

Field Evaluation of Almond Varieties

Project No.: 21-Hort2-Lampinen

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Summary:

The current generation Regional Almond Variety Trials were planted in the winter of 2014 in Butte, Stanislaus, and Madera counties. Rows of Nonpareil were alternated with 29 varieties and/or experimental selections at all three sites. Trees at the Butte, Stanislaus, and Madera trials were planted on Krymsk 86, Nemaguard, and Hansen 536 rootstocks, respectively, (with the exceptions listed at the bottom of Table 5). Unlike the previous generations of Regional Almond Variety Trials, there are four replications of each variety and selection at each of the three sites. Bloom overlap of pollenizers with Nonpareil has been generally good at all the sites, with the exception of UCD 3-40, which blooms an average of ten days before Nonpareil. Yields in 2021 were higher than in past years, primarily due to excellent weather during bloom and the young orchards nearly reaching full canopy cover. Main kernel defects observed in 2021 were doubles, twins, naval orange worm damage, blanks, and severe shrivel. Four of the varieties were not monitored in the Madera and Butte County sites in 2021 due to unacceptable field performance, and more will likely be dropped in the upcoming year.

Objective: To evaluate new almond varieties and experimental selections in replicated field trials for parameters such as yield, bloom overlap with Nonpareil, hullsplit and bloom timing, kernel quality, and substantial susceptibility to insects and diseases

Results and discussion:

General observations for each site in 2021

Butte- Bloom conditions were excellent at the Butte County site in 2021. Following a heavy 2020 crop, bloom density was lower than in previous years. Consistent with past years, honeybee stocking rate was low. Jenette had the strongest bloom in the trial, while UCD 1-16, UCD 18-20, Sterling, Kester on Hansen, and UCD 8-201 had low bloom density. For a second year, almond leaf scorch symptoms were widespread across the trial site, however symptoms appeared less severe and widespread than in 2020. Trees experienced severe water stress during harvest, and the late splitting varieties had a high incidence of stick tight hulls. However, water stress was not as severe as during the 2020 harvest, and there was no widespread re-greening/leaf out observed in the fall of 2021.

Stanislaus- Weather conditions during bloom were excellent in Stanislaus County in 2021. Return bloom density in 2021 was generally below average for most varieties, including Nonpareil. Bloom density was excellent in Jennette, Aldrich, UCD 3-40, and UCD 271 but very poor in UCD1-16, UCD8-160, Capitola, and Folsom. There were no notable disease or insect outbreaks in the trial in 2021.

Madera- Weather at the Madera County site in 2021 was ideal in the spring, though there was poor return bloom in some varieties, possibly because of a heavy crop in 2020. There were no significant disease issues noted, aside from hull rot. Some trees are exhibiting *Botryosphaeria*-like cankers (samples have not been collected) – all are still alive but may cause mortality in the future.

Bloom, Hullsplit, Yield and Quality 2021

Butte- UCD 3-40 was removed from data collection at the Butte site since it is too early to serve as a pollinizer in these trials. Bloom was fairly compact at the Butte site in 2021 with only about 11 days of difference between full bloom dates for the earliest versus latest varieties (Fig. 2). Bloom overlap was generally good across all varieties and selections. Hullsplit ranged from July 6th to September 8th in 2021 (Fig. 3). Midday canopy PAR interception ranged from 45 to 78% with Nonpareil coming in at 73% (Table 2). Yield ranged from 1564 kernel pounds per acre for UCD8-201 to 3579 for Nonpareil (Table 3). Yield per unit PAR intercepted ranged from 24.8 for Capitola to 54.4 for Aldrich (Table 4). Cumulative yield for the Butte site from 2017-2021 ranged from 7175 for UCD1-271 to 16527 for Nonpareil (Table 5).

Stanislaus- Bloom timing and duration was fairly typical in 2021, with good bloom overlap with Nonpareil for most varieties. Nonpareil full bloom occurred on February 19, while most other varieties reached peak bloom between February 17 and 20. Full bloom for selection 3-40 and Kester occurred on February 10 and 23, respectively, indicating neither would be suitable pollinizers for Nonpareil. Self-fertile selections Y121-42-99 and P016.013 also reached full bloom on February 23. Hullsplit occurred from July 13 to August 6 for the Nonpareil variety (duration of 24 days). Hull split ranged from July 13 to September 3 for all other varieties, with hull split duration that ranged from twelve days (Y121-42-99) to 34 days (UCD8-27). Midday Photosynthetically Active Radiation (PAR) interception ranged from 42.9% for UCD8-160 to 71.9% for Kester on Hansen rootstock (Table 6). Yields ranged from 885 kernel pounds per acre for UCD1-16 to 4293 lb/a for Y117-91-03 (Table 7). Yield per unit PAR intercepted was very high for some varieties at this site in 2021 ranging from 67.2 kernel pounds/% PAR for Y117-91-03 down to 17.3 for UCD1-16 (Table 8). Cumulative yield currently ranges from 7,259 kernel pounds per acre for UCD8-27 to 14,909 for Kester on Hansen (Table 9). Yield has not been optimal at the Stanislaus site due to the use of Nemaguard rootstock with well water high in bicarbonate and moderate levels of chloride. The Kester variety on Hansen rootstock has accumulated 14,909 pounds per acre compared to Kester on Nemaguard that has accumulated only 10,438 pounds/acre, a difference of 43%.

Madera- As at the other two sites, bloom was less compact at the Madera site in 2021 compared to 2020, with full bloom ranging 11 days from Feb. 11 to Feb. 22 (UCD 3-40 was earlier but it is no longer being monitored in these trials). Hullsplit ranged from July 12 to September 12 (Fig. 2). Midday PAR interception ranged from 61% for UCD8-160 to 89% for Folsom in 2021 (Table 10). Nine varieties had PAR interception greater than 80%. The grower-cooperator has been hedging alternate rows, so light interception is being managed at this site. Yields in 2021 ranged from 1394 kernel pounds per acre for UCD1-16 to 3175 kernel pounds per acre for Y117-91-03 (Table 11). Yield per unit PAR intercepted ranged from 19.7 for UCD1-16 to 45.8 kernel pounds per 1% PAR intercepted for Y117-91-03 (Table 12). Cumulative yields ranged from 6948 for UCD1-271 to 16,613 kernel pounds per acre for Nonpareil (Table 13). Hull rot strikes were collected again using a better methodology than in 2020.

