Field Evaluation of Almond Varieties

Project No.: 17-HORT2-Lampinen

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Objectives:

The objective is to evaluate new almond varieties and selections in replicated trials at three locations in the almond growing areas of California.

Interpretive Summary:

The next 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 selections at all 3 sites. 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 5**). Unlike the previous generation Regional Almond Variety Trials, there are four replications of each of the varieties and selections at each of the three sites in the 2014 trials. Bloom overlap of pollenizers with Nonpareil was generally good at all the sites except for UCD 3-40. Yields at the three trials were higher than the previous generation trials likely due at least in part to higher planting densities. Main kernel defects observed in 2016 were doubles, twins, navel orangeworm damage, blanks and severe shrivel.

Materials and methods:

Regional Almond Variety Trials Planted in 2014

The next generation 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). These densities are significantly higher than the previous generation RAVTs where planting densities for the Butte, San Joaquin and Kern trials were 64, 75 and 86 trees per acre respectively. 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 every three days and recorded as onset of bloom, full bloom, and the end of petalfall. Hullsplit was recorded from the beginning of the first non-blank splits to completion of hullsplit.

Results and Discussion:

General observations for each site

<u>Butte</u>. The winter of 2016-2017 was very wet in Butte County with roughly 40.3 inches of rain measured in Chico. This is 13.8 inches greater than the Chico long term average. The spring 2017 growing season experienced 7.7 inches of rainfall in February, 3.1 inches in March, 3.4 inches in April, and 0.8 inches in May. These wet inseason conditions likely increased disease pressure at this site.

Varieties with noticeable twig dieback (cause unknown) occurring mostly on low and interior canopy shaded twigs included UCD 8-27, Winters, Supareil, UCD 1-232, Self-Fruitful P13.019, and Y 117-86-03. Some varieties also had more hull rot at harvest than others, these included Folsom, UCD 3-40, Supareil, UCD 8-160, Eddie, UCD 1-232, UCD 8-201, and Capitola. Finally, bacterial spot symptoms continue to be documented and were observed on UCD 18-20, UCD 1-271, Booth, Self-Fruitful P13.019, and Self-Fruitful P16.013, with a slight case on Aldrich in 2017.

With only three shakes in the 2017 harvest, many varieties were not shaken at 100% hull split. They continued to dry for prolonged periods and had poor nut removal as a result. With unsatisfactory nut removal and very high mummy counts on many varieties (see **Table 7**), we hope this can be improved with four harvests planned in 2018.

<u>Stanislaus</u>. Trees in the Stanislaus RAVT have grown about average for trees on Nemaguard rootstock, although there have been some problems. In 2015 (second

leaf), many trees in the trial exhibited signs of Verticillium wilt, and to a lesser degree in 2016. In 2016, a significant portion of the field suffered drift injury from an errant, aerial application of glyphosate and glyphosonate to an adjacent field. This herbicide drift occurred during bloom and appeared to have affected 3rd-leaf nut set / retention throughout much of the field. Trees appear to have recovered and no long-term deleterious effects are expected. Beginning in 2016 and continuing through 2017, over 15% of the Nonpareil trees have had moderate to severe signs of band canker (*Botryosphaeria* spp.). Approximately 100 Nonpareil trees will be replaced. Relatively few of the test variety trees showed obvious band canker symptoms although Y121-42-99, Sterling and Kester on Hansen rootstock appear to have been disproportionately affected.

<u>Madera</u>. A number of trees at the Madera site have died. The majority of deaths have been in two sections with infiltration issues in blocks three and four (see areas with missing trees in (**Figure 4**). The rest have been scattered throughout the site, mostly of undetermined causes, although a few Nonpareil and Wood Colony deaths have been due to bark damage. Remaining missing trees will be replaced by next spring.

As for diseases, in the spring many trees showed shot-hole like symptoms. However, samples were not tested to confirm this. Additionally, many varieties were suffering from cankers. All Y121-42-99 trees in block one had cankers on lower limbs leading to lower limb death and a few trees also had trunk cankers. Multiple Jenette trees also had cankers in blocks one and two, however this variety was not affected as badly. In late July branch samples were sent to the Trouillas Laboratory at Kearney Research and Extension Center. The lab only found saphrophytic fungi present so the cause of the cankers is unknown. Other varieties suffered from occasional branch cankers, but not at a high enough frequency to be noted.

Bloom, Hullsplit, Yield and Quality 2016

Bloom was very compact at all 3 sites in 2016 (**Figure 1**). Overlap with Nonpareil was good for everything except UCD 3-40 which was quite early at all sites. Bee flying hours during Nonpareil bloom for 2016 are shown in (**Table 2**).

Midday canopy photosynthetically active radiation interception (PAR) was collected using the mobile platform light bar in June 2016 (**Table 3, 4 and 5**). PAR interception varied from 20 to 43 percent at the Butte trial, 23 to 36 percent at the Stanislaus trial and 23 to 61 percent at the Madera trial. The level of PAR interception at the Madera site is among the highest we have seen for an almond orchard this age. This is partly due to the high tree density (173 trees/acre) and vigorous Hansen peach x almond rootstock.

Hullsplit data for 2016 is presented in the top of (**Figure 2**). Completion of hullsplit ranged from August 3 to September 6 at the Butte trial. At the Stanislaus trial it ranged from July 15 to August 22. At the Madera trial it ranged from July 21 to August 17.

- 3 -

Yield data for 2016 is shown in (**Table 3, 4 and 5**). Yields at the Butte and Stanislaus sites ranged from about 100 to 800 kernel pounds per are which is about normal for a 3rd leaf orchard but those at the Madera site were among the highest we have seen for a 3-year-old orchard (up to 2000 kernel pounds per acre). The yields for the 2014 trials versus those for previous generation trials is shown in (**Figure 3**). The yields for the 2014 Butte and Stanislaus trials were greater than those for the 1993 trials at a similar age but the Madera yields were significantly higher (and slightly higher than those from the McFarland trial). (**Figure 6**) shows the relationship between midday canopy photosynthetically active radiation interception and yield by site. Although there is a relationship at each site, the overall relationship is quite different for each site. This is likely due to a combination of planting density variability, management differences and weather-related issues. Note that yields at Butte site were higher than those at the Stanislaus site despite the higher planting density at Stanislaus. This is likely due to the previously noted issues with disease as well as herbicide damage at the Stanislaus site.

Yield efficiency (expressed as yield per unit PAR intercepted) is presented in (**Table 3**, **4 and 5**). This is a useful piece of data since it can show whether a new variety or selection is more efficient at producing yield per unit PAR intercepted or whether it is yielding more simply because it is growing faster. This will be important data to follow as the orchards develop but may or may not be meaningful at this early stage.

The relative number of mummies left on the tree after shaking were estimated at the Madera trial in 2016 (**Table 6**). Although this may give some estimation of relative ease of shaking, it should be noted that many varieties were harvested together for convenience. Therefore, some varieties or selections were likely harvested before or after their ideal harvest timing, so these results should be considered with that in mind.

The main kernel defects observed in 2016 were double kernels, twin kernels, naval orangeworm damage, and severe shrivel (**Table 8**). A double kernel results when both ovules develop within the nut resulting in two kernels within the nut, each with a separate seed coat or pellicle. A twin kernel result when two embryos develop within a single pellicle. Defects are listed if they have equal to or greater than 6% incidence.

2017

In 2017 bloom was much more protracted (right side of **Figure 1**), due to extended periods of rain and clouds at all 3 sites. Bee flying hours during Nonpareil bloom are shown in (**Table 2**). Bloom overlap with Nonpareil was again good for all pollenizers except UCD 3-40 (**Figure 1**).

Hullsplit at the Madera site started earlier and was completed significantly earlier than at either of the other sites in 2017 (**Figure 2**). In general, the patterns at all 3 sites in 2017 was quite similar to the patterns observed in 2016 (**Figure 2**).

Yields in 2017 continued to be high relative to the yields at a similar age from the previous generation Butte, Delta and Kern variety trials (**Figure 3, Table 3-5**). Yields were more similar among the sites in 2017 compared to 2016 with the highest yielding cultivars producing 2145, 2058 and 2604 kernel pounds per acre at the Butte,

Stanislaus and Madera sites respectively (**Table 3, 4, 5 and Figure 3**). There was a fair amount of tree loss at both the Madera and Stanislaus sites (**Figure 4**). Most of these trees have been replanted.

Yield efficiency (expressed as yield per unit PAR intercepted) is presented in (**Table 3**, **4**, **and 5**). We have found that our best orchards and varieties can produce in the range of 50 kernel pounds per 1% PAR intercepted. In 2017, yield efficiency ranged from 7 to 43 for the Butte site, 19 to 54 for the Stanislaus site and 11-44 for the Madera site. This is a useful piece of data since it can show whether a new variety or selection is more efficient at producing yield per unit PAR intercepted or whether it is yielding more simply because it is growing faster. These data suggest there is room for improvement at all 3 sites and these values are likely to increase as the orchards mature.

The relationship between midday PAR interception and yield for 2016 for all varieties and selections at each site is shown in (**Figure 5**). In general, more PAR interception led to higher yields but there is a lot of scatter in the data suggesting there are differences among varieties and selections. The equivalent data for 2017 are shown in the top of (**Figure 6**) and for the cumulative yield in the bottom of (**Figure 6**).

The number of mummies left on the trees after harvest were rated at all three sites in 2017 and results are shown in (**Table 7**). Again, it is important to remember that all varieties and selections were likely not shaken at their ideal development stage due to large number of items in these trials.

The main kernel defects observed in 2017 were similar to those observed in 2016 including double kernels, twin kernels, naval orangeworm damage, and severe shrivel (**Table 9**). Defects are listed if they have equal to or greater than 6% incidence.

Tree architecture

We are working on methodology to assess tree architecture. For details about our current strategies see Tom Gradziel's report on the Almond Breeding Program report. We plan to discuss this at the Almond Workgroup meeting this coming December. We have the Mule light bar photos from all years allowing us to go back and assess canopy structure from the beginning of the study once we decide on the best options for rating this.

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Table 1. Varieties and selections planted at the next generation 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
	Eddie	Jen rerene	Bright'
	Capitola		Burche
	Supareil		Burche
	Self-fr P13.019	yes	Burche
5	Self-fr P16.013	yes	Burche
6	Booth		Burche
7	Sterling		Burche
8	Bennett		Duarte
9	Nonpareil		Fowle
	Durango		Fowle
11	Jenette		Fowle
12	Winters	partial	UCD
13	Sweetheart	partial	UCD
14	Kester (2-19E)		UCD
15	UCD3-40		UCD
16	UCD18-20		UCD
17	UCD1-16		UCD
18	UCD8-160	yes	UCD
19	UCD8-27	yes	UCD
20	UCD1-271	yes	UCD
21	UCD1-232	yes	UCD
22	UCD7-159	yes	UCD
23	UCD8-201	yes	UCD
24	Y121-42-99	yes	USDA
25	Y117-86-03	yes	USDA
26	Y116-161-99	yes	USDA
27	Y117-91-03	yes	USDA
28	Folsom		Wilson
29	Aldrich		

^{*} of the twenty nine varieties in the main trials fourteen are either partially or fully self-fertile (as is Lonestar- see below) Additional items

Butte site- Wood Colony on Kyrmsk 86, one rep of Lone Star (self-fertile and one year younger) on Krymsk 86 Madera site- Wood Colony added

Butte and Stanislaus sites- Kester on Hanson 536 in addition to on normal site rootstock Stanislaus site- one rep of Lonestar (self-fertile) on Nemaguard

Table 2. Bee flying hours during Nonpareil bloom by site for 2016 and 2017. Bee flying hours were calculated as daylight hours with air temperature greater than or equal to 55°F, windspeed less than or equal to 15mph, and no precipitation.

