Field evaluation of almond varieties

Project No.: **Hort2-3rd**

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A. Summary

The third generation of regional almond variety trials, planted in the winter of 2014, includes 30 varieties, however 9 are no longer being followed due to poor yields, poor harvestability, or other major flaws. This trial is replicated over three locations in Butte, Stanislaus, and Madera Counties. At all locations, Nonpareil has been planted as the standard variety to compare test varieties to. Rootstocks differ at each location and were selected based on commonly planted rootstocks in the area; Krymsk 86, Nemaguard, and Hansen 536 in Butte, Stanislaus, and Madera respectively. Each test variety is replicated four times at each location. Due to an unusually cold winter and spring, bloom and harvest dates were two to three weeks later in 2023 than in previous years. Bloom and hullsplit evaluations ceased in 2022, as the average date for each site changed very little during the last several years of evaluation. The final average bloom date and hullsplit initiation and length for each location are included in this report. Yields in 2023 were less than in previous years at Stanislaus and Madera, possibly due to poor bloom weather. Despite the weather, bloom density and yields were excellent at Butte in 2023 following an off-year from freeze in 2022. Navel orangeworm damage was severe this year at the southern two sites, particularly at the Madera location.

B. Objectives

To compare new almond varieties and advanced selections against industry standards, under commercial production practices. Traits under evaluation are yield, bloom and hullsplit timing and duration, and any notable diseases or other issues that occur.

C. Annual Results and Discussion

Site conditions

Butte – Weather conditions were cold or cold and wet for much of the 2023 bloom. However, there was a key period from February 17 through 21st (21st was approximately full bloom in Nonpareil) where there was no rainfall and highs were between 62 and 74 allowing for bee activity. Bloom density was very strong in 2023 following a severe freeze during bloom in 2022 that reduced yields. Despite rainfall – there were no reported spring diseases in the trial. Spring and summer growing conditions were good. Harvest started approximately a month late for Nonpareil (September 19) and the 12 earliest harvested varieties (September 21). The harvest of the remaining varieties was delayed until October 9 because of a 2-inch rain event that fell after those varieties were already shaken. Due in part to the protracted hullsplit – there was extensive hull rot in the trial. Moderate to severe hull rot was noted in Nonpareil, Eddie, Capitola, Yorizane, and UCD 7-159. Despite the challenging bloom weather – yields were excellent, due in-part to the strong bloom density following an off-year. 2023 and cumulative yields, 2023 major defects, and yields over-time can be found in Tables 4, 8, and Figure 1, resepectively.

Bloom, hullsplit, yield, and nut quality

Bloom and hullsplit observations ended after 2022. Final average full bloom, relative to Nonpareil, can be found in Table 2, and final average hullsplit can be found in Table 3.

Stanislaus – Weather conditions were abnormally cold and wet during bloom at the Stanislaus regional variety trial in 2023. Between 0.30 and 0.48 inches of rain occurred each day during the week of the heaviest Nonpareil bloom, with maximum air temperatures between 46 – 50 F, with few windows suitable for bee activity. In addition, the use of high bicarbonate irrigation water continues to moderate yield in this test orchard, which is on Nemaguard rootstock. Trees in this trial exhibited yellow leaves with interveinal chlorosis well into May before soil temperatures and increased root growth improved. As a result, yield of most varieties was below 2500 pounds per acre, including Nonpareil (1652 pounds per acre). The Kester variety on Hansen rootstock averaged 3510 pounds per acre while the same variety on Nemaguard yielded only 2163 in comparison. In 2023, all varieties other than Nonpareil were harvested on October 19, at least one month later than many varieties were ready. As a result, some varieties, including Eddie and Bennett-Hickman, had high levels of NOW feeding injury. For the second year in a row, Yorizane and Jennette exhibited fairly high levels of pellicle staining from an unknown cause. Despite the very wet spring, no notable outbreaks of spring or summer foliar diseases were apparent. However, UCD 1-232, Supareil, Folsom, Kester on Hansen, Eddie, Winters, Sterling, and Nonpareil had moderate to severe hull rot at harvest. Yields, light interception, and major defects can be found in Tables 5, 10, and Figure 2.