Average cumulative yield for all three sites averaged ranged from 7,721 for UCD1-271 to 14,864 for Nonpareil (Table 14). UCD18-20 which is the second top yielding selection or variety overall also has a large number of doubles every year so this may be problematic.

Outreach activities:

- In January 2021, Luke Milliron gave the talk “Almond Variety Evaluation in the Sacramento Valley” at the UCCE Sacramento Valley Almond Grower Meeting.
- Presentation: Field Evaluation of Almond Varieties and Selections. Almond Board of California Sustainable Agriculture Innovation Committee. March 31, 2021. Roger Duncan
- Field Presentation: Almond Variety and Rootstock Options. Nickels Field Day. June 1, 2021. Roger Duncan
- Presentation: Update on Almond Varieties. Wilbur Ellis staff meeting. June 22, 2021. Roger Duncan
- Field Day: Field Evaluation of Almond Varieties. Stanislaus County variety trial. Salida, CA. June 30, 2021. Roger Duncan
- Presentation: Considerations When Choosing Almond Varieties. 11-9-21. Tree & Vine Expo. Turlock, CA. Roger Duncan
- Presentation: Current and Future Almond Variety Trials. 11-10-21. Almond Breeding Field Day. Kearney Ag Center. Roger Duncan
- Newsletter article: “Regional Testing of Almond Varieties” in *The Scoop on Fruits and Nuts in Stanislaus County*. November 2021.
- Poster: Field Evaluation of Almond Varieties. 12-8-21. Lampinen, et. al.

Materials and methods:

Regional Almond Variety Trials Planted in 2014

The current regional almond variety trials were planted in the winter of 2014 in Butte (Chico State University), Stanislaus (Salida School District Site), and Madera (Chowchilla grower site) counties. The varieties and selections planted are listed in Table 1. The first 30 items are common to all 3 sites and a few different items added at individual sites are listed at the bottom of Table 1. Trees at the Butte, Stanislaus and Madera trial were planted on Krymsk 86, Nemaguard, and Hansen 536 rootstocks,

respectively, (with the exceptions listed at the bottom of Table 1). Trees were planted at a spacing of 18' x 22' at the Butte site (110 trees/acre), 16' x 21' at the Stanislaus site (130 trees/acre), and 12' x 21' at the Madera site (173 trees/acre). Of the items planted in the main trials, fourteen are either partially or fully self-fertile (Table 1).

Bloom, hullsplit, canopy light interception and yield data collection were initiated in 2016. Bloom data were collected approximately three times per week and recorded as onset of bloom, full bloom (80% flowers open), and the end of petalfall. Hullsplit was recorded from the beginning of the first non-blank splits to completion of hullsplit.

Publications that emerged from this work:

Gordon, P.; Duncan, R.; Milliron, L.; Lampinen, B. (2020). Field Evaluation of Almond Varieties: A Look at Regional Trial Results through Sixth Leaf. *West Coast Nut*. September 17. <http://www.wcngg.com/2020/09/17/field-evaluation-of-almond-varieties/>

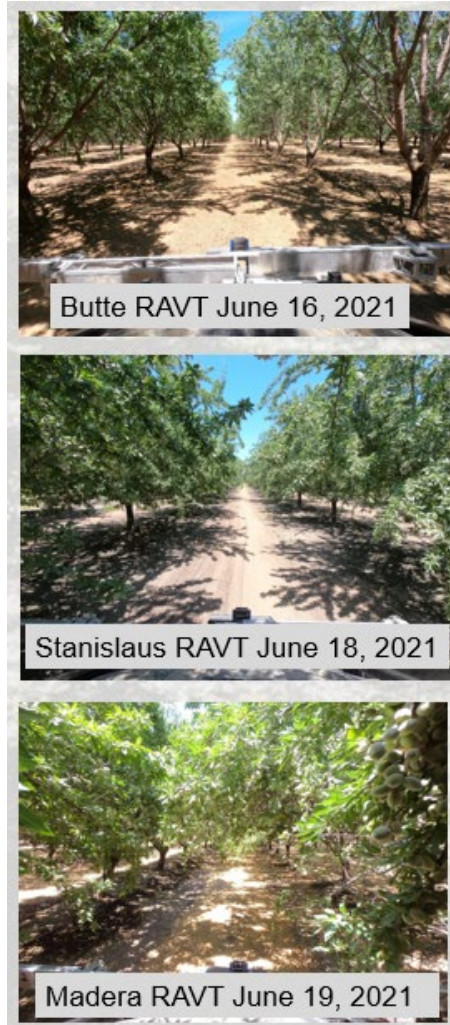
Gradziel, T.; Milliron, L. (2020). Breeding pt. 3: Almond with Tom Gradziel. *Growing the Valley*. February 18. <https://www.growingthevalleypodcast.com/podcastfeed/almond>

[Duncan, Roger. \(2021\). Regional Almond Variety Trials- Results through 7th leaf. <https://www.growingthevalleypodcast.com/podcastfeed/ravt2>](https://www.growingthevalleypodcast.com/podcastfeed/ravt2)

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Table 1. Varieties and selections planted at the regional almond variety trials. Items 1-29 are planted at all 3 sites while additional material planted at individual sites is listed at the end. Trees at the Butte, Stanislaus and Madera sites were planted on Krymsk 86, Nemaguard, and Hansen 536 rootstock respectively (exceptions are noted at bottom of table).