Site	2016	2017
Butte	80	119
Stanislaus	101	104
Madera	83	127

Table 3. Yield, midday canopy light interception and yield per unit PAR intercepted for the 2016 (top), and 2017 years (middle) and cumulative yield for both years (bottom) for the Butte RAVT.

2016

			Yield (kernel														
	# reps	Variety or selection	Ibs/ac)														
		4 Booth	796	a													
		4 Self-fruitful P13.019	764	а	ь												
		4 UCD18-20	717	а	ь	С											
		4 UCD1-232	712	a	ь	С											
		4 UCD8-160	670	а	ь	С	d										
		4 Kester (2-19e)	649	а	ь	С	d	e									
		4 Kester (2-19e) / Hansen	609		ь	С	d	e	f								
		4 self-fruitful P16.013	577		ь	С	d	e	f								
		4 UCD1-16	556			С	d	e	f	g							
		4 Y116-161-99	529			С	d	e	f	g	h						
a		4 Folsom	523				d	e	f	g	h						
$\mathbf{\Psi}$		4 UCD8-201	517				d	e	f	g	h						
 		4 UCD8-27	507				d	e	f	g	h	1					
Butte		4 Nonpareil	482				d	e	f	g	h	1	j				
-		4 Y117-91-03	481				d	e	f	g	h	1	j				
		4 Winters	469					e	f	g	h	1	j	k			
101		4 Y117-86-03	460					e	f	g	h	1	j	k	-1		
		4 Capitola	455					e	f	g	h	1	j	k	-1		
		4 Eddie	447						f	g	h	1	j	k	-1		
		4 Wood Colony	419						f	g	h	- 1	J	k	- 1		
		4 Durango	390							9	h	- 1	J	k	- 1	m	
		4 UCD3-40	347								h	- 1	J	k	- 1		n
		4 Sterling	336								h	1	j	k	-1	m	n
		4 Aldrich	316									1	j	k	-1	m	n
		4 Sweetheart	311									1	j	k	-1	m	n
		4 Supareil	308										j	k	1	m	n
		4 Bennett	291										j	k	-1	m	n
		4 Jenette	271												-1	m	n
		4 UCD7-159	211													m	n
		4 UCD1-271	159														n

	Midday canopy PAR															Yield per												
# reps Variety or selection	interception (%)													# rec	s Variety or selection	intercepte	4											
4 UCD8-160	29.5 a												_	_	4 Kester (2-19e) / Hansen	43.0	a	_	_	_	_	_		_	_	_	_	_
4 self-fruitful P16.013	28.9 a	ь													4 Self-fruitful P13.019	39.6	a	ь										
4 Booth	23.9 a	ь	С												4 Capitola	37.5		ь	С									
4 Y116-161-99	22.7	ь	С	d											4 UCD18-20	33.7			С	d								
4 UCD1-232	22.4	ь	С	d	c										4 Y117-91-03	33.6			С	d								
4 UCD18-20	21.4		С	d	c	f									4 Kester (2-19e)	33.6			С	d								
4 UCD1-16	20.0		С	d	c	f	g								4 Booth	33.3			С	d	e							
4 UCD8-27	19.6		С	d	c	f	g	h							4 Folsom	33.2			С	d	e							
4 Eddle	19.4		С	d	c	f	g	h							4 Winters	32.7			С	d	e							
4 UCD8-201	19.4		С	d	c	f	g	h							4 UCD1-232	32.0				d	e	f						
4 Self-fruitful P13.019	19.3		С	d	e	f	g	h							4 Nonpareil	31.7				d	e	f	g					
4 Kester (2-19e)	19.2		С	d	c	f	g	h							4 Supareil	31.2				d	e	f	g	h				
4 Wood Colony	18.1		С	d	c	f	g	h	- 1						4 Durango	29.0				d	e	f	g	h	1			
4 Y117-86-03	16.2			d	c	f	g	h	i.	j					7 UCD3-40	28.7				d	e	f	g	h	1	j		
4 Folsom	15.7			d	c	f	g	h	i.	j	- 1	c			4 Y117-86-03	28.3				d	e	f	g	h	1	j		
106 Nonpareil	15.2				e	f	g	h	1	j	- 8	c	1		4 Sterling	28.0					e	f	g	h	1	j		
4 Y117-91-03	14.4					f	g	h	i.	j	- 1	c	1		4 UCD1-16	27.8					e	f	g	h	1	j		
4 Winters	14.3					f	g	h	i.	j	- 1	c	1		4 UCD8-201	26.7						f	g	h	1	j		
4 Kester (2-19e) / Hansen	14.2					f	g	h	i.	j	- 1	c	1		4 Sweetheart	26.2							g	h	1		k	
4 Durango	13.4						g	h	į.	j	3	c	1		4 UCD7-159	26.0								h	1		k	
4 Aldrich	12.7						g	h	į.	j	3	c	1		4 UCD8-27	25.9								h	1	j	k	
4 Bennett	12.7						g	h	į.	j	3	c	1		4 Eddie	25.0									1	j	k	- 1
4 Capitola	12.3							h	į.	j	3	c	1		4 Aldrich	25.0									1	j	k	- 1
7 UCD3-40	12.2							h	į.	j		c	1		4 Jenette	24.3									1	j	k	- 1
4 Sterling	12.1							h	į.	j		c	1		4 Wood Colony	23.4									1	j	k	- 1
4 Jenette	11.1								į.	j		c	1		4 UCD8-160	23.2										j	k	1
4 Sweetheart	10.6									j		c	1		2 Y121-42-99	23.2										j	k	1
4 Supareil	9.9									j		c	1		4 Y116-161-99	23.1										j	k	1
4 UCD7-159	8.2										3	c	1		4 Bennett	20.8											k	1
4 UCD1-271	7.9												1		4 UCD1-271	20.7											k	- 1

2017

		Yield (kernel										
	# reps Variety or selection	lbs/ac)										
	124 Nonpareil	2145										
	4 Winters	2040		ь								
	4 Booth	1982		ь	с							
	4 UCD18-20	1933		ь	с							
	4 UCD1-232	1869		ь	С							
	4 UCD8-160	1708		ь	С	d						
	2 Y121-42-99	1597		ь	С	d	e					
	4 Folsom	1583		ь	С	d	e					
	4 Jenette	1524		ь	С	d	e	f				
	4 Y117-91-03	1500		ь	С	d	e	f				
Butte	4 Capitola	1500	a	ь	С	d	e	t	9			
1 9	4 UCD8-201	1405		ь	С	d	e	t	9			
=	4 Wood Colony	1382		ь	С	d	e	t	g			
-	4 Durango	1271			С	d	e	t	g	h		
	4 Self-fruitful P13.019	1117				d	e	t	g	h		
	4 Kester (2-19e)	1114				d	e	t	g	h		
1 m 1	4 UCD8-27	1105				d	e	f	g	h	1	
	4 Eddie	1090				d	e	f	g	h	1	
	4 Kester (2-19e) /Hanse					d	e	f	g	h	1	
	4 Aldrich	1031				d	e	f	9	h		
	4 UCD7-159	1019				d	e	t	g	h		
	4 UCD1-16	964				d	e	t	g	h		
	4 Y117-86-03	932					e	t	9	h		
	4 Sterling	922					e	t	9	h		
	4 Bennett	902					e	t	g	h		
	4 Y116-161-99	823						f	g	h	1	
	4 Supareil	773						f	g	h	1	
	4 UCD3-40	735							8	h	1	
	3 self-fruitful P16.013	712							g	h	1	
	4 Sweetheart	526								h		
	4 UCD1-271	405									1	

	Midday canopy PAR interception (%)																s Variety or selection		field per init PAR									
# reps Variety or selection 4 Kester (2-19e) /Hansen	(%) 67.3 a		_	_	_	_	_	_	_	_	_	_	_	_	_	# rep	3 LICDS-160	in	43.1		_	_	_	_	_	_		
																			43.1 41.6	a								
4 Capitola	66.1 a																3 UCD1-232			a								
4 UCD18-20	62.4 a																2 Y121-42-99		38.9		ь							
4 Y117-91-03	60.5 a	ь	С	d												1	55 Nonpareil		35.9	a	ь	С						
4 Kester (2-19e)	59.5 a	ь	С	d													4 Wood Colony		34.4	a	ь							
124 Nonpareil	59.1 a	ь	С	d	e												4 Jenette		34.3	a	ь	С	d					
4 Booth	58.2	ь	С	d	c	f											2 Winters		34.3	a	ь	С	d					
4 Self-fruitful P13.019	57.7	ь	С	d	c	f											4 Booth		34.2	a	ь	С	d					
4 Sterling	55.6		С	d	c	f	g										3 UCD18-20		30.3	a	ь	С	d					
4 Folsom	55.6		С	d	c	f	g										4 UCD8-201		29.5	a	ь	С	d	e	f			
4 Winters	55.5		С	d	c	f	g										4 Folsom		28.7	a	ь	С	d	e	f			
4 Supareil	55.1		С	d	c	f	g										4 Y117-91-03		24.8		ь	С	d	e	f	g		
4 Sweetheart	54.3		С	d	c	f	g	h									4 Durango		23.1			С	d	e	f	g		
4 Durango	54.2		С	d	c	f	g	h									4 UCD8-27		22.8			С	d	e	f	g		
4 UCD3-40	51.7			d	c	f	g	h	1								4 Capitola		22.6			С	d	e	f	g		
4 UCD1-16	50.6				c	f	g	h	1	i							4 Aldrich		22.1			С	d	e	f	g	h	
4 UCD7-159	50.5				c	f	g	h	1	i							4 Eddie		21.5			С	d	e	f	g	h	
4 Y117-86-03	49.6					f	g	h	1	i							4 Bennett		20.9			С	d	e	f	g	h	
4 UCD8-201	49.5					f	g	h	- 1	- î							4 Y116-161-99		20.2				d	e	f	g	h	
4 UCD8-27	48.8						g	h	1	ì	k						4 UCD7-159		20.2				d	e	f	g	h	
4 Eddie	48.3						g	h	1	- î	k	- 1					3 self-fruitful P16.013		19.8				d	e	f	g	h	
4 UCD1-232	47.4						g	h	1	- î	k	- 1					4 Self-fruitful P13.019		19.4				d	e	f	g	h	
4 Aldrich	46.6						-	h	- 1	- î	k	- 1					4 UCD1-16		19.0				d	e	f	ā	h	
4 Jenette	44.5								1	î	k	- 1	m				4 Kester (2-19e)		18.8				d	e	f		h	
4 Y116-161-99	42.6									-î	k	- 1	ш	n			3 Sterling		18.5					e	f	g	h	
2 Y121-42-99	41.0										k	- 1	ш	n			4 Y117-86-03		18.5					e	f	g	h	
4 Bennett	40.7										k	- 1	ш	n			4 Kester (2-19e) /Hansen		15.6					e	f		h	
4 Wood Colony	40.2											i	ш	n			4 Supareil		14.0						f		h	
4 UCD8-160	37.7													n n			4 UCD1-271		10.9							g	h	
4 UCD1-271	37.1												ш	n			4 Sweetheart		9.2							g	h	
4 mail for inter DAR DAR																	1110000 10											

Cumulative 2016-2017

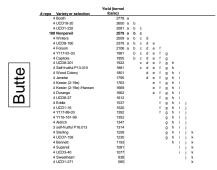


Table 4. Yield, midday canopy light interception and yield per unit PAR intercepted for the 2016 (top), and 2017 years (middle) and cumulative yield for both years (bottom) for the Stanislaus RAVT.

