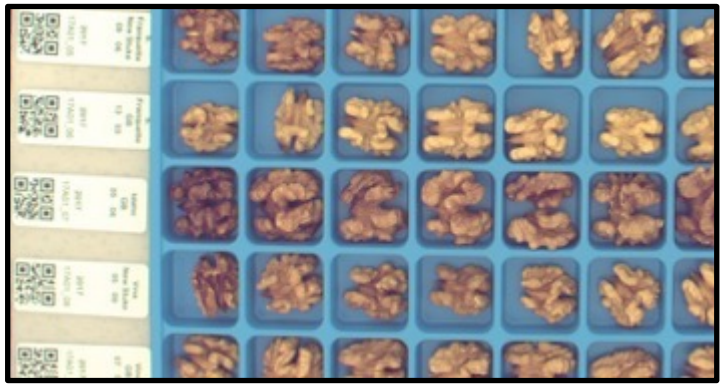
The Future of Walnut Varieties

Pat J. Brown, UC Davis

April 7th, 2022



Name	Year	Breeder(s)
Amigo	1968	Serr/Forde
Chico	1968	Serr/Forde
Gustine	1968	Serr/Forde
Lompoc	1968	Serr/Forde
Midland	1968	Serr/Forde
Pedro	1968	Serr/Forde
Pioneer	1968	Serr/Forde
Serr	1968	Serr/Forde
Tehama	1968	Serr/Forde
Vina	1968	Serr/Forde
Chandler	**1979**	**Serr/Forde**
Howard	1979	Serr/Forde
Sunland	1979	Serr/Forde
Cisco	1990	McGranahan
Tulare	1993	McGranahan/Forde
R. Livermore	1999	McGranahan/Leslie
Sexton	2004	McGranahan/Leslie
Gillet	2004	McGranahan/Leslie
Forde	2004	McGranahan/Leslie
Ivanhoe	2010	Leslie/McGranahan
Solano	2013	Leslie/McGranahan
Durham	2016	Leslie/McGranahan
Wolfskill	**2021**	**Leslie/McGranahan/ Brown**
?	**?**	**?**

Who We Are

Ilean Tracy

Field/Greenhouse

Pat J. Brown

Steven Lee

Tissue culture lab

Chuck Leslie

Kristina McCreery

Molecular lab

Not pictured: Ivan Bermudez, Dave Cripe, Wes Hackett, Michael Smathers

Thanks to the California Walnut Board, farm advisors, and growers testing advanced selections

What We Do -- Crossing Walnuts

What We Do -- Evaluating Walnuts

Phenology & Orchard Performance

Nut & Kernel quality

What We Do – Maintaining germplasm

In vitro: 1000 cultures

Greenhouse & field: 50 acres

Breeding scheme

1500 new nuts per year

100%

Seedling blocks

- Own-rooted *Juglans regia*
- Unreplicated
- 6’ spacing

< 1%

Selection blocks + Grower Trials

- Grafted onto Paradox
- Replicated
- 20’ spacing

Release

Parents of controlled crosses

DNA info

Increasing genetic gain with DNA information

3000 new nuts per year

50%

Seedling blocks

- Own-rooted *Juglans regia*
- Unreplicated
- 6’ spacing

< 1%

Selection blocks + Grower Trials

- Grafted onto Paradox
- Replicated
- 20’ spacing

Release

Parents of controlled crosses

DNA info

Increasing genetic gain with DNA information

6000 new nuts per year

25%

Seedling blocks

- Own-rooted *Juglans regia*
- Unreplicated
- 6’ spacing

< 1%

Selection blocks + Grower Trials

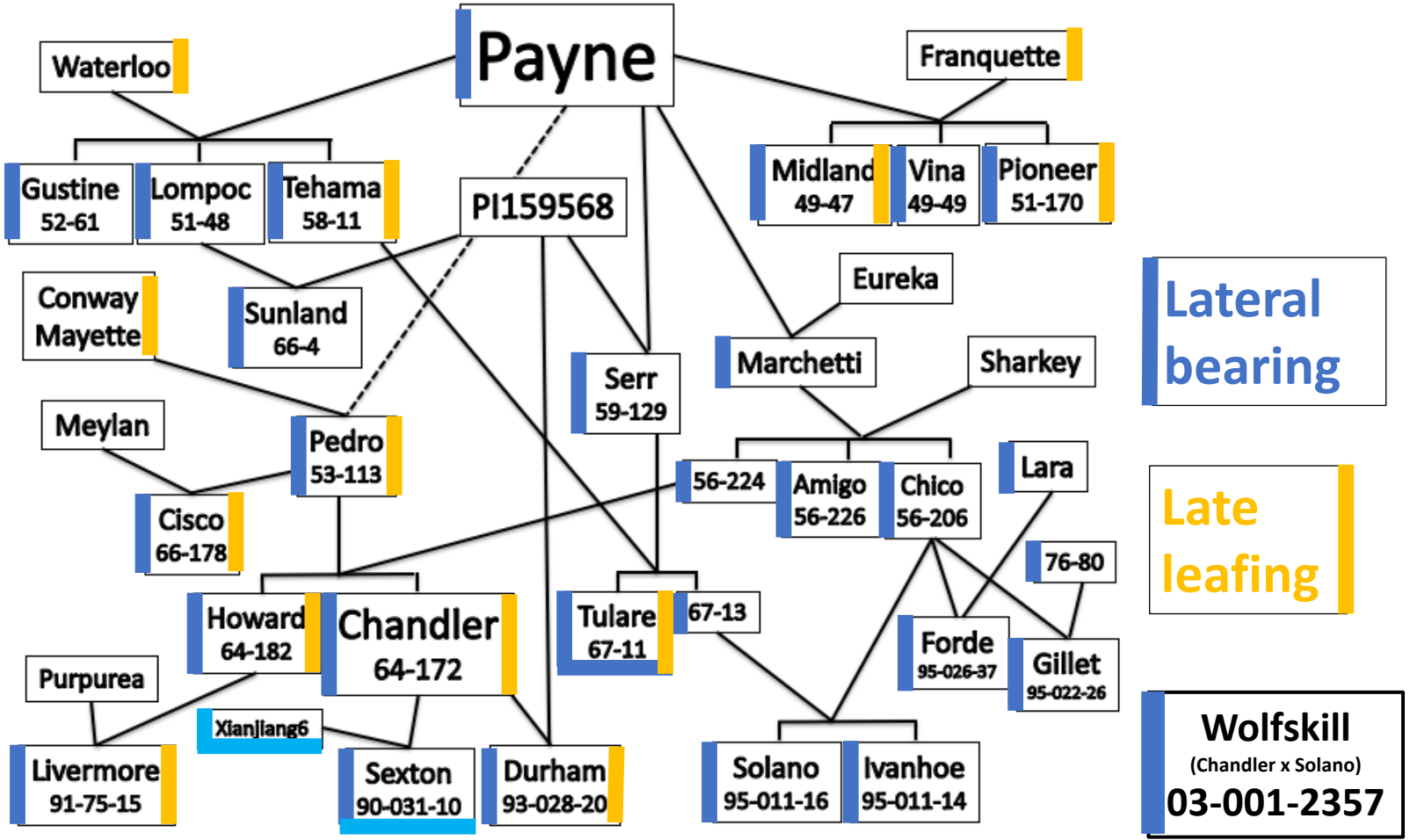
- Grafted onto Paradox
- Replicated
- 20’ spacing

