavor. The seed, as will be noticed in the illustration, is comparatively small. This variety has a considerable reputation in the vicinity of the city of Guatemala, owing principally to its large size. Avocados weighing more than 2 pounds are rare in Guatemala. (Photographed at the city of Guatemala, December 2, 1917; P17466/FS.)

Where is the original home of the avocado?



INDEX FRESH®

GENERAL TRAITS

	Mexican	Guatemalan	West Indian
Native Region	Mexican Highlands	Guatemalan Highlands	Tropical lowlands
Climate Adaptation	Subtropical	Subtropical	Tropical
Cold Tolerance	Most	Intermediate	Least
Salinity	Least	Intermediate	Most

LEAF and FLOWER TRAITS

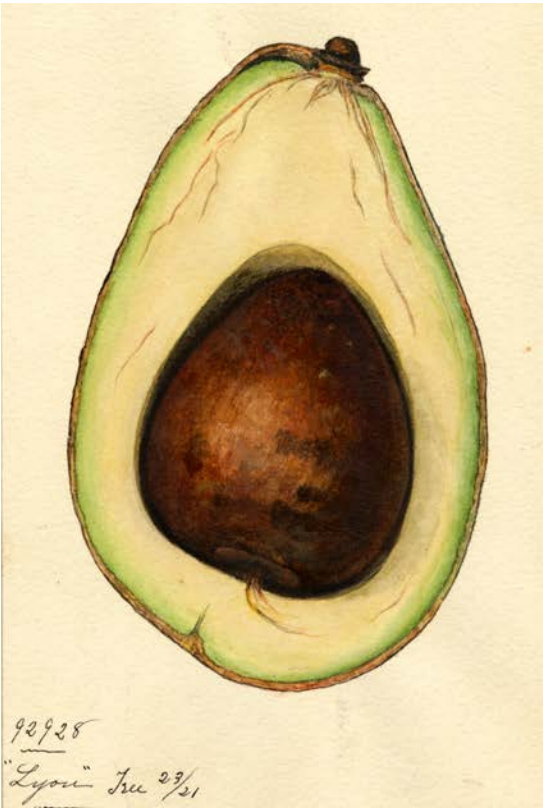
	Mexican	Guatemalan	West Indian
Flush Color	Greenest	Reddest	Yellowish-green
Anise Scent	Present (usually)	Absent	Absent
Season	Early	Late	Early/Intermediate
Fruit maturity	5-7 mos.	10-18 mos.	6-8 mons.

FRUIT TRAITS

	Mexican	Guatemalan	West Indian
Size	Tiny-Medium	Small-Large	Medium-V. Large
Peel Color	Usually purple	Black or green	Green/maroon
Peel Thickness	Very thin	Thick	Medium
Seed Coat	Thin	Usually thin	Thick
Seed Tightness	Often loose	Tight	Often loose
Flavor	“Anise”, spicy	Often rich	Sweet, mild
Oil Content	Highest	High	Low



- Avocados produced worldwide
- More tropical areas produce West Indian Race varieties
- Most leading avocado producing countries produce Guatemalan/Mexican race avocados
- Leading cultivar worldwide is HASS



1870's – First trees planted

1911 – First budded trees sold

– Fuerte introduced to CA
from Atlixco Mexico (Carl Schmidt
of West India Gardens, Altadena)

1915 – First meeting of the CA
Avocado Society

– W. Popenoe reports on
86 named varieties



One of the first avocado
trees planted in CA - 1870



Figure 61. One of the first avocados planted in California, being one of three trees brought from Mexico and planted at Santa Barbara by the late Judge Ord in 1870. (Photo from Dr. Franceschi).

The Parent 'Fuerte' Tree in Atlixco, MX (1911)



FRUITS FROM THE PARENT FUERTE AVOCADO TREE

Alejandro Le Blanc, Jr. is here shown holding several avocados of the 1910 crop from the parent Fuerte tree. When told of the present importance of Fuerte in California and its probable future value to the avocado industry Senor LeBlanc expressed himself as delighted that he had been able to give to horticulture something of merit.

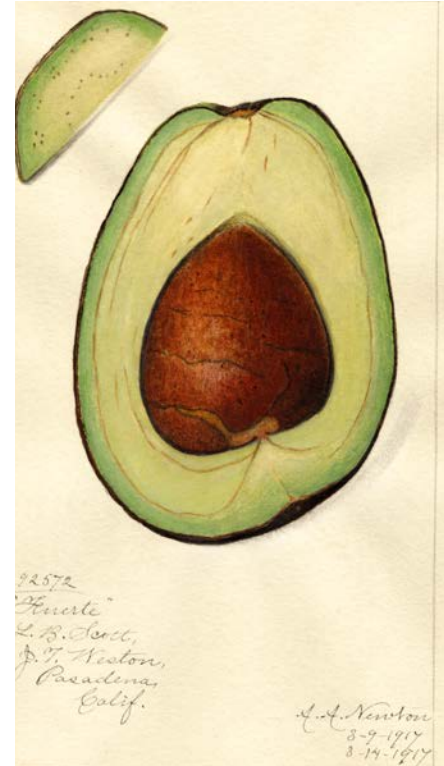
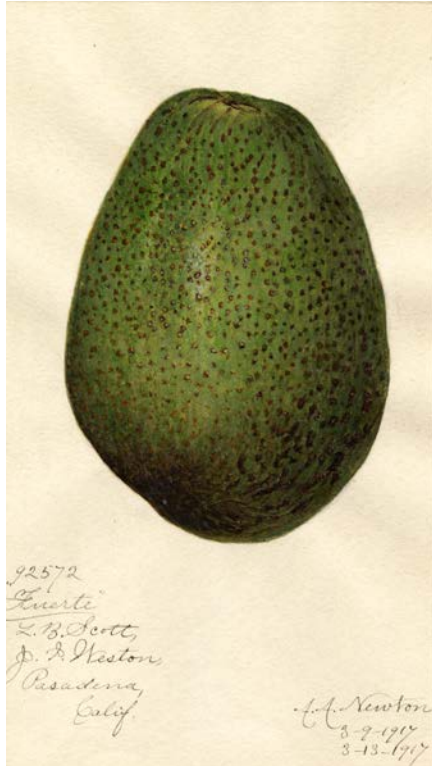


THE PARENT TREE OF THE FUERTE AVOCADO

At the present time no tree in Atlixco is of greater interest to Californians than the parent Fuerte, which stands in the garden of Alejandro Le Blanc. It is believed to be about 60 years old, and its crown is approximately 25 feet high and 50 feet in spread.

FUERTE

- The leading variety from 1920's to 1970's
- Adapted to a wide variety of climates
- Known for high fruit quality
- Large spreading tree
- Recognized to have erratic or severe alternate bearing



Varieties originating before 1940

Variety	Seedling Year	Location	C.A.S. Reg. or Introduced	Patented
Lyon	1908	Hollywood	-	-
Fuerte	1911	Atlixco, MX	1915	-
Hass	1926	La Habra Hts.	1932	1935
Zutano	1926	Fallbrook	1932	-
Edranol	1927	Vista	1932	-
Bacon	1928	Buena Park	1948	-



The CA Avocado Society
visits in the 1960's

'HASS'



Rudolph and Elizabeth Hass



Facts about Hass

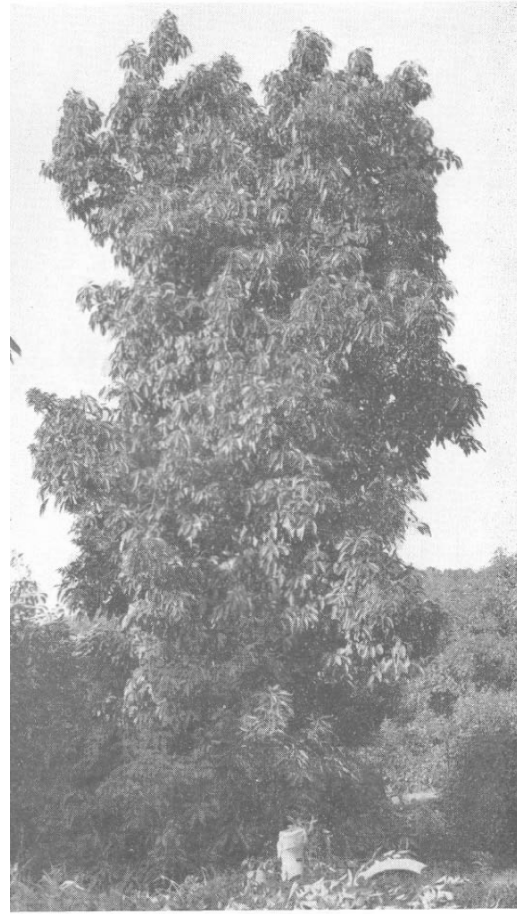
- Chance find in La Habra Heights in 1926 and patented in 1935
- Considered interesting but black skin considered a flaw as compared to leading variety, Fuerte
- Did not overtake Fuerte in importance until the planting boom of the mid-1970's
- Now worldwide leading variety and major variety marketed in US
- High fruit quality when harvested at proper maturity



INVENTOR.
RUDOLPH G. HASS
BY *R. Craig*
ATTORNEY.