2016

				Midday canopy PAR		Yield per
		Yield (kernel		interception		unit PAR
	#reps Variety or selection	lbs/ac)	#reps Variety or selection	(%)	# reps Variety or selection	intercepted
	4 Self-fruitful P13.019	460 a	4 UCD1-16	13.6 a	4 Y117-91-03	35.7 a
	4 Y121-42-99 4 UCD1-16	373 a b 357 a b c	4 Self-fruitful P13.019 4 Y116-161-99	13.3 a b 12.7 a b c	4 Kester (2-19e) / Hansen 4 Self-fruitful P13.019	35.6 a 33.6 a b
	3 Kester (2-19e) / Hansen	357 a b c d	4 F116-161-99 4 Bennett	12.7 a b c 12.4 a b c	4 Sterling	33.6 a b c
	4 Bennett	334 a b c d e	4 Y121-42-99	11.9 a b c d	4 Folsom	31.7 a b c
	4 Y116:161-99	325 a b c d e f	3 Kester (2-19e)	10.4 a b c d e	4 Y121-42-99	31.7 a b c
	3 Kester (2-19e)	321 abcdefg	4 Eddie	10.2 a b c d e	4 Booth	30.7 a b c d
	4 Eddie	309 abcdefgh	3 Kester (2-19e) / Hansen	9.6 abcdef	4 UCD18-20	30.0 a b c d
ဟ	4 Folsom	281 abcdefghi	4 Folsom	8.6 bcdefg	4 UCD1-232	29.0 a b c d
	4 UCD18-20	262 bcdefghi	4 Y117-86-03	8.6 bcdefg	4 UCD3-40	28.9 a b c d
	4 UCD1-232	225 bcdefghij	4 UCD18-20	8.5 bcdefg	4 Eddie	28.9 a b c d
- -	4 UCD8-160 4 Y117-86-03	224 bcdefghij 213 bcdefahii	4 UCD8-160 4 UCD1-232	8.4 bcdefg 7.7 cdefah	4 Capitola 4 Kester (2-19e)	28.1 b c d 28.1 b c d
Ø	4 Y117-86-03 4 Winters	213 bcdefghij 195 bcdefghij	4 UCD1-232 4 Winters	7.7 cdefgh 7.2 defah	4 Kester (2-19e) 16 Nonpareil	28.1 b c d 27.6 b c d
	16 Nonpareil	179 cdefghij	4 UCD8-27	7.1 defghi	4 Winters	27.1 b c d
(0)	4 Sweetheart	178 cdefghij	4 Durango	69 e f a h i i	4 Sweetheart	26.8 b c d
Stanisl	4 UCD8-27	178 cdefghij	16 Nonpareil	6.7 efahii	4 UCD8-160	26.7 b c d
	4 Y117-91-03	177 cdefghij	4 Sweetheart	6.6 efghij	4 Bennett	26.3 b c d
	4 Aldrich	162 cdefghij	4 Aldrich	6.3 efghij	4 UCD8-201	26.2 c d
10	4 Durango	159 defghij	4 self-fruitful P16-013	5.7 efghij	4 Y116-161-99	25.7 c d
ب	4 self-fruitful P16-013	149 efghij	4 Jenette	4.9 fghij	4 UCD1-16	25.5 c d
(n	4 UCD3-40	133 f g h i j	4 Y117-91-03	4.8 f g h i j 47 f g h i i	4 Supareil	25.5 c d
0,	4 Booth 4 Capitola	128 g h i j	4 UCD8-201 4 UCD3-40		4 UCD1-271 4 Aldrich	25.3 c d 24.9 c d
	4 Capitola 4 UCD8-201	123 h i j 123 h i j	4 UCD3-40 4 Capitola		4 Aldrich 4 Y117-86-03	
	4 UCD8-201 4 Jenette	123 n i j 120 h i j	4 Capitola 4 Booth	4.4 fghij 4.2 ghij	4 1117-86-03 4 self-fruitful P16-013	24.7 c d 24.6 c d
	4 UCD1-271	86 i j	4 UCD1-271	3.4 g h i j	4 Jenette	24.0 C d
	4 Sterling	54	3 Supareil	2.0 h i i	4 UCD8-27	23.7 d
	3 Supareil	53	4 Sterling	1.8 i	4 UCD7-159	23.5 d
	4 UCD7-159	40	4 UCD7-159	1.7 j	4 Durango	23.4 d
2047	7					
2017	7	Yield (kernel		Midday canopy PAR interception		Yield per unit PAR
2017	#reps Variety or selection	lbs/ac)	#reps Variety or selection	canopy PAR interception (%)	#reps Variety or selection	unit PAR intercepted
2017	# reps Variety or selection 4 UCD8-160	Ibs/ac) 2058 a	4 Kester (2-19e) / Hansen	canopy PAR interception (%) 55.1 a	4 UCD8-160	unit PAR intercepted 54.2 a
2017	# reps Variety or selection 4 UCD8-160 4 UCD18-20	1bs/ac) 2058 a 1971 a b	4 Kester (2-19e) / Hansen 4 Y117-91-03	canopy PAR interception (%) 55.1 a 53.4 a b	4 UCD8-160 4 UCD18-20	unit PAR intercepted 54.2 a 42.8 b
2017	# reps Variety or selection 4 UCD8-160 4 UCD18-20 4 Y117-91-03	Ibs/ac) 2058 a 1971 a b 1918 a b c	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Booth	canopy PAR interception (%) 55.1 a 53.4 a b 50.1 a b c	4 UCD8-160 4 UCD18-20 4 Aldrich	unit PAR intercepted 54.2 a 42.8 b 41.7 b c
2017	# reps	Ibs/ac)	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Booth 4 Self-fruitful P13.019	canopy PAR interception (%) 55.1 a 53.4 a b 50.1 a b c 48.8 a b c	4 UCD8-160 4 UCD18-20 4 Aldrich 4 UCD8-201	unit PAR intercepted 428
2017	# reps Variety or selection 4 UCD8-160 4 UCD18-20 4 V117-91-03 4 Self-funitul P13.019 4 Aldrich	Ibs/ac) 2058 a 1971 a b 1918 a b c 1783 a b c d 1675 a b c d e	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Booth 4 Self-fruitful P13.019 4 Sweetheart	canopy PAR intercaption (**) 55.1 a 53.4 a b 50.1 a b c 49.8 a b c 49.6 a b c d	4 UCD8-160 4 UCD18-20 4 Aldrich 4 UCD8-201 4 Y117-86-03	unit PAR intercepted 542 a 428 b 41.7 b c 38.6 b c d 38.8 b c d e
2017	#reps Variety or selection 4 UCD8-160 4 UCD18-20 4 Y117-91-03 4 Self-furtid P13.019 4 Akdrich 4 Kester (2-19e)	Ibs/lac)	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Booth 4 Self-fruitful P13.019 4 Sweetheart 4 Sterling	canopy PAR interception (%) 551 a 534 a b c 486 a b c c 486 a b c d 486 a b c d 686 a b c d	4 UCD8-160 4 UCD18-20 4 Aldrich 4 UCD8-201 4 Y17-86-03 3 Durango	unit PAR intercepted 54.2 a 45.2 b 41.7 b c 39.6 b c d 38.8 b c d e 37.9 b c d e f
2017	# reps Variety or selection 4 UCD8-160 4 UCD18-20 4 V117-91-03 4 Self-funitul P13.019 4 Aldrich	Iba/ac)	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Booth 4 Self-fruitful P13.019 4 Sweetheart	canopy PAR interception (%) 551 a 534 a b c 486 a b c 486 a b c d 486 a b c d 686 a b c d	4 UCD8-160 4 UCD18-20 4 Aldrich 4 UCD8-201 4 Y117-86-03	unit PAR intercepted 54.2 8 42.8 b 41.7 b c 39.6 b c d 38.8 b c d e 37.9 b c d e f
	# reps Variety or selection 4 UCD8-160 4 UCD18-20 4 UTD18-20 3 4 Self-fruitu P1-03 4 Abtich 4 Kester (2-19e) / Hansen 4 UCD8-201 4 Booth		4 Kester (2-19e) / Hansen 4 Y17-91-03 4 Booth 4 Self-ruiful P13.019 4 Swertheart 4 Sterling 4 Folsom 4 Capitola 4 UCD18-20	camop PAR interception (%) CSL a B CS	4 UCDB-160 4 UCDB-20 4 Aldrich 4 UCDB-201 4 Y117-86-03 3 Durango 4 Kester (2-19e) 4 Nonparell 4 Self-futul P13.019	uni PAR intercepted 42.8 b 41.7 b c 336.6 b c d 339. b c d e f 337.7 b c d e f g 370.7 b c d e f g 370.8 b c d e f g
<u>σ</u>	# reps Variety or selection 4 UCD8-160 4 UCD8-160 4 UCD18-20 4 VTT-91-03 4 ABSICh UCD8-160 4 ABSICh UCD8-160 4 Kenter (2-19e) / Hansen 4 UCD8-20 4 Booth 4 Writerts	Ibblack 2058 a 1971 a b 1971 a b 1971 a b 1978 a b c 1978 a b c d 1978 a b c d e 1978 a b c	4 Kester (2-19e) / Hansen 4 Y117-91-03 4 Borth 4 Self-fruitul P13.019 4 Sweetheart 4 Sterling 4 Folsom 4 Capitols 4 UCD18-20 4 Y121-42-99	Camopy PAR interception (%) 55.1 a 53.4 a b 50.1 a b c 48.8 a b c 48.8 a b c d 48.0 a b c d e 48.0 c d e	4 UCD18-160 4 UCD18-20 4 Aldrich 4 UCD18-201 4 Y117-86-03 3 Durango 4 Kester (2-19e) 4 Nonparell 4 Self-futtul P13.019 4 Y177-91-03	uni PAR Intercepted 42.8 b c 43.8 b c 33.6 b c d e 37.9 b c d e f 37.7 b c d e f g 37.7 b c d e f g 37.8 b c d e f g
<u>σ</u>	# reps Variety or selection 4 UCD8-190 4 UCD8-190 4 V117-91-03 4 Self-ridux P13-019 4 Abtich 4 Kester (2-19e) 4 Kester (2-19e) / Hansen 4 UCD8-04 4 Wireter 4 Virters 4 Virters 4 Virters 4 Virters 4 Virters		4 Kester (2-19e) / Harsen 4 Y17-91-03 4 Booth 4 Self-fruitful P13.019 4 Sweetheart 4 Sterling 4 Folsom 4 Capitola 4 UCD18-20 4 Y121-42-99 4 UCD3-40	camop PAR interception (%) 55.1 a b 55.1 a b c 48.8 a b c 48.8 a b c 48.8 a b c d e 48.2 a b c d e 48.2 a b c d e 55.2 a b c d e 55.3 a b c	4 UCD16-160 4 UCD16-20 4 Aldrich 4 UCD8-201 4 Y117-86-03 3 Durango 4 Kester (196) 4 Cester (196) 4 Y117-91-03 4 Y117-91-03 4 Bennett	unh PAR intercepted 428 b 417 b c 388 b c d e 337 b c d e f 377 b c d e f g 377 b c d e f g 378 b c d e f g 379 b c d e f g 370 b c d e f g 370 b c d e f g h