Madera – As with the two other locations, bloom and harvest was approximately two weeks later than in previous years due to cooler than average temperatures in February and March. Temperatures were generally favorable during almond bloom, however rain likely reduced bee hours. Yields for many varieties, notably Nonpareil, were lower in 2023 than in 2022. Navel orangeworm damage was extraordinarily bad this year, a common problem in the region. Cultivars with the worst damage tended to be cultivars with thin shells and/or open sutures. Eddie in particular has a thin shell that adheres strongly to the hull, and the shell will split open during hullsplit. As a result, NOW damage was almost 30%. Damage was worse in the first

cultivar shake than the second, likely due to a long wait between when they were ready to shake and when they were harvested due to the site manger becoming sick. Probable *Carpophilus truncatus* damage was observed at low rates in many cultivars. No notable diseases were observed, however an extremely severe spider mite outbreak caused significant defoliation after the second harvest. Yields, light interception, and major defects can be found in Tables 6, 9, and Figure 3.

Navel orangeworm damage was severe this year, particularly at the Madera site. Navel orangeworm damage was bad statewide in 2023, likely due to a combination of abandoned orchards and low rates of winter sanitation due to heavy rains/cost saving measures. Doubles continue to be high for some cultivars, notably UCD18-20, UCD8-201, UCD8-160, and Booth.

D. Outreach Activities

Presentation: Included as part of “Key Management Lessons in Almond and Walnut” by L. Milliron at North Valley Nut Conference – January 19, 2023. Approximately 200 attendees.

Presentation: “Almond Rootstock and Variety Selection in the Northern Sacramento Valley” by L. Milliron at Butte County Grower Day – November 29, 2023. Approximately 150 attendees.

Additionally, all advisors on this project have fielded many calls and emails from growers on the variety trial results. These primarily have been to get experiences and opinions with Yorizane, and a few have been on when Y117-91-03 may be released.

E. Materials and Methods:

This third generation of Regional Almond Variety Trials consists of three nearly identical field trials located in important almond growing regions of the Central Valley; Butte County (California State University, Chico), Stanislaus County (Salida School District), and Madera County (Creekside Farming Company). Table 1 contains the complete list of varieties and selections, 14 of which are partially or fully self fertile. The rootstocks used differ by location and reflect commonly used rootstocks in each region: Krymsk 86 at the Butte location, Nemaguard at the Stanislaus location, and Hansen 536 at the Madera site. The tree spacing is 18’ x 22’ (110 trees/acre), 16’ x 21’ (130 trees/acre) and 12’ x 21’ (173 trees/acre), respectively.

Bloom initiation is recorded when approximately 1% of flowers are open, full bloom is recorded when 80% of flowers are open, and the end of bloom is marked when almost all flowers have lost their petals. Bloom data was recorded three days a week. Hullsplit was considered initiated when 1% of non-blank fruit had reached stage 2c (the hull suture had opened), and completed when 100% of the fruit had reached stage 2c. Hullsplit was collected 1-2x a week, depending on the site and the speed of hullsplit progression. Bloom and hullsplit observations ended after 2022. Final average full bloom, relative to Nonpareil, can be found in Table 2, and final average hullsplit can be found in Table 3.

F. Publications that emerged from this work

Key Takeaways from Ongoing Regional Almond Variety Trials. R. Duncan, B. Lampinen, P. Gordon, L. Milliron, R. Brar, and C. Reyes. West Coast Nut. May 2023. Ppg 8-13.

Be Careful with Almond Variety-Rootstock Selection. L. Milliron, F. Niederholzer, K. Jarvis-Shean, C. Reyes, and E. Smith. Sacramento Valley Almond News. September 2023.

Tables and Figures

Table 1. Varieties planted in this trial. 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 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 as of 2022

Table 2: Full bloom for each cultivar, relative to Nonpareil for all three locations. Bloom data was generated by calculating the days before or after Nonpareil bloom at each site for each year, then averaging all years from 2016-2022 to obtain the final full bloom date relative to Nonpareil. The average Nonpareil full bloom date for Butte County was February 20, Stanislaus was February 19, and Madera was February 21.