From the market standpoint the Hass would appear to have everything. Excellent quality, popular size, small seed, good shipper, its leathery skin and long season complimenting the Fuerte. **Its single disadvantage is its black color which has been associated in the minds of the public with poor quality fruits.** Experience is indicating however that when properly handled this **color handicap** can be overcome. The Hass variety gives satisfaction and repeat business follows.

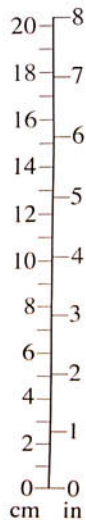
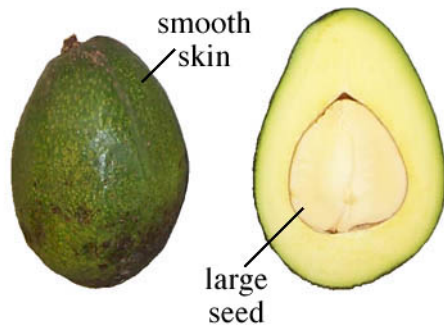
The Hass Avocado by H. B. Griswold
California Avocado Society 1945 Yearbook 30



Original Hass Avocado
Tree at La Habra, Calif.
Photo 1945

Bacon

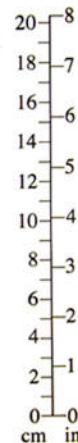
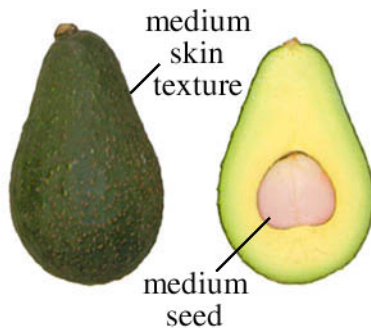
"B" flower type
Green when ripe
Thin skin



Other varieties originating before 1940

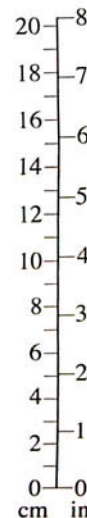
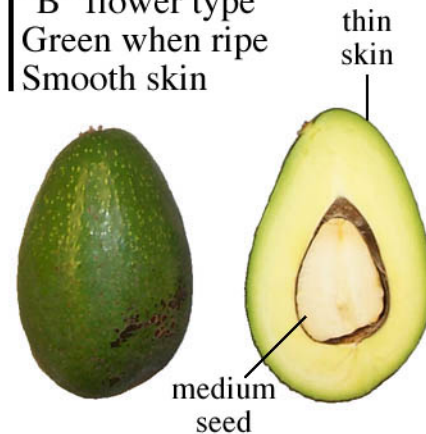
Edranol

"B" flower type
Green when ripe



Zutano

"B" flower type
Green when ripe
Smooth skin

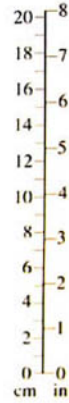
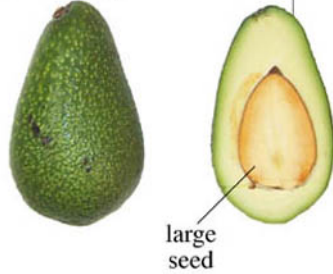


Varieties originating 1940 - 1980

Variety	Seedling Year	Location	C.A.S. Reg. or Introduced	Patented
Ettinger	1940	Israel	1954	-
Reed	1948	Carlsbad	1953	1967
Sharwil	1951	Qld, Australia	-	-
Pinkerton	1960	Saticoy	1974	1975

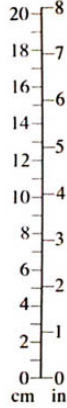
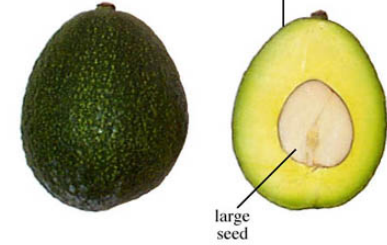
Ettinger

"B" flower type
Green when ripe
Pear fruit shape



Reed

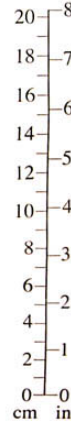
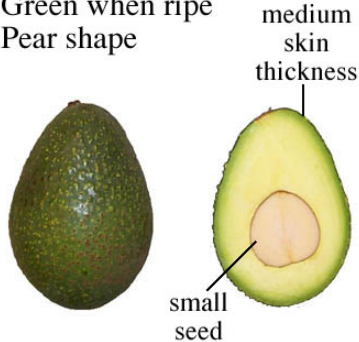
"A" flower type
Thick ovate shape
Green when ripe



Other
varieties
originating
between
1940 - 1980

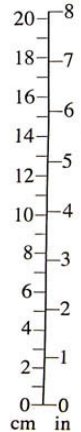
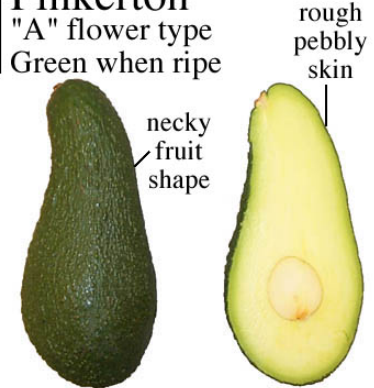
Kona Sharwil

"B" flower type
Green when ripe
Pear shape



Pinkerton

"A" flower type
Green when ripe

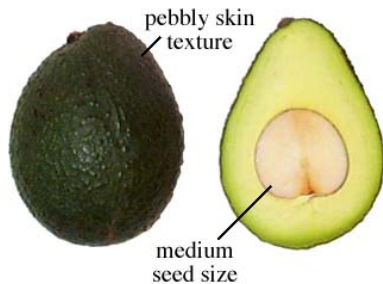


Varieties originating after 1980

Variety	Seedling Year	Location	C.A.S. Reg. or Introduced	Patented
Gwen	-	Irvine	1982	1984
Whitsell	-	Irvine	1982	1984
Esther	-	Irvine	1982	1984
Lamb Hass	1985	Camarillo	1995	1996
Sir Prize	1986	Irvine	1995	1996
GEM	1985	Camarillo	2003	2003
Harvest	1985	Camarillo	2003	2003

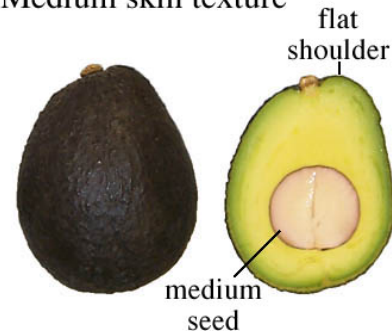
Gwen

A flower type
Green when ripe
Ovate fruit shape



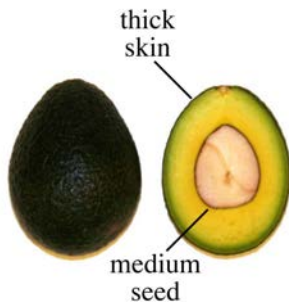
Lamb Hass

"A" flower type
Black when ripe
Medium skin texture



GEM

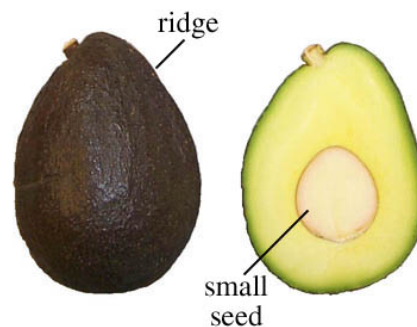
Flower Type "A"
Black when ripe
Thick skin