<u>σ</u>	#reps Variety or selection 4 UCDB-160 4 UCDB-160 4 V117-91-03 4 Y117-91-03 4 Y117-91-03 4 Keater (2-19e) 4 Keater (2-19e) 4 VCDB-201 4 Booth 4 VCDB-201 4 Booth 4 V117-98-03 4 Booth 4 V117-98-03 4 Booth 4 V117-98-03	Ibblac 2058 a 1971 a b 1971 a b 1972 a b 1978 a b c d 1978 a b c d 1978 a b c d e 1988 a b c d e 1989 a b c d e 1989 a b c d e 1990 a b	4 Kester (2-19e) / Horsen 4 Y117-91-03 4 Booth 4 Self-inutial P13.019 4 Sweetheart 4 Stefring 4 Folsom 4 Capitols 4 UCD18-20 4 Y121-42-99 4 UCD3-40 4 Supareil	Camop PAR Interception (%) CSL4 a b CSL4 a b	4 UCD8-160 4 UCD18-20 4 Addich 4 UCD8-201 4 Y117-86-03 3 Durangp 4 Kester (2-19e) 4 Nonparell 4 Self-futful P13.019 4 Y117-91-03 4 Bennett 4 UCD7-159	uni PAR intercepted 42.0 42.0 43.0 5 c 6 c 43.7 5 c 6 c 6 c 6 c 6 c 6 c 6 c 6 c
<u>σ</u>	# reps		4 Kester (2-19e) / Hansen 4 Y11-91-03 4 Booth 4 Self-Huitful P13.019 4 Sweetheart 4 Serfing 4 Fotom 4 Captalo 4 UC21-42-09 4 UC21-42-09	camopy PAR interception (%) 55.1 a 55.4 a b 55.4 a b 68.6 a b c 48.6 a b c d 48.2 a b c d e 48.2 a b c d e f 46.4 a b c d e f 46.4 a b c d e f 46.5 a b c d e f	4 LOCR-160 4 LOCR-160 4 LOCR-201 4 Marich 4 LOCR-201 4 Y117-86-203 3 Durango 4 Kesster (2-18e) 4 Norsparell 4 General 173.019 4 Bernett 4 LOCR-759 4 Y16-161-99	uni PAR intercepted 41.7 b 42.8 c 43.6 b c d 33.6 b c d e f 337.7 b c d e f g 337.9 b c d e f g 347.8 c d e f g 348.9 c d e f g 349.0 b c d e f g 350.0 b c d e f g 360.0 b c d e f g
<u>σ</u>	#rops Variety or selection 4 UCD8-160 4 UCD8-160 4 V117-91-03 4 Selectural P13.019 4 Selectural P13.019 4 Kenter (2-19e) / Hansen 4 UCD8-201 4 Worter 4 UCD8-201 4 Worter 3 Durango 3 Stering		4 Kester (2-19a) / Hensen 4 Y179-9 3 d Booth 4 Sef-hutstl P13,019 4 Serverthaut 5 Gloom 4 Capitola 4 UD198-0 4 UD198-0 4 UD198-0 4 UD01-6 6 Edde 6 UD198-0 6 UD01-6 6 Edde	Camppy PAR Interception (%) SSL 1 a b SSL 2 a b SSL 3 a b SSL 3 a b SSL 4 a b SSL 4 a b SSL 5 a c 488 a b c 488 a b c 488 a b c d e f 484 a b c d e f 484 a b c d e f g 485 b c d e f g	4 UCD-160 4 UCD-1620 4 Matich 4 UCD-201 5 Matich 5 UCD-201 5 Durange 6 Kester (2-16e) 4 Nonparell 4 Self-hutful F1 3.019 4 Y117-91-03 4 V117-91-03 4 V117-91-03 4 V119-10-10-99 6 V116e-99 6 V116e-99 6 V116e-99	unh PAR intercepted 428 b 438 b c d 338 b c d e 379 b c d e f 377 b c d e f g 377 b c d e f g 360 b c d e f g 360 b c d e f g 48 b c d e f g 48 b c d e f g 58 b c
<u>σ</u>	# reps		4 Kester (2-19a) / Hansen 4 Y17-9-10a) / Hansen 4 Y17-9-10a 4 Booth 4 Self-fusits P13,019 4 Sweetheart 4 Sering 4 Folsom 4 Captable 4 UCD15-20 4 UCD15-20 4 Superel 4 Edde 4 UCD1-16 4 Worlers 6 UCD1-16 4 Winters	Camopy PAR Interception (%) SSL 1 a b SSL 2 a b SSL 3 a b SSL 3 a b SSL 4 a b SSL 5 a b SSL 6 a b c 488 a b c 488 a b c 488 a b c d 488 a	4 LOCR-160 4 LOCR-160 4 LOCR-201 4 Marich 4 LOCR-201 4 Y117-86-203 3 Durango 4 Kesster (2-18e) 4 Norsparell 4 General 173.019 4 Bernett 4 LOCR-759 4 Y16-161-99	uni PAR intercepted 442 b 442 b 442 b 386 b c d 379 b c d e f 377 b c d e f 370 b c d e f 370 b c d e f g 470 c d e f
<u>σ</u>	# reps Variety or selection 4 UCDB-160 4 UCDB-160 4 UCDB-160 5 Self-fruitu P13.019 4 Alstich 4 Kester (2-19e) 4 UCDB-201 4 VCBB-201 4 VCBB-201 4 VVIT-69-03 5 Distings 3 Distings 4 VIT-69-03 4 Verset 5 Distings 5 VIT-61-99		4 Kester (2-19a) / Hensen 4 Y179-9 3 d Booth 4 Sef-hutstl P13,019 4 Serverthaut 5 Gloom 4 Capitola 4 UD118-20 4 Y121-42-39 4 UD01-40 6 Edde 6 UDD1-16	Camopy PAR interception (%) 55.1 a 53.4 a b 53.1 a b c 48.6 a b c d 48.2 a b c d e f 48.4 a b c d e f 48.6 a b c d e f 45.9 b c d e f	4 UCD9-160 4 UCD9-160 4 Match 4 Match 4 Match 4 V17-86-03 3 Durange 4 Kester (7-19e) 4 Nonprest 4 Nonprest 4 V17-97-97 4 Nonprest 4 V17-97-97 4 Rennett 4 UCD7-199 4 V17-97-10-199	uni PAR intercepted 44.2 b 42.2 b 43.8 b c 38.6 b c d 37.9 b c d e f 37.7 b c d e f 37.7 b c d e f 37.0 b c d e f 38.0 b c d e f 38.0 b c d e f g h 38.0 b c d e f g h 38.2 b c d e f g h
<u>σ</u>	#reps Variety or selection 4 UCD9-160 4 UCD9-160 4 VTP-1-13 4 Self-inutial P1-3.019 4 ASAIch 4 Keater (2-16e) 5 UCD9-17-6 Only / Farrsen 4 UT17-60 3 Utunapp 3 Sterling 4 Y171-61-69 4 Y171-62-69 4 Y171-62-69 4 Y171-62-69 4 Nonperell		4 Kester (2-19a) / Hersens 4 Y17-9-10a) / Hersens 4 Y17-9-10a) 4 Booth 4 Self-fruith P13.019 4 Sweetheast 4 Sering 4 Capible 5 Capible 6 Capible 6 Capible 7 Y12-1-42-99 4 UCD-4-0 4 Suppress 6 Capible 7 Capi	Camopy PAR interception (Ys) 55.1 a b 50.1 a b c 50.1 a b c 488 a b c 488 a b c d e 482 a b c d e f 48.2 a b c d e f g 48.3 b c d e f g 48.5 b c d e f g 45.5 c d e f g 45.5 c d e f g	4 UCD1-160 4 UCD1-160 4 UCD1-160 4 Marich 4 UCD2-201 4 Y117-8-60 3 Durang 4 Nonparel 4 Nonparel 4 Nonparel 4 Self-withd P13-019 4 Y117-9-160 4 Bernett 4 UCD7-159 4 Winters 4 UCD7-159 4 UCD1-122 4 UCD1-122 6 UCD1-126 6 self-withd P16-013	uni PAR intercepted 41.7 b 42.8 c 43.6 b c d 33.6 b c d 43.7 b c 43.7 b c 43.6 b c d 43.7 b c 43.7 b c 43.8 b c d 44.8 c 44.8 c 44.8 c 45.8 c 46.8 c
<u>σ</u>	#reps Variety or selection 4 UCDB-160 4 UCDB-160 4 V117-91-03 4 Y117-91-03 4 Y117-91-03 4 With P13.019 4 Kester (2-19e) 4 Kester (2-19e) 4 Kester (2-19e) 4 Victor (2-19e) 5 Victor (2-19e) 7 Vitor (2-19e) 7		4 Kester (2-19a) / Hersen 4 Y17-9-0 3 d Booth 4 Set-huttle P13,019 4 Set-huttle P13,019 4 Stering 4 Stering 4 Folcom 4 Capitola 4 UCD1-8-20 4 Y121-42-90 4 Y121-42-90 4 Winters 5 Edde 6 UCD1-16 6 UCD1-16 6 UCD1-16 6 UCD1-16 7 Kester (2-19a) 6 UCD1-22 6 Y116-161-99	Camopy PAR Interception (%) SSL 1 a b SSL 2 a b SSL 3 a b SSL 3 a b SSL 3 a b SSL 4 a b SSL 4 a b SSL 5 a c 488 a b c 488 a b c d 488 a b c d e f 484 a b c d e f 485 b c d e f g 485 c d e f g	4 UCD1-90 4 UCD1-90 4 Matich 4 UCD2-90 4 Matich 5 UCD2-90 5 Durango 6 Kester (2-19e) 4 Nonparell 4 Self-hutful P13.019 4 Y177-91-03 4 Y179-91-03 4 V110-16-99 4 V110-16-99 4 UCD1-122 4 UCD1-22 4 UCD1-22 4 UCD1-23 4 UCD1-24	unh PAR intercepted 42.0 42.0 43.0 44.0 45.0 46.
<u>σ</u>	# reps Variety or selection 4 UCDS-160 4 UCDS-160 4 UCDS-160 4 UCDS-160 4 Self-fruituf P13.019 4 Alderic 4 Kenter (2-19e) 4 Self-fruituf P13.019 4 Self-fruituf P13.019 4 Self-fruituf P13.019 4 Self-fruituf P13.019 5 Self-fruituf P13.019 6 UCDS-159 6 VIDT-169 6		4 Kester (2-19a) / Horsens 4 Y17-9-0.0 4 Booth 4 Capitals 4 Sterling 4 Folicem 4 Capitals 6 Good 4 Y212-4-29 9 4 UCD3-40 4 Superel 4 Education 4 Superel 4 Superel 4 Capitals 6 Good 4 UCD3-20 4 UCD	Camopy PAR interception (%) 55.1 a b c 55.1 a b c 48.0 a b c 48.0 a b c d 48.0 a b c d e f 48.0 a c d e f 48.1 a c d e f	4 UCD1-90 4 UCD1-90 4 Match 5 Match 4 Match 5 Match 4 Match 5 Match 6	unh PAR Intercepted 442 b 442 b 442 b 443 b 444
<u>σ</u>	#reps Variety or selection 4 UCD8-160 4 UCD8-160 4 V117-91-03 4 Selectural P13.019 4 Middle 4 Kester (2-19) 4 Middle 4 Kester (2-19) 5 Horsen 4 UCD8-201 4 Booth 4 Winters 5 UCD8-201 5 UCD8-201 6 Booth 4 Winters 6 V117-86-03 7 V116-16-19 8 V116-16-19 9 V117-42-29 9 4 Mongarel 1 UCD8-201 6 UCD8-201		4 Kester (2-19a) / Hensen 4 Y173-93 3 Booth 4 Sel-huttld P13,019 4 Seventheat 5 Booth 6 Capital 6 Capital 6 Capital 6 UCD18-20 6 V121-42-99 6 UCD3-40 6 Edde 6 UCD1-16 6 UCD1-16 6 UCD1-17 1 UCD1-271 6 UCD1-271 6 UCD1-271 6 UCD1-271 6 UCD1-272 6 UCD1-272 6 UCD1-272 6 UCD1-273 6 UCD1-273 6 UCD1-273 6 UCD1-274 6 UCD1-274 6 UCD1-275 6 UCD1-275 6 UCD1-276	Camop PAR interception (%) CSL 1 a b CSL 2 a b CSL 3 a b CSL 3 a b CSL 4 a b CSL 4 a b CSL 5 a c 488 a b c 489 a c 48	4 UCD1-90 4 UCD1-90 4 Matich 4 UCD2-201 4 Matich 4 UCD2-201 5 Y177-86-203 6 Kester (2-19e) 4 Moraparell 4 Self-valual P1-3.019 4 Y177-91-03 4 W178-91-03 4 UCD1-12 4 UCD1-12 4 UCD1-12 6 Self-valual P16-013	unh PAR intercepted 428 b 438 b c d 339 b c d e f 3379 b c d e f g 377 b c d e f g 360 b c d e f g 460 b c d e f g 478 b c d e f g h
