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Regional Almond Variety Trials for Cultivar Evaluation in California

B.D. Lampinen*[1], G. Brar[2], J.H. Connell[3], R.A. Duncan[4] S.G. Metcalf[1], Bill Stewart[1], M.A. Thorpe[1], T. M. Gradziel[1], Mario Viveros[5] and Minerva Gonzales[5]

[1]UC Davis Plant Sciences [2]UCCE Fresno/Madera Counties [3]UCCE Butte County [4]UCCE Stanislaus County [5]UCCE Kern County

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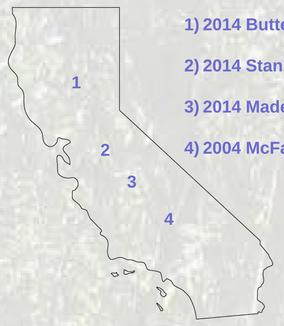

1) 2014 Butte RAVT

2) 2014 Stanislaus RAVT

3) 2014 Madera RAVT

4) 2004 McFarland Variety Trial

Background

Data collection at the 1993 regional almond variety trials in Butte, San Joaquin and Kern coun6ies was discontinued by 2005. 2015 was the final year for data collection at the 2004 McFarland Variety trial and 2016 will be the first year for data collection at the 2014 Regional Variety Trials in Butte, Stanislaus and Madera counties. These new trials are set up with four replications of each variety or selection.

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

Planted in 2004
Seven varieties or selections and eight Nonpareil clones replicated 6 times

Kester (2-19e)	Nonpareil- 3-8-2-70
Chips	Nonpareil- 5
Kahl	Nonpareil- 6
Kochi	Nonpareil- 7
Marcona	Nonpareil- Driver
Sweetheart	Nonpareil- Jones
Winters	Nonpareil- Newell
	Nonpareil- Nico

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

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 between 2800 and 4300 kernel pounds per acre for the past 4 years (Table 1).

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

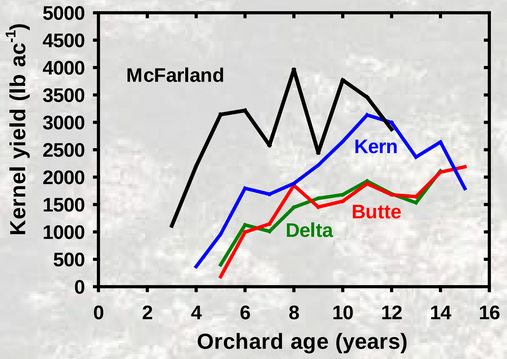

Fig. 1. Average annual yield for all varieties and selections combined at each trial by orchard age.

Results and Summary

Average bloom progression for 2006-2015 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 2006-2015 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). Average *Alternaria* and Scab occurrence from 2008-2015 shows a significantly higher rating in Winters and Kahl (Table 2).

Yields at the McFarland Trial showed some sign of alternate bearing for the last 8 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

Table 1. Yield, shelling percentages, and yield per unit PAR intercepted by year and variety for 2012-2015 seasons.

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
2-19e	11507 a	0.94 e	69.6 bcd	41.8 ab	23.8 a	2881 a	20441 bc
Nonpareil-6	7617 bc	1.19 bcd	69.4 bcd	32.1 cde	20.1 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 b	1.01 f	61.9 bcd	38.4 abc	19.3 abc	2338 abc	17095 d
Chips	8653 b	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 bc	2201 bc	16416 d
Kahl	8830 b	1.05 fg	55.0 d	43.0 a	20.4 abc	2465 abc	15979 d
Kochi	6449 c	1.22 b	65.5 bcd	28.2 e	17.4 c	2104 c	13351 e
Marcona	2025 d	1.41 a	26.0 e	12.7 f	6.3 d	763 d	12816 e

2013		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	20367 a	0.87 b	63.5 a	61.6 a	39.2 a	4738 a	27121 a
Nonpareil-3-8-2-70	18718 b	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
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 e	19.0 d	2300 d	15651 e

