# UCDAVIS

### **DEPARTMENT** OF **PLANT** SCIENCES



#### Background

Regional Almond Variety Trials (RAVTs) were designed to evaluate newer varieties in a commercial (20 to 40 trees per variety) manner and to compare them to standard varieties such as Nonpareil, Mission and currently accepted

# Regional Almond Variety Trials for Cultivar Evaluation in California

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Table 1. Yield, shelling percentages, and yield per unit PAR interceptedby year and variety for 2010-2014 seasons.

2010					Kernel pounds per		
		Average kernel wt	Shelling				Cumulative kernel yield
/ariety	No. of nuts/tree	(g)	percentage	unit PAR int.	Tree	Acre	(lbs/acre)
Ionpareil-Nico	9521 abc	1.24 abcdef	72.5 ab	49.7 a	25.9 a	3141 a	14558 a
Ionpareil-Newell	8429 cde	1.31 ab	73.6 a	45.2 abc	24.2 a	2931 a	14022 ab
Ionpareil-3-8-2-70	8823 bcd	1.28 abcd	72.3 ab	47.1 ab	24.9 a	3011 a	13916 ab
Ionpareil-Driver	8368 cde	1.28 abcd	71.0 ab	46.2 abc	23.6 a	2849 a	13911 ab
lonpareil-7	10611 ab	1.16 bcdef	69.8 ab	49.4 a	27.1 a	3282 a	13510 abc
lonpareil-5	9410 abc	1.24 abcde	72.3 ab	50.8 a	25.8 a	3130 a	13708 abc
Ionpareil-6	9498 abc	1.21 abcdef	71.8 ab	48.7 ab	25.5 a	3081 a	13220 bc
(ester (2-19e)	6832 efg	1.10 bcdef	56.1 e	33.7 def	16.7 bc	2020 bc	13100 bc
Ionpareil-Jones	8315 cde	1.23 abcdef	70.9 ab	43.8 abc	22.6 a	2737 a	12691 c
Vinters	6601 efg	1.11 bcdef	60.7 cde	38.5 bcde	16.0 bc	1945 bc	11203 d
Chips	9089 abc	1.15 bcdef	65.9 abc	48.4 a	23.0 a	2789 a	10933 d
Sweetheart	10915 a	0.80 g	71.8 ab	42.2 abcd	23.4 a	2839 a	10803 d
(ahl	7587 cde	1.01 f	56.5 de	43.4 abcd	16.9 b	2048 c	10561 d
larcona	5072 gh	1.28 abc	26.2	36.7 cdef	14.4 bc	1745 bc	9308 e
lochi	3902 ł	1.40 a	64.4 bcd	23.5	12.1 bc	1466 bc	8421 e