	#reps Variety or selection 4 UCD8-160 4 UCD8-160 4 UTB-16-20 4 YFF-16-20 4 YFF-16-20 4 YFF-16-20 4 Montained P13.019 4 Montained P13.019 4 Montained P13.019 4 World (2-199) / Handern 4 UCD8-201 4 UCD8-201 5 UCD8-201 5 UCD8-201 5 UCD8-201 6 UCD8-201 6 UCD7-169 6 UC		4 Kester (2-19a) Plansens 4 Y17-9-03 4 Booth 4 Booth 5 Booth 6	Camop PAR Interception (%) CSL 4 a b CSL 4 a b CSL 4 a b CSL 5 a CSL 6 a b c 48.8 a b c 48.9 a c 4	4 UCD1-100 4 UCD1-100 4 March 4 March 4 March 4 V17-86-00 3 Durange 6 Kester (2-16e) 4 Monparell 4 See*-habil #13.019 4 Monparell 5 See*-habil #13.019 4 Winders 4 UCD1-159 4 V116-16-16-99 4 V116-16-16-99 4 UCD1-16 4 see*-futable #16-013 4 UCD1-16 4 see*-futable #16-013 4 See	unh PAR intercepted 428 b c 438 b c d 3396 b c d e 3379 b c d e f 3377 b c d e f g 3370 b c d e f g 348 b c d e f g 347 b c d e f g 347 b c d e f g 348 b c d e f g 349 b c d e f g 340 b c d e f g 350 b c d e f g h 362 b c d e f g h 362 b c d e f g h 362 b c d e f g h 363 b c d e f g h 363 b c d e f g h 364 b c d e f g h 365 c d e f g h 366 c f g h 367 c d e f g h 368 b c d e f g h 369 c d e f g h 360 c d e f g h 360 c d e f g h 360 c e f g h
<u>σ</u>	# reps		4 Kester (2-19a) / Hensene 4 Y117-9 (2) (2) (2) (3) 4 Booth 4 Sef-hutful P13,019 4 Sweetheast 4 Febora 4 Capitola 4 Capitola 4 Capitola 4 Capitola 4 Capitola 4 UCD18-20 4 Y121-42-99 4 UCD0-40 4 Superell 4 UCD1-16 4 Winters 4 Kester (2-19a) 4 UCD1-27 4 UCD1-272 4 UCD1-272 4 Y116-161-99 4 UCD1-222 4 Y116-161-99 4 UCD1-16 4 Winters 4 Kester (2-19a) 5 UCD1-272 5 UCD1-272 6 Y116-161-99 6 UCD1-273 6 UCD1-274 6 UCD1-274 6 UCD1-275 6	Camopy PAR interception (%) 55.1 a 55.1 b 55.1 a b 5	4 UCD19-20 4 UCD19-20 4 Match 4 Match 4 Match 5 Match 5 Match 5 Match 6 Match 8 Match 6 Match 8 Match	unit PAR intercepted 41.7 b 42.8 43.8 b c d 43.9 b c d 43.7 b b c 43.8 b c d 44.7 b c 44.7 b c 44.7 b c 44.7 c 4
<u>σ</u>	#reps Variety or selection 4 UCDB-160 4 UCDB-160 4 UT17-91-03 4 Y117-91-03 4 Y117-91-03 4 Y117-91-03 4 Kester (2-19e) 4 Kester (2-19e) 4 Victor (2-19e) 4 Victor (2-19e) 5 Victor (2-19e) 5 Victor (2-19e) 6 Victor (2-19e) 7 Vitor (2-19e) 7		4 Kester (2-19a) / Harsen 4 Y17-9-10a) / Harsen 4 Y17-9-10a 4 Booth 4 Set Hustlin P13,019 4 Sterling 4 Sterling 4 Follow 4 Capitals 4 UCD19-29 4 Y16-16-9-9 4 Bennett 4 Jamete 4 Jametee 4	Campop PAR Interception (%) 53.1 a b 5	4 UCD1-90 4 UCD1-90 4 Match 4 UCD1-90 4 Match 4 UCD1-90 4 Match 5 UCD1-90 5 UCD1-90 6 Kester (2-190) 4 Nonparell 4 Self-statul P13-019 4 V177-91-03 6 V177-91-03 6 V177-91-03 6 V177-91-03 6 V177-91-03 6 UCD7-199 6 V1716-19-19 6 V1716-19-19 6 V1716-19-19 7 V1716-19-19 7 V1716-19-19 8 UCD1-19 8 UCD1-19 9 UCD	unh PAR intercepted 428 b c 438 b c d 338 b c d e f 3377 b c d e f g 3377 b c d e f g 347 b c d e f g 448 b c d 45 c d e f g 45 c d e f g 46 c d e f g 47 c d e f g 48 c d e
<u>σ</u>	# reps		4 Kester (2-19a) / Hensene 4 Y117-9 (2) (2) (2) (3) 4 Booth 4 Sef-hutful P13,019 4 Sweetheast 4 Febora 4 Capitola 4 Capitola 4 Capitola 4 Capitola 4 Capitola 4 UCD18-20 4 Y121-42-99 4 UCD0-40 4 Superell 4 UCD1-16 4 Winters 4 Kester (2-19a) 4 UCD1-27 4 UCD1-272 4 UCD1-272 4 Y116-161-99 4 UCD1-222 4 Y116-161-99 4 UCD1-16 4 Winters 4 Kester (2-19a) 5 UCD1-272 5 UCD1-272 6 Y116-161-99 6 UCD1-273 6 UCD1-274 6 UCD1-274 6 UCD1-275 6	Camopy PAR interception (%) 55.1 a 55.1 b 55.1 a b 5	4 UCD19-20 4 UCD19-20 4 Match 4 Match 4 Match 5 Match 5 Match 5 Match 6 Match 8 Match 6 Match 8 Match	unh PAR Intercepted 44.7 b 42.8 44.7 b 5 c 38.6 b c d 6 d 37.9 b c d e f 38.8 b c d 6 f 9 f 38.2 b c d e f 9 f 1 d 1 d 1 d 1 d 1 d 1 d 1 d 1 d 1 d 1 d
<u>σ</u>	# reps		4 Kester (2-199) / Horsens 4 Y17-9-03 4 Booth	Campop PAR Interception (%) CSL 4 a b CSL 4 a b CSL 4 a b CSL 5 a CSL 5 a CSL 6 a b c 48.8 a b c 48.9 a b	4 UCD1-90 4 UCD1-90 4 Apach 4 Apach 4 Apach 4 Y17-86-03 3 Durange 4 Kester (7-19e) 4 Monopredia 4 Monopredia 4 Monopredia 4 Monopredia 4 Monopredia 4 Monopredia 4 Y17-91-03 4 Bennett 4 UCD7-199 4 Y17-91-03 4 W16-10-199 4 Y17-91-03 5 Monette 4 UCD1-16 4 seek-nutall PT6-013 4 V17-12-29 3 Stefring 4 Kester (7-19e) / Harden 4 Coptable 5 Edde	unh PAR intercepted 44.7 b 44.7 b 45.2 a 46.7 b 4
<u>σ</u>	# reps		4 Kester (2-19a) Pisseen 4 Y179-903 4 Booth 4 Seventhal P13.019 4 Seventhal P13.019 4 Seventhal P13.019 4 Febore 5 Febore 5 Febore 6 Febore 6 Febore 6 Febore 6 Febore 7 Febor	camop PAR interception (%) 55.1 a b 55.1 a b c 55.1 a b c 55.1 a b c 48.8 a b c 48.8 a b c d e 48.2 a b c d e f 48.2 a b c d e f g 45.9 c d e f g 45.1 c d e f g 45.2 c d e f g 45.2 c d e f g 45.3 c d e f g 45.3 c d e f g 45.4 c d e f g 45.5 c d e f g	4 UCD1-90 4 UCD1-90 4 Valent 4 Valent 4 Valent 4 Valent 5 Valent 4 Valent 6	uni PAR intercepted 417 b 428 417 b 529 418 b 620 418 b 620 438 b 620 437 b 620 438 b 620 437 b 620 438 b 620 438 b 620 420 420 420 420 420 420 420
<u>σ</u>	#reps Variety or selection 4 UCDB-160 4 UCDB-160 4 VTT-29-16-20 4 VTT-29-16-20 4 VTT-29-16-20 4 VEST-20-20 4 VEST-20-20 4 VEST-20-20 4 VEST-20-20 4 VEST-20-20 4 VEST-20-20 5 Downgo 3 UCDD-201 3 UCDD-201 3 UCDD-201 4 UCDD-201 4 UCDD-201 4 UCDD-201 4 UCDD-201 4 VTT-26-03 5 UCDD-201 4 UCDD-201		4 Kester (2-19a) / Harsen 4 Y17-9-3 3 4 Booth 4 Set Hustel P13.019 4 Set Hustel P13.019 4 Set Hustel P13.019 4 Set Hustel P13.019 4 Floring 4 Floring 4 Floring 4 Floring 4 Floring 5 Floring 5 Floring 6 Floring 6 Floring 7 Flor	Camop FAR Interception (%) CSL 1 a b c CSL 2 a b c CSL 3 a b c CSL 3 a b c CSL 4 a b c CSL 4 a b c CSL 5 a c ASS 6 a b c ASS 6 a	4 UCD1-90 4 UCD1-90 4 Match 4 Match 4 Match 4 Match 5 UCD1-90 4 Match 4 Match 5 UCD1-90 6 Kester (C-19e) 4 Neoperal 4 Sester (C-19e) 4 Neoperal 4 Sester (C-19e) 4 Neoperal 4 UCD1-199 4 Y116-19-199 4 Y116-19-199 4 Winters 4 Jamella 5 UCD1-16 6 sest-install P16-013 6 Booth 4 Y121-42-90 3 Sester (C-19e) / Nersen 6 UCD1-27 6 Edde 6 Pelcon 6 Pelcon 6 Pelcon 6 UCD1-27 7 UCD1-90 7	unh PAR intercepted 428 b c 438 b c d 3386 b c d e 3379 b c d e f 3377 b c d e f g 3370 b c d e f g 348 b c d 45 c d e f g 45 c d e f g 45 c d e f g 46 c d e f g 47 c d e f g 48 c d e f
<u>σ</u>	# reps		4 Kester (2-19a) Pisseen 4 Y179-903 4 Booth 4 Seventhal P13.019 4 Seventhal P13.019 4 Seventhal P13.019 4 Febore 5 Febore 5 Febore 6 Febore 6 Febore 6 Febore 6 Febore 7 Febor	camop PAR interception (%) 55.1 a b 55.1 a b c 55.1 a b c 55.1 a b c 48.8 a b c 48.8 a b c d e 48.2 a b c d e f 48.2 a b c d e f g 45.9 c d e f g 45.1 c d e f g 45.2 c d e f g 45.2 c d e f g 45.3 c d e f g 45.3 c d e f g 45.4 c d e f g 45.5 c d e f g	4 UCD1-90 4 UCD1-90 4 Valent 4 Valent 4 Valent 4 Valent 5 Valent 4 Valent 6	uni PAR intercepted 417 b 428 417 b 529 418 b 620 418 b 620 438 b 620 437 b 620 438 b 620 437 b 620 438 b 620 438 b 620 420 420 420 420 420 420 420

