Field Evaluation of Almond Varieties

Project No. 21-Hort2-Lampinen

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Summary:
The current Regional Almond Variety Trial includes 30 varieties, planted in the winter of 2014 in Butte, Stanislaus, and Madera counties. At all three locations, Nonpareil was planted alongside the test and standard varieties. The selected rootstocks at Butte, Stanislaus, and Madera sites were Krymsk 86, Nemaguard, and Hansen 536 respectively, with exceptions as listed in Table 1. This trial consists of four replications of 11-12 trees of each variety or selection at each of the three sites. The peak bloom dates of all pollinizers in 2022 coincided with Nonpareil, except for the extremely early blooming variety UCD 3-40, which was dropped from the trial in the previous years. Despite three freeze events, yield for some varieties at the Butte trial were exceptional (4432 for Y117-86-03), however, yield was much lower for other varieties (1103 kernel pounds per acre for Supareil). In general, the bloom overlap has been good at all sites. Yields in the Salida trial continue to be moderated by irrigation water that is high in bicarbonates (Fig. 2). More mature almond orchards grown under favorable weather conditions resulted in higher yield in 2022 than the previous year at the Madera site (Fig. 3). In 2022 the most common kernel defects were doubles, twins, navel orangeworm, creases, discoloration, and mold. Varieties no longer under evaluation are UCD 3-40, UCD 1-232, UCD 1-271, UCD 1-16, Self-frP13.019, UCD 8-27, Self-fr P16.013, Y121-42-99, and UCD 7-159 due to poor yields, poor harvestability (high mummy counts), or insufficient replications.

Objectives: To compare new almond varieties and experimental selections for parameters such as yield, bloom overlap, bloom timing, hull split occurrence, kernel quality, and susceptibility to insects and diseases.

Annual Results and Discussion

General observations for each site in 2022:

Butte- Dry, warm weather conditions in Butte County with highs in the 70-80s led to a very quick bloom across all varieties. Temperatures dipped into the 20's on 2/6/22 as well 2/22-23/22, which significantly affected the yield. Bloom density was high in Booth, Jenette, and UCD 8-201 (up significantly for UCD 8-201 from last year), but poor in Folsom and Sterling. For a third year, ALS symptoms were noted across the trial site, however they subjectively appeared less severe than in previous years. Trees had less hulltights (failure to complete hullsplits, often due to extreme water stress) throughout the trial than in 2021. Pick-

up of late varieties was interrupted by rain in Mid-September after nuts had already been shaken and windrowed.

Stanislaus- Bloom weather in 2022 was mostly sunny and very dry, with no rain until 0.09 inches fell on March 15, well after petal fall for all varieties. Minimum temperatures dipped into the 20's for four consecutive nights from February 23-26, reaching a low of 25 degrees F on February 25, when most varieties were well into petal fall. A post-freeze inspection indicated that less than 10% of the flowers of any variety appeared to be damaged by the cold temperatures. Trees of all varieties exhibited interveinal leaf chlorosis through the first few months of the season, exacerbated by being on Nemaguard rootstock. There were no particular disease or insect problems in this trial in 2022.

Madera- Most of the varieties reached full bloom when temperatures were comparatively warmer (75-80's) than other sites during early February in Madera County. There was no frost reported in 2022. A significant amount of rain during mid-September delayed the pickup for late harvest varieties until the end of October. Rain fell after the nuts for the first variety harvest were shaken and wind-rowed, which caused growth of Aspergillus on the hulls and likely caused kernel staining. Nuts from some of the varieties got mixed when windrows were conditioned to facilitate drying after rain. We had to drop those replicates, which will result in less rigorous post-hoc comparisons. Other than that, there were no specific diseases and frost damage observed in 2022.

Bloom, Hullsplit, Yield and Quality
2022

Butte- In 2022, Overall, bloom overlap was generally good across the varieties. Except for Kester, all varieties reached peak bloom from February 10th to 19th. Kester reached full bloom on the February 26th, indicating that it would not be a suitable pollinizer for Nonpareil (Fig. 5). Hullsplit for all the varieties ranged from July 10th to September 7th, with Nonpareil hullsplit ranging from 12 July to 14 August (Fig. 6). Midday canopy PAR interception ranged from 50% for UCD 8-160 to 81 % for Supareil, with Nonpareil at 76% (Table 2). Yield ranged from 1103 kernel pounds per acre for Supareil to 4432 for Y117-86-03 (Table 3). Yield per unit PAR intercepted ranged from 13.4 kernel pounds/% PAR for Supareil to a very high 67.7 for Y117-86-03 (Table 4). The cumulative yield (2016-2022) for the Butte site ranged from 10,311 kernel pounds per acre for Supareil to 19,541 for Nonpareil (Fig. 1). Kernel quality and characteristics are listed in Tables 12 and 15.

Stanislaus- Most varieties' peak bloom days ranged from February 14th to 18th, which coincided with Nonpareil. Self-fertile varieties Y117-86-03 and Y121-42-99, reached peak bloom on February 21st and 23rd, respectively (Fig. 5). Hullsplit ranged from July 6th to August 26th. Hullsplit duration for Nonpareil was 23 days, compared to other varieties that ranged from 14 days (Y-117-91-03) to 28 days (Supareil) (Fig. 6). The lowest midday canopy PAR interception was 41.4 % for UCD 8-160 and the highest for Kester on Hansen rootstock at 72%, with 53% for Nonpareil. (Table 5). Yield in 2022 ranged from 1522 kernel pounds per acre (Jenette) to 4245 pounds (Kester/Hansen) (Table 6). The yield per unit PAR intercepted ranged from 22.3 kernel pounds/% PAR for Supareil to 58.7 for Kester/Hansen (Table 7). The cumulative yield (2016-2022) ranged from 10,139 kernel pounds per acre for Jenette to 18,895 for Kester/Hansen (Fig. 2). The Kester variety on Hansen rootstock has accumulated 13%

more yield than Kester on Nemaguard at the Stanislaus site. Kernel quality and characteristics are listed in Tables 13 and 16.