UC Releases
since 1982

Sir Prize

"B" flower type
Black when soft
Thin skin





Hass

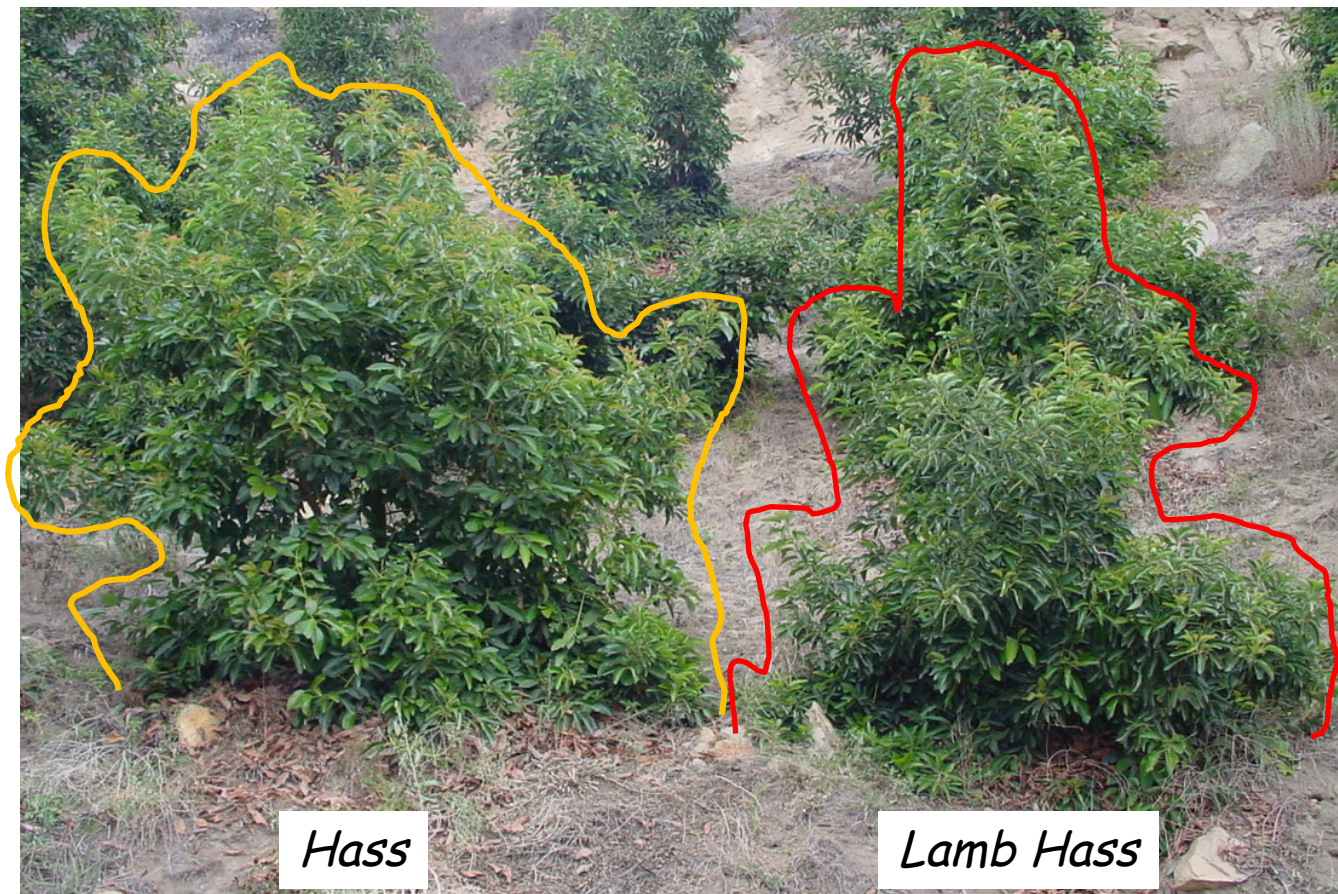


Lamb/Hass

Differences between Hass and Lamb Hass

- *Lamb Hass maturity season – mid to late summer*
NOT A SUBSTITUTE BUT SUPPLEMENT TO HASS
- *Fruit shape and size – more “square” but larger*
- *Lamb Hass has more upright growth habit*
- *Flexible wood – fruit borne interior of tree; tends to set fruit in clusters*
- *Lamb Hass is more “tolerant” to Persea mite and other pests (?)*
- *Photosynthetic rate approximately 30% higher than Hass and higher chlorophyll content*

Growth habit differences between Hass and Lamb Hass





Hass



Gem

Differences between Hass and GEM

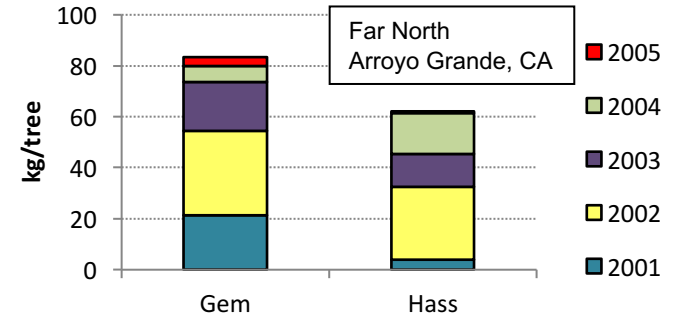
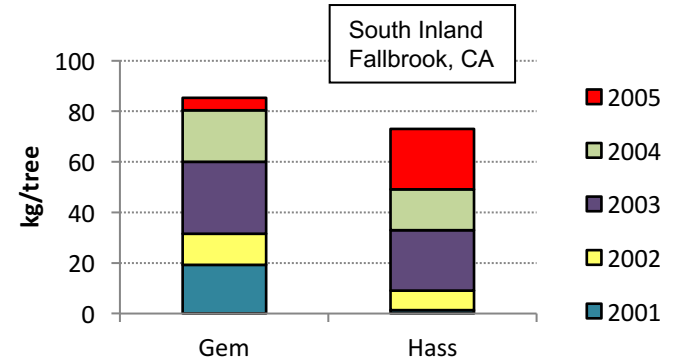
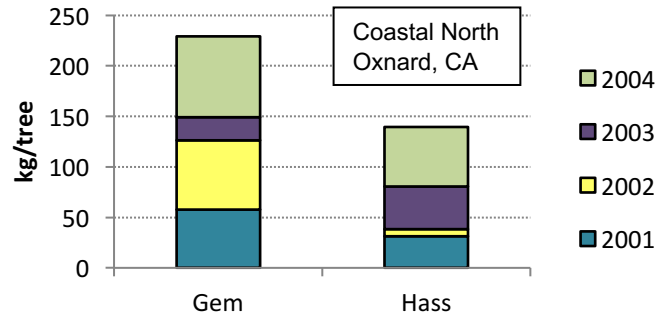
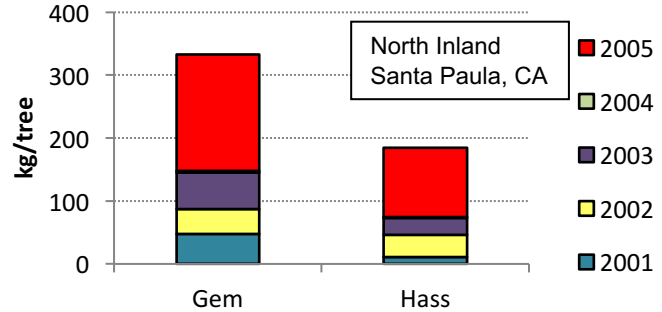
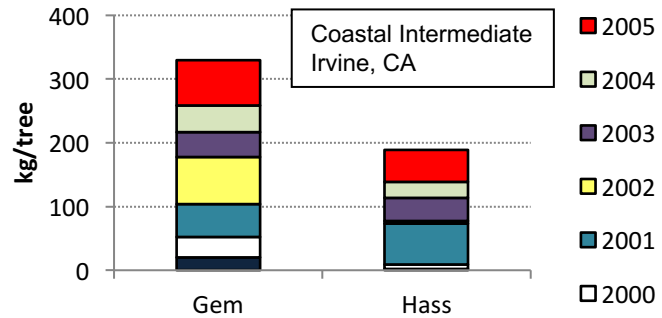
- *Maturity seasons overlap; GEM slightly later - COULD BE A SUBSTITUTE TO HASS*
- *Can accumulate very high levels of dry matter*
- *Fruit shape – more “tear drop”*
- *GEM growth habit more vasselike and compact*
- *Flexible wood – interior fruiting; tends to set fruit in clusters*
- *Pest tolerance (?)*
- *Less Alternate Bearing*
- *Tends to be more productive under most conditions*

Gem is a more compact tree than Hass, very similar to Gwen
Bears fruit on the inside of the tree