Cultivar	Butte	Stanislaus	Madera*
Capitola	-3	-1	0
Eddie	-1	0	-2
Winters	-1	0	-2
Aldrich	0	0	-2
Jenette	-2	1	-1
Bennett	1	-1	-1
Sterling	-1	0	0
Supareil	0	-1	0
Booth	0	1	-1
Nonpareil	0	0	0
UCD 8-160	-1	0	1
Wood Colony	2	N/A	-2
Sweetheart	1	2	-2
UCD 18-20	1	2	-2
Durango	1	1	0
Yorizane	-1	2	1
Y 117-91-03	2	2	3
UCD 8-201	2	2	5
Y 117-86-03	3	4	2
Folsom	5	2	3
Kester	4	3	3
Kester/Hansen	5	4	N/A

*Bloom data for the Madera site is through 2021 only due to lost data in 2022.

Table 3: Final hullsplit data for all three locations. The average start of hullsplit was calculated by averaging the date that 1% of the fruit in a cultivar were at stage 2c (the hull suture has completely opened). The average length was calculated by averaging the number of days, on average, it took for 100% of the fruit in a cultivar to reach stage 2c. The data included in this calculation was from 2016 to 2022. Large differences in hull split duration between locations is largely due to rootstock.

	Butte		**Stanislaus**		**Madera**	
Cultivar	Average start	Average length*	Average start	Average length	Average start	Average length
Y117-91-03	7/12	14	7/11	15	7/13	15
Eddie	7/13	15	7/11	21	7/14	23
Yorizane	7/16	20	7/12	19	7/10	24
Nonpareil	7/17	13	7/11	21	7/12	31
Folsom	7/17	18	7/17	22	7/19	34
Capitola	7/21	17	7/20	19	7/22	29
Booth	7/22	15	7/23	20	7/26	33
Sterling	7/22	15	7/21	22	7/28	30
UCD 8-201	7/23	19	7/21	21	7/22	25
Bennett	7/23	14	7/27	26	7/26	31
Kester	7/24	10	7/19	18	7/19	33
Jennette	7/25	27	7/28	21	7/23	21
Wood Colony	7/25	22	N/A		7/23	25
Y117-86-03	7/26	13	7/26	17	7/27	27
Kester / Hansen	7/26	19	7/25	27	N/A	
Sweetheart	7/26	18	7/22	21	7/26	21
UCD 8-160	7/29	26	7/31	24	7/31	44
Supareil	7/31	28	8/4	20	8/5	35
Aldrich	8/1	17	8/2	18	7/31	28
Winters	8/1	34	8/2	25	8/5	35
Durango	8/4	23	8/1	21	7/26	33
UCD 18-20	8/11*	26	8/11	19	8/1	33

*The average length of hullsplit was only calculated using data from 2016 to 2021; severe water stress prevented the cultivars from completing hullsplit in 2021, and for UCD18-20, hullsplit was never initiated.

Table 4: 2023 yield, crackout %, kernel mass, and cumulative yields from 2016-2023 for the Butte site. Cultivars are ranked by 2023 yield, to see ranking by cumulative yield see Figure 1. Cumulative yields are statistically analyzed, therefore one replicate that has data missing from a year is excluded from the entire analysis. Light interception was not collected at the Butte location in 2023.