2014		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	15387 b	0.91 de	70.1 bc	57.0 b	37.0 ab	4476 ab	31379 a
Nonpareil-3-8-2-70	15105 b	1.12 bcd	70.5 bc	57.6 b	37.4 ab	4522 ab	30486 ab
Nonpareil-Newell	14172 bc	1.12 bcd	69.8 bc	51.9 bc	34.8 ab	4208 ab	30082 abc
Nonpareil-Driver	13082 bcd	1.15 bc	70.3 bc	51.2 bc	33.1 b	4007 b	29824 bcd
Nonpareil-7	14201 bc	1.12 bcd	70.4 bc	52.1 bc	34.9 ab	4224 ab	29467 bcd
Nonpareil-5	14523 bc	1.15 bc	71.7 b	57.6 b	36.8 ab	4450 ab	29297 bcd
Nonpareil-6	13930 bc	1.13 bcd	69.5 bcd	52.8 bc	34.7 ab	4195 ab	28831 cd
Nonpareil-Jones	16267 c	0.86 e	57.6 d	48.4 bc	32.2 b	3901 b	28584 d
2-19e	14378 bc	0.92 cde	69.5 bcd	49.1 bc	29.1 bc	3616 bc	27075 e
Winters	17427 a	0.91 de	77.1 a	67.0 a	35.0 ab	4237 ab	24532 f
Chips	11188 cde	0.98 cde	67.7 bcd	39.9 cd	23.9 cd	2886 cd	22353 g
Kahl	9310 e	1.03 bcde	55.3 e	40.6 cd	21.0 d	2543 d	22046 g
Sweetheart	10145 de	0.92 cde	66.7 cd	31.5 d	20.5 d	2477 d	21794 g
Kochi	5981 f	1.25 b	66.8 cd	26.4 d	16.5 d	1996 d	17646 h
Marcona	1721 g	1.48 a	57.6 e	10.3 e	5.6 e	682 e	16705 h

2015		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	12982 abc	1.07 bc	68.6 ab	46.5 ab	30.8 ab	3728 ab	35046 a
Nonpareil-3-8-2-70	11502 de	1.10 b	71.3 a	41.8 bcd	27.9 bc	3383 bc	33870 ab
Nonpareil-Newell	12638 bcd	1.10 b	72.8 a	44.2 abcd	30.5 ab	3702 ab	33784 ab
Nonpareil-Driver	12664 bcd	1.07 bc	72.8 a	45.1 abc	29.9 ab	3623 ab	33447 bc
Nonpareil-7	14058 a	1.01 cd	73.9 a	46.1 ab	31.3 a	3797 a	33222 bcd
Nonpareil-5	11025 e	1.11 b	72.6 a	40.7 cde	26.9 c	3263 c	32560 bcd
Nonpareil-Jones	13579 ab	1.00 d	69.5 ab	45.1 abc	30.2 ab	3659 ab	32286 cd
Nonpareil-6	11439 de	1.06 bcd	71.0 a	40.0 cde	26.8 c	3246 c	32077 d
2-19e	7827 g	0.94 e	52.5 e	25.0 g	16.2 e	1965 e	29086 e
Winters	5464	1.06 bcd	62.1 cd	22.6 gh	12.7 f	1542 f	26075 f
Chips	11843 cde	0.89 ef	57.4 d	37.2 ef	23.1 d	2806 d	25159 f
Kahl	13661 ab	0.84 f	58.4 d	47.9 a	25.4 cd	3081 cd	25127 f
Sweetheart	6953 g	0.86 f	64.9 bc	20.0 h	13.2 f	1607 f	23402 g
Kochi	9506 f	1.08 b	65.3 bc	35.8 f	22.7 d	2758 d	20404 h
Marcona	2798	1.27 a	26.2	13.2	7.7 g	943	17548

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.

Yield per unit light (PAR) intercepted has averaged above 50 over the last 7 years in this trial for Winters, the Nonpareil clones, Kahl and Kester (selection 2-19e). See poster 58 for more detailed analysis of yield trends from this trial.