Madera- Due to the higher average temperature at bloom time in 2022 than in 2021, varieties reached their peak bloom earlier than they did in 2021. Bloom was condensed, with a difference of only 7 days between the full bloom dates for the earliest versus latest varieties. Full bloom dates ranged from February 12th to 19th (Fig. 5). Hullsplit duration ranged from a minimum of 10 days (Jenette) to a maximum of 36 days (Folsom) and 29 days for Nonpareil. (Fig. 6). Most of the varieties at this site had 70% or higher midday canopy PAR interception. The grower-cooperator has been hedging alternate rows to manage the light interception at this site for some time, resulting in somewhat uniform PAR values and making variety by variety comparisons not very meaningful (Table 8). The PAR interception ranged from 61% (UCD 8-160) to 89% (Folsom), with 79% for Nonpareil. The yield in 2022 ranged from 2085 kernel pounds per acre for Supareil to 4024 for Capitola. (Table 9). The yield per unit PAR interception varied from 19.7 kernel pounds/%PAR for Kester to 48.4 for the Wood Colony (Table 10). The cumulative yield (2016-2022) ranged from 12,605 kernel pounds per acre for Wood Colony to 20,100 for Nonpareil (Fig. 3). Kernel quality and characteristics are listed in Tables 14 and 17.

All sites - The average cumulative yield for all three sites ranged from 12,212 kernel pounds per acre for Supareil to 18.556 for Nonpareil, followed by Y117-91-03 at 16,855 (Table 11), though these results have not been statistically analyzed. Overall, Supareil has the lowest average cumulative yield (Fig. 4). The variety UCD 8-160 has the lowest PAR interception in 2021 and 2022 at all three sites.

Outreach Activities

- Almond Variety Trial Field Day, Madera County Variety Trail. Chowchilla, CA. 5-5-22. Phoebe Gordon
- On 4-5-22. Phoebe Gordon gave a talk on Almond Variety Trial in Almond meeting.
- Poster: “Field Evaluation of Almond Varieties” poster presented at Almond Conference, 2022.
- Regional Field Evaluations of Almond Varieties. R. Duncan, B. Lampinen, P. Gordon, L. Milliron, and T. Gradziel. West Coast Nut. May 2022; ppg 16-20.
- Presentation: Almond Varieties. North San Joaquin Valley Almond Day. 2-7-22
- Two Butte Regional Almond Variety Trial and Irrigation Management Field Meetings: 3-31-22 and 6-23-22.
- Presentation: “Almond Rootstock and Variety Selection in the Northern Sacramento Valley” at the North Valley Nut conference. 6-8-22.
- Interviewed by Taylor Chalstrom on MyAgLife podcast on the topic of “Almond Rootstock & Variety Selection in the Sacramento Valley”. 7-15-22

Materials and Methods

The current regional almond variety trials were planted in winter of 2014 in Butte (Chico State University), Stanislaus (Salida School District Site), and Madera (Creekside Farming Company) counties. Table 1 lists all varieties and selections that were planted in these sites.

There are 29 common items across all the sites plus a few different items that were added to individual sites, as listed in Table 1. The selected rootstocks at Butte, Stanislaus, and Madera trails were Krymsk 86, Nemaguard, and Hansen 536 rootstocks respectively, with the exceptions mentioned in Table 1. Tree spacing is 18'×22' (110 trees/acre) at Butte site, is 16'×21' (130 trees/acre) at Stanislaus site and 12'×21' at the Madera site (173 trees/acre). The trial consists of fourteen partially or fully self-fertile varieties (Table 1).

Bloom time, hull split, canopy light interception, yield data collection, and kernel quality are being evaluated at all three sites. Bloom data was recorded as the onset of bloom when 1% of blossoms are open, full bloom, when 80% of the flowers are open, and the end of petal fall. Bloom data was collected three times per week. Hullsplit data was collected when 1% of the first non-blank splits were open to when all the nuts in the monitored block had entered hullsplit.

List of publications:

Duncan, R.; Milliron, L.; Gordon, P. (2018). Regional Almond Variety Trial - A Discussion with Roger Duncan, Luke Milliron, and Phoebe Gordon. Growing the Valley. L. Milliron. 19. December 3. https://www.growingthevalleypodcast.com/podcastfeed/2018/12/3/regional-almond-variety-trial-a-discussion-with-roger-duncan-luke-milliron-and-phoebe-gordon

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

R. Duncan, B. Lampinen, P. Gordon, L. Milliron, and T. Gradziel. (2022). Regional Field Evaluations of Almond Varieties. *West Coast Nut*. May 2022; ppg 16-20. https://issuu.com/myaglife/docs/wcn_may_2022_e

Acknowledgements

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Table 1. Varieties planted at the regional almond variety trails. The selected rootstocks at Butte, Stanislaus, and Madera trail were Krymsk 86, Nemaguard, and Hansen 536 rootstocks, respectively.

Variety or selection	**Self-fertile**	**Source**
Eddie		Bright's
Capitola		Burchell
Supareil		Burchell
Self-fr P13.019***	yes	Burchell
Self-fr P16.013***	yes	Burchell
Booth		Burchell
Sterling		Burchell
Bennett-Hickman		Duarte
Nonpareil		
Durango		Fowler
Jenette		Fowler
Aldrich		
Winters	partial	UCD
Sweetheart	partial	UCD
Kester (2-19E) *		UCD
UCD3-40***		UCD
UCD18-20		UCD
UCD1-16***		UCD
UCD8-160	yes	UCD
UCD8-27***	yes	UCD
UCD1-271***	yes	UCD
UCD1-232***	yes	UCD
UCD7-159***	yes	UCD
UCD8-201	yes	UCD
Y121-42-99***	yes	USDA
Y117-86-03	yes	USDA
Yorizane (Y116-161-99)	yes	USDA
Y117-91-03	yes	USDA
Folsom		Dave Wilson
Wood Colony (Butte and Madera sites only)		

*Kester was planted at all three sites on the usual rootstock for each site. In addition, Kester was planted on Hansen 536 rootstock in the replicated trisl at the Butte and Stanislaus sites.
**Y116-161-99 was released as Yorizane in 2020.
*** Nine of the varieties were dropped from the data collection at all three sites.

Table 2. PAR interception for 2022 season for the Butte site.

Variety or selection	PAR interception (%)				
Supareil	81	a			
Nonpareil	76.3	a	b		
Sweetheart	75.4	a	b		
Booth	74.4	a	b		
Kester	73.9	a	b		
Folsom	73.1	a	b	c	
Capitola	72.1	a	b	c	
UCD 18-20	70.2	a	b	c	d
Y117-91-03	70.2	a	b	c	d
Durango	69.1	a	b	c	d
Winters	67.2	a	b	c	d
Y117-86-03	65.2	a	b	c	d
Bennett-Hickman	64.7	a	b	c	d
Aldrich	63.2	a	b	c	d
UCD 8-201	63.1	a	b	c	d
Eddie	61.6	a	b	c	d
Kester/Hansen	61.1	a	b	c	d
Jenette	59.6	a	b	c	d
Sterling	57.9		b	c	d
Wood Colony	56.1		b	c	d
Yorizane	51.7			c	d
UCD 8-160	49.2				d

Table 3. 2022 yield for the Butte site.