Release

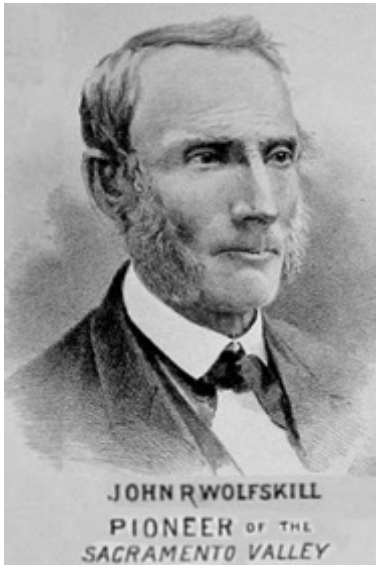
Parents of controlled crosses

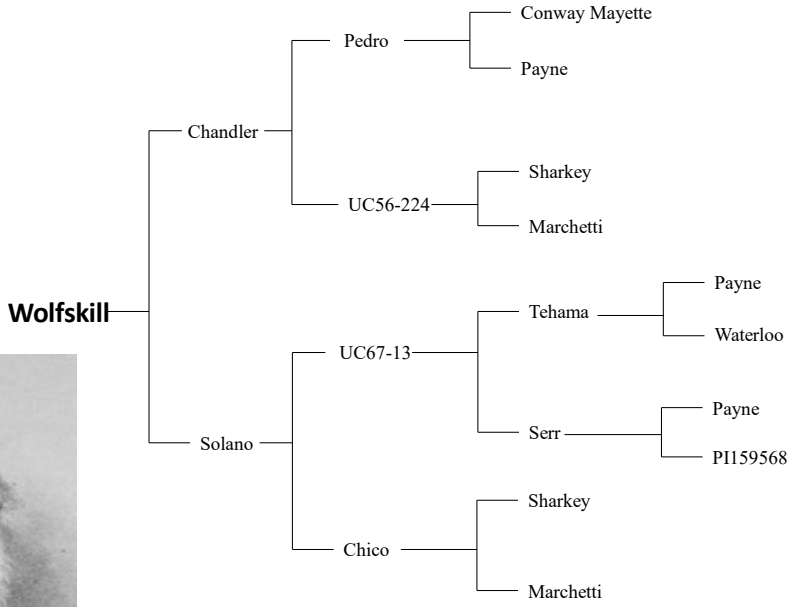
DNA info

What We've Done – Combining Lateral Bearing & Late Leafing



Wolfskill (03-001-2357)