Cultivar	2023 Yield (lbs)	Cumulative yield (lbs)	Crackout %[1]	Kernel weight (g)
Booth	5135^{a}	21121^{abcd}	0.60^{bcdef}	1.3
Durango	3783^{ab}	19501^{abcde}	0.55^{cdef}	1.2
Aldrich	3731^{ab}	21840^{ab}	0.56^{bcdef}	0.7
Y117-91-03	3658^{bc}	20158^{abcd}	0.65^{abc}	1.1
Nonpareil	3613^{bc}	23526^{a}	0.67^{ab}	1.2
Kester	3553^{bc}	18297^{bcdef}	0.52^{def}	1.1
UCD 18-20	3399^{bc}	21545^{abc}	0.49^{ef}	1.5
Capitola	3389^{bc}	18261^{bcdef}	0.55^{cdef}	1.1
Jenette	3381^{bc}	19288^{abcde}	0.64^{abc}	1.4
Winters	3375^{bc}	15664^{efg}	0.55^{cdef}	1.1
Supareil	3312^{bcd}	13643^{g}	0.55^{cdef}	1.5
Folsom	3254^{bcd}	15221^{efg}	0.63^{abcd}	1.2
Wood Colony	3105^{bcd}	15221^{efg}	0.59^{bcdef}	1.3
UCD 8-201	3058^{bcd}	16805^{defg}	0.53^{cdef}	1.2
Y117-86-03	3056^{bcd}	18170^{bcdef}	0.61^{bcde}	1.3
Sweetheart	2986^{bcd}	15219^{efg}	0.59^{bcdef}	1.0
Yorizane	2943^{bcd}	16595^{efg}	0.58^{bcdef}	1.2
Eddie	2892^{bcd}	17065^{defg}	0.74^{a}	1.7
Bennett-Hickman	2679^{bcd}	17126^{cdefg}	0.63^{abcd}	1.3
Kester/Hansen	2351^{bcd}	15774^{efg}	0.53^{cdef}	0.9
Sterling	2226^{cd}	12903^{g}	0.49^{f}	0.8
UCD 8-160	1893^{d}	14623^{fg}	0.57^{bcdef}	1.5

[1]Percent crackout is the percent kernel weight of the in-shell product.

Table 5: 2023 yield, PAR, yield/PAR, crackout %, kernel mass, and cumulative yields from 2016-2023 for the Stanislaus site. Cumulative yields are statistically analyzed, therefore one replicate that has data missing from a year is excluded from the entire analysis. Cumulative yields in this table may differ from Figure 2.

Cultivar	2023 yield (lbs)	2023 PAR	2023 Yield/PAR	Crackout %[1]	Kernel mass (g)	Cumulative yield (lbs)
Kester/Hansen	3510^{a}	75.1^{a}	48.0^{ab}	59.8^{defg}	1.09	22751^{a}
Booth	3207^{abc}	62.7^{abcd}	48.7^{a}	62.6^{bcde}	1.37	16135^{bc}
Supareil	3203^{ab}	69.8^{ab}	46.6^{ab}	55.8^{gh}	1.52	14260^{bcd}
Y117-91-03	2702^{abcd}	62.6^{abcd}	43.3^{abc}	65.8^{ab}	0.93	1851^{b}
Bennett-Hickman	2587^{abcde}	61.1^{abcd}	43.0^{abc}	64.6^{abc}	1.3	15406^{bcd}
Aldrich	2545^{abcdef}	55.3^{cdef}	46.3^{ab}	58.7^{efg}	0.93	16619^{bc}
UCD18-20	2437^{abcdefg}	55.8^{bcde}	43.8^{abc}	50.4^{i}	1.25	16951^{bc}
Yorizane	2342^{abcdefg}	47.5^{def}	50.0^{a}	60.6^{cdef}	1.13	14113^{bcd}
Kester	2163^{bcdefg}	54.0^{cdef}	40.2^{abcd}	53.7^{hi}	0.92	14701^{bcd}
Folsom	2104^{bcdefg}	62.5^{abcd}	33.5^{abcd}	61.3^{cde}	1.13	12951^{cd}
UCD8-201	1999^{bcdefg}	52.2^{cdef}	39.1^{abcd}	61.8^{bcde}	1.13	14572^{bcd}
Sweetheart	1899^{cdefg}	69.8^{ab}	27.6^{abcd}	63.0^{bcd}	0.94	13078^{cd}
UCD8-160	1749^{defg}	39.5^{f}	44.4^{abc}	61.0^{cdef}	1.49	14507^{bcd}
Nonpareil	1652^{defg}	56.0^{bcde}	30.8^{abcd}	63.2^{bcd}	1.34	15938^{bcd}
Winters	1475^{defg}	53.2^{cdef}	27.7^{abcd}	54.1^{hi}	1.07	14418^{bcd}
Jenette	1442^{efg}	51.0^{cdef}	28.1^{abcd}	63.1^{bcd}	1.01	11581^{d}
Eddie	1412^{efg}	64.2^{abc}	22.1^{cd}	68.7^{a}	1.61	14206^{bcd}
Capitola	1406^{efg}	66.1^{abc}	21.3^{cd}	56.8^{fgh}	1.15	14126^{bcd}
Durango	1404^{efg}	57.0^{bcde}	24.8^{bcd}	59.3^{hi}	1.18	13646^{cd}
Y117-86-03	1341^{fg}	43.3^{ef}	30.8^{abcd}	61.2^{cde}	0.85	13184^{cd}
Sterling	1267^{g}	69.9^{ab}	18.4^{d}	64.7^{abc}	1.26	13338^{cd}