Variety or selection	2022 Yield (Kernels lbs/ac)							
Y117-86-03	4432	a						
Y117-91-03	3926	a	b					
UCD 18-20	3887	a	b	c				
Capitola	3632	a	b	c	d			
Aldrich	3412	a	b	c	d	e		
Kester/Hansen	3403	a	b	c	d	e		
Kester	3309	a	b	c	d	e		
UCD 8-201	3252	a	b	c	d	e	f	
Durango	3209	a	b	c	d	e	f	
Nonpareil	3014	a	b	c	d	e	f	
Bennett-Hickman	2926	a	b	c	d	e	f	
Jenette	2889	a	b	c	d	e	f	
Sweetheart	2533		b	c	d	e	f	g
Eddie	2358			c	d	e	f	g
UCD 8-160	2279				d	e	f	g
Yorizane	2269				d	e	f	g
Winters	2063					e	f	g
Booth	2000					e	f	g
Sterling	1700						f	g
Folsom	1248							g
Wood Colony	1210							g
Supareil	1103							g

Table 4. 2022 Yield per % unit light intercepted at the Butte site.

Variety or selection	Yield per unit PAR intercepted							
Y117-86-03	67.7	a						
Y117-91-03	56.2	a	b					
UCD 18-20	55.5	a	b					
UCD 8-201	54.1	a	b					
Aldrich	52.9	a	b	c				
Capitola	50.2	a	b	c	d			
Jenette	48.3	a	b	c	d	e		
UCD 8-160	46.6	a	b	c	d	e		
Durango	46.6	a	b	c	d	e		
Bennett-Hickman	45.2	a	b	c	d	e		
Kester/Hansen	45.1	a	b	c	d	e		
Kester	44.7		b	c	d	e		
Yorizane	43.9		b	c	d	e	f	
Eddie	40.2		b	c	d	e	f	
Nonpareil	39.9		b	c	d	e	f	
Sweetheart	33.5		b	c	d	e	f	g
Winters	30.4			c	d	e	f	g
Sterling	29.5				d	e	f	g
Booth	26.7					e	f	g
Wood Colony	21.7						f	g
Folsom	16.8							g
Supareil	13.4							g

Table 5: PAR interception for 2022 season for the Stanislaus site.

Variety or selection	PAR interception (%)							
Kester/Hansen	72.4	a						
Sweetheart	67.7	a	b					
Supareil	67.3	a	b					
Sterling	62.4	a	b	c				
Folsom	62.4	a	b	c				
Y117-91-03	62.1	a	b	c				
Eddie	61.3	a	b	c	d			
Booth	60.9	a	b	c	d			
Capitola	59.4		b	c	d	e		
Bennett-Hickman	57.7		b	c	d	e		
Winters	54.5			c	d	e	f	
Kester	54.3			c	d	e	f	
Aldrich	53.7			c	d	e	f	g
UCD 18-20	53.6			c	d	e	f	g
Nonpareil	53.1			c	d	e	f	g
UCD 8-201	50.9			c	d	e	f	g
Durango	50.4			c	d	e	f	g
Jenette	49.3				d	e	f	g
Yorizane	46.9					e	f	g
Y117-86-03	43.7						f	g
UCD 8-160	41.4							g

Table 6: 2022 yield for the Stanislaus site.

Variety or selection	2022 Yield (Kernel lbs/ac)										
Kester/Hansen	4245	a									
Capitola	3118		b								
Winters	2993		b	c							
Y117-91-03	2850		b	c	d						
Nonpareil	2831		b	c	d	e					
Eddie	2811		b	c	d	e	f				
UCD 8-201	2681		b	c	d	e	f	g			
Yorizane	2647		b	c	d	e	f	g			
Sterling	2460		b	c	d	e	f	g	h		
UCD 18-20	2499		b	c	d	e	f	g	h		
UCD 8-160	2452			c	d	e	f	g	h		
Booth	2274				d	e	f	g	h	i	
Durango	2227				d	e	f	g	h	i	
Kester	2175					e	f	g	h	i	j
Sweetheart	2167						f	g	h	i	j
Aldrich	2130							g	h	i	j
Supareil	1954								h	i	j
Y117-86-03	1912								h	i	j
Bennett-Hickman	1870								h	i	j
Folsom	1745									i	j
Jenette	1522										j

Table 7: 2022 yield per % unit light intercepted for the Stanislaus site.

Variety or selection	Yield per unit PAR interception (%)					
Kester/Hansen	58.7	a				
UCD 8-160	58.7	a				
Winters	54.9	a	b			
Yorizane	54.2	a	b			
Nonpareil	53.1	a	b			
UCD 8-201	53.0	a	b			
Capitola	52.6	a	b	c		
UCD 18-20	46.8	a	b	c	d	
Eddie	46.0	a	b	c	d	
Durango	43.9	a	b	c	d	
Y117-86-03	43.8	a	b	c	d	
Y117-91-03	43.4	a	b	c	d	
Kester	39.9	a	b	c	d	
Aldrich	39.8	a	b	c	d	
Sterling	38.2	a	b	c	d	
Booth	37.7		b	c	d	
Bennett-Hickman	35.9		b	c	d	
Sweetheart	32.0			c	d	
Jenette	30.8				d	
Supareil	29.8				d	
Folsom	28.2				d	

Table 8: PAR interception for 2022 season for the Madera site.

Variety or selection	PAR interception (%)			
Folsom	89.3	a		
Sterling	86.7	a	b	
Supareil	85.8	a	b	
Booth	84.4	a	b	
Capitola	84.3	a	b	
Eddie	84.0	a	b	
Kester	82.2	a	b	
Nonpariel	79.1	a	b	c
Aldrich	78.9	a	b	c
Sweetheart	78.0	a	b	c
Durango	77.8	a	b	c
Bennett-Hickman	72.4	a	b	c
UCD 8-20	72.2	a	b	c
Y117-86-03	71.8	a	b	c
Yorizane	70.3	a	b	c
Y117-91-03	70.1	a	b	c
Winters	69.1	a	b	c
Jenette	68.5	a	b	c
UCD 8-201	67.5		b	c
Wood Colony	67.0		b	c
UCD 8-160	60.9			c

Table 9: 2022 yield for Madera site.