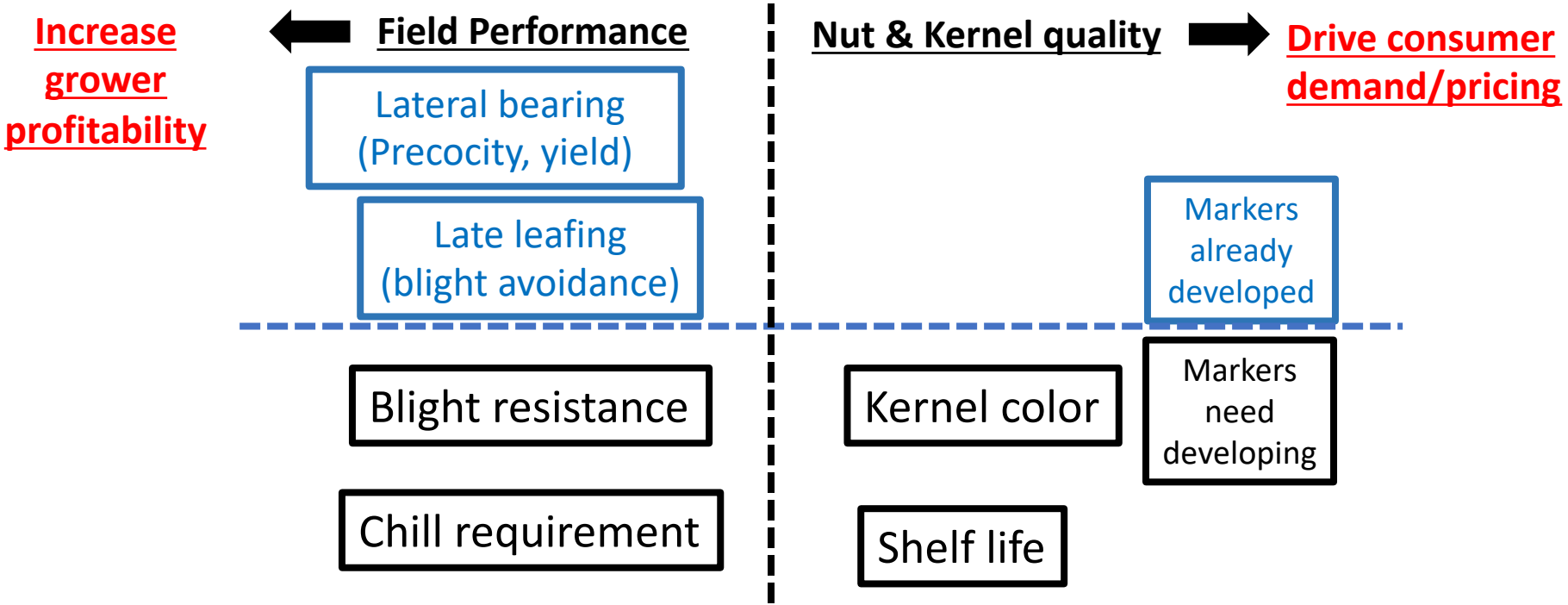




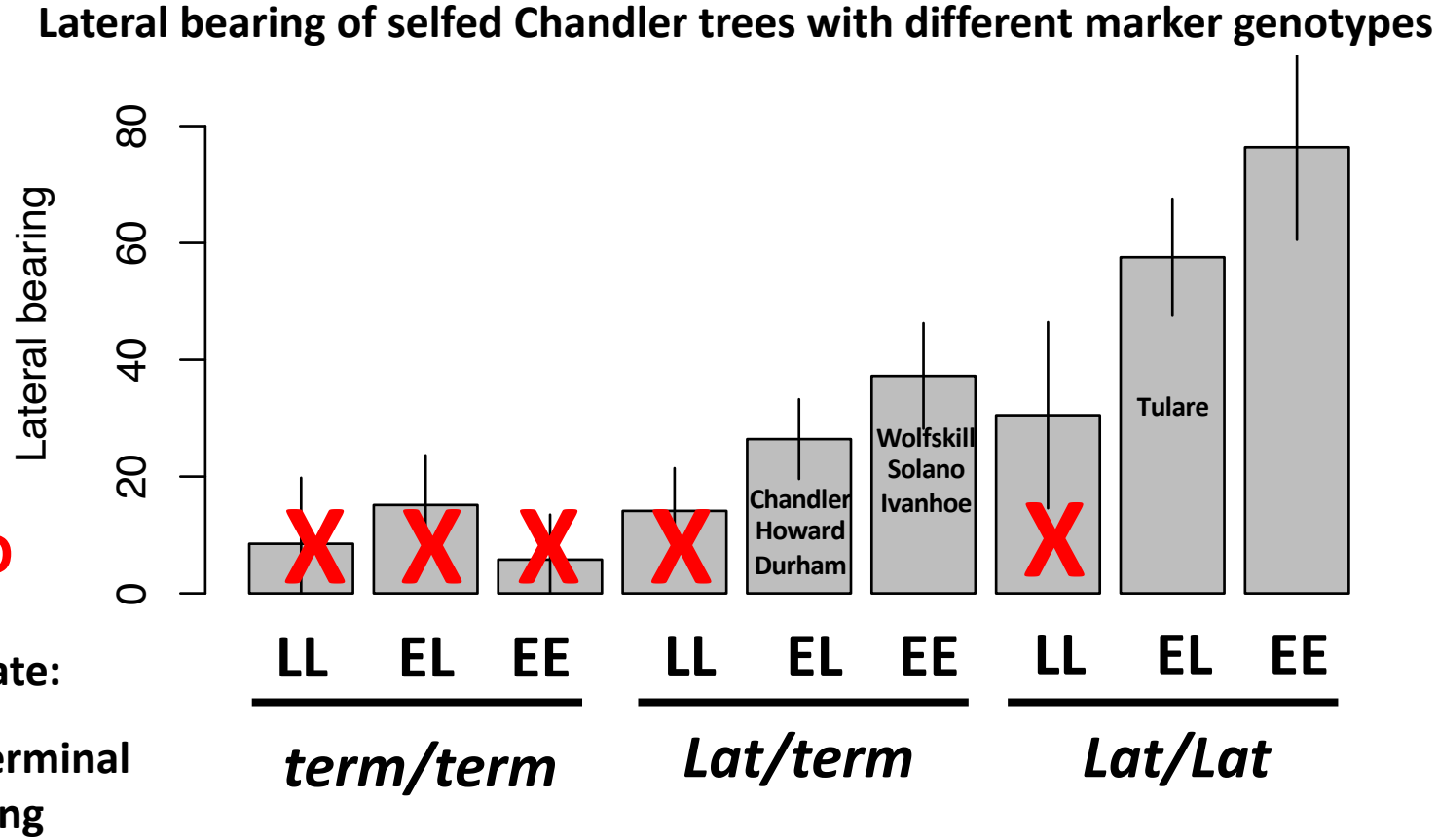
How Wolfskill compares with existing cultivars