[1]Percent crackout is the percent kernel weight of the in-shell product.

Table 6: 2023 yield, PAR, yield/PAR, crackout %, kernel mass, and cumulative yields from 2016-2023 for the Madera site. Cumulative yields are statistically analyzed, therefore one replicate that has data missing from a year is excluded from the entire analysis. Cumulative yields in this table may differ from Figure 2.

Cultivar	2023 yield (lbs)	2023 PAR	2023 Yield/PAR	cumulative yield (lbs)[2]	crackout %[1]	kernel weight (g)
Supareil	3332^{a}	86.8^{a}	38.4^{a}	18548^{ab}	56^{ghi}	1.6
Booth	2727^{ab}	85.2^{a}	32.0^{abc}	18100^{ab}	62^{bcdef}	1.5
Y117-86-03	2646^{abc}	72.8^{ab}	36.4^{ab}	20689^{ab}	65^{b}	1.1
Folsom	2604^{abcd}	90.5^{a}	28.6^{abcd}	15666	65^{b}	1.2
Sweetheart	2334^{abcde}	77.8^{ab}	30.1^{abcd}	16751^{ab}	61^{bcdef}	1.0
Capitola	2276^{abcde}	86.6^{a}	26.4^{abcd}	21263^{ab}	58^{efgh}	1.1
UCD18-20	2273^{abcdef}	77.1^{ab}	31.1^{abcd}	19749^{ab}	52^{i}	1.6
Nonpareil	2240^{bcdef}	84.3^{ab}	26.7^{abcd}	22443^{a}	65^{b}	1.2
Wood colony	2176^{bcdef}	71.3^{ab}	31.5^{bcd}	14684^{b}	66^{ab}	1.2
Kester	2123^{bcdef}	84.6^{ab}	24.7^{abcd}	19315^{ab}	59^{cdefg}	1.0
Yorizane	2063^{bcdef}	76.0^{ab}	27.2^{abcd}	20842^{ab}	61^{bcdef}	1.1
Aldrich	1910^{bcdef}	81.5^{ab}	23.2^{abcd}	15240^{b}	58^{defgh}	0.9
Y117-91-03	1741^{bcdef}	71.2^{ab}	24.8^{abc}	18475^{ab}	66^{ab}	1.0
Jenette	1739^{bcdef}	72.8^{ab}	23.8^{abcd}	18561^{ab}	64^{bc}	1.2
UCD8-160	1679^{bcdef}	64.9^{ab}	27.1^{abcd}	16564^{ab}	57^{fghi}	1.5
Winters	1678^{bcdef}	71.6^{ab}	23.5^{abcd}	15939^{ab}	54^{hi}	1.1
Sterling	1602^{cdef}	89.4^{a}	18.0^{cd}	17176^{ab}	63^{bcd}	1.0
Eddie	1560^{cdef}	86.1^{a}	18.0^{cd}	16866^{ab}	71^{a}	1.5
Durango	1517^{def}	83.0^{ab}	18.3^{cd}	17196^{ab}	56^{ghi}	1.3
UCD8-201	1445^{ef}	72.7^{ab}	22.3^{bcd}	16791^{ab}	61^{bcdef}	1.1
Bennett	1138^{f}	76.2^{ab}	15.1^{d}	17318^{ab}	62^{bcde}	1.1

[1]Percent crackout is the percent kernel weight of the in-shell product.
[2]Three of the four replicates for Folsom have incomplete yields from 2016-2023, and were not included in the cumulative yield analysis. Because of this, Tukey-HSD cannot be completed, so this cultivar was excluded from the cumulative yield analysis

Table 7: Cumulative yield for all sites combined (2016-2023).