#	Variety or selection	Self-fertile*	Source
1	Eddie		Bright's
2	Capitola		Burchell
3	Supareil		Burchell
4	Self fr P13.019***	yes	Burchell
5	Self fr P16.013***	yes	Burchell
6	Booth		Burchell
7	Sterling		Burchell
8	Bennett		Duarte
9	Nonpareil		Fowler
10	Durango		Fowler
11	Jenette		Fowler
12	Aldrich		Fowler
13	Winters	partial	UCD
14	Sweetheart	partial	UCD
15	Kester (2-19E)*		UCD
16	UCD3-40***		UCD
17	UCD18-20		UCD
18	UCD1-16		UCD
19	UCD8-160	yes	UCD
20	UCD8-27	yes	UCD
21	UCD1-271	yes	UCD
22	UCD1-232	yes	UCD
23	UCD7-159	yes	UCD
24	UCD8-201	yes	UCD
25	Y121-42-99	yes	USDA
26	Y117-86-03	yes	USDA
27	Yorizane (Y116-161-99)**	yes	USDA
28	Y117-91-03	yes	USDA
29	Folsom		Wilson
30	Wood Colony on Krymsk 86 (Butte site only)		
31	Wood Colony on Nemaguard (Madera site only planted one year later after Lone Star was removed)		

*Kester was planted at all three sites on the usual rootstock for the site. In addition, at the Butte and Stanislaus sites it was also planted in the replicated trial on Hansen 536 rootstock.

**Y116-161-99 was released as Yorizane in 2020

***Self-fruitful P16.013 and Self-fruitful P13.019 were eliminated from data collection in the Madera and Butte County sites in 2020 since they have been dropped by the nursery that developed them. Data collection for these selections has continued at the Stanislaus site.

Table 2. 2021 canopy PAR interception for Butte County.

	#reps	Variety or selection	PAR interception	
				(%)
Butte	4	Supareil	77.8	a
	4	Nonpareil	72.6	a b
	4	UCD18-20	71.8	a b c
	4	Sweetheart	70.6	a b c d
	4	UCD1-16	70.4	a b c d
	4	Capitola	70.1	a b c d
	4	Booth	69.9	a b c d
	4	Y117-91-03	69.7	a b c d e
	4	Folsom	69.7	a b c d e
	4	Kester	69.7	a b c d e
	4	Durango	67.2	a b c d e f
	4	UCD8-27	65.9	a b c d e f
	4	Y117-86-03	65.4	b c d e f g
	4	Winters	65.2	b c d e f g
	4	UCD3-40	64.1	b c d e f g
	4	Bennett	63.1	b c d e f g
	4	Self-fr-P13-019	62.0	b c d e f g
	4	Aldrich	60.7	b c d e f g h
	4	Sterling	59.9	c d e f g h
	4	UCD8-201	59.0	d e f g h
	4	UCD7-159	58.2	d e f g h
	4	Kester/Hansen	57.5	e f g h
	4	Jenette	57.3	f g h
	4	Eddie	57.0	f g h
	4	Yorizane (Y116-161-99)	56.5	f g h
	4	UCD1-232	56.3	f g h
4	UCD1-271	53.3	g h i	
4	Wood Colony	49.6	h i	
4	Self-fr-P16-013	49.2	h i	
4	UCD8-160	44.6	i	

Table 3. 2021 yield for Butte County.

	#reps	Variety or selection	2021 Yield	
			(kernel lbs/ac)	
Butte	4	Nonpareil	3579	a
	4	Y117-91-03	3558	a
	4	Aldrich	3308	a b
	4	Durango	2967	a b c
	4	Bennett	2841	b c d
	4	UCD18-20	2820	b c d
	4	Kester	2819	b c d
	4	Jenette	2779	b c d
	4	Booth	2722	b c d e
	4	UCD7-159	2509	c d e f
	4	Folsom	2454	c d e f g
	4	Y117-86-03	2413	c d e f g
	4	Wood Colony	2405	c d e f g
	3	Kester/Hansen	2373	c d e f g
	4	Sweetheart	2312	c d e f g
	4	Yorizane (Y116-161-99)	2306	c d e f g
	4	UCD8-27	2290	c d e f g
	4	UCD1-271	2287	c d e f g
	4	Eddie	2242	c d e f g h
	4	Supareil	2226	d e f g h
	4	Winters	2152	d e f g h
	4	UCD1-16	2039	e f g h
	4	Sterling	1943	f g h
	4	UCD8-160	1933	f g h
	1	UCD1-232	1784	f g h
	4	Capitola	1742	g h
	4	UCD8-201	1564	h

Table 4. 2021 yield per unit light intercepted for Butte County.

	#reps	Variety or selection	Yield per unit PAR	
			intercepted	
Butte	4	Aldrich	54.4	a
	4	Y117-91-03	51.0	a b
	4	Nonpareil	49.1	a b c
	4	Jenette	48.6	a b c d
	4	Wood Colony	48.1	a b c d
	4	Bennett	45.1	a b c d e
	4	Durango	44.3	b c d e f
	4	UCD8-160	43.4	b c d e f
	4	UCD7-159	43.2	b c d e f
	4	UCD1-271	43.0	b c d e f
	4	Yorizane (Y116-161-99)	40.8	c d e f g
	4	Kester	40.4	c d e f g
	4	Eddie	40.2	c d e f g
	4	UCD18-20	39.3	c d e f g
	4	Booth	38.9	d e f g h
	4	Y117-86-03	36.8	e f g h i
	4	Folsom	35.6	e f g h i
	4	UCD8-27	34.9	e f g h i
	3	Kester/Hansen	34.4	f g h i j
	1	UCD1-232	32.9	g h i j
	4	Winters	32.9	g h i j
	4	Sweetheart	32.8	g h i j
	4	Sterling	32.7	g h i j
	4	UCD1-16	28.9	h i j
4	Supareil	28.5	i j	
4	UCD8-201	26.8	i j	
4	Capitola	24.8	j	

Table 5. Cumulative yield for Butte County from 2017-2021.