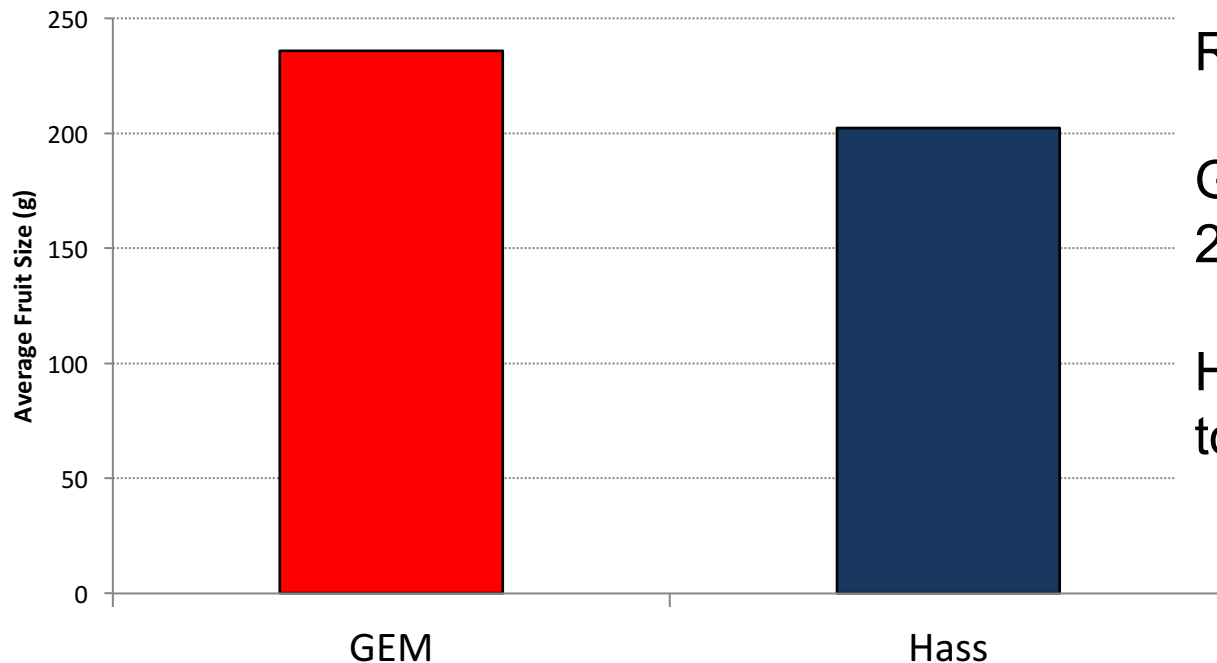


Topwork Trials – Kg/tree

Mixed age trees, seedling rootstock at all sites



Fruit size – All sites, all years



Range across all sites:

GEM – 170 (Far North) to 294 (North Coastal)

HASS – 129 (Far North) to 270 (North Coastal)

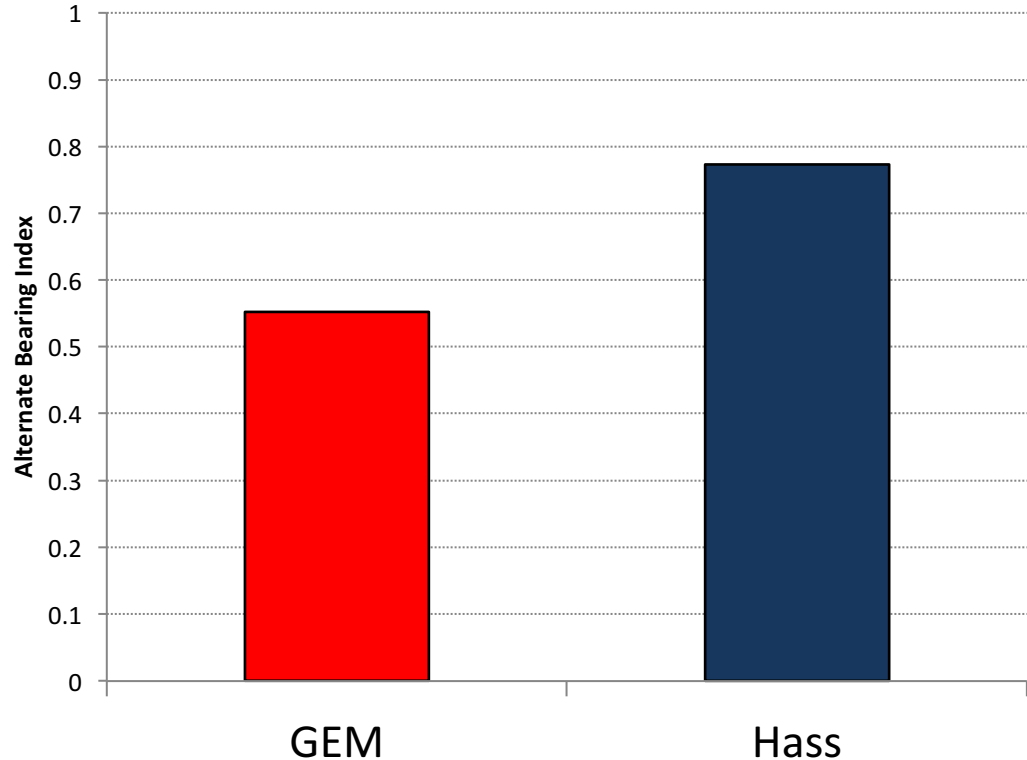
Alternate bearing – All sites, all years

The lower the number the less alternate bearing

Range across all sites:

GEM – 0.43 (Far North) to
0.71 (North Inland)

HASS – 0.65 (North Coastal)
to 0.89 (South Inland)



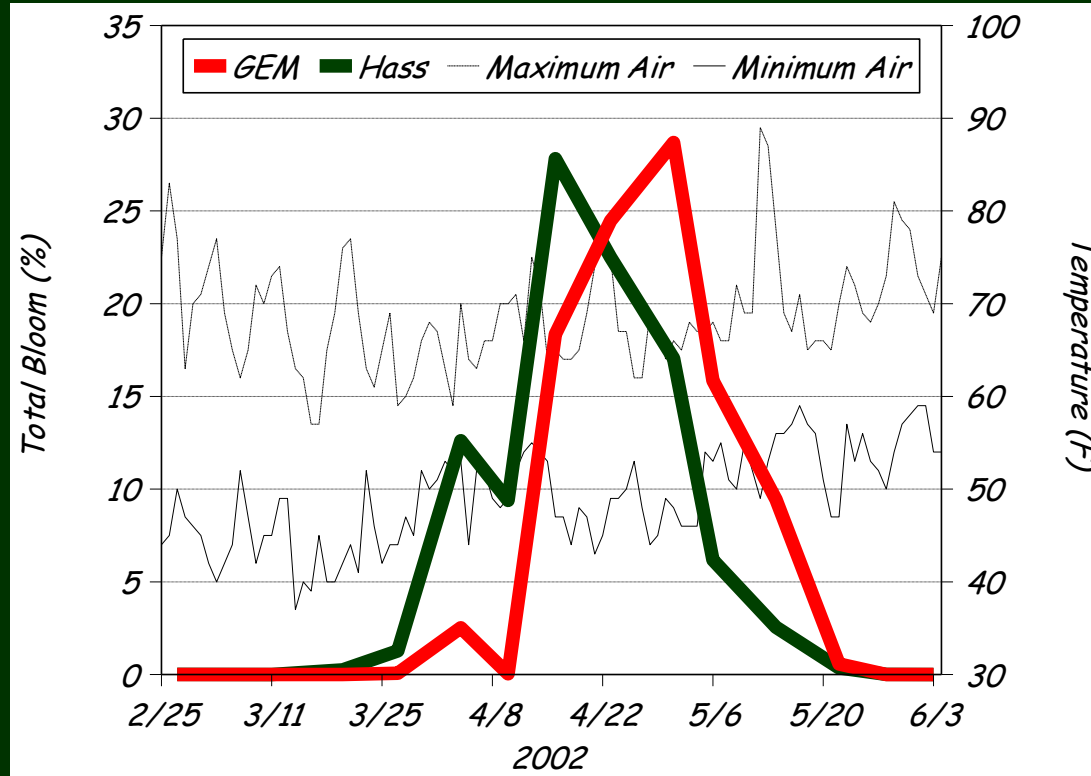
We had other varieties in these trials.

In all trials the cumulative yield of Gem was ranked either #1 or 2. Alternate bearing was least in GEM at all sites.

We have noted that climate can greatly influence fruit shape (as in all varieties); in very hot climates the fruit can be very elongated.