Cultivar	Leafing date	Harvest	Kernel wt (g)	% kernel	% Extra-light	% Light	Pollenizer(s)
Ivanhoe	Very early	Very early	7.6	56	39	57	Serr, Payne
Payne/Ashley	Very early	Early	7.1	52	3	80	Solano, Vina, Ivanhoe
Vina	Early	Mid-early	7.0	51	3	47	Chandler, Howard, Tulare
Solano	Early	Mid-early	8.4	55	34	59	Chandler, Howard, Tulare
Wolfskill	**Early**	**Mid**	**8.1**	**57**	**63**	**36**	**Chandler, Howard, Tulare**
Durham	Mid	Mid	8.9	57	51	48	Chandler, Howard, Tulare
Tulare	Mid-late	Mid	8.1	55	8	80	not commonly used
Howard	Mid-late	Mid	7.3	51	24	58	Cisco, Franquette
Hartley	Mid-late	Late	6.9	46	19	64	Cisco, Franquette
Chandler	**Mid-late**	**Late**	**6.8**	**49**	**54**	**36**	**Cisco, Franquette**

What are our future goals?



What We Do – Marker-based-prediction



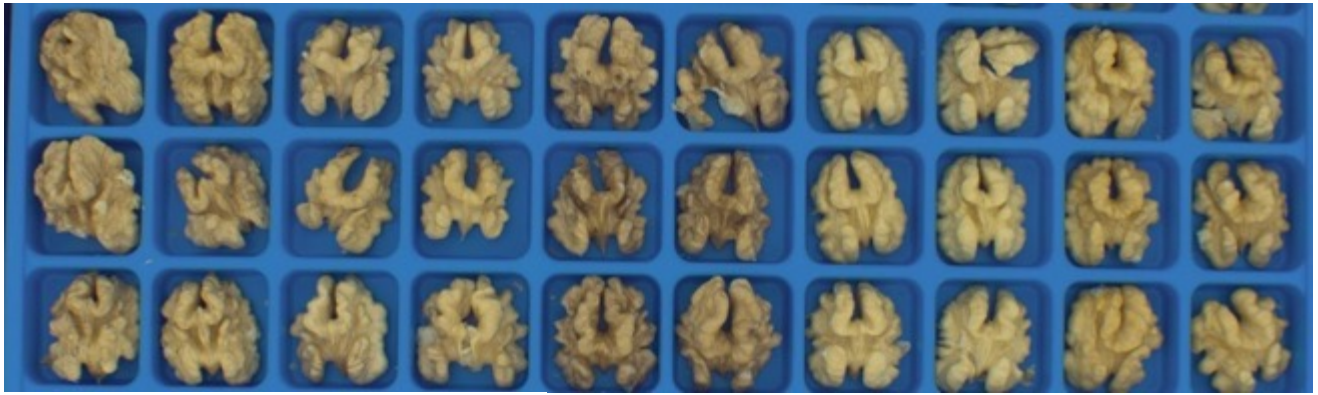
DISCARD

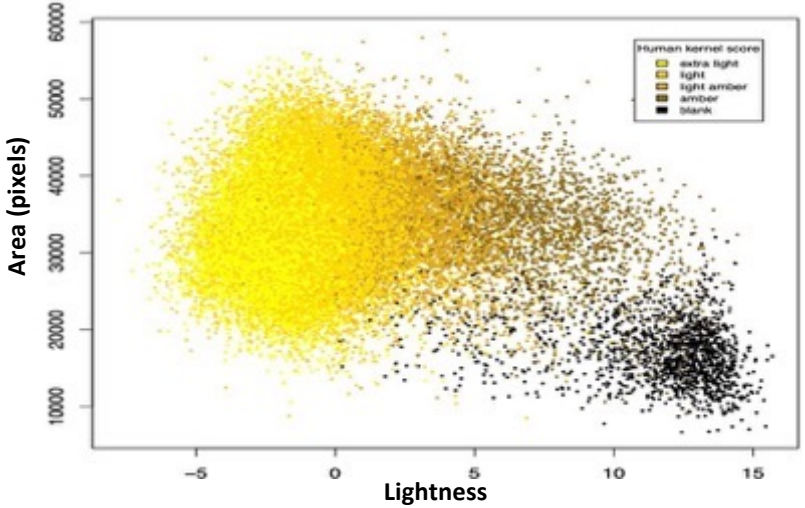
Early/Late:

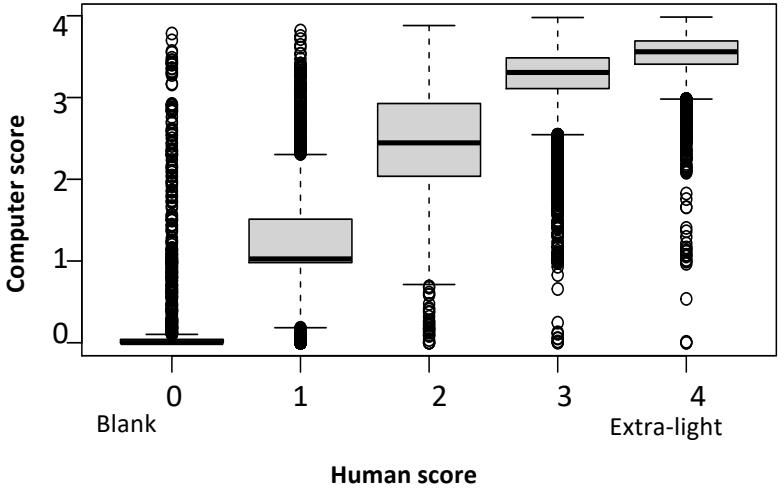
Lateral/Terminal bearing

New assays: quantifying kernel color from image data

Sean McDowell, Mason Earles, Steven Lee



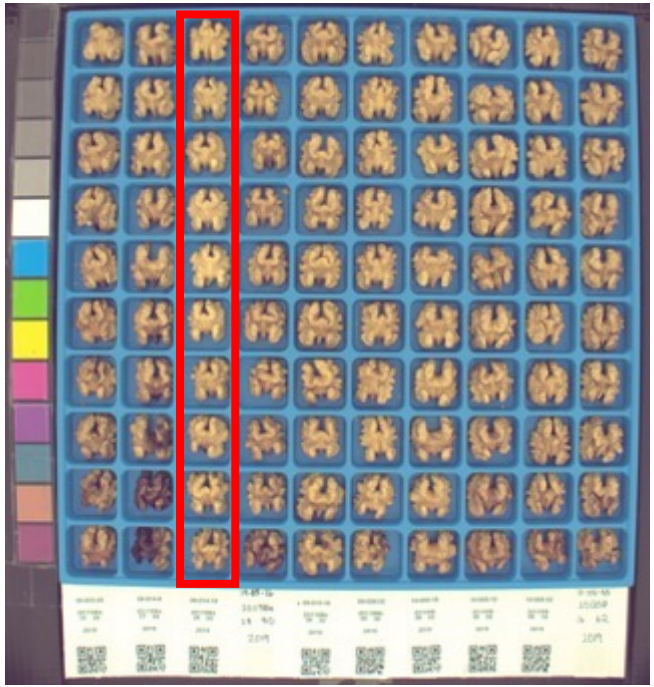




Quantifying color change during storage

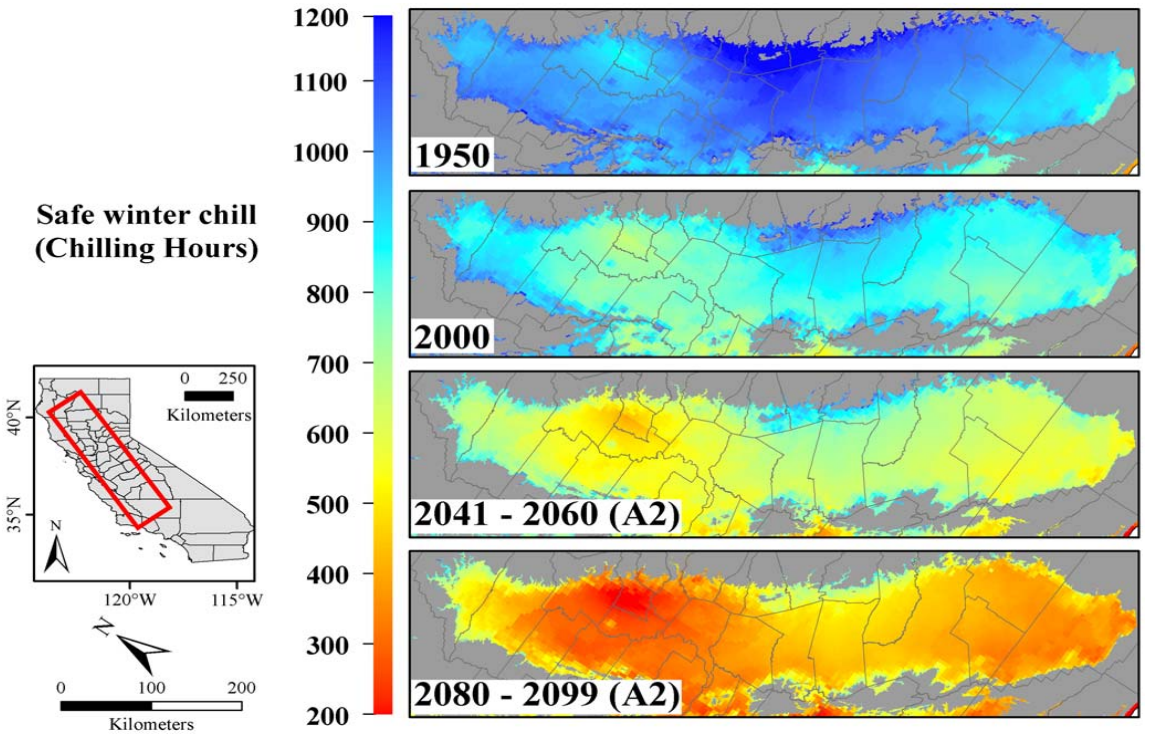
Initial

4 months @ room temp.