#reps	Variety or selection	Cumulative yield (kernel lbs/ac)	
4	Nonpareil	16527	a
4	Aldrich	14297	b
4	UCD18-20	14232	b c
4	Booth	14035	b c
4	Y117-91-03	13619	b c d
4	Durango	12912	b c d e
3	Jenette	12885	b c d e f
4	Winters	12075	c d e f g
4	Bennett	11559	d e f g
4	Kester	11479	d e f g h
4	Capitola	11469	d e f g h
4	Yorizane (Y116-161-99)	11367	e f g h
4	Folsom	11137	e f g h
4	Wood Colony	11043	e f g h
4	Y117-86-03	10669	e f g h
4	UCD8-160	10627	f g h
4	Eddie	10592	g h
4	UCD8-201	10543	g h
3	Kester/Hansen	10480	g h
4	UCD7-159	10469	g h
4	UCD1-16	10209	g h
4	Sterling	9831	g h
4	Sweetheart	9741	g h
4	UCD8-27	9727	h
1	UCD1-232	9205	h
4	Supareil	9190	h
4	UCD1-271	7175	i

Butte

Table 6. PAR interception for Stanislaus site 2021.

	#reps	Variety or selection	PAR interception	
			(%)	
Stanislaus	4	Kester/Hansen	71.9	a
	4	Sweetheart	68.2	a b
	4	Supareil	65.9	a b c
	4	Folsom	64.9	a b c d
	4	Y117-91-03	64.2	a b c d
	4	Capitola	63.7	b c d e
	4	Booth	61.7	b c d e f
	4	UCD3-40	60.9	b c d e f g
	4	Eddie	60.4	b c d e f g h
	4	Sterling	60.3	b c d e f g h
	4	UCD8-27	59.3	c d e f g h l
	4	Nonpareil	58.4	c d e f g h l
	4	Self-fr-P13-019	57.1	d e f g h l j
	4	Winters	56.6	d e f g h l j
	4	UCD1-271	56.3	d e f g h l j k
	4	Bennett	56.1	d e f g h l j k l
	4	UCD18-20	55.2	e f g h l j k l
	4	Kester	54.8	f g h l j k l
	4	Durango	53.4	f g h l j k l
	4	Aldrich	52.5	g h l j k l
	4	Self-fr-P16-013	51.8	h l j k l
	4	UCD7-159	51.6	l j k l
	4	UCD8-201	51.5	l j k l
	4	Jenette	51.2	l j k l m
	4	UCD1-16	50.9	l j k l m
	4	Y121-42-99	50.8	l j k l m
	4	UCD1-232	48.4	j k l m
	4	Yorizane (Y116-161-99)	47.8	k l m
4	Y117-86-03	47.4	l m	
4	UCD8-160	42.9	m	

Table 7. 2021 yield for the Stanislaus site.

	#reps	Variety or selection	2021 Yield	
			(kernel lbs/ac)	
Stanislaus	4	Y117-91-03	4293	a
	4	Kester/Hansen	3759	a
	4	Aldrich	2964	b
	4	Nonpareil	2931	b c
	3	Yorizane (Y116-161-99)	2779	b c d
	4	Booth	2731	b c d
	4	Eddie	2727	b c d
	4	UCD18-20	2725	b c d
	4	Bennett	2721	b c d
	4	Supareil	2566	b c d e
	4	Kester	2550	b c d e
	4	Self-fr-P16-013	2496	b c d e
	4	Jenette	2432	b c d e
	4	Folsom	2419	b c d e
	3	UCD1-232	2362	b c d e
	4	Self-fr-P13-019	2348	b c d e
	4	Sweetheart	2316	b c d e
	4	UCD7-159	2311	b c d e
	4	UCD8-201	2293	b c d e
	3	Winters	2258	c d e
	4	Durango	2210	d e f
	4	UCD3-40	2195	d e f
	2	Sterling	2195	d e f
	4	Y117-86-03	2153	d e f g
	4	UCD1-271	2116	d e f g
	4	UCD8-27	2108	d e f g
	4	UCD8-160	1953	e f g
	2	Y121-42-99	1573	f g
	4	Capitola	1533	g
	4	UCD1-16	885	h

Table 8. Yield per unit PAR intercepted for Stanislaus site 2021.

	Yield per unit PAR	
	#reps	intercepted
Stanislaus	4	Y117-91-03 67.2 a
	3	Yorizane (Y116-161-99) 59.1 a b
	4	Aldrich 56.4 b c
	4	Kester/Hansen 52.4 b c d
	4	Nonpareil 50.1 b c d e
	4	UCD18-20 49.9 b c d e f
	4	Bennett 49.4 b c d e f
	4	Self-fr-P16-013 48.4 c d e f g
	4	Jenette 47.5 c d e f g
	4	Kester 46.3 c d e f g h i
	4	Y117-86-03 46.0 d e f g h i
	4	Eddie 45.3 d e f g h i
	3	UCD1-232 45.3 d e f g h i
	4	UCD8-160 45.2 d e f g h i
	4	UCD8-201 44.6 d e f g h i j
	4	UCD7-159 44.5 d e f g h i j
	4	Booth 44.1 d e f g h i j
	4	Self-fr-P13-019 41.3 e f g h i j k
	4	Durango 41.3 e f g h i j k
	3	Winters 40.8 e f g h i j k
	4	Supareil 39.1 f g h i j k
	4	UCD1-271 37.5 g h i j k l
	4	Folsom 37.1 h i j k l
	4	UCD3-40 36.3 i j k l
	4	UCD8-27 35.5 i j k l
	4	Sweetheart 34.0 j k l
	2	Sterling 33.3 k l m
	2	Y121-42-99 28.0 l m
4	Capitola 24.0 m n	
4	UCD1-16 17.3 n	

Table 9. Cumulative yield for Stanislaus County from 2016-2021.