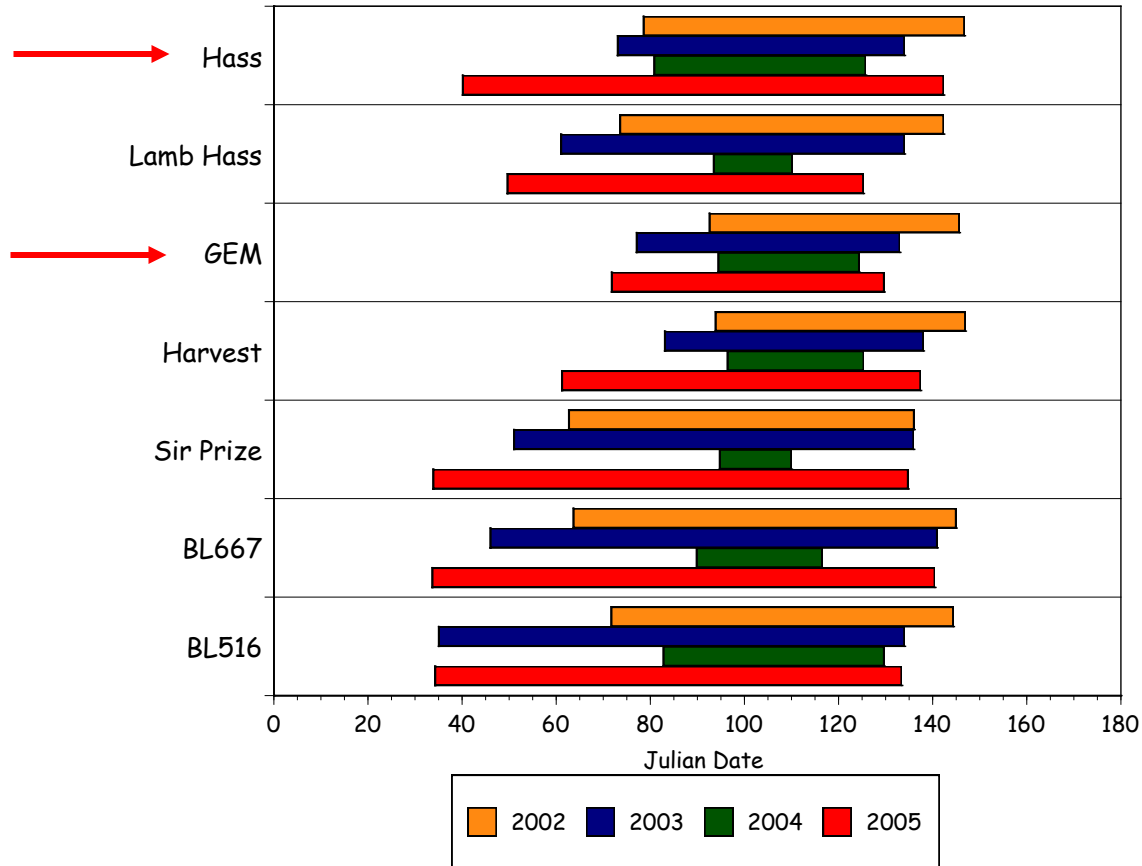
Anecdotal observations following 2007 Freeze was that GEM did best in return bloom

*Bloom time and minimum and maximum temperatures in 2002.
Data collected at UC South Coast REC in Irvine, CA.*



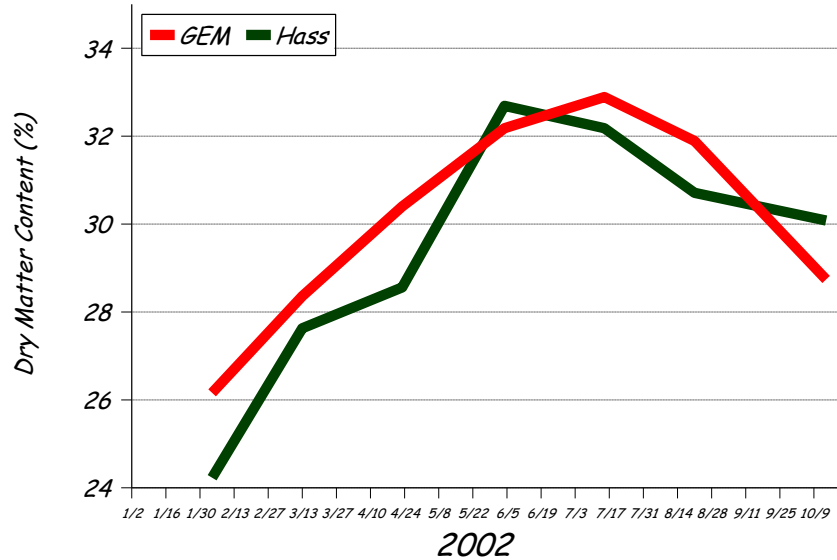
GEM flowers later than Hass

Duration of bloom over 4 years

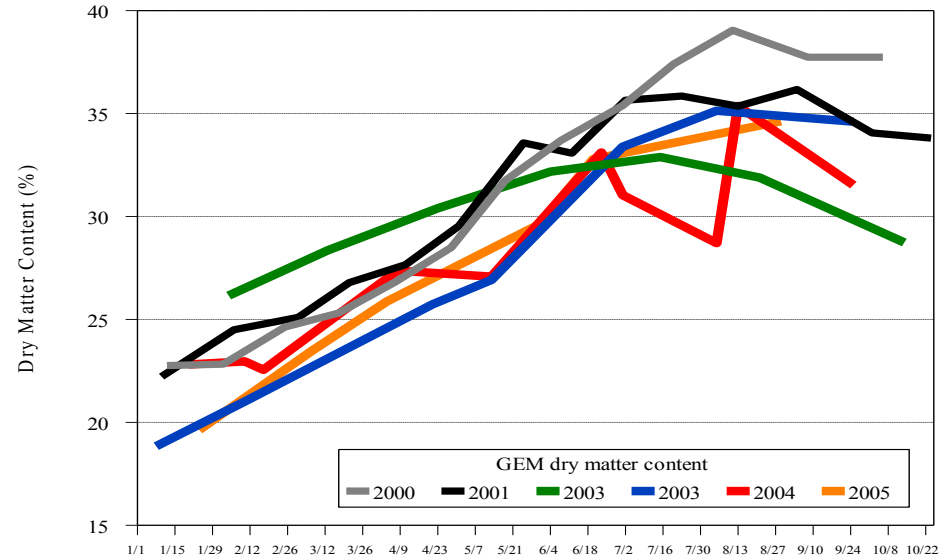


Fruit Maturity - GEM

Irvine, CA




*Similar pattern of DM to Hass;
tends to be slightly later*



*Comparison of dry matter
changes over season*

What do we know about flavor and postharvest characteristics





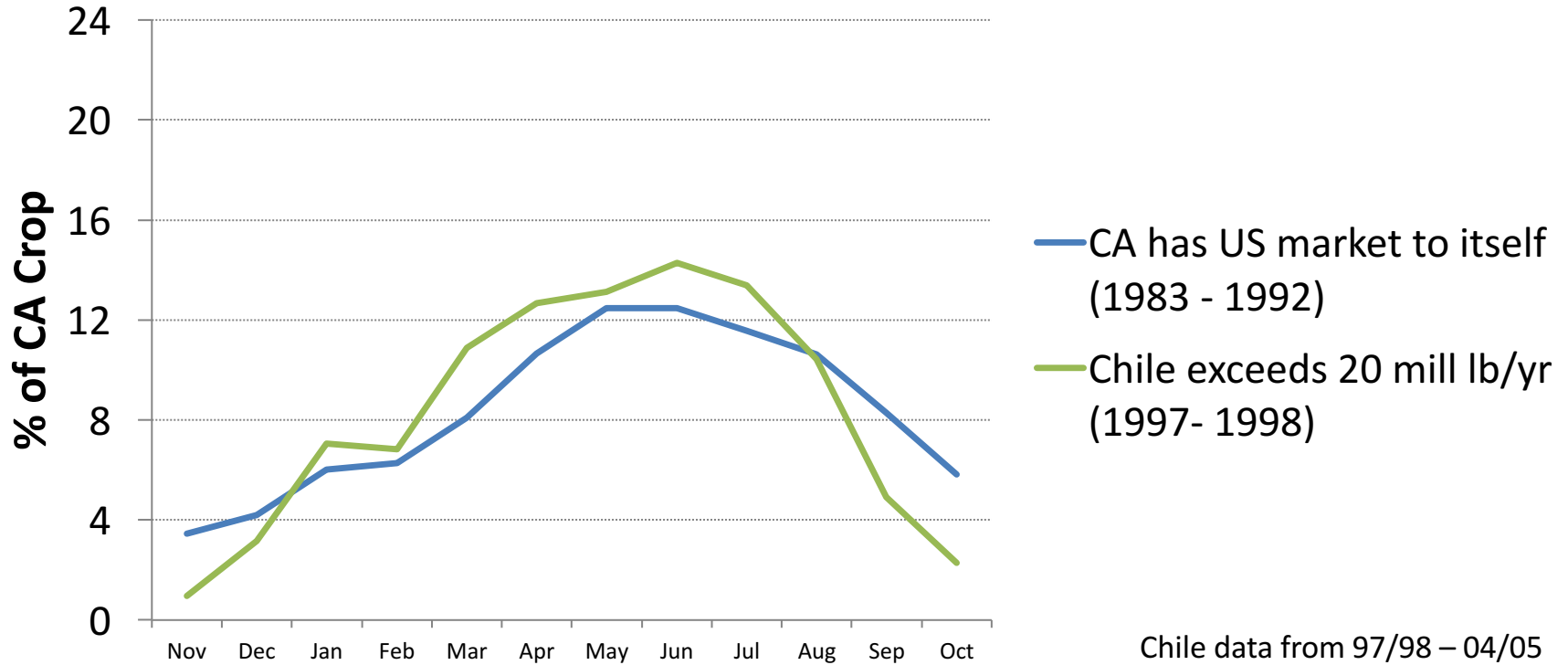
Is there life after Hass?