Variety or selection	Yield (Kernel lbs/ac)		
Capitola	4024	a	
Sterling	3668	a	b
Nonpareil	3445	a	b
Bennett-Hickman	3327	a	b
Kester	3182	a	b
Aldrich	3196	a	b
Booth	3173	a	b
Yorizane	3154	a	b
UCD 8-201	3045	a	b
Y117-86-03	3034	a	b
Durango	3025	a	b
Eddie	2912	a	b
Wood Colony	2877	a	b
Y117-91-03	2820	a	b
UCD 8-160	2795	a	b
Jenette	2755	a	b
UCD 18-20	2750	a	b
Sweetheart	2744	a	b
Folsom	2603	a	b
Winters	2245	a	b
Supareil	2085		b

Table 10: 2022 yield per % unit light intercepted for the Madera site.

Variety or selection	Yield per unit PAR intercepted		
Wood Colony	48.4	a	
Capitola	47.7	a	b
Bennett-Hickman	46.0	a	b
UCD 8-160	45.6	a	b
Yorizane	45.5	a	b
UCD 8-201	44.5	a	b
Sterling	42.3	a	b
Y117-86-03	42.2	a	b
Jenette	42.1	a	b
Nonpareil	41.7	a	b
Aldrich	40.7	a	b
Y117-91-03	40.3	a	b
Booth	39.0	a	b
Durango	38.9	a	b
UCD 18-20	38.4	a	b
Sweetheart	37.4	a	b
Eddie	34.7	a	b
Winters	31.1	a	b
Folsom	29.4	a	b
Kester	26.3	a	b
Supareil	24.6		b

Table 11: Cumulative yield for all the sites combined.

Variety or selection	Cumulative yield (Kernel lbs/ac)
Nonpareil	18556
Y117-91-03	16855
UCD 18-20	16290
Kester/Hansen	15439
Aldrich	15402
Capitola	15347
Yorizane	15198
Booth	14980
Durango	14959
Bennett-Hickman	14446
Jenette	14231
Y117-86-03	14607
UCD 8-201	13788
Kester	13759
Winters	13651
UCD 8-160	13525
Sterling	13367
Eddie	13453
Sweetheart	12791
Folsom	12263
Supareil	12212
Wood Colony*	12186

*Wood Colony cumulative yield includes data from Butte site and Madera County. This cultivar was planted a year later than the other varieties and cumulative yields are lower due to this reason.

Figure 1. Average kernel yield (lbs ac^{-1}) from 2016-2022 for all varieties and selections at the Butte site.

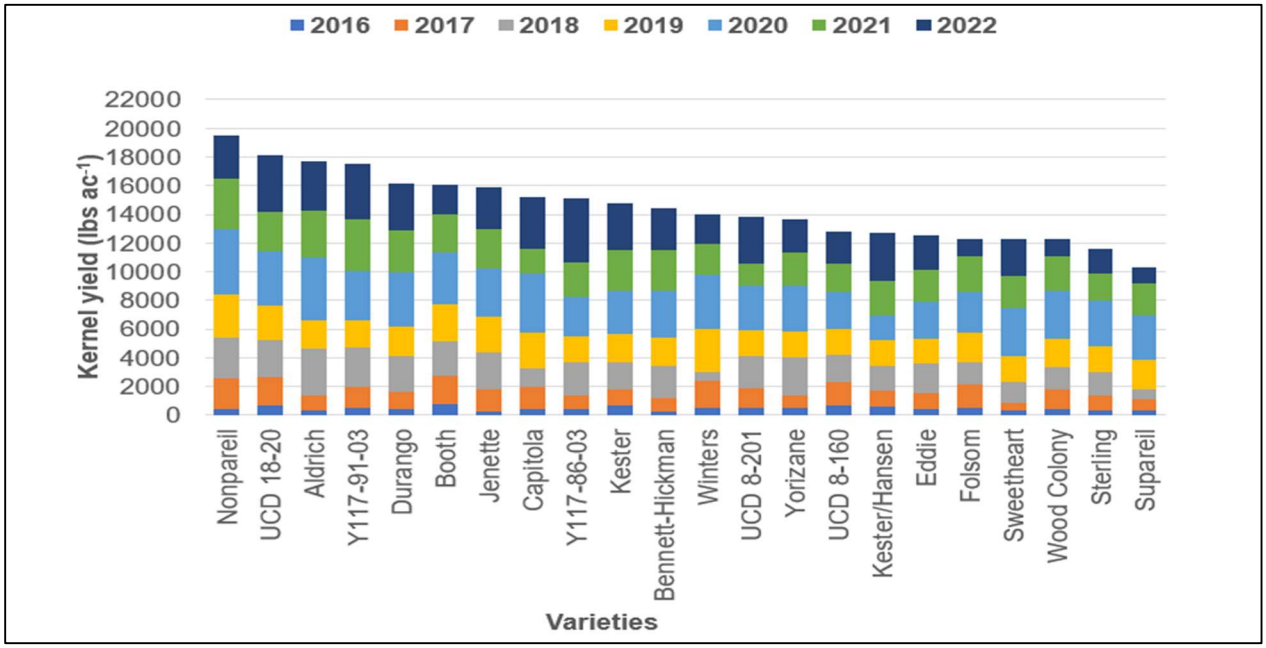


Figure 2. Average kernel yield (lbs ac^{-1}) from 2016-2022 for all varieties and selections at the Stanislaus site.