Chilling hours/portions are not going to increase

We can't rely on Chandler forever

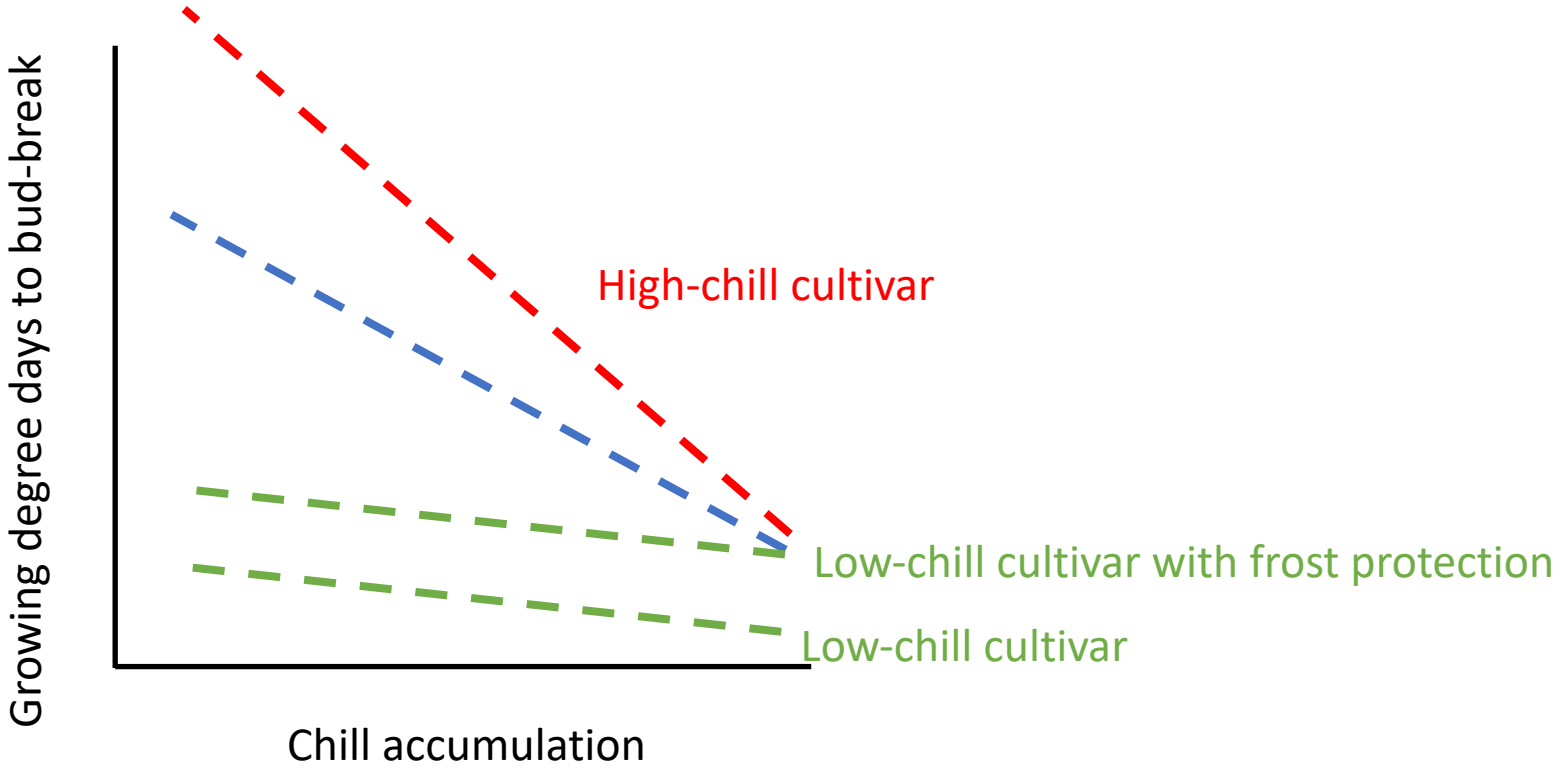


Chilling Hours to Break Bud After 15 Days at 22C

Early Ehrhardt	627
Payne	627
Placentia	627
Serr	827
Tulare	984
Hartley	984
Cascade	1015
Chandler	1015
Fernor	1015
Howard	1015
S. Franquette	1015
XXX Mayette	1015

Early leafing genotypes require less chilling

Chilling and heat requirements determine walnut leafing/flowering dates



New assays: quantifying chill & heat requirements separately

Leafing date (chill + heat unit requirements)

Low chill variety

High chill variety

Increasing shelf life and nutritional value of walnuts

Kernel

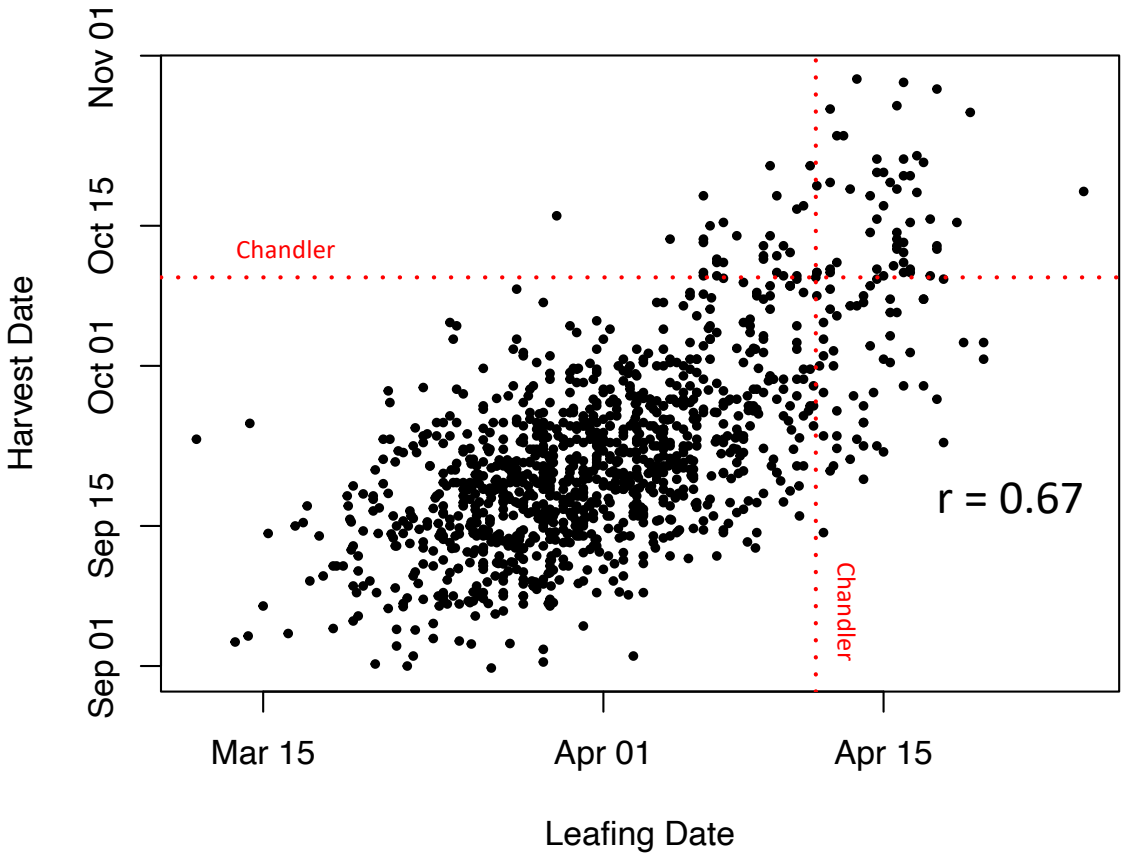
- Zygotic tissue
- High in poly-unsaturated fats and **tocopherols**