2 perspectives

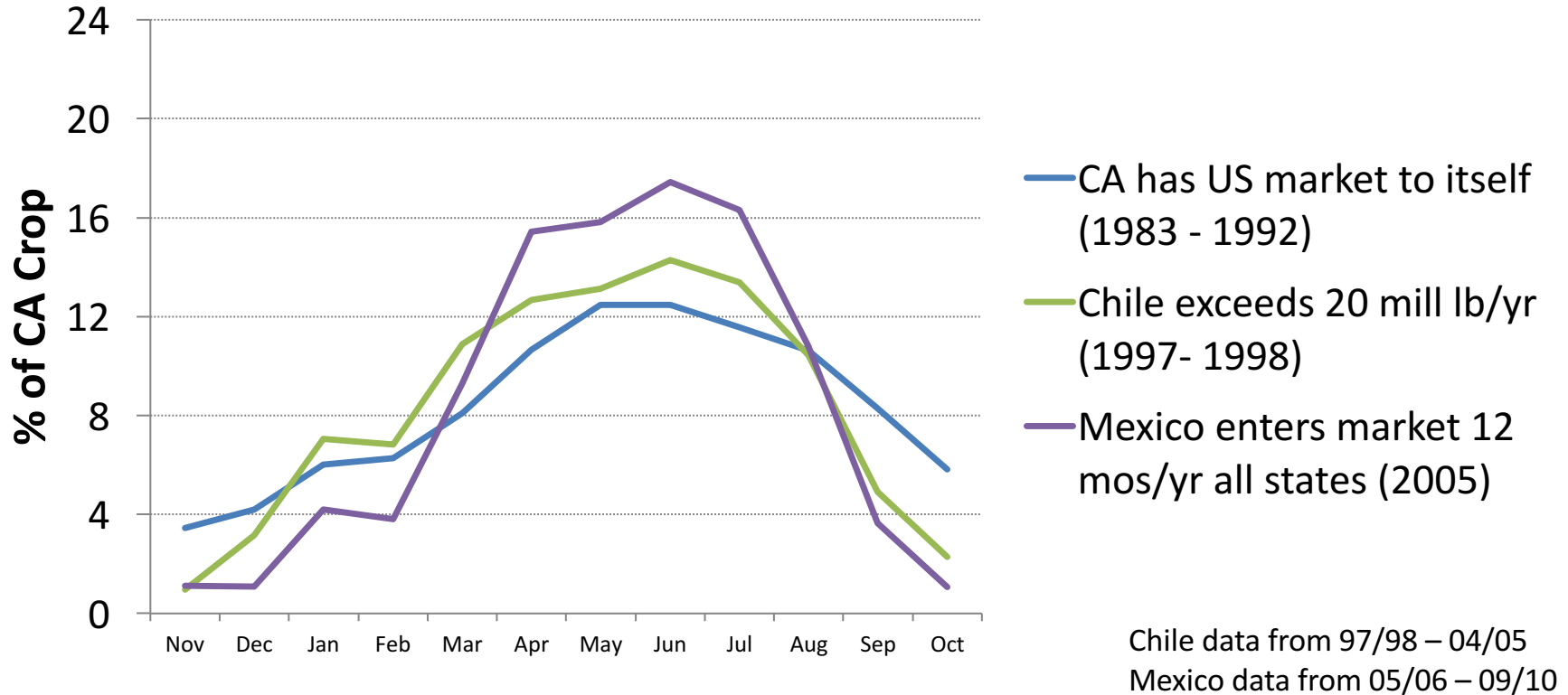
- Market/Trade considerations
- Limitations of Hass under CA conditions

•

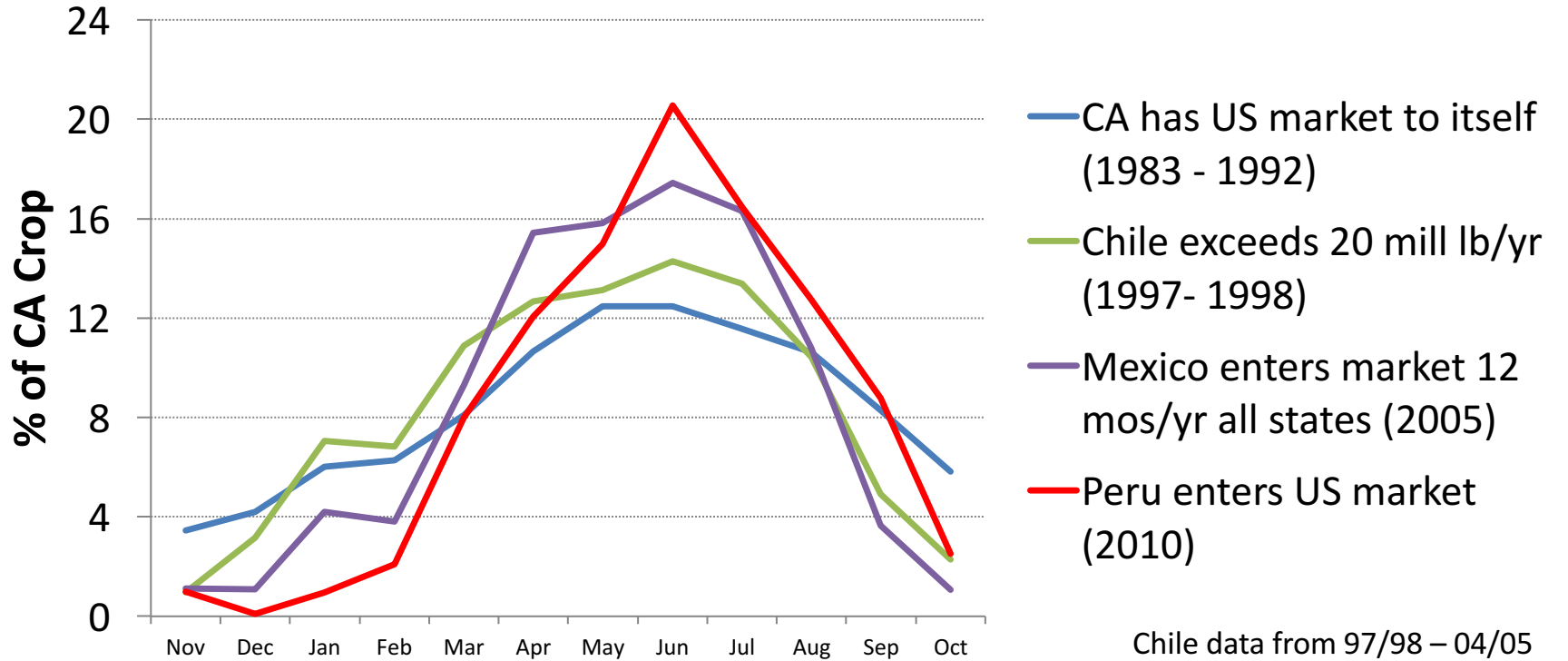
Percentage of CA Hass Crop Marketed by Month



Percentage of CA Hass Crop Marketed by Month



Percentage of CA Hass Crop Marketed by Month



Chile data from 97/98 – 04/05
Mexico data from 05/06 – 09/10
Peru data from 10/11 – 15/16



What will happen to our marketing window when Columbia, South Africa and the other countries that have petitioned entry finally gain entry?

Will we be squeezed even further since 95% of CA's volume is Hass?



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There is a potential silver lining

- 25 countries allowed to ship avocados into the continental US (USDA-FAVIR)
- Most of these are Caribbean countries with limited access to continental US and are shipping mainly West Indian varieties into US

Is there a silver lining?

There is a market in the US for things other than HASS



*Spain allowed to ship Hass in under cold treatment

There is a potential silver lining



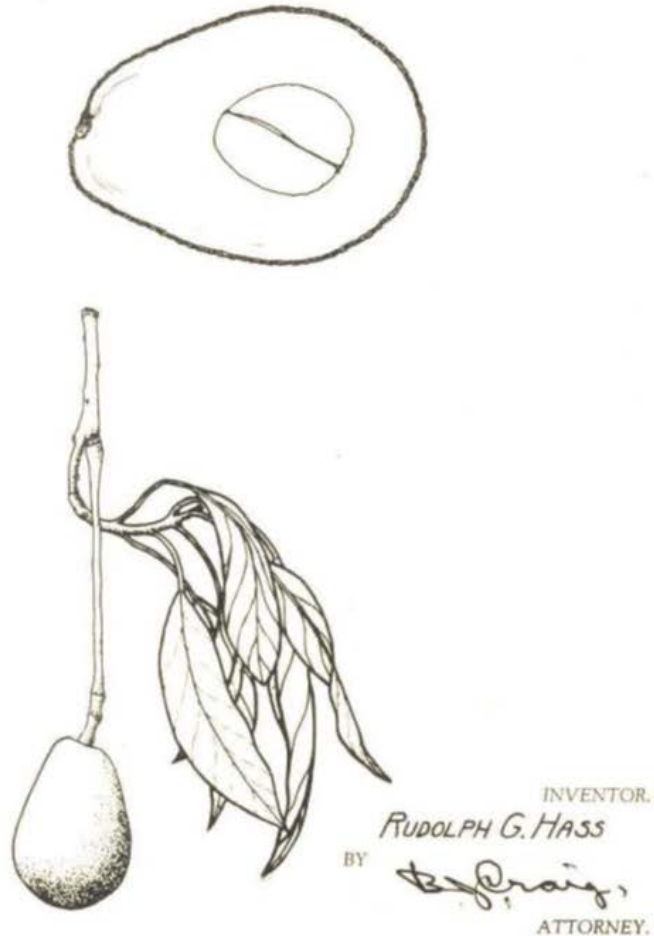
- The major importing sources for avocado are currently Mexico, Chile, Peru
- Of these Mexico and Peru are limited to **ONLY HASS**
- Colombia will be limited to Hass
- The petition from South Africa will likely also only allow HASS

The silver lining?