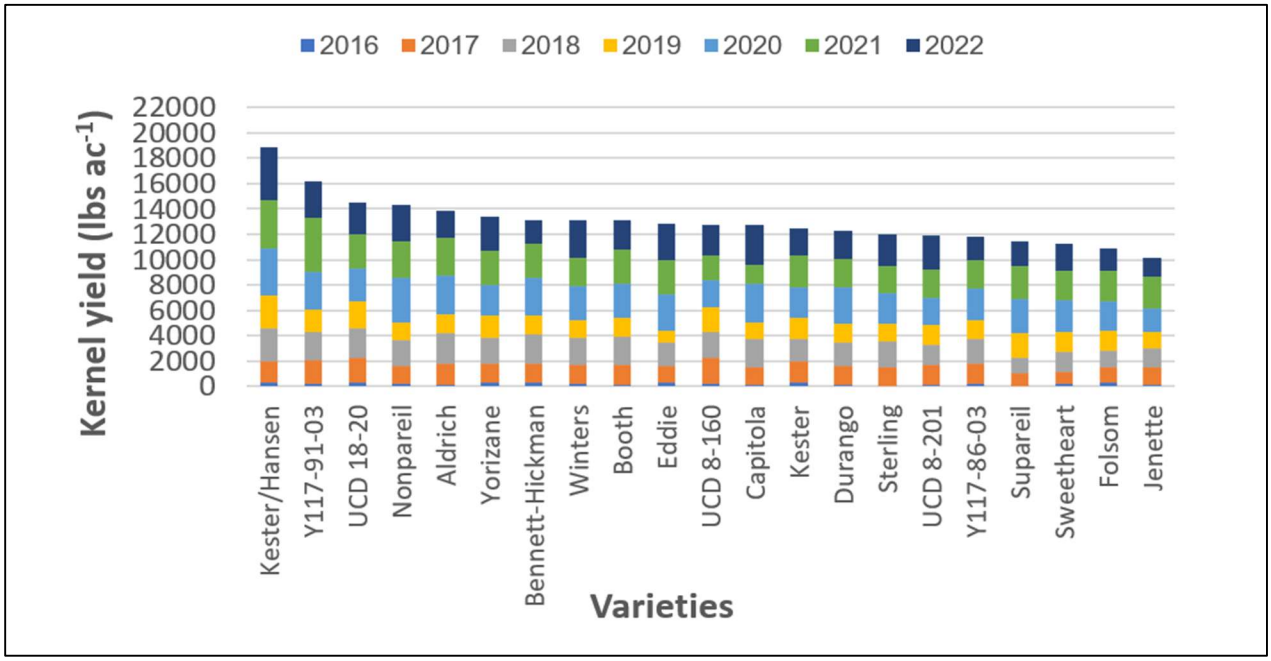


Figure 3. Average kernel yield (lbs ac^{-1}) from 2016-2022 for all varieties and selections at the Madera site.

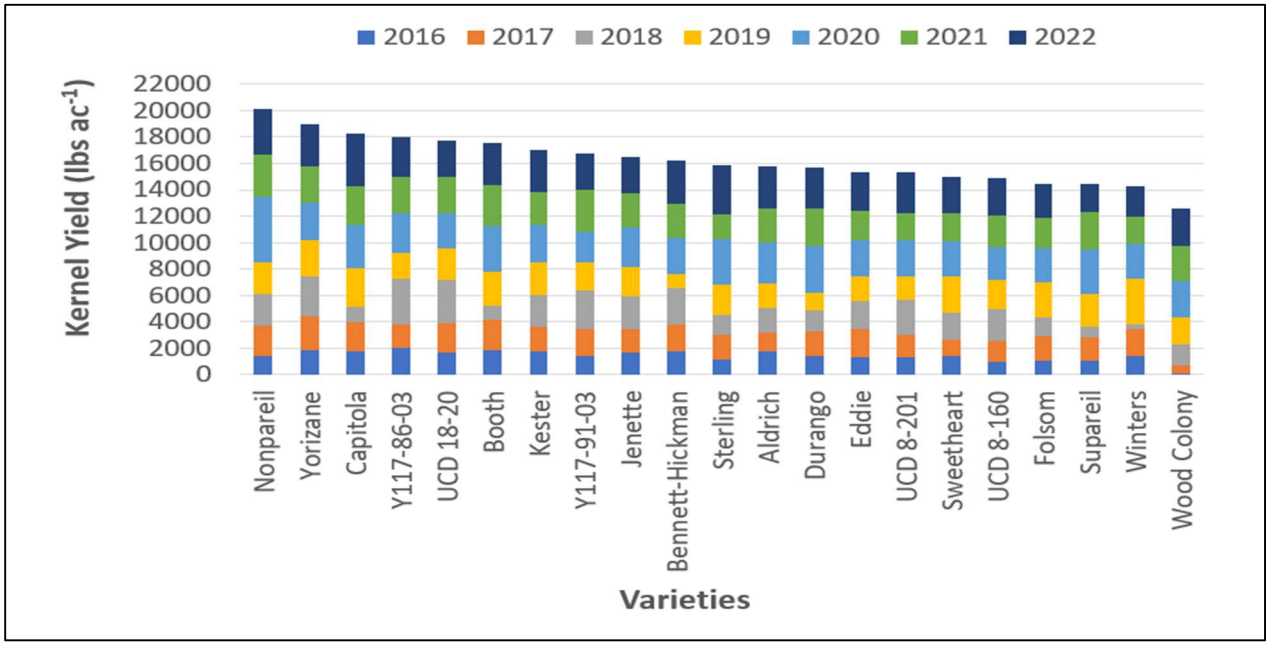
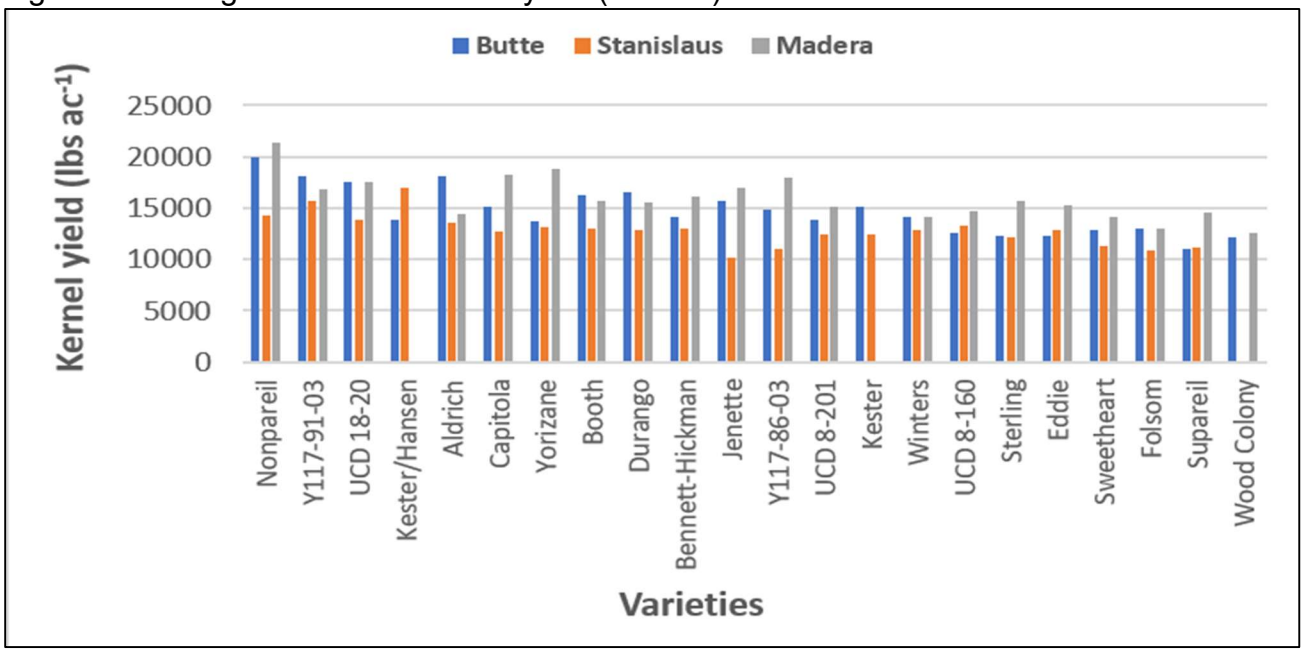


Figure 4. Average cumulative kernel yield (lbs ac^{-1}) from 2016-2022 at all three sites.