Pellicle

- Maternal tissue
- Astringent, high in **tannins**
- Anti-oxidant barrier that gets breached during shelling

Genetic potential in the breeding program: Phenology

(n = 1184 with 3+ years of data from 2017-2021; 3-5 year averages)



- Most selections have earlier leafing + earlier harvest than Chandler

Genetic potential in the breeding program: Phenology

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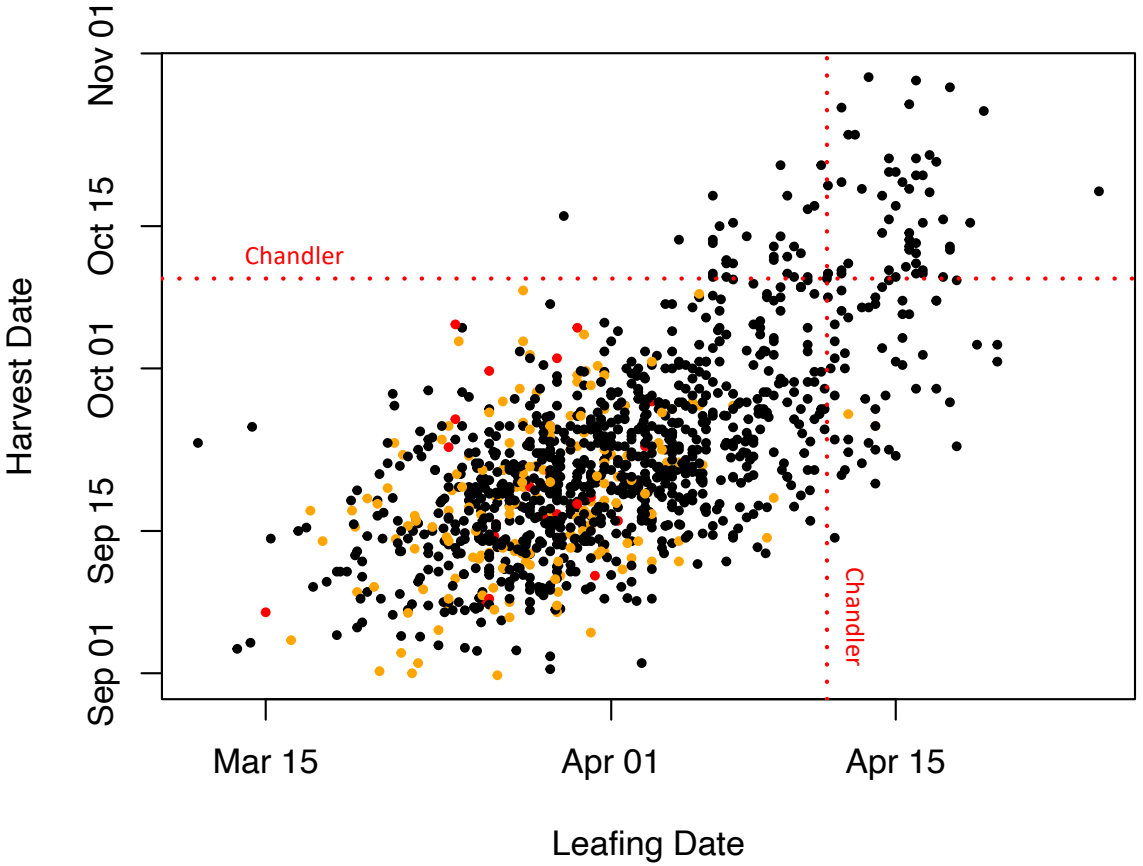

Blight score < 2 (OK)

Blight score 2-4

Blight score > 4

- Some early selections don't appear to get much blight….