Does this give us an opportunity to differentiate ourselves and regain a strong 12 month present in US market????



*Spain allowed to ship Hass in under cold treatment



Our leading cultivar, 'Hass' CAN BE improved:

- ✓ Tree size and structure
- ✓ Bearing habit
- ✓ Alternate bearing
- ✓ Stress tolerance (Cold, Heat, Salinity)
- ✓ Disease and pest tolerance
- ✓ Productivity
- ✓ Seasonality

It is dangerous to have an industry based on one variety

We need to go from



Here



There



To stay competitive

The challenge of finding new avocado varieties

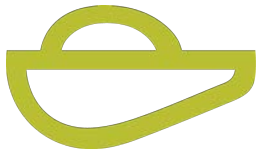


- Long seasonality
- Fruit must be ripened in order to evaluate; ripening time depends on maturity
- Eating quality changes throughout the season
- Industry standard 'Hass' sets a high standard for postharvest and eating quality



Looking for:

- Precocious and low AB varieties with high fruit quality
- Upright, slender tree architecture for HD plantings



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Do we have
alternatives
to Hass?





465418-99

Planted 2007 on Duke 7



465518-99

Planted 2007 on Duke 7





464918-99

Planted 2008 on Duke 7



465202-99

Planted 2008 on Duke 7



Tier 3 Planting Fruit picked,
Santa Paula CA, January 2016



Very
Early



Very
Late



Mid to
Late



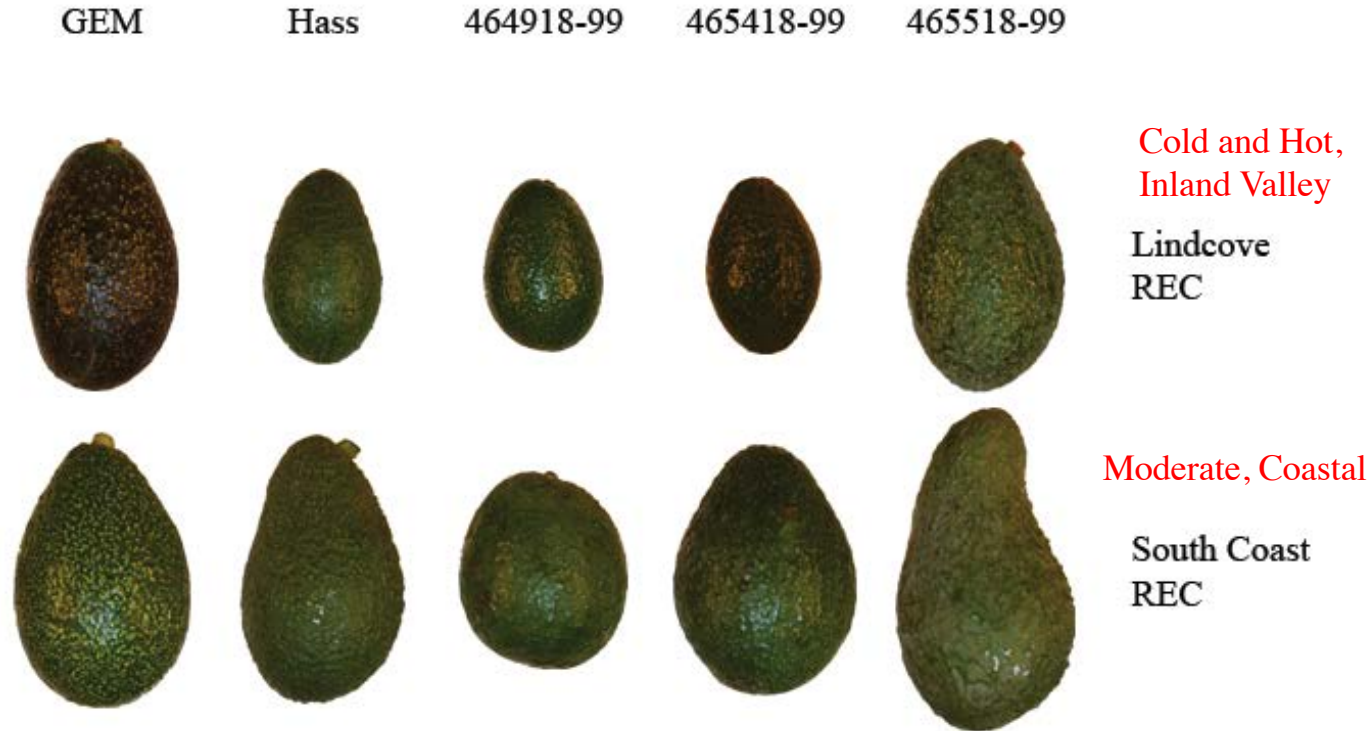
Early



Mid
"B" Flower



Environment influences fruit shape and seasonality



GEM

464918-99

Irvine
(SCRS)

Santa
Paula

De Luz
(ACW)



Irvine
(SCRS)

Santa
Paula

De Luz
(ACW)



Irvine
(SCRS)

Santa
Paula

De Luz
(ACW)



Irvine
(SCRS)

Santa
Paula

De Luz
(ACW)



All planted on Dusa Rootstock

OK ...
Carrot in
between



Great Aftertaste
Check it out!!



Good,
Right?



How about eating quality?