*Wood Colony cumulative yield data is only from Butte site and Madera site. The cultivar was planted a year later than the others and yields are lower for this reason.

Figure 5. Bloom data for 2022 by site and variety or selection.

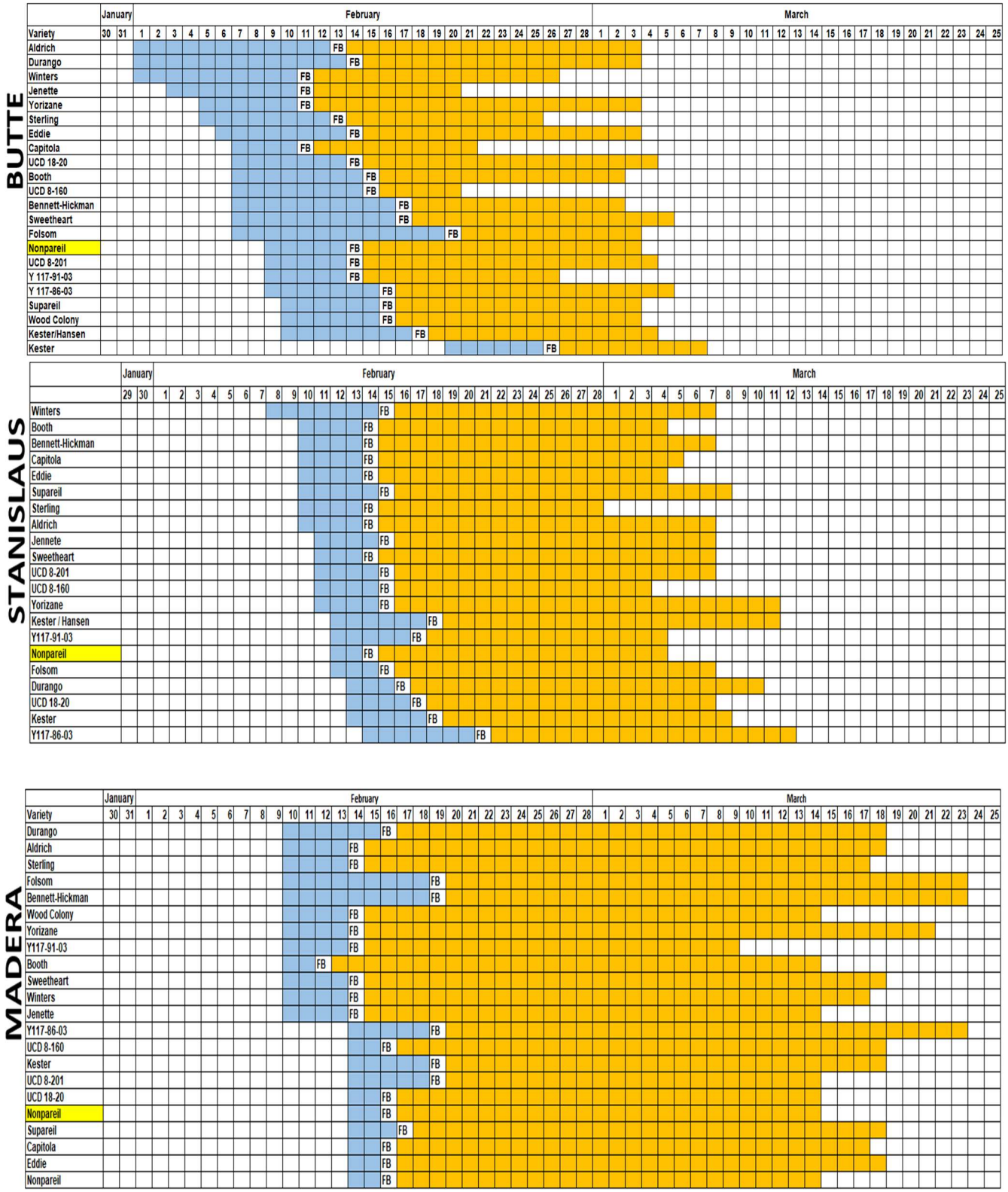


Figure 6. Hullsplit by site, variety or selection for 2022.