	#reps	Variety or selection	Cumulative yield	
			(kernel lbs/ac)	
Stanislaus	3	Kester/Hansen	14909	a
	3	Y117-91-03	13927	a
	4	UCD18-20	12015	b
	3	Bennett	11810	b c
	4	Nonpareil	11451	b c d
	4	Aldrich	11126	b c d e
	4	Booth	10834	b c d e f
	4	UCD7-159	10440	b c d e f
	3	Kester	10438	b c d e f
	4	UCD8-160	10307	b c d e f g
	3	Yorizane (Y116-161-99)	10295	b c d e f g
	3	Durango	10175	b c d e f g
	4	Eddie	9982	b c d e f g
	3	Winters	9979	b c d e f g
	4	Y117-86-03	9931	b c d e f g
	2	Sterling	9681	c d e f g
	4	Capitola	9603	c d e f g h
	3	UCD1-232	9555	c d e f g h
	3	UCD8-201	9475	d e f g h i
	3	Supareil	9183	d e f g h i
	4	Sweetheart	9122	e f g h i
	4	Folsom	9103	e f g h i
	4	UCD1-271	8653	f g h i
	4	Jenette	8618	f g h i
4	UCD3-40	8063	g h i	
4	UCD1-16	7381	h i	
4	UCD8-27	7259	i	

Table 10. PAR interception for 2021 season for Madera site.

	#reps	Variety or selection	PAR interception	
			(%)	
Madera	4	Folsom	89.0	a
	4	Sterling	86.1	a b
	4	Booth	83.7	a b c
	4	Supareil	83.6	a b c
	4	Capitola	83.5	a b c d
	4	Kester	82.3	a b c d
	4	Eddie	82.3	a b c d e
	4	Nonpareil	82.2	a b c d e
	4	UCD1-271	80.2	a b c d e
	4	Durango	79.7	a b c d e
	4	Aldrich	78.1	a b c d e
	4	Sweetheart	77.8	a b c d e
	1	Y121-42-99	76.7	a b c d e f
	4	Bennett	73.4	a b c d e f
	4	UCD8-27	72.5	b c d e f
	4	UCD18-20	71.7	b c d e f
	4	Yorizane (Y116-161-99)	71.2	b c d e f
	4	Y117-86-03	71.1	b c d e f
	4	UCD7-159	71.0	b c d e f
	4	Y117-91-03	70.3	b c d e f
	4	Winters	70.2	b c d e f
	4	UCD1-16	69.8	c d e f
	4	Jenette	68.9	c d e f
	4	UCD8-201	67.6	c d e f
	4	Wood Colony	67.4	d e f
	4	UCD1-232	66.1	e f
4	UCD8-160	61.4	f	

Table 11. 2021 yield for Madera site.

	#reps	Variety or selection	2021 Yield	
			(kernel lbs/ac)	
Madera	4	Y117-91-03	3175	a
	4	Nonpareil	3167	a
	4	Booth	3116	a
	4	Capitola	2889	a b
	4	Durango	2868	a b c
	3	Supareil	2832	a b c
	4	Yorizane (Y116-161-99)	2780	a b c
	4	Y117-86-03	2775	a b c
	4	UCD18-20	2694	a b c d
	3	Jenette	2604	a b c d
	4	Aldrich	2565	a b c d
	4	Bennett	2543	a b c d
	4	Kester/Hansen	2536	a b c d
	4	UCD8-160	2440	a b c d
	4	UCD1-232	2386	a b c d
	4	Folsom	2322	a b c d
	4	Eddie	2277	a b c d e
	4	Sweetheart	2106	b c d e
	4	Winters	2073	b c d e
	4	UCD7-159	2070	b c d e
	4	UCD8-201	2060	b c d e
	4	UCD8-27	2054	b c d e
	4	Sterling	1922	c d e
3	UCD1-271	1799	d e	
4	UCD1-16	1394	e	

Table 12. Yield per unit PAR intercepted for Madera site in 2021.

	#reps	Variety or selection	Yield per unit PAR	
			intercepted	
Madera	4	Y117-91-03	45.8	a
	4	UCD8-160	40.7	a b
	4	Yorizane (Y116-161-99)	39.9	a b c
	3	Jenette	39.7	a b c
	4	Y117-86-03	39.3	a b c
	4	Nonpareil	38.5	a b c d
	4	UCD18-20	37.6	a b c d
	4	Booth	37.0	a b c d
	4	Durango	36.1	a b c d
	4	UCD1-232	35.8	a b c d
	4	Bennett	34.8	a b c d e
	4	Capitola	34.5	a b c d e
	3	Supareil	34.3	a b c d e
	4	Aldrich	32.7	b c d e
	4	UCD8-201	31.7	b c d e f
	4	Kester	30.8	b c d e f
	4	Winters	30.0	b c d e f
	4	UCD7-159	29.6	b c d e f
	4	UCD8-27	28.7	b c d e f
	4	Eddie	27.9	b c d e f
4	Sweetheart	26.9	c d e f	
4	Folsom	26.1	d e f	
3	UCD1-271	22.4	e f	
4	Sterling	22.2	e f	
4	UCD1-16	19.7	f	

Table 13. Cumulative yield for 2016-2021 for Madera site.

	#reps	Variety or selection	Cumulative yield	
			(kernel lbs/ac)	
Madera	4	Nonpareil	16613	a
	3	Yorizane (Y116-161-99)	15822	a b
	4	Y117-86-03	14917	a b c
	4	UCD18-20	14812	a b c d
	4	Booth	14292	a b c d e
	4	Capitola	14195	a b c d e
	3	Jenette	14134	a b c d e f
	4	Y117-91-03	13939	a b c d e f
	4	Kester	13796	a b c d e f
	4	Bennett	12867	b c d e f g
	4	Durango	12568	c d e f g h
	3	Supareil	12452	c d e f g h
	4	Aldrich	12420	c d e f g h
	4	Eddie	12379	c d e f g h
	4	UCD8-201	12207	c d e f g h i
	4	Sterling	11983	c d e f g h i
	4	UCD8-160	11856	c d e f g h i
	4	Winters	11850	c d e f g h i
	4	Folsom	11690	d e f g h i
	4	Sweetheart	11526	e f g h i
	4	UCD1-16	11044	f g h i
	4	UCD8-27	10402	g h i
	3	UCD7-159	9724	h i
3	UCD1-232	9193	i j	
2	UCD1-271	6948	j	

Table 15. Main kernel defects for 2021 harvest. Items are listed if they had 6% or more of kernels exhibiting the defect.