Cumulative 2016-2017

			Yield (kerne										
		ariety or selection	lbs/ac)										_
		CD8-160	2282										
		elf-fruitful P13.019	2243		ь								
		CD18-20	2233		ь								
		ester (2-19e)	2127		ь	с							
		117-91-03	2096		ь	с	d						
		ldrich	1837		ь	С	d	e					
		ester (2-19e) /Hansen	1809		ь	с	d	e					
l W		ennett	1808		ь	с	d	e					
		121-42-99	1785		ь	с	d	e					
	4 Y	116-161-99	1763	а	ь	с	d	e					
~	4 Y	117-86-03	1749	а	ь	с	d	e	f				
(0	4 W	/inters	1739	а	ь	с	d	e	f				
		CD8-201	1692		ь	с	d	e	f	g			
l co	4 B	ooth	1678		ь	с	d	e	f	g	h		
		urango	1633			с	d	e	f	g	h	i	
	4 U	CD1-232	1629			С	d	e	f	g	h	i	
	4 E	ddie	1595			с	d	e	f	g	h	i	
Stanislaus	4 N	onpareil	1587			c	d	e	f	g	h	1	
1 , 0	4 U	CD1-16	1580			с	d	e	f	g	h	i	
77	4 F	olsom	1522				d	e	f	g	h	i	
(I)		enette	1515				d	e	f	g	h	i	
0	3 S	terling	1497				d	e	f	g	h	i	
	4 C	apitola	1488					e	f	g	h	i	
	4 U	CD7-159	1456					e	f	g	h	i	
	4 s	elf-fruitful P16-013	1401					e	f	g	h	i	
	4 U	CD1-271	1319					e	f	g	h	i	
	4 U	CD3-40	1149						f	g	h	i	
	4 S	weetheart	1115							g	h	i	
	4 U	CD8-27	1085								h	i	
	3 S	upareil	1056	1								i	

Table 5. Yield, midday canopy light interception and yield per unit PAR intercepted for the 2016 (top), and 2017 years (middle) and cumulative yield for both years (bottom) for the Madera RAVT.

2016

		Tield		canopy PAR		riela per
		(kernel		interception		unit PAR
	# reps Variety or selection	lbs/ac)	#reps Variety or selection	(%)	# reps Variety or selection	intercepted
	4 Y-117-86-03	1995 a	4 Capitola	61.1 a	4 Y-117-86-03	45.4 a
	4 Self-fr-P16-013	1911 a b	4 Folsom	56.6 a b	4 Bennett	42.0 a b
	4 Booth	1857 a b c	4 Sweetheart	54.4 a b c	4 Self-fr-P16-013	41.2 a b
	3 Y-116-161-99	1804 a b c	4 Booth	54.1 a b c d	4 UCD-1-16	38.4 a b c
	4 Kester (2-19e)	1783 a b c	4 Kester (2-19e)	53.5 a b c d	4 Jenette	38.0 a b c
	4 Capitola	1781 a b c	4 Sterling	52.0 a b c d	3 Y-116-161-99	37.4 a b c d
	4 Bennett	1770 a b c	105 Nonpareil	52.0 a b c d	4 UCD-18-20	37.3 a b c d
	4 Aldrich	1724 a b c d	4 Eddie	51.7 a b c d	4 Aldrich	36.3 a b c d
	4 UCD-18-20	1680 a b c d e	4 Supareil	50.9 a b c d	4 Self-fr-P13-019	34.5 a b c d e
	4 Jenette	1644 a b c d e	4 UCD-1-271	50.7 a b c d	4 Booth	34.2 a b c d e
ן ש	4 Self-fr-P13-019	1606 a b c d e f	4 Y-116-161-99	49.3 a b c d	4 Kester	33.2 b c d e
	1 Y-121-42-99	1533 a b c d e f g	4 Y-117-91-03	48.4 a b c d	4 Winters	33.2 b c d e
= =	4 UCD-1-16	1469 a b c d e f g	4 Aldrich	48.2 a b c d	1 Y-121-42-99	33.1 b c d e
ש ו	4 Sweetheart	1429 a b c d e f g	4 UCD-3-40	47.3 a b c d	4 UCD-8-201	31.3 b c d e f
	4 Y-117-91-03	1427 a b c d e f g	4 Self-fr-P13-019	46.3 a b c d	4 Durango	31.2 bcdef
0	4 Durango	1415 a b c d e f g	1 Y-121-42-99	46.3 a b c d	4 Capitola	29.2 cdefg
~	4 Winters	1369 bcdefg	4 Self-fr-P16-013	46.0 a b c d	4 Y-117-91-03	29.0 cdefg
ש	104 Nonpareil	1360 bcdefg	4 UCD-18-20	45.9 a b c d	4 UCD-8-27	28.3 cdefgh
	4 UCD-8-201	1310 cdefgh	4 Y-117-86-03	45.2 b c d	4 Sweetheart	27.2 cdefgh
	4 Eddie	1262 cdefgh	4 Durango	45.2 b c d	104 Nonpareil	26.8 cdefgh
	4 UCD-8-27	1145 defgh	4 Jenette	44.8 b c d	4 UCD-8-160	26.2 defgh
	4 Sterling	1112 e f g h i	4 UCD-8-201	42.3 b c d	4 Eddie	24.6 e f g h
	4 Folsom	1052 f g h i	4 Bennett	42.2 b c d	4 UCD-1-232	23.5 e f g h
	4 Supareil	1010 g h i	4 UCD-7-159	41.9 b c d	4 Sterling	21.3 f g h i
	4 UCD-8-160	964 g h i	4 Winters	41.1 b c d	4 Supareil	20.1 fghi
	4 UCD-1-232	954 g h i	4 UCD-1-232	41.0 b c d	4 Folsom	18.5 g h i
	4 UCD-7-159	775 h i j	4 UCD-8-27	38.8 c d	4 UCD-7-159	17.5 h i j
	4 UCD-3-40	577 i j k	4 UCD-8-160	38.1 d	4 UCD-3-40	12.2 i j
	4 UCD-1-271	409 j k	4 UCD-1-16	38.1 d	4 UCD-1-271	8.0 j k
	2 Wood Colony	24 k	4 Wood Colony	23.4 e	2 Wood Colony	1.7 k