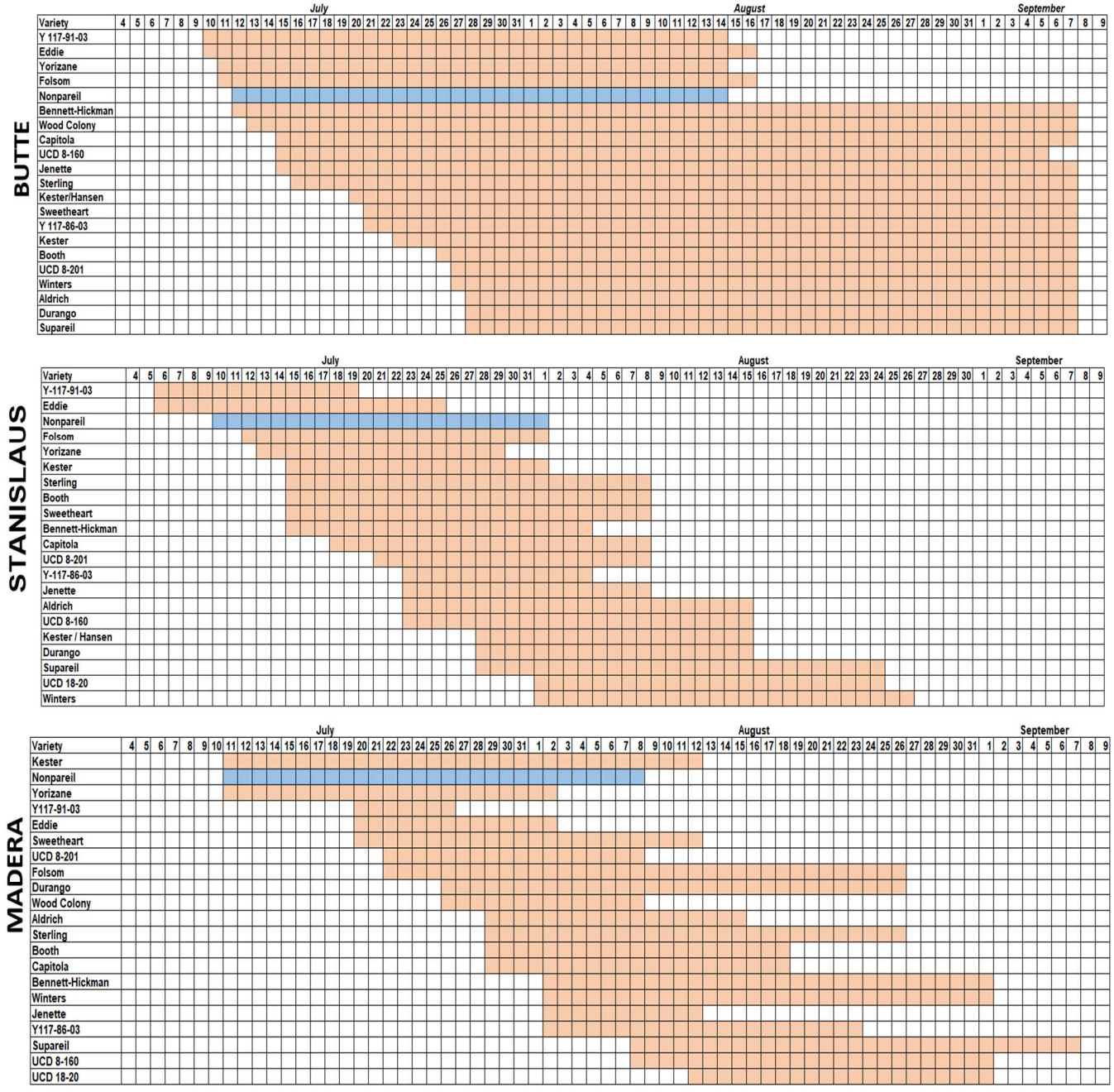
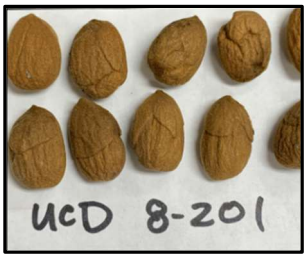


Figure 7. Defects observed in 2022 harvest. All photos were contributed by Roger Duncan.

The variety Yorizane had high incidences of staining on nuts at Stanislaus and Madera site in 2022.

We have observed high incidences of creases on nuts for UCD 8-160 and Jenette varieties.



UCD 8-201 has about 6.5 % twin kernels at Butte and Madera site in 2022.

This is variety Booth having incidences of brown spots.

Table 12: Percent kernel defects and insect at damage at the Butte site in 2022.

Variety	Doubles (%)	Twins (%)	Crease (%)	Brown spots[1](%)	NOW (%)	Kernel discolor[2] (%)
Y117-86-03	12.2	2.2	2.0	2.0	0.7	1.2
UCD 8-201	8.7	6.0	7.5	1.5	2.2	1.0
Booth	5.0	4.7	4.0	0.7	3.0	0.0
UCD 18-20	4.0	2.2	2.7	0.5	0.0	1.7
UCD 8-160	3.5	6.0	14.7	0.5	1.7	0.0
Y117-91-03	2.2	2.5	0.7	0.2	0.2	0.0
Kester	1.5	1.5	1.0	0.5	0.2	0.0
Nonpareil	1.2	2.7	1.7	0.0	0.7	0.2
Folsom	1.2	5.7	2.0	0.0	2.5	0.0
Supareil	1.2	3.2	4.0	0.0	7.5	0.5
Winters	1.0	4.2	1.0	0.2	3.2	0.7
Kester/Hansen	0.7	0.2	1.0	0.0	0.2	0.2
Sterling	0.5	5.5	4.5	0.2	1.7	1.0
Durango	0.5	1.0	1.0	0.0	3.0	0.2
Yorizane	0.5	1.5	2.0	0.0	0.2	4.0
Capitola	0.2	2.7	0.7	1.0	0.2	0.5
Aldrich	0.2	0.2	0.7	1.2	3.7	0.0
Jenette	0.2	3.0	7.5	0.2	0.2	0.0
Sweetheart	0.2	1.7	2.2	0.0	0.7	2.5
Eddie	0.2	2.2	0.2	0.2	1.7	1.0
Bennett-Hickman	0.0	1.0	0.0	1.0	3.5	0.2
Wood Colony	3.5	1.5	16.5	0.2	0.2	0.0

[1]Brown spots mostly from plant bug / stink bug feeding injury

[2]Kernel pellicle discolor / staining from unknown cause(s).

Table 13: Percent kernel defects and insect at damage at the Stanislaus site in 2022.

Variety	Doubles (%)	Twins (%)	Crease (%)	Brown spots[1](%)	NOW (%)	Kernel discolor[2] (%)
UCD 8-201	32.8	3.0	0.3	1.8	0.0	1.5
UCD 18-20	9.0	1.5	0.0	1.0	0.3	0.5
Booth	5.0	2.8	0.8	4.3	0.0	1.0
UCD 8-160	4.3	3.0	2.5	1.8	0.0	0.8
Kester/Hansen	3.5	1.0	3.8	0.0	0.0	0.3
Y117-86-03	3.0	1.3	0.3	1.3	0.0	8.5
Winters	2.3	0.8	0.0	6.3	0.0	0.8
Aldrich	1.8	0.0	0.3	0.8	0.0	0.5
Nonpareil	1.3	0.5	0.0	0.3	0.0	0.0
Yorizane	1.0	0.3	0.0	1.8	0.0	17.0
Y117-91-03	1.0	0.3	0.0	1.8	0.0	0.5
Kester	0.8	1.5	0.8	0.0	0.0	0.3
Capitola	0.5	0.3	0.5	0.5	0.0	1.5
Folsom	0.5	0.8	1.5	0.8	0.0	0.5
Durango	0.5	0.0	0.5	1.5	0.0	0.3
Supareil	0.3	1.5	0.0	1.0	0.3	0.3
Sterling	0.3	1.0	0.3	1.0	0.0	0.5
Bennett-Hickman	0.3	0.8	0.3	1.5	0.0	0.3
Jenette	0.0	2.0	2.8	1.8	0.0	0.3
Sweetheart	0.0	3.0	0.0	0.8	0.0	2.3
Eddie	0.0	0.3	0.0	0.0	0.0	0.5

[1]Brown spots mostly from plant bug / stink bug feeding injury

[2]Kernel pellicle discolor / staining from unknown cause(s)

Table 14: Percent kernel defects and insect at damage at the Madera site in 2022.