Varieties with defect	Trial					
	Butte	(%)	Stanislaus	(%)	Madera	(%)
6% or more double kernels	UCD 8-201	31	UCD 8-27	22	UCD 8-201	33
	UCD 8-27	24	UCD 8-201	19	UCD 8-27	32
	UCD 18-20	11	UCD 18-20	10	Booth	12
	Wood Colony	7	Booth	8	UCD 8-160	9
	Kester/Hansen	6			UCD 1-232	8
	UCD 8-160	6			UCD 18-20	7
	Winters	6			Kester	6
6% or more twin kernels (two kernels within the same pellicle)			UCD 3-40	15		
			UCD 8-201	6.5		
navel orange worm damage	UCD 1-16	6.5			Bennett	28
					UCD 1-271	27
					UCD 1-16	24
					UCD 8-160	19
					UCD 8-27	18
					Durango	16
					UCD 7-159	15
					UCD 8-201	15
					Eddie	14
					Lone Star	13
					Y116-161-99	12
					Sterling	11
					Y117-86-03	10
					Aldrich	10
					Nonpareil	10
				UCD 18-20	10	
				Supareil	9	
				Booth	9	
				Winters	9	
				Folsom	7	
6% or more crease	UCD 8-160	22	UCD 8-160	27	UCD 8-160	7
	Wood Colony	17	UCD 3-40	6		
	UCD 1-271	8				
6% or more stain/discolor	UCD 1-271	21	UCD 1-271	11	Eddie	8
	Yorizane (Y116-161-	19	UCD 1-232	7.5	Y117-91-03	7
	Capitola	11	Y116-161-99	7.5		
	Y117-86-03	11	Eddie	6.5		
	Eddie	10	Sweetheart	6.5		
	UCD 8-201	9.5				
	Sweetheart	8				
Y117-91-03	6.5					
6% or more mold	Bennett	23	UCD 1-271	6.5	UCD 1-271	9
	UCD 1-271	22			Eddie	6
	Eddie	21				
	Nonpareil	20				
	UCD 1-232	20				
	Capitola	16				
	UCD 8-201	16				
	Y117-86-03	12				
	UCD 7-159	10				
	Kester/Hansen	8.7				
	Y117-91-03	7.5				
	Winters	7				
	Booth	6.5				
UCD 1-16	6.5					
UCD 8-27	6.5					
6% or more brown spot			UCD 1-232	19	UCD 1-271	19
			UCD 3-40	6	UCD 1-232	7

Fig. 1. Number of hullrot strikes per tree at the Madera site in 2021.

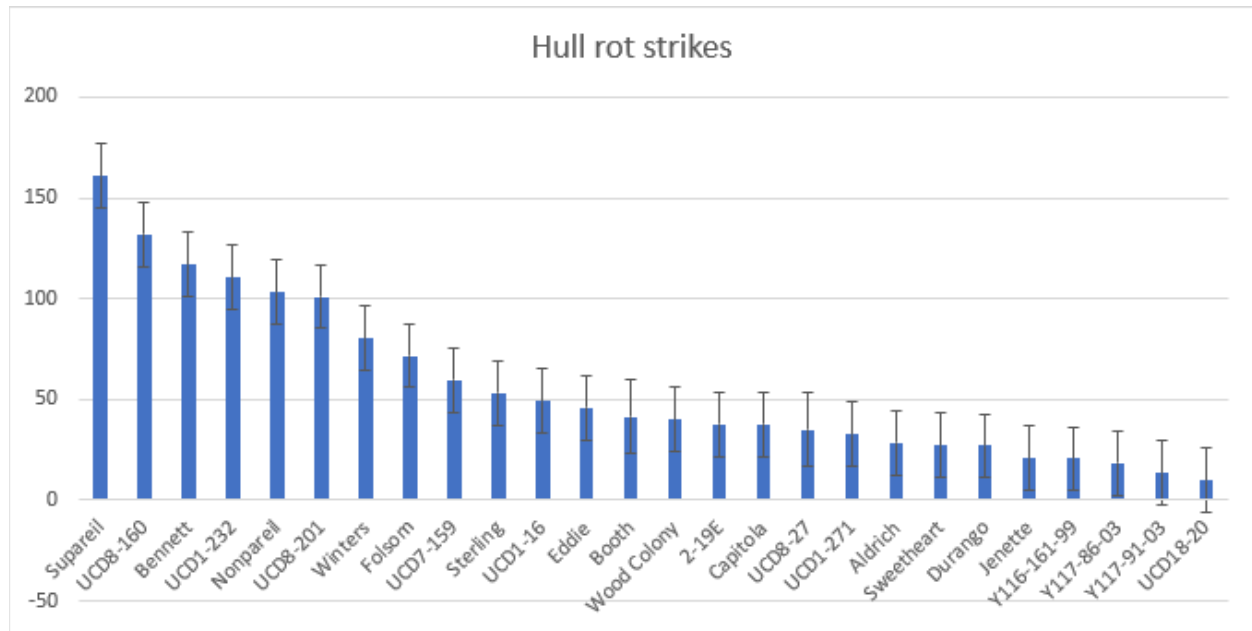


Fig. 2. Bloom data for 2021 by site and variety or selection.