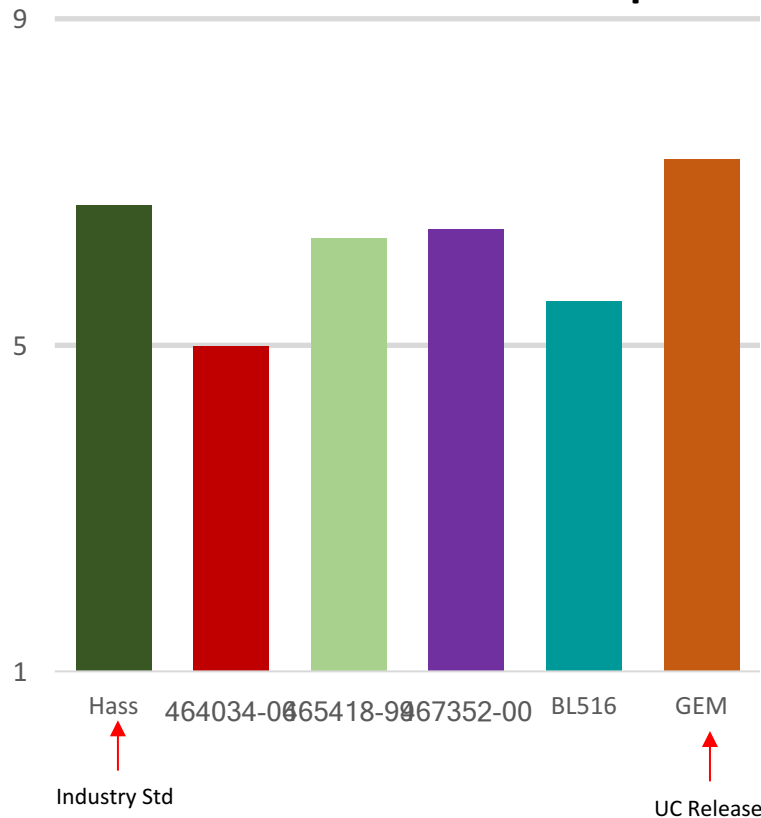


Collected data on Visual and Eating Acceptability

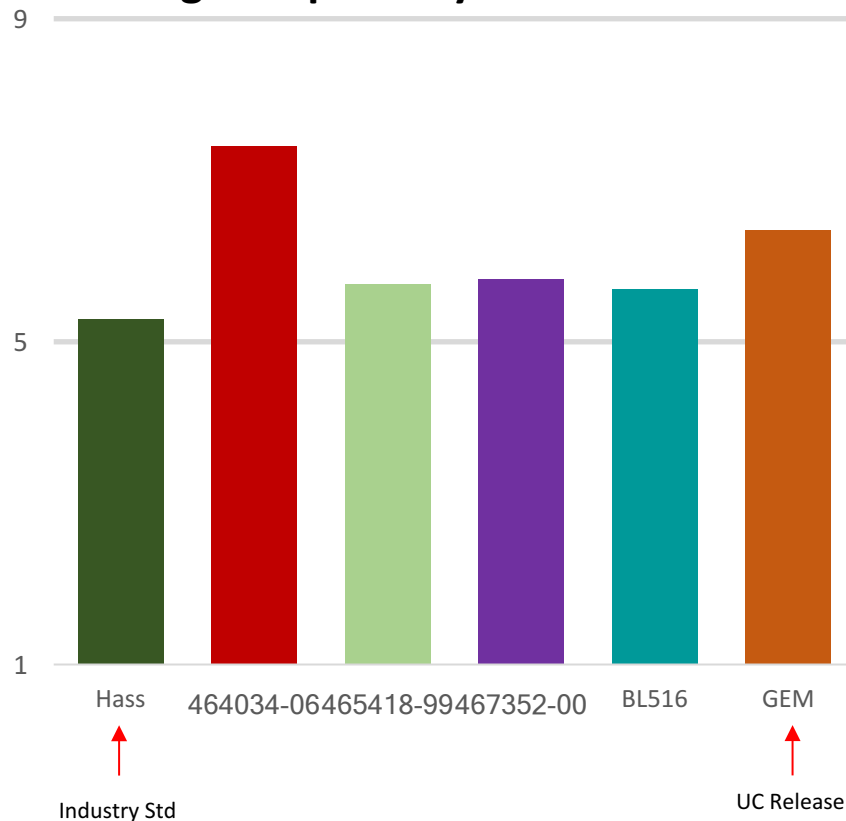


Example of monthly rating – 07/16/2014

Visual Acceptability



Eating Acceptability



Avocado Grower Field Day Taste Panel Results - 2014

Like
extremely 9

5

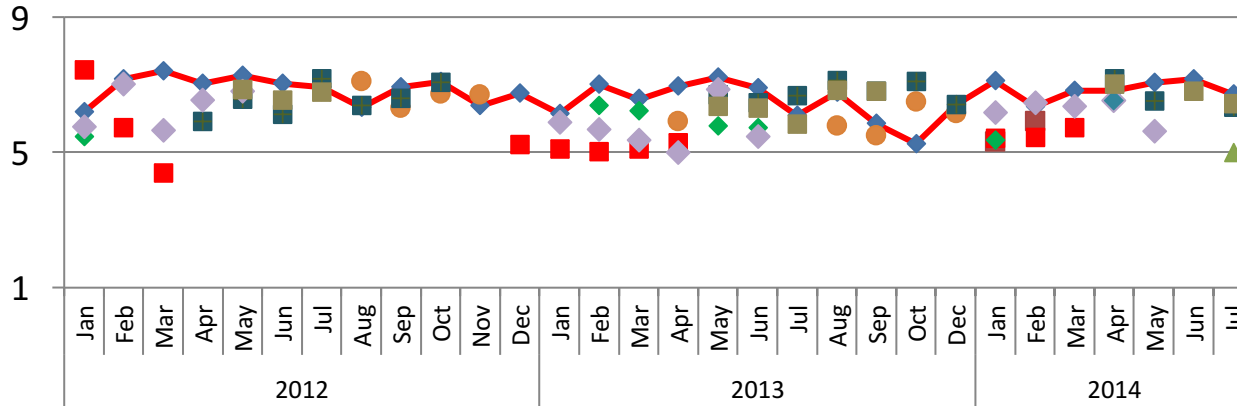
Neither like
or dislike

1

Dislike
extremely

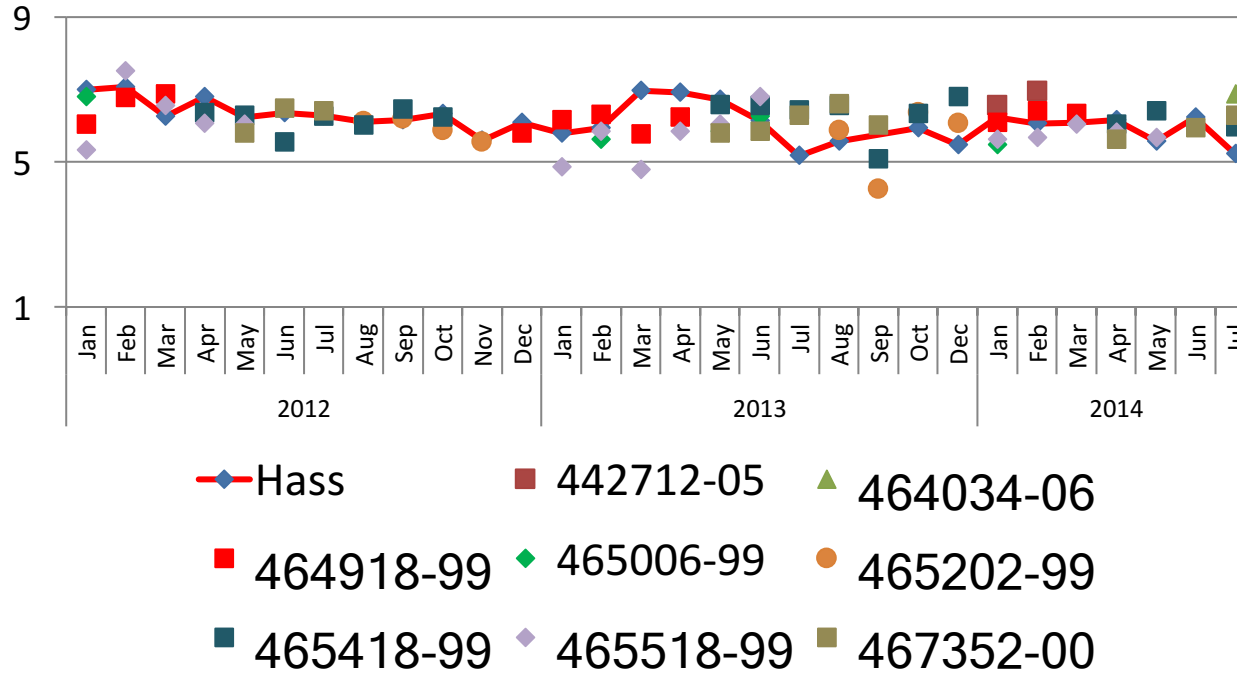


Visual acceptability across all years (8 new selections)



—◆— Hass ■ 442712-05 ▲ 464034-06
■ 464918-99 ◆ 465006-99 ● 465202-99
■ 465418-99 ◆ 465518-99 ■ 467352-00

Flavor acceptability across all years (8 new selections)





THE BIG PICTURE



Have a range of both dark skin and green skin varieties that are comparable to 'Hass' in terms of eating quality

We HAVE material that potentially can

- Provide 12 month market coverage
- Improved tree architecture
- Precocious
- Greater yield efficiency



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A photograph of a dirt road winding through a vineyard. The road is flanked by rows of grapevines. In the background, a line of tall, bare trees stands against a clear blue sky. The text is overlaid on the center of the image.

The road from the grove to the consumer

The most important thing to remember is that there
is a **continuum** from the grower to the
consumer

THE ULTIMATE GOAL

**Enhanced productivity
and production efficiency**



**Satisfied consumers and
increased consumption**

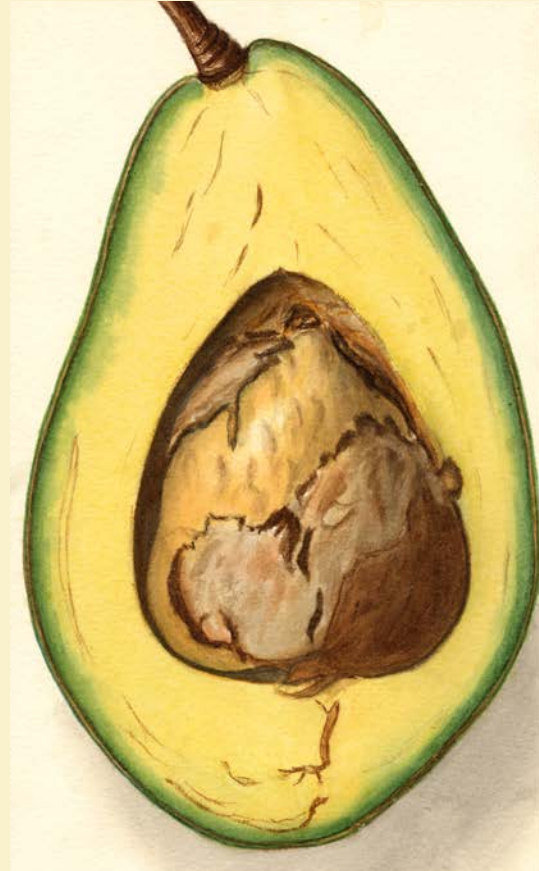


Thank you for your attention

Information gathered from

The California Avocado Society Yearbooks
UC Experiment Station and USDA
documents

All Archived on www.avocadosource.com





Questions?



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TITLE

SUBTITLE

Enter Information here



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