2011					Kernel pounds per		
Vorioty	No of nuts/tree	Average kernel wt	Shelling	unit DAD int	Troo	Aoro	Cumulative kernel yield
variety	19776 0	(9) 0.00 bodo			11 0 o		
	10//0 d			00.7 a	41.0 a	4904 a	19525 a
Nonparell-3-8-2-70	17744 abc	1.05 DC	70.7 a	87.9 a	41.0 a	4962 a	18878 ab
Nonpareil-Newell	17790 abc	1.00 bcd	70.1 ab	81.0 ab	39.2 a	4745 a	18767 abc
Nonpareil-Driver	17943 ab	0.98 bcde	66.0 abcd	84.3 a	38.7 a	4683 a	18593 abc
Nonpareil-7	1/0/8 abcd	0.83 e	69.2 abc	76.1 ab	31.4 a	4555 a	18443 abc
Nonpareil-5	15/45 de	1.03 bc	70.4 ab	78.0 ab	35.9 a	4342 a	18050 bcd
Nonpareil-6	16630 bcde	1.04 bc	70.0 ab	81.6 ab	38.2 a	4619 a	17838 bcd
Kester (2-19e)	18253 ab	0.91 bcde	64.8 abcd	73.6 ab	36.8 a	4460 a	17560 cd
Nonpareil-Jones	16993 abcd	0.96 bcde	70.0 ab	81.6 ab	36.0 a	4360 a	17051 d
Winters	15979 cde	0.83 e	58.7 ei	67.3 bc	29.4 b	3554 b	14757 e
Sweetheart	14969 e	0.86 de	64.1 bcde	52.5 de	28.2 bc	3412 bc	14215 e
Chips	11901 f	0.94 bcde	60.3 de	51.4 de	24.7 bcd	2985 bcd	13918 e
Kahl	12420 f	0.89 cde	53.5	59.1 cd	24.4 bcd	2953 bcd	13514 e
Marcona	9633 g	1.07 b	30.8	51.8 de	22.7 d	2746 d	12054 f
Kochi	8701 g	1.22 a	63.5 cde	43.4 e	23.3 d	2825 d	11247 f
							and the second se
2012		Average kernel wt	Shelling		Kernel pounds per		Cumulative kernel yield
Variety	No. of nuts/tree	(g)	percentage	unit PAR int.	Tree	Acre	(lbs/acre)
Nonpareil-Nico	9520 b	1.13 de	67.7 bcd	38.2 abc	23.6 a	2861 a	22384 a
Nonpareil-3-8-2-70	8530 b	1.20 bc	70.9 bc	36.2 abcde	22.6 ab	2733 ab	21611 ab
Nonpareil-Newell	8481 b	1.15 cde	66.9 bcd	33.4 bcde	21.2 abc	2563 abc	21329 ab
Nonpareil-Driver	8606 b	1.18 bcd	67.6 bcd	36.6 abcde	22.3 ab	2695 ab	21288 ab
Nonpareil-7	9262 b	1.14 cde	85.2 a	36.7 abcd	23.2 a	2811 a	21254 abc
Nonpareil-5	8090 bc	1.19 bcd	69.0 bcd	34.7 abcde	21.2 abc	2563 abc	20613 bc
Kester (2-19e)	11507 a	0.94	59.6 cd	41.8 ab	23.8 a	2881 a	20441 bc
Nonpareil-6	7617 bc	1 19 bcd	69.4 bcd	32.1 cde	2012 abc	2432 abc	20270 bc
Nonpareil-Jones	8855 b	1.18 bcd	67.7 bcd	38.2 abc	23.0 ab	2783 ab	19833 c
Winters	8679 h	1.01	61.9 bcd	38.4 abc	19.3 abc	2338 abc	17095 d
Chins	8653 b	1.01 1.10 ef	59.8 cd	37.1 abcd	21.0 abc	2538 abc	16456 d
Sweetheart	9008 b	0.92	75.3 ab	28.8 de	18.2 hc	22000 abo	16416 d
Kahl	8830 h	1.05 f	55.0 d	43.0 a	20.4 abc	2201 bc	15979 d
Kochi	6449 C	1.00 i	65.5 bcd	28.2 P	17.4 c	2400 abc	13351 P
Marcona	2025 d	1.22 5	26.0 P	12 7 f	63 d	763 d	12816
Marcona	2023 U	1. <del>4</del> 1 a	20.0 C	12.7 1	0.0 u	700 U	12010 C
2012		A	Challing				
2013			Snelling		Kernel pounds per	•	
Variety	No. of nuts/tree	(g)	percentage		Iree	Acre	
	20367 a	0.87 b	63.5 a	61.6 a	39.2 a	4738 a	2/121 a
Nonpareil-3-8-2-70	18/18 D	0.87 b	63.5 ab	56.5 ab	36.0 a	4354 a	25965 ab
Nonpareil-Newell	19539 ab	0.87 b	63.5 ab	58.0 ab	37.6 a	4545 a	25874 ab
Nonpareil-Driver	19539 ab	0.87 b	63.5 ab	60.2 a	37.4 a	4529 a	25817 ab
Nonpareil-7	19439 ab	0.87 b	63.5 ab	58.6 ab	37.4 a	4522 a	25776 ab
Nonpareil-5	18202 b	0.87 b	63.5 ab	55.4 ab	35.0 a	4234 a	24847 bc
Nonpareil-6	18769 b	0.87 b	63.5 ab	56.8 ab	36.1 a	4366 a	24636 bc
Nonpareil-Jones	18241 b	0.87 b	63.5 ab	54.7 ab	35.1 a	4243 a	24076 c
Kester (2-19e)	16267 c	0.66 c	56.6 b	44.0 cd	23.9 c	2890 c	22958 c
Winters	13894 d	0.86 b	55.6 b	50.3 bc	26.5 bc	3201 bc	20296 d
Kahl	15587 c	0.85 b	55.3 b	57.9 ab	29.1 b	3524 b	19503 d
Chips	12689 d	0.89 b	57.3 b	39.7 de	24.9 bc	3010 bc	19466 d
Sweetheart	13943 d	0.78 b	66.5 a	40.4 de	24.0 c	2902 c	19318 d
Marcona	10858 e	1.11 a	28.9 c	49.4 bc	26.5 bc	3206 bc	16023 e
Kochi	7911	1.09 a	63.7 ab	33.5	19.0 d	2300 d	15651 e

#### **Results and Summary**

Average bloom progression for 2006-2014 is shown in Fig. 2. Marcona, Winters and Sweetheart all bloomed before Nonpareil (but also had good overlap) which has been shown to be ideal for providing good pollination to Nonpareil.