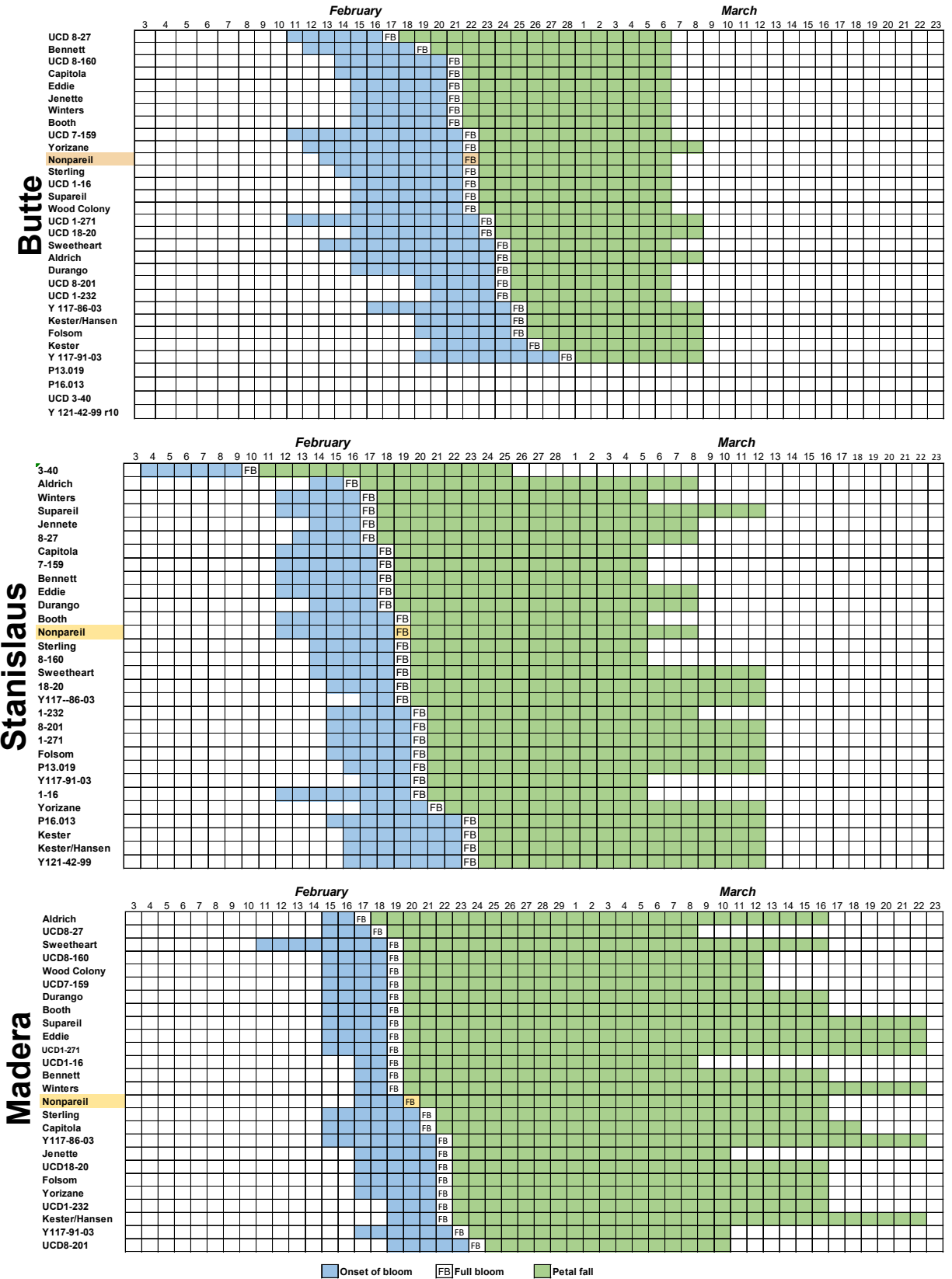


Fig. 3. Hullsplit by site, variety and selection for 2021.

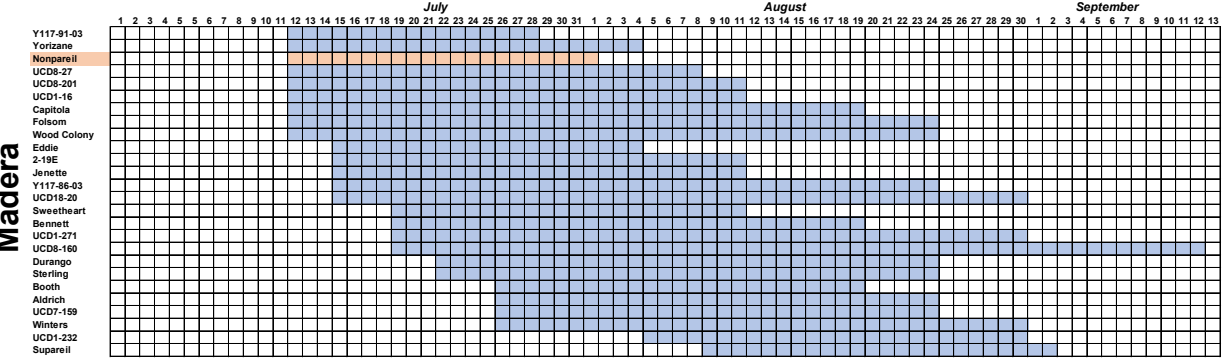
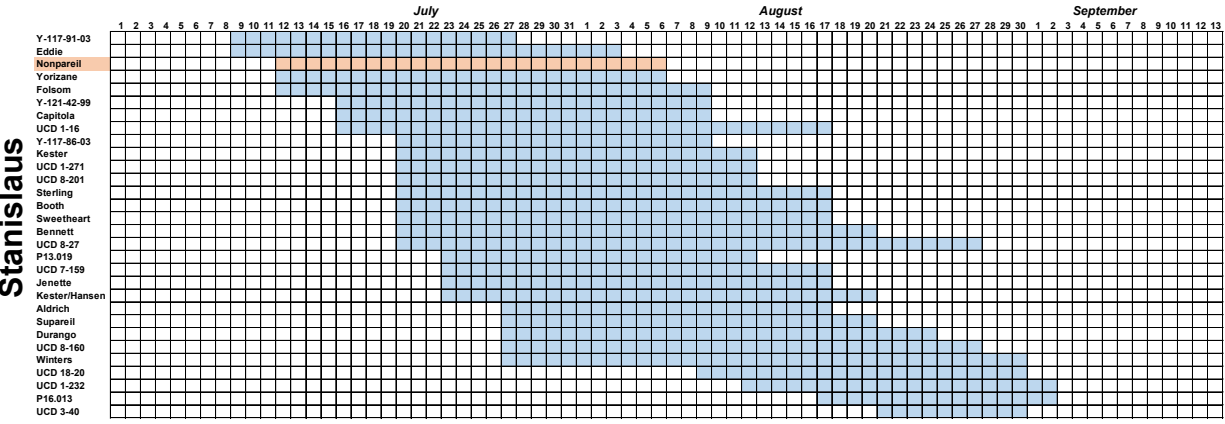
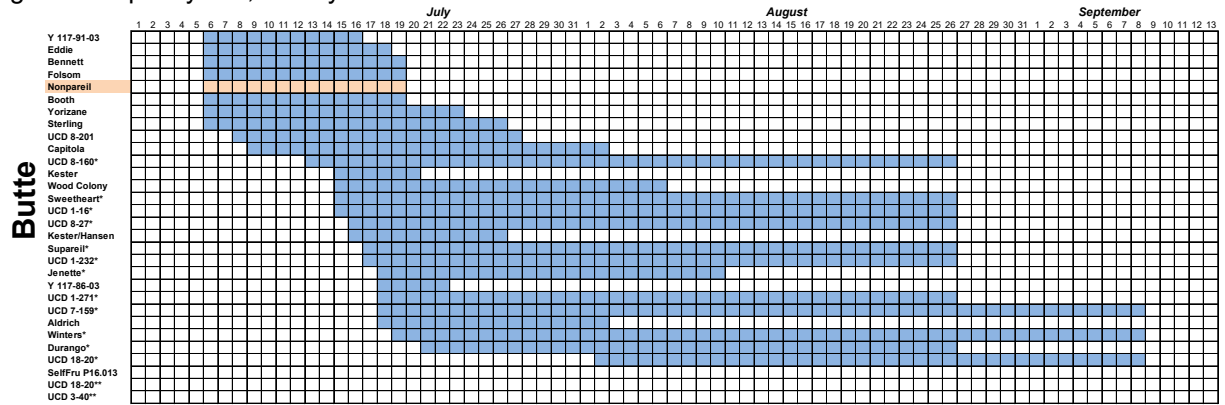