Cultivar	Average yields (lbs)
Nonpareil	20636
UCD18-20	19415
Y117-91-03	19228
Kester/Hansen	19047
Booth	18452
Aldrich	17899
Capitola	17883
Kester	17438
Y117-86-03	17348
Yorizane	17183
Durango	16781
Bennett	16617
Jenette	16476
UCD8-201	16056
Eddie	16046
Supareil	15484
Winters	15340
UCD8-160	15231
Sweetheart	15016
Wood Colony	14953
Folsom	14713
Sterling	14472

Table 8: Percent kernel defects and insect damage at the Butte site

Cultivar	Doubles	Twin	NOW	Crease	Stain/ Discolor[1]	*Brown Spot/ Bug damage[1]
18-20	31.3	0.5	0.0	2.5	9.8	0.8
8-201	27.3	3.5	0.0	5.8	2.5	2.8
8-160	24.0	1.3	0.3	18.8	12.5	6.8
Booth	22.3	1.3	0.8	3.8	1.5	1.0
Wood Colony	18.0	0.5	0.0	21.0	4.3	2.0
Durango	13.5	0.8	0.0	3.5	3.8	2.8
Kester	7.8	0.8	0.0	4.8	1.5	2.5
Y117-91-03	7.3	0.5	0.3	1.3	3.0	2.8
Aldrich	7.0	0.0	2.0	3.3	3.0	5.0
Winters	6.8	0.5	1.5	1.0	17.3	8.5
Kester/Hansen	6.3	1.0	1.3	6.7	3.3	4.7
Capitola	6.3	1.0	0.0	4.5	17.5	3.8
Jenette	6.0	1.8	0.0	4.8	7.3	7.3
Bennett	5.8	2.7	1.3	1.8	10.5	6.3
Supareil	4.8	0.3	1.3	6.0	11.0	1.5
Nonpareil	4.0	5.3	0.5	3.8	5.3	1.5
Folsom	2.8	2.8	0.3	5.0	6.8	2.3
Y117-86-03	2.3	0.8	0.3	24.3	6.3	6.0
Sweetheart	2.0	3.3	0.0	6.8	6.0	0.3
Yorizane	2.0	0.3	0.0	1.8	6.8	0.8
Eddie	1.3	1.0	1.0	4.0	3.7	2.7
Sterling	0.7	0.0	0.0	4.3	5.5	2.0

[1]Brown spot/bug damage is over-estimated. Early in the quality grading process kernels with small brown spots that should have been assigned to stain/discolor (i.e. not from bug damage) were erroneously assigned to brown spot/ bug damage.

Table 9: Percent kernel defects and insect damage at the Madera site

Cultivar	Double	Twin	NOW	Crease	Stain/ Discolor	Brown Spot / Bug Damage
Booth	24.8	1.3	2.5	0.5	2.3	0.8
UCD 18-20	23.8	0.3	4.0	0.5	2.5	1.8
UCD 8-201	15.5	1.8	20.3	2.0	7.3	1.3
UCD 8-160	14.5	1.0	13.3	16.5	3.5	1.0
Capitola	8.5	0.3	9.3	7.3	4.0	0.3
Wood Colony	7.8	0.3	11.5	3.3	3.0	1.0
Winters	6.5	0.5	3.5	0.0	5.8	0.3
Y117-91-03	6.0	0.3	7.5	0.3	1.5	4.3
Kester	5.7	1.7	1.3	2.3	2.3	1.0
Durango	4.0	0.5	19.3	4.5	0.8	0.3
Sweetheart	3.8	2.3	11.8	4.3	4.5	2.0
Folsom	2.5	2.3	14.0	2.0	8.0	0.5
Supereil	2.5	0.3	3.5	3.5	9.3	1.3
Eddie	2.3	0.5	28.5	2.5	5.5	0.8
Y117-86-03	2.3	0.3	8.3	3.8	2.5	1.3
Jenette	2.0	2.8	5.0	1.5	3.8	1.5
Nonpareil	2.0	1.0	16.3	1.8	6.0	0.3
Yorizane	1.8	0.5	14.3	2.0	6.5	1.5
Bennett	1.5	0.5	43.0	0.5	1.8	1.8
Sterling	1.5	0.0	15.8	1.0	5.3	1.0
Aldrich	0.3	0.3	12.0	0.3	4.0	3.3