2017

		(kernel		interception		interception
	# reps Variety or selection	lbs/ac)	#reps Variety or selection	(%)	# reps Variety or selection	(%)
	4 Y-116-161-99	2604 a	4 Folsom	70.4 a	4 Y-116-161-99	44.5 a
	83 Nonpareil	2341 a b	4 Capitola	70.2 a	4 UCD-18-20	41.8 a b
	4 Booth	2247 a b c	4 UCD-1-271	66.0 a b	84 Nonpareil	40.7 a b
	4 UCD-18-20	2226 a b c	4 Sterling	65.9 a b	4 Winters	39.7 a b c
	4 Capitola	2190 a b c d	4 Booth	65.7 a b	4 Bennett	36.5 a b c d
	4 Eddie	2167 a b c d	4 Supareil	65.3 a b c	4 UCD-1-16	36.2 a b c d e
	4 Winters	2066 a b c d	4 Sweetheart	64.4 a b c	4 Self-fr-P16-013	36.0 a b c d e
	4 Y-117-91-03	2042 a b c d	4 UCD-3-40	62.6 a b c	4 Eddie	35.5 a b c d e
	4 Bennett	1977 a b c d e	4 Kester (2-19e)	61.5 a b c d	4 UCD-8-160	35.5 a b c d e
	4 Self-fr-P16-013	1931 a b c d e	4 Eddie	60.5 a b c d	4 Y-117-91-03	35.1 a b c d e
	4 Sterling	1889 a b c d e f	1 Y-121-42-99	59.1 a b c d	4 Durango	34.7 a b c d e
W	4 Kester (2-19e)	1840 bcde f	105 Nonpareil	59.0 a b c d	4 Jenette	34.6 a b c d e
	4 Durango	1827 bcdef	4 Y-117-91-03	58.7 a b c d	4 Y-117-86-03	34.6 a b c d e
	4 Folsom	1818 bcdef	4 Y-116-161-99	58.5 a b c d	4 Booth	34.1 a b c d e
- Φ	4 Y-117-86-03	1807 bcdef	4 Aldrich	57.7 a b c d	4 UCD-8-201	32.0 b c d e
	4 Supareil	1791 bcdefg	4 UCD-8-27	56.0 a b c d e	4 Capitola	31.3 b c d e
	4 Jenette	1783 b c d e f g	4 Bennett	55.2 a b c d e	4 UCD-1-232	29.9 c d e
	1 Y-121-42-99	1758 bcdefg	4 Self-fr-P16-013	54.7 a b c d e	4 Kester (2-19e)	29.9 c d e
∣ α ∣	4 UCD-8-201	1671 bcdefg	4 Durango	52.9 b c d e	1 Y-121-42-99	29.7 c d e
	4 UCD-1-16	1647 bcdefg	4 UCD-18-20	52.9 b c d e	4 Sterling	28.5 d e
	4 UCD-8-160	1596 bcdefg	4 Self-fr-P13-019	52.8 b c d e	4 Supareil	27.6 d e f
_	4 UCD-1-232	1490 c d e f g	4 UCD-7-159	52.5 b c d e	4 UCD-7-159	26.9 d e f g
	4 UCD-7-159	1465 c d e f g	4 Y-117-86-03	52.3 b c d e	4 Self-fr-P13-019	26.0 defgh
	4 Self-fr-P13-019	1417 defgh	4 UCD-8-201	51.7 b c d e	4 Folsom	25.7 e f g h
	4 Aldrich	1413 defgh	4 Jenette	51.6 bcde	4 Aldrich	25.4 e f g h
	4 Sweetheart	1210 e f g h i	4 Winters	51.0 b c d e	4 UCD-8-27	18.1 fghi
	4 UCD-1-271	1137 f g h i	4 UCD-1-232	49.5 c d e	4 Sweetheart	17.6 g h i
	4 UCD-8-27	1022 g h i	4 UCD-1-16	46.1 d e	4 UCD-1-271	17.2 g h i
	4 UCD-3-40	708 h i	4 UCD-8-160	46.0 d e	4 Wood Colony	16.7 h i
	4 Wood Colony	676	4 Wood Colony	41.2	4 LICD 2 40	11 5

Cumulative 2017-2018

	#reps	Variety or selection	lbs/ac)												
	3	Y-116-161-99	4782	а											
	4	Booth	4103	а	b										
	4	Capitola	3971	а	b	С									
	4	UCD-18-20	3905	а	b	С	d								
	4	Self-fr-P16-013	3842	а	b	С	d								
	4	Y-117-86-03	3801	а	b	С	d								
	4	Bennett	3747	а	b	С	d	е							
	83	Nonpareil	3641		b	С	d	е	f						
	4	Kester	3623		b	С	d	е	f						
	4	Y-117-91-03	3469		b	С	d	е	f	g					
	4	Winters	3435		b	С	d	е	f	g					
	4	Eddie	3429		b	С	d	е	f	g					
l (U l	4	Jenette	3427		b	С	d	е	f	g					
Madera	1	Y-121-42-99	3290		b	С	d	е	f	g	h				
as l	4	Durango	3242		b	С	d	е	f	g	h	i.			
$-\mathbf{\Psi}$	4	Aldrich	3137		b	С	d	е	f	g	h	i.			
\sim	4	UCD-1-16	3116		b	С	d	е	f	g	h	i.			
	4	Self-fr-P13-019	3023		b	С	d	е	f	g	h	i.			
$-\omega$	4	Sterling	3001		b	С	d	е	f	g	h	i.			
<u></u>	4	UCD-8-201	2981			С	d	е	f	g	h	i.			
	4	Folsom	2870			С	d	е	f	g	h	i.			
	4	Supareil	2801				d	е	f	g	h	i.			
	4	Sweetheart	2639					е	f	g	h	i.			
	4	UCD-8-160	2559						f	g	h	i.			
	4	UCD-1-232	2444							g	h	i.	j		
	4	UCD-7-159	2240								h	i.	j	k	
		UCD-8-27	2167									i	j	k	
	4	UCD-1-271	1546										j	k	
	4	UCD-3-40	1285											k	1
	2	Wood Colony	587												1

Table 6. Relative number of mummies left on tree after shaking at the Madera trial in 2016. Ratings categories are described below. Although this might give some idea about relative ease of shaking, it is likely confused by the fact that not all varieties or selections were shaken at their ideal time. Varieties and selections are rated from least mummies at top to most at bottom. Wood Colony was planted in place of Lonestar at the Madera trial and is one year younger and was not harvested.

	ī
Variety or selection	Relative mummy count rating
UCD1-16	1
Y116-161-99	1
Y117-91-03	1
Y121-42-99	1
Eddie	1
Y117-86-03	2
Jenette	2
Aldrich	2
Self-fr P13.019	2
UCD8-27	2
Self-fr P16.013	2
Capitola	2
UCD1-232	3
Supareil	3
Durango	3
Marcona	3
Bennett	3
Booth	3
UCD3-40	3
Nonpareil	3
Sweetheart	4
UCD8-160	4
Winters	5
2-19E	5
UCD1-271	5
UCD8-201	5
Sterling	5
Folsom	5
UCD7-159	5
Wood Colony	one year behind

Rating categories

1 = < 20/tree

2 = 20-49

3 = 50-99

4 = 100-199

5 = > 200

Table 7. Relative number of mummies left on tree after shaking at the Butte, Stanislaus, and Madera trials in 2017. Although this might give some idea about relative ease of shaking, it is likely complicated by the fact that not all varieties or selections were shaken at their ideal time, and the presence of hull rot at the Madera site. Ease of knocking was rated with the following scale after shaking and before poling: 1=fewer than 20 mummies per tree, 2=20-50 mummies, 3=50-100, 4=100-200, 5=200-500, 6= over 500.

	Butte County	Stanislaus County	Madera County
Folsom	1	2	4
Y121-42-99	2	5	4
Eddie	2	1	2
Y116-161-99	2	3	1
Aldrich	2	1	3
P16.013	2	1	4
Supareil	2	1	2
3-40	2	2	3
Nonpareil	2	1	4
Capitola	2	2	2
Bennett	3	2	3
Y117-91-03	3	3	2
Y117-86-03	3	3	1
Booth	3	3	4
Wood Colony	3	-	1
Durango	4	1	3
Winters	4	2	3
1-16	4	2	3
18-20	4	1	2
Jenette	4	3	3
P13.019	4	2	4
8-27	4	3	2
Sweetheart	4	6	3
Sterling	4	5	5
Kester / Hansen	4	5	4
1-232	5	3	4
Kester	5	5	-
7-159	5	5	5
8-160	5	1	3
8-201	5	3	4
1-271	6	6	4

Table 8. Main kernel defects for 2016 harvest. Items are listed if they had 6% or more of kernels exhibiting the defect.

Varieties with defect			Trial			
	Butte	(%)	Stanislaus	(%)	Madera	(%)
Double kernels	UCD 18-20	15	Booth	22	UCD8-201	25
(both ovules in ovary developed)	UCD 8-201	14	UCD 18-20	21	Y121-42-99	20
	Booth	12	UCD 8-201	17	Booth	16
	Self-Fru P16.013 UCD 1-232	10 10	P16-013 Y121-42-99	14 10	UCD1-232	7 7
	Jenette	8	P13-019	8	Y117-86-03 UCD18-20	6
	UCD 8-27	7	Capitola	6	UCD8-27	6
	UCD 1-16	6	Ouphola	Ŭ	002021	·
	UCD 8-160	6				
Twin kernels	UCD 3-40	27	Jenette	21	UCD8-201	18
(two kernels within the same pellicle)	Sweetheart	20	UCD 8-27	19	Kester	12
(the terricle main the came period)	Jenette	19	UCD 3-40	16	Jenette	12
	UCD 8-201	17	Sweetheart	12	Sweetheart	6
	UCD 8-27	13	Folsom	11	Wood Colony	6
	UCD 8-160	11	P16-013	11	ĺ	
	Nonpareil	11	UCD 8-160	10		
	Kester	8	UCD 8-201	10		
	Bennett	8	Booth	9		
	UCD 7-159	8	Kester/Hanse	9		
	Kester/Hansen	7	Capitola	9		
	Eddie	7	Kester	9		
	UCD 1-232	7	Supareil	7		
	Y-117-91-03	6	Aldrich	7		
			Nonpareil	7		
			Durango	7		
			UCD 7-232	7 7		
			UCD 7-159	′		
Naval orange worm damage	(none)		Booth	14	(none)	
gg-	()		Y116-161-99	8	(******)	
			Eddie	7		
Blank kernels	LICD 1 222	10	Folcom	10	(none)	
Diank kerners	UCD 1-232	10	Folsom Booth	13 11	(none)	
			UCD 1-232	11		
			UCD 8-27	9		
			UCD 7-159	7		
Severe shrivel	Capitola	12	Capitola	24	Folsom	14
Severe Silliver	Folsom	12	UCD 7-159	23	Wood Colony	8
	Self Fru P13.019	11	Folsom	19	Eddie	7
	Supareil	8	UCD 8-201	18	Booth	6
	Y-117-91-03	8	Y117-86-03	17	UCD8-27	6
				16	Y117-91-03	_
	Bennett	7	Jenette	16		О
	Bennett Y117-86-03	7 7	Jenette UCD 8-160	16		О
						ь
	Y117-86-03	7 7 6	UCD 8-160 UCD 8-27 Bennett	16 15 11		ь
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth	16 15 11 11		ь
	Y117-86-03 UCD 1-271 Self-Fru P16.013	7 7 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart	16 15 11 11		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232	16 15 11 11 11		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil	16 15 11 11 11 11		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013	16 15 11 11 11 11 10 9		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling	16 15 11 11 11 11 10 9		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271	16 15 11 11 11 11 10 9 8		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271 UCD 18-20	16 15 11 11 11 10 9 8 8		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271 UCD 18-20 Durango	16 15 11 11 11 10 9 8 8 8		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271 UCD 18-20 Durango P13-019	16 15 11 11 11 10 9 8 8 7 7		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271 UCD 18-20 Durango P13-019 Y117-91-03	16 15 11 11 11 10 9 8 8 7 7		0
	Y117-86-03 UCD 1-271 Self-Fru P16.013 Sweetheart	7 7 6 6	UCD 8-160 UCD 8-27 Bennett Booth Sweetheart UCD 1-232 Supareil P16-013 Sterling UCD 1-271 UCD 18-20 Durango P13-019	16 15 11 11 11 10 9 8 8 7 7		6

Table 9. Main kernel defects for 2017 harvest. Items are listed if they had 6% or more of kernels exhibiting the defect.