Fig. 4. Average annual yield for all varieties and selections combined at each trial by orchard age. Kern, Butte old and Delta are from the previous generation variety trials and the McFarland trial was in Kern County with Mario Viveros.

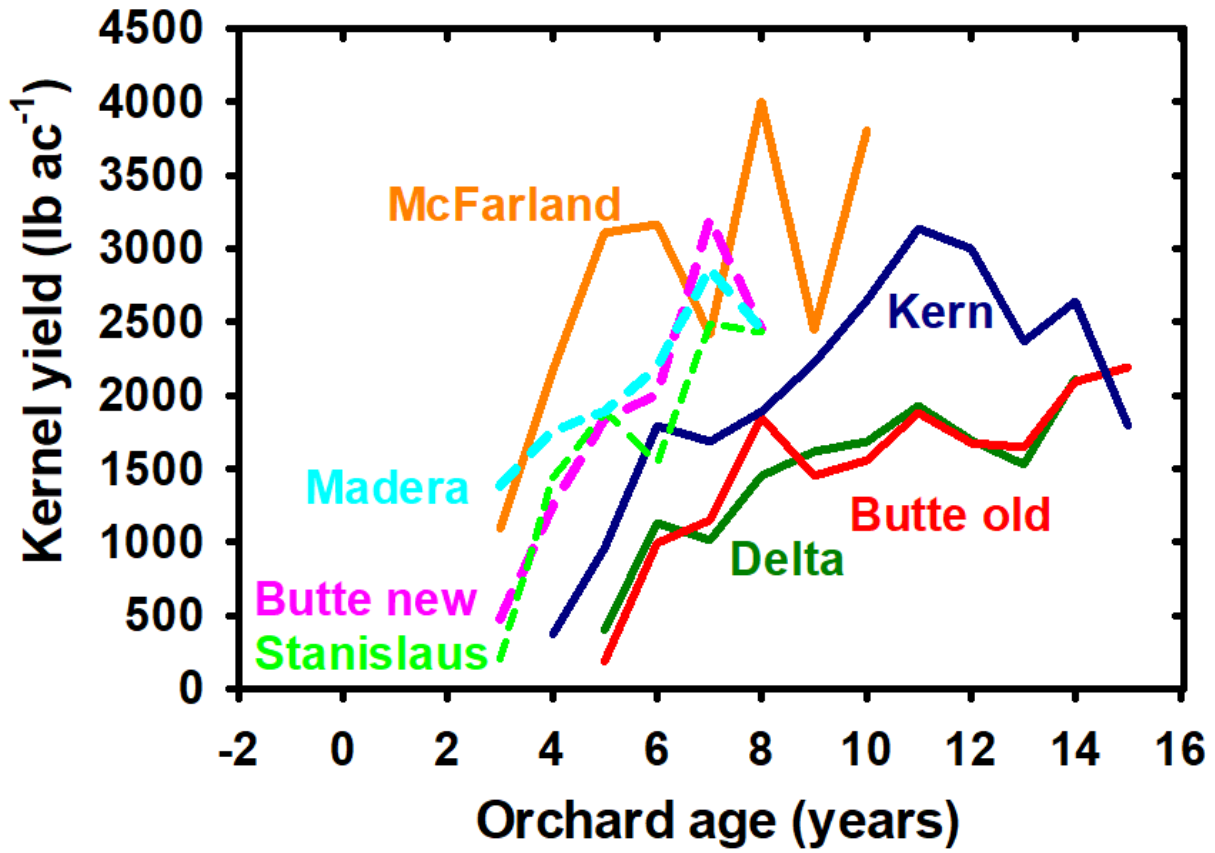


Fig. 5. Google Earth images of the three sites.