Table 10: Percent kernel defects and insect damage at the Stanislaus site

Cultivar	Doubles	Twin	NOW	Crease	Stain/ Discolor	Brown Spot/ Bug damage
UCD18-20	17.8	0.8	0.5	0.3	0.0	0.8
UCD8-201	16.5	1.0	0.3	1.0	1.3	2.8
UCD8-160	11.8	1.3	2.8	13.0	1.5	1.8
Booth	11.0	5.5	0.5	1.5	3.3	0.8
Durango	6.5	1.0	1.0	5.0	0.0	1.3
Aldrich	5.3	1.0	0.0	0.0	0.3	1.0
Kester/Hansen	5.3	1.3	0.0	1.3	0.0	0.3
Y117-91-03	5.0	0.5	0.3	0.3	0.0	2.8
Winters	2.8	1.5	0.5	1.5	3.3	1.5
Bennett-Hickman	2.5	1.8	3.8	0.8	0.5	4.5
Capitola	2.5	2.0	0.3	0.8	1.8	0.8
Y117-86-03	2.0	0.8	0.0	0.5	0.3	1.0
Nonpareil	1.8	4.5	0.3	0.0	0.3	0.3
Yorizane	1.5	1.3	0.0	0.5	12.0	3.8
Folsom	1.3	5.8	0.8	2.0	0.0	0.8
Jenette	0.8	5.8	0.0	0.5	4.8	1.0
Supareil	0.8	2.0	1.0	1.5	0.0	1.3
Sweetheart	0.7	14.7	0.0	1.0	1.3	1.3
Eddie	0.5	0.3	11.3	0.3	3.8	0.8
Sterling	0.5	1.3	2.5	2.5	1.3	0.5

Figure 1: Average kernel yields kernel yields at the Butte site from 2016 to 2023. The results are averaged by year, therefore replicates with missing data are not automatically excluded from other years. Cumulative yield data may differ from Table 5.