Average hull split progression for 2006-2014 is shown in Fig. 3. Hullsplit was completed in early August for Nonpareil, Kochi and selection 2-19e. Hullsplit was completed in late August for Sweetheart and Chips and in early September for Winters, Kahl and Marcona.

There have been severe problems with *Alternaria* and hull rot in the orchard (especially in 2009 when there were 122 strikes per tree in Kochi). In 2014, disease pressure was relatively low. There was no scab and hull rot was most severe in Kochi with lesser amounts in the Nonpareil clones (Table 4). Alternaria pressure was low with the most in Winters followed by Kahl and Sweetheart.

Yields at the McFarland Trial showed some sign of alternate bearing for the last 6 years (Fig. 1). In the early years, the orchard tended to go through fairly severe stress cycles with midday stem water potentials reaching the -15 to -18 bar range (data not shown). It appears that water penetration problems may have contributed to these problems. Since 2010, every other row middle has been ripped each year and water penetration and water relations have been significantly improved.



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#### **1993 Trials**

To be comparable, the 1993 trials were all planted in the same year and with essentially the same variety composition. Thus, any differences in varietal performance among various regions should become evident.

Varieties were planted on peach rootstock; Lovell for those at CSU-Chico and Nemaguard for trees in the Delta College and Kern plots.

Yield data collection discontinued on most varieties at the Butte RAVT after the 2005 season due to extensive tree damage and loss in most varieties. The replacement varieties (Avalon, Durango, Kochi, and Carmel) which were planted in 2001 at a density of 128 trees per acre were also harvested in 2007. All trees were removed from the Butte trial in 2008.

After the 2006 season, yield data collection was discontinued for the Delta and Kern RAVTs as well.

#### **2004 McFarland Trial**

A replicated variety trial was planted in 2004 near McFarland in Kern County. This trial consists of eight almond varieties and eight Nonpareil clones planted at a spacing of 18' x 20' (121 trees/acre). Although Sonora was originally supposed to be included in the trial, the budwood for the Sonora variety was a mixture of several other varieties and hence will not be reported here.

McFarland Replicated Variety Trial

Winters

)14		Average kernel wt	Shelling		Kernel pounds per		Cumulative kernel yield
riety	No. of nuts/tree	(g)	percentage	unit PAR int.	Tree	Acre	(lbs/acre)
onpareil-Nico	15387 b	0.91 de	70.1 bc	57.0 b	37.0 ab	4476 ab	31379 a
onpareil-3-8-2-70	15105 b	1.12 bcd	70.5 bc	57.6 b	37.4 ab	4522 ab	30486 ab
onpareil-Newell	14172 bc	1.12 bcd	69.8 bc	51.9 bc	34.8 ab	4208 ab	30082 abc
onpareil-Driver	13082 bcd	1.15 bc	70.3 bc	51.2 bc	33.1 b	4007 b	29824 bcd
onpareil-7	14201 bc	1.12 bcd	70.4 bc	52.1 bc	34.9 ab	4224 ab	29467 bcd
onpareil-5	14523 bc	1.15 bc	71.7 b	57.6 b	36.8 ab	4450 ab	29297 bcd
onpareil-6	13930 bc	1.13 bcd	69.5 bcd	52.8 bc	34.7 ab	4195 ab	28831 cd
onpareil-Jones	16267 c	0.86 e	57.6 d	48.4 bc	32.2 b	3901 b	28584 d
ester (2-19e)	14378 bc	0.92 cde	69.5 bcd	49.1 bc	29.1 bc	3616 bc	27075 e
inters	17427 a	0.91 de	77.1 a	67.0 a	35.0 ab	4237 ab	24532 f
nips	11188 cde	0.98 cde	67.7 bcd	39.9 cd	23.9 cd	2886 cd	22353 g
ıhl	9310 e	1.03 bcde	55.3 e	40.6 cd	21.0 d	2543 d	22046 g
veetheart	10145 de	0.92 cde	66.7 cd	31.5 d	20.5 d	2477 d	21794 g
chi	5981 f	1.25 b	66.8 cd	26.4 d	16.5 d	1996 d	17646 h