Genetic potential in the breeding program: Kernel Yield

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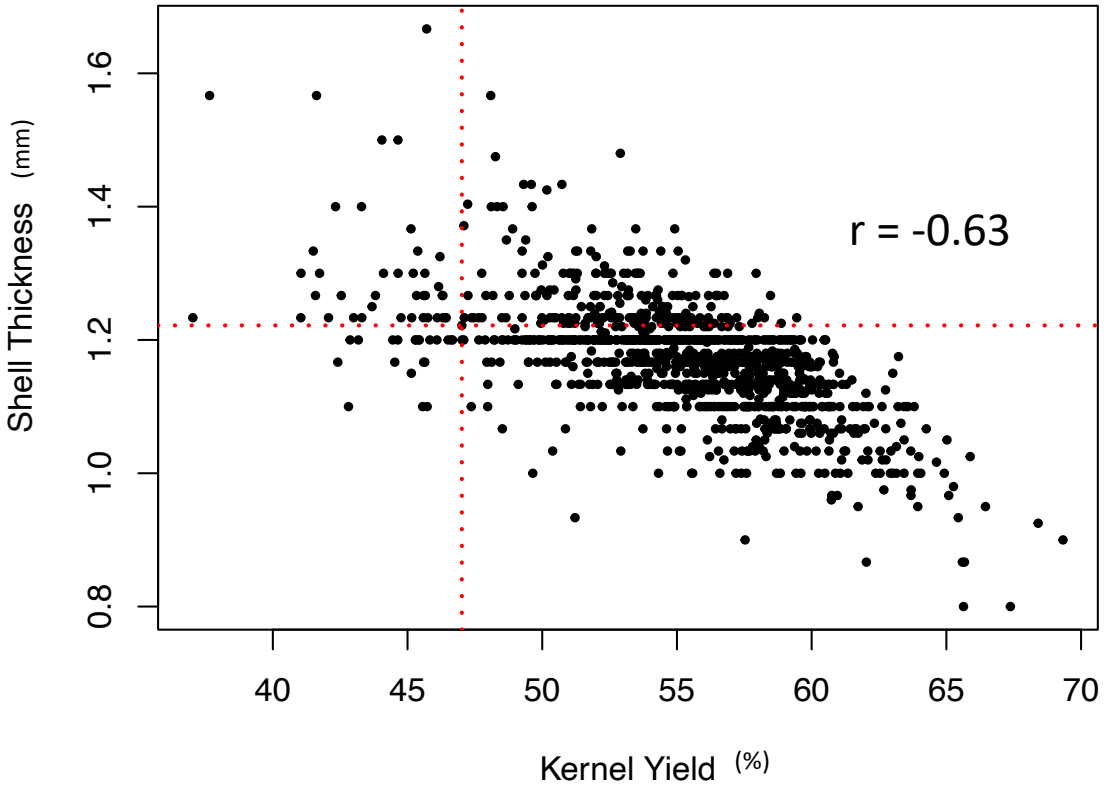

Genetic potential in the breeding program: Kernel Yield

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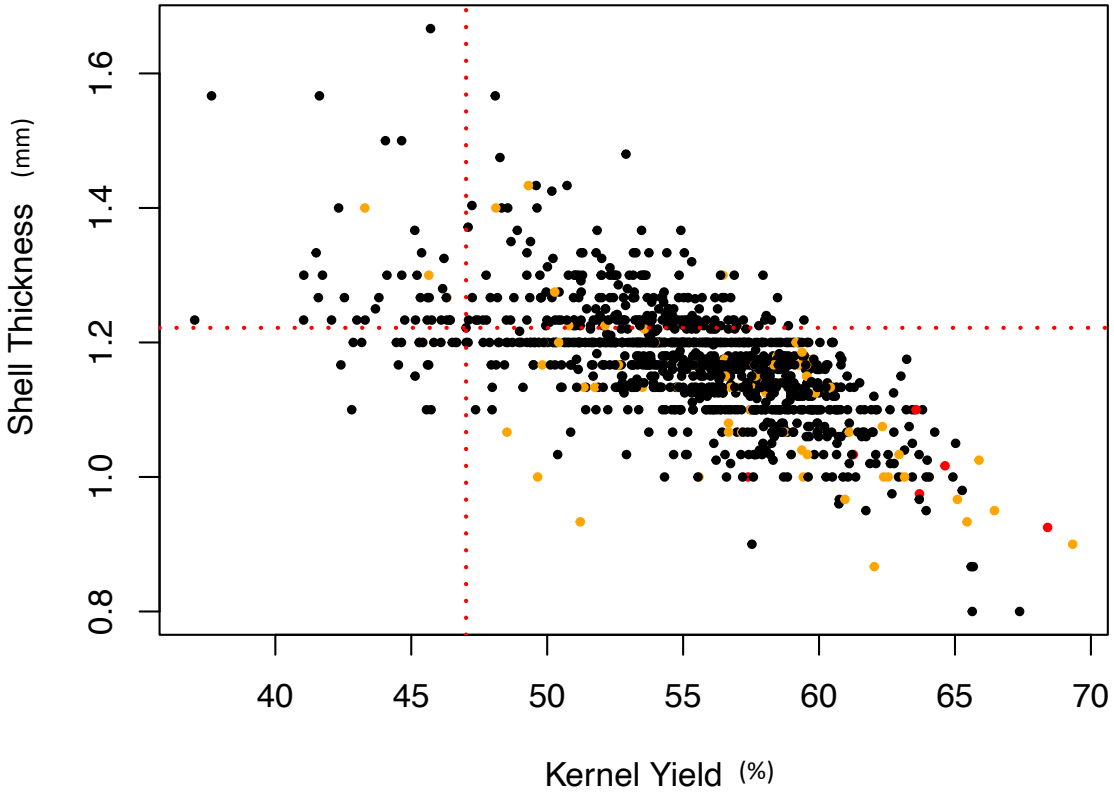

Seal strength > 4.5 (OK)

Seal strength 4.0 - 4.5

Seal strength < 4

- Some selections with high kernel yield appear to have strong seals….

Attention walnut growers:
WIP needs your help trialing advanced selections!

How it works:

- We consult with you to determine the selections that best fit your needs or interests.
- We provide graftwood, budwood, or finished trees.
- **You grow them.**
- We coordinate with you to collect samples and data from both the selections and reference cultivars.

What's in it for you:

- First access to future releases.

New beginning in 2022:

- Free finished trees!

Contact: Pat J. Brown, pjbrown@ucdavis.edu

Send your ideas, requests, complaints:

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