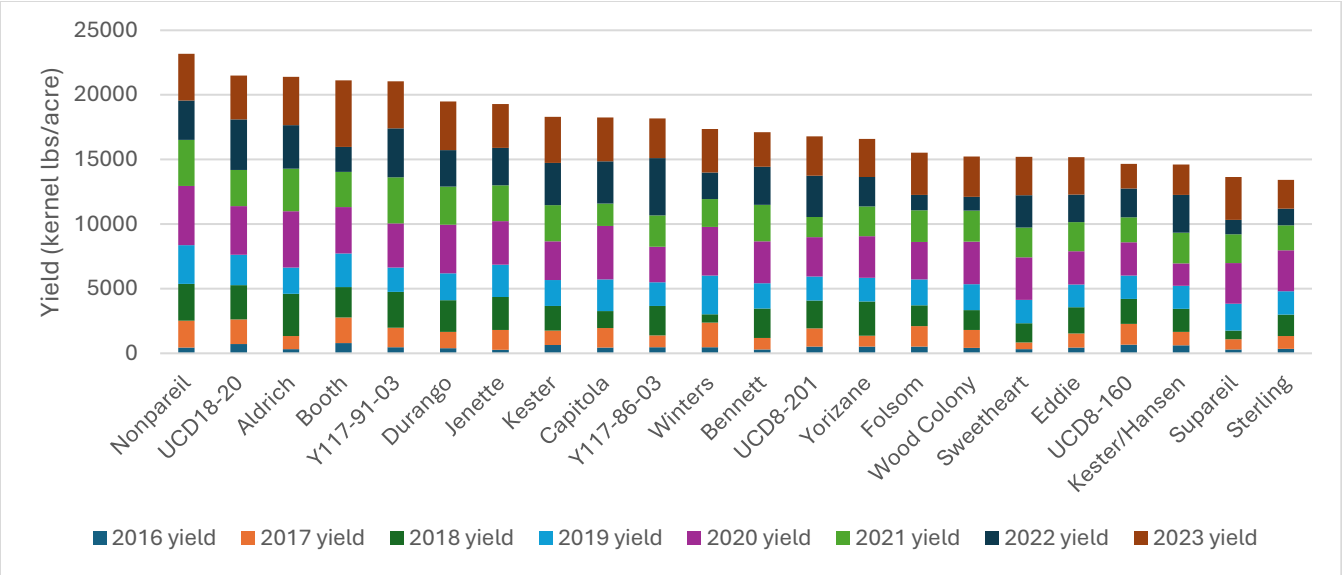

Figure 2: Average kernel yields at the Stanislaus site from 2016 to 2023. The results are averaged by year, therefore replicates with missing data are not automatically excluded from other years. Cumulative yield data may differ from Table 5.

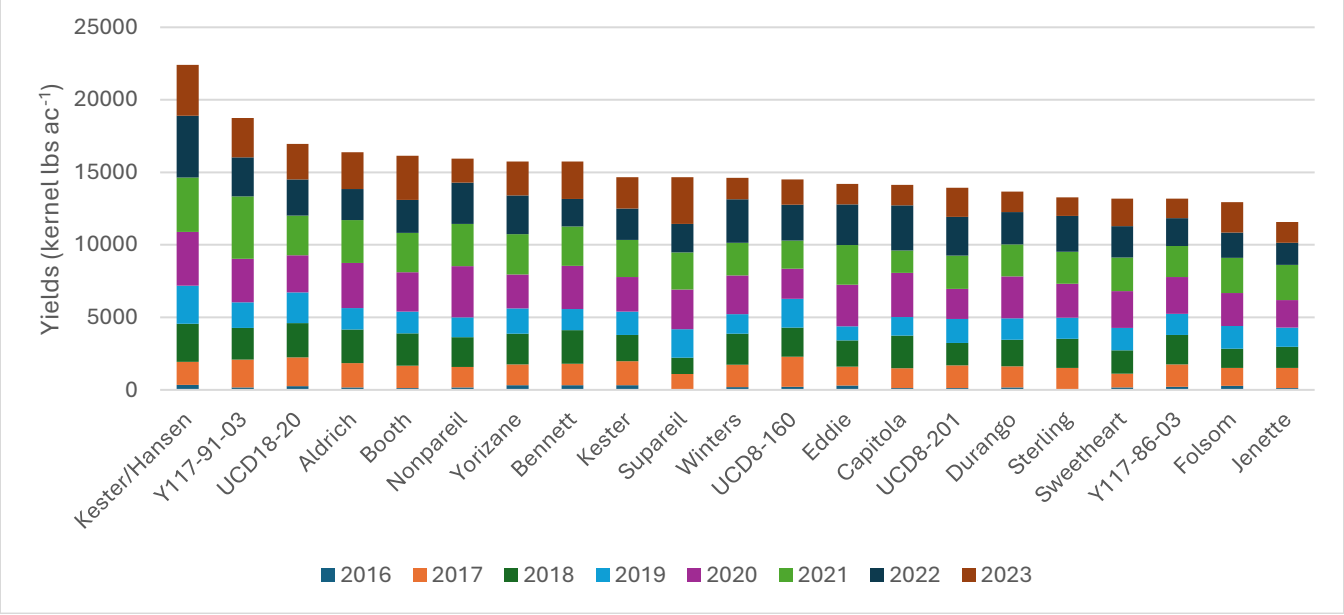

Figure 3: Average kernel yields at the Madera site from 2016 to 2023. The results are averaged by year, therefore replicates with missing data are not automatically excluded from other years. Cumulative yield data may differ from Table 5.