Variety	Doubles (%)	Twins (%)	Crease (%)	Brown spots (%)	NOW (%)	Kernel Discolor (%)
UCD 8-201	46.5	0.5	11.2	0.0	6.0	9.2
UCD 18-20	25.0	0.0	9.7	0.0	3.7	24.2
UCD 8-160	13.2	0.5	8.5	0.5	5.2	10.0
Y117-86-03	13.7	0.2	5.5	12.7	4.2	0.0
Booth	12.5	1.0	6.7	0.0	8.0	21.5
Kester	5.0	2.5	2.5	0.0	0.0	33.5
Folsom	5.0	0.0	0.2	0.2	4.0	48.5
Y117-91-03	4.5	0.0	6.0	2.5	8.0	12.5
Wood Colony	4.3	0.2	2.6	1.3	4.0	42.6
Yorizane	3.7	0.2	4.5	0.5	1.6	26.6
Capitola	2.7	0.0	14	0.5	1.5	12.2
Winters	2.2	0.0	8.0	0.0	11.5	29.5
Durango	2.2	0.0	3.2	0.0	7.7	8.0
Bennett-Hickman	1.5	0.0	2.7	0.0	13.5	38.2
Supareil	1.3	0.0	7.0	0.0	13.6	7.3
Nonpareil	1.2	0.5	4.7	0.0	4.0	2.0
Sterling	1.2	0.0	28.0	0.0	7.0	26.5
Jenette	1.0	0.2	17.6	0.7	5.3	13.3
Sweetheart	1.0	0.0	8.5	0.0.	3.0	6.0
Aldrich	0.7	0.0	6.0	0.0	4.0	14.6
Eddie	0.5	0.7	0.7	0.2	7.0	58.7

[1]Brown spots mostly from plant bug / stink bug feeding injury

[2]Kernel pellicle discolor / staining from unknown cause(s)

Table 15: Kernel Mass and Crackout Percentage at the Butte site in 2022.

Variety	Kernel Mass (g/100 kernels)	Crackout[1] (%)
Eddie	154.3 a	73.9 a
Supareil	150.0 ab	56.2 abcd
Booth	147.3 abc	53.2 bcd
UCD 8-160	146.0 abcd	60.7 abc
Capitola	138.5 abcde	54.4 bc
UCD 18-20	136.3 abcd	51.7 bcd
Nonpareil	132.7 abcdef	67.8 abc
Wood Colony	128.9 abcdef	59.7abcd
Yorizane	128.8 abcdef	58.1 abcd
Folsom	128.5 abcdef	64.4 abc
Y117-86-03	122.9 abcdef	69.3 ab
Sterling	120.4 bcdef	61.9 abc
Durango	116.0 cdef	53.7 bc
Jenette	113.3 def	61.2 abcd
Bennett-Hickman	111.1fgh	65.0 abc
Aldrich	110.6 ef	43.3 d
Winters	108.1 ef	56.2 abcd
Y117-91-03	107.9 ef	67.1 abc
UCD 8-201	100.4 f	60.7 abcd
Kester	100.3 f	51.1 bc
Sweetheart	100.2 f	61.6 abc
Kester/Hansen	98.8 f	53.2 bcd

[1]Crackout percentage is kernel weight divided by the weight of kernel and shell
Data followed by the same letters are not statistically different. (Tukey's $P \geq 0.05$)

Table 16: Kernel Mass and Crackout Percentage at the Stanislaus site in 2022

Variety	Kernel Mass (g/100 kernels)		Crackout[1] (%)	
Supareil	134.7	a	51.2	hi
Booth	122.8	ab	61.7	bcde
UCD 8-160	116.6	bc	60.4	bcde
Eddie	110.0	bcd	71.6	a
Nonpareil	106.2	cde	63.2	bc
UCD 18-20	104.9	cdef	50.3	hi
UCD 8-201	99.4	defg	57.9	defg
Bennett-Hickman	99.2	defg	64.2	b
Sterling	98.0	defg	62.5	bcd
Folsom	96.5	efgh	61.6	bcde
Yorizane	95.1	efghi	60.7	bcde
Kester/Hansen	92.6	fghi	52.7	ghi
Durango	91.0	ghi	54.0	fghi
Aldrich	89.2	ghij	57.0	efg
Capitola	87.6	ghij	54.2	fgh
Jenette	87.2	ghij	58.3	cdef
Y117-86-03	86.9	ghij	61.9	bcde
Winters	84.8	hij	53.3	fghi
Y117-91-03	84.0	hij	64.2	b
Sweetheart	82.9	ij	61.2	bcde
Kester	77.0	j	48.8	i

[1]Crackout percentage is kernel weight divided by the weight of kernel and shell
Data followed by the same letters are not statistically different. (Tukey's $P \geq 0.05$)

Table 17: Kernel Mass and Crackout Percentage at the Madera site in 2022.

Variety	Kernel Mass (g/100 kernels)	Crackout[1] (%)
Supareil	150.7 a	55.3 h
UCD 8-160	135.7 ab	64.8 bcdef
Eddie	123.6 bc	73.5 a
UCD 18-20	119.9 bcd	58.7 fgh
Booth	119.1 bcde	63.3 cdefg
Wood Colony	107.6 cdefg	68.7 abc
Folsom	108.7 cdef	66.8 bcde
UCD 8-201	107.5 cdefg	67.1 bcd
Y117-86-03	106.4 cdefg	68.3 abc
Durango	101.1 cdefg	61.9 defg
Capitola	99.9 cdefg	59.0 fgh
Nonpareil	99.2 cdefg	70.5 ab
Sterling	95.8 defg	66.9 bcde
Bennett-Hickman	94.5 efg	70.0 ab
Winters	93.4 fg	57.8 gh
Yorizane	93.3 fg	67.8 bcd
Kester	92.7 gh	61.1 efgh
Jenette	90.7 fg	66.3 bcde
Y117-91-03	84.7 fg	66.7 abcd
Aldrich	83.6 g	63.8 cdefg
Sweetheart	83.1 g	63.5 cdefg

[1]Crackout percentage is kernel weight divided by the weight of kernel and shell
Data followed by the same letters are not statistically different. (Tukey's $P \geq 0.05$)