	1		Trial			
Varieties with defect	Butte	(%)	Stanislaus	(%)	Madera	(%)
6% or more double kernels	UCD 18-20	41	UCD 18-20	22	UCD 8-201	36
	Self-fru P16.013	37	UCD 8-201	18	Booth	22
	Booth	30	Booth	16	UCD 18-20	20
	UCD 8-201	26	Y121-42-99	16	UCD 8-27	18
	Wood Colony	24	Self-fru P16.013		Self-fru P16.013	
	UCD 8-27	21	UCD 8-27	15	UCD 1-16	8
	UCD 8-160	20	Self-fru P16.013	14	Durango	7
	UCD 1-232	19	UCD 1-16	11	UCD 1-232	7
	Self-fru p13.019	19	Jenette	8		
	UCD 1-16	18	Durango	7		
	Jenette	14	Y117-91-03	6		
	Durango	13				
	Aldrich	9				
	Winters	9				
	Folsom	8				
	Kester	7				
	Bennett	7				
6% or more twin kernels	UCD 8-27	18	UCD 3-40	14	UCD 3-40	28
(two kernels within the	UCD 8-27 UCD 3-40	18	UCD 3-40 UCD 8-27	14		28 9
same pellicle)	Sweetheart	10	Jenette	9	Jenette	8
same peniciej		10 9		8	UCD 8-27 UCD 8-201	8 7
	Nonpareil		UCD 8-201			
	UCD 1-232	7	UCD 8-160	7	2-19E	7
	UCD 8-160	7	Self-fru P16.013	7	UCD 7-159	6
	Booth	6				
	Jenette	6				
	UCD 8-201	6				
6% or more navel orange worm damage	UCD 8-27	6	UCD 8-27	8	UCD 1-271	14
o/o or more nater orange from damage	00202.	ŭ	005 0 27	Ū	UCD 8-27	11
					UCD 8-201	8
					Supareil	7
					Bennett	7
					UCD 3-40	7
6% or more blank kernels	Self-fru P16.013	16	(none)		(none)	
	Booth	14				
	Y121-42-99	12				
	UCD 18-20	9				
	Jenette	6				
6% or more severe shrivel	Folsom	21	Jenette	10	Folsom	10
	Y117-86-03	17	UCD 8-201	8	Jenette	9
	Eddie	16	Y117-86-03	6	UCD 8-201	8
	Self-fru P16.013	14			Self-fru P13.019	
	UCD 8-201	13			Wood Colony	7
	Capitola	13			Supareil	6
	UCD 8-27	12			UCD 8-27	6
	Y117-91-03	11			305 0 27	U
	UCD 3-40	10				
	Y116-161-99	9				
	Self-fru p13.019	8				
	Sweetheart	8				
	UCD 1-232	8				
	UCD 8-160	8				
	UCD 1-16	8				
	Jenette	7				
	Supareil	6				
	UCD 18-20	6				

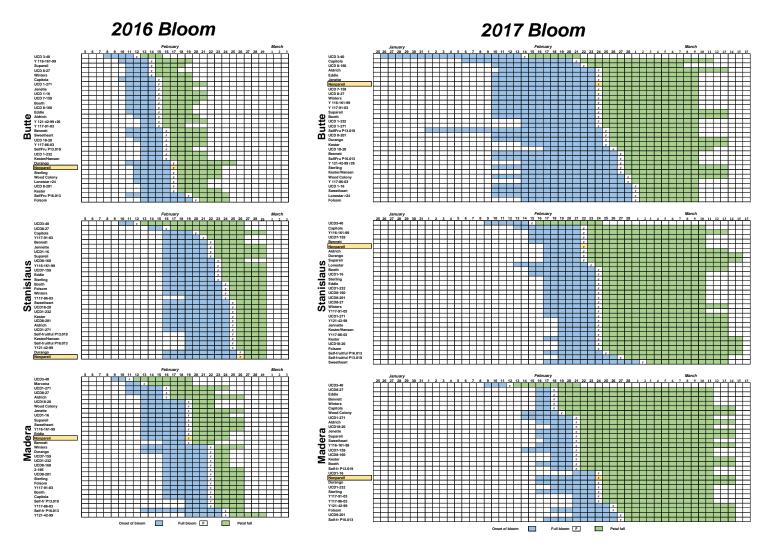


Figure 1. Bloom data for 2016 (left) and 2017 (right) by site and variety or selection.

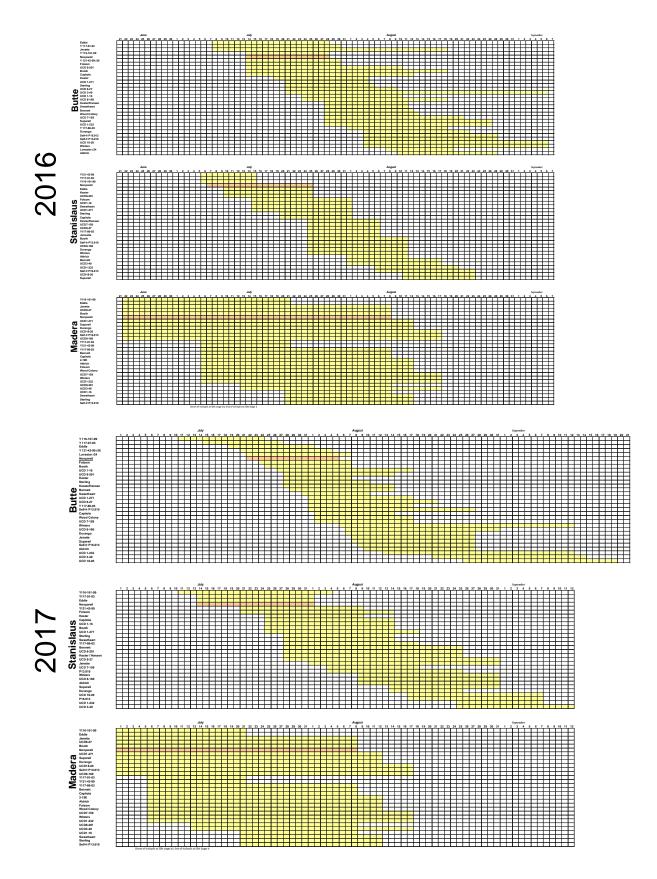


Figure 2. Hullsplit by site, variety and selection for 2016 (top) and 2017 (bottom).

	Trees per	2016	2017
Site	acre	(kernel lb/ac)	(kernel lb/ac)
Butte	110	159-796	405-2145
Stanislaus	130	40-460	907-2058
Madera	173	410-1999	708-2604

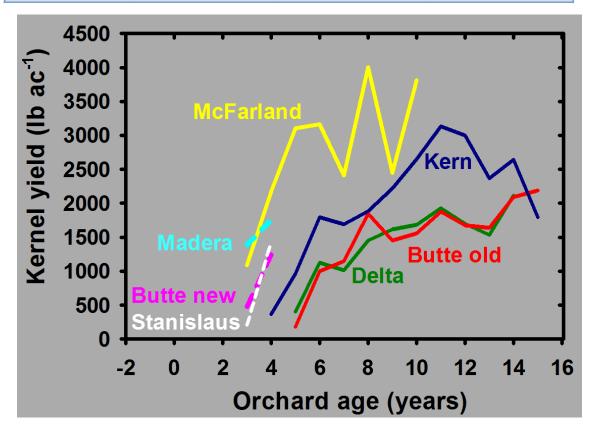


Figure 3. Average yield for all varieties, selections and Nonpareil sources by orchard age for the 1993 Butte (64 trees per acre), Delta (75 trees per acre) and Kern (86 trees per acre) Regional Almond Variety Trials as well as the McFarland Variety Trial that was planted in 2004 at a density of 121 trees per acre. Data for the 2014 trials is shown on the left. Madera, Butte new and Stanislaus trials have tree densities of 110, 130 and 173 trees per acre respectively.

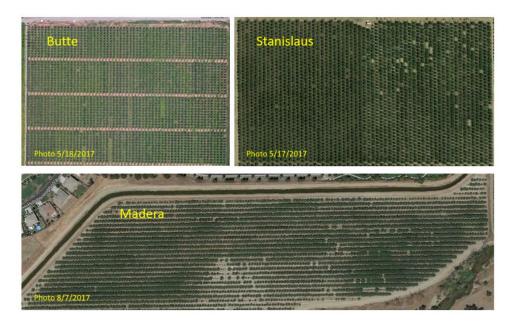


Figure 4. Google Earth images of the three sites. Note extensive tree loss in several areas at the Madera trial and to a lesser extent at the Stanislaus trial.

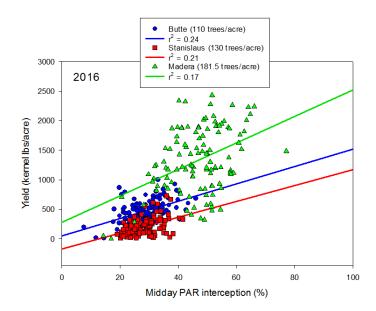


Figure 5. Midday canopy photosynthetically active radiation interception (PAR) versus kernel pounds per acre yield by site for 2016.

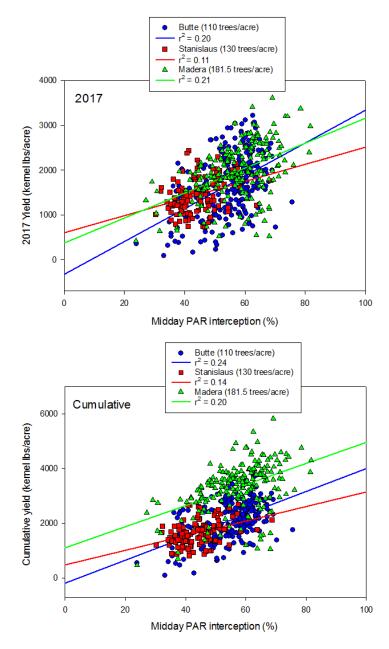


Figure 6. Midday canopy photosynthetically active radiation interception (PAR) versus kernel pounds per acre yield by site for 2017 (top) and cumulative per acre yield by site for 2016-2017 (bottom).