#### Table 2. Disease rating for McFarland Trial by variety for 2014 season.

		Scab Rating		A	ternaria rating			Hull Rot Strikes
Winters	2.17	b	Nonpareil-J	0.0	a	Kahl	0	a
Kochi	0.17	а	Nonpareil-5	0.0	а	Marcona	0	а
Kester (2-19E)	0	а	Nonpareil 3-8-2-70	0.0	а	Sweetheart	1	a
Nonpareil-7	0	а	Nonpareil-7	0.0	а	2-19E	2	a
Nonpareil-Newell	0	а	Nonpareil-Nico	0.0	а	Nonpareil 3-8-2-70	2	a
Nonpareil-J	0	а	Nonpareil-6	0.0	а	Winters	2	a
Nonpareil-5	0	а	Nonpareil-Newell	0.2	a b	Chips	3	a
Nonpareil 3-8-2-70	0	а	Kochi	0.3	a b	Nonpareil-Nico	3	a b
Nonpareil-DR	0	а	2-19E	0.5	bc	Nonpareil-7	4	abc
Nonpareil-6	0	а	Nonpareil-DR	0.5	bc	Nonpareil-6	5	abc
Marcona	0	а	Chips	0.5	bc	Nonpareil-Newell	5	abc
Kahl	0	а	Marcona	0.8	c d	Nonpareil-5	6	abc
Sweetheart	0	a	Sweetheart	1.0	d e	Nonpareil-J	11	bc
Nonpareil-Nico	0	а	Kahl	1.3	е	Nonpareil-DR	11	С
Chips	0	a	Winters	3.0	f	Kochi	25	d

Yield per unit light (PAR) intercepted has averaged above 50 over the last 6 years in this trial for Winters, the Nonpareil clones, Kahl and Kester (selection 2-19e. See poster 64 for more detailed analysis of yield trends from this trial.

#### **2014 Regional Almond Variety Trials**

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 4. 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 4. 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 4). 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.

# Planted in 2014Seven varieties or selections and eight Nonpareil clones<br/>replicated 6 timesKester (2-19e)Nonpareil- 3-8-2-70ChipsNonpareil- 5KahlNonpareil- 6KochiNonpareil- 7MarconaNonpareil- DriverSweetheartNonpareil- Jones

**Nonpareil- Newell** 

Nonpareil- Nico 20' x 18' planting distance 121 trees per acre Irrigated with double line drip Class 1 McFarland Ioam/Wasco sandy Ioam

Irrigation is with double line drip. The soil is Class I McFarland loam and Wasco sandy loam. Trees in this trial grew rapidly and continue to produce high yields with Nonpareil yields above 4000 kernel pounds per acre in 3 of the last 4 years (Table 1).

## Yield for this trial continues to be well above that for any of the 1993 trial yields (Fig. 1).



#### ha 1721 g 1.48 a 57.6 ε 10.3 e 5.6 e 682 e 16705

Figure 2. Average bloom progression for McFarland Trial by variety from 2006-2014.

	Average Bloom 2006-2014
	February March
	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Marcona	
Winters	<i></i>
Sweetheart	
Nonpareil-Newell	F MINING F
Nonpareil-7	F WINNING F
Nonpareil-Driver	F ////////////////////////////////////
Nonpareil-5	F MANA
Nonpareil-Jones	F MANA
Nonpareil-6	F WINNING F
Nonpareil-3-8-2-70	F MANAGER F
Kahl	F WINNING F
Chips	F WINNING F
Nonpareil-Nico	F
Kochi	F MANA
Kester (2-19E)	

## Figure 3. Average hull-split progression for McFarland Trial by variety from 2006-2014.

		Average Hullsplit 2006-2014	
	July	August	September
	14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 2 3 4 5 6 7 8 9 10 11 12 13
Ionpareil-5			
Ionpareil-7			
Ionpareil-Newell			
lonpareil-Nico			
lonpareil-6			
lonpareil-Driver			
lonpareil-Jones			
onpareil-2-70			
ochi			

Table 3 Varieties and selections planted at the next generation regional almond variety trials. Items 1-30 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	Source
1	Eddie	Bright's
2	Capitola	Burchell
3	Supareil	Burchell
4	self-fruitful P16.013	Burchell
5	Self-fruitful P13.019	Burchell
6	Booth	Burchell
7	Sterling	Burchell
8	Bennett	Duarte
9	Nonpareil	Fowler
10	Durango	Fowler
11	Jenette	Fowler
12	Aldrich	Fowler
13	Marcona	Spain
14	Winters	UCD
15	Sweetheart	UCD
16	Kester (2-19e)*	UCD
17	UCD3-40	UCD
18	UCD18-20	UCD
19	UCD1-16	UCD
20	UCD8-160	UCD
21	UCD8-27	UCD
22	UCD1-271	UCD
23	UCD1-232	UCD
24	UCD7-159	UCD
25	UCD8-201	UCD
26	Y121-42-99	USDA
27	Y117-86-03	USDA
28	Y116-161-99**	USDA
29	Y117-91-03	USDA
30	Folsom	Wilson
31	Wood Colony on Krymsk 86 (Butte only)	
31	Lone Star on Hansen 536 (Chowchilla only	











Hull Split Start

 \*Kester (2-19e) was planted at all three sites on the usual rootstock f In addition at the Butte and Stanislaus sites it was also planted in t replicated trial on Hansen 536 rootstock
\*\* Y116-161-99 planted only in two reps outside of main trial at Butte



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