Since Nonpareil have more value than the pollenizer varieties presently, it is advantageous for the pollenizers to be shorter than the adjacent Nonpareil since this can shift some yield potential to the taller variety. Since this orchard is oriented with north/south facing rows, this allows the Nonpareil to intercept more light for serveral hours in late morning and early

Figure 2. Average bloom progression for McFarland Trial by variety from 2006-2015.

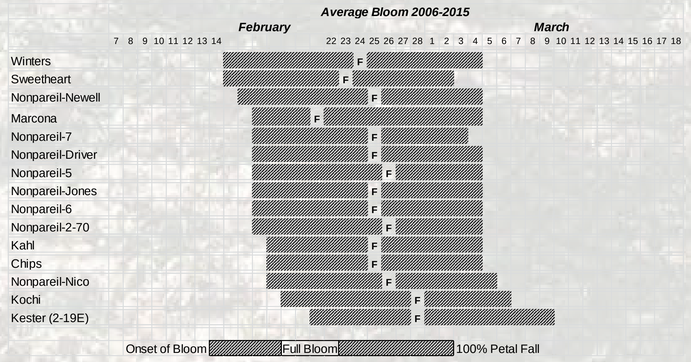

Figure 3. Average hull-split progression for McFarland Trial by variety from 2006-2015 (ranked by beginning of hullsplit).

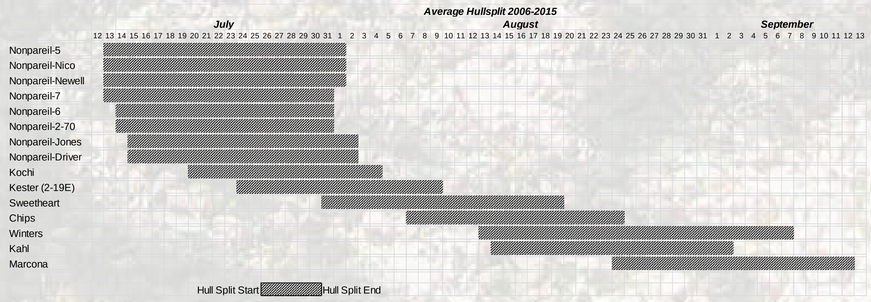

Table 2. Disease rating for McFarland Trial by variety from 2008-2015 season.

Variety	Scab Rating	Alternaria Rating	Unharvested Nuts	Hull Rot
Winters	1.86 a	1.83 a	410.5 a	27.5 bc
Sweetheart	0.31 b	0.61 cdefg	318.7 a	21.3 bcd
Marcona	0.19 bc	0.97 bc	159.9 bc	1.9 d
Nonpareil-Newell	0.17 bc	0.36 efg	164.6 bc	22.1 bcd
Nonpareil-3-8-2-70	0.14 bc	0.39 defg	115.6 bc	17.8 bcd
Kester-(2-19E)	0.14 bc	0.64 cdefg	196.9 b	39.3 b
Nonpareil-7	0.11 bc	0.32 fg	150.3 bc	18.3 bcd
Kochi	0.11 bc	0.72 cdef	114.4 bc	72.4 a
Nonpareil-DR	0.08 bc	0.47 defg	174.3 bc	18.5 bcd
Nonpareil-5	0.08 bc	0.39 defg	132.7 bc	13.6 cd
Nonpareil-Nico	0.08 bc	0.28 g	104.1 bc	9.6 cd
Kahl	0.06 bc	1.19 b	154.7 bc	2.1 d
Nonpareil-J	0.06 bc	0.31 fg	157.5 bc	19.9 bcd
Nonpareil-6	0.03 bc	0.33 fg	123.9 bc	20.8 bcd
Chips	0.00 c	0.78 cde	147.1 bc	4.3 cd

Table 3. Tree height for the McFarland trial measured during the winter of 2007 and 2015. Disease rating for McFarland Trial by variety from 2008-2015 season.

	2007		2015	
Variety	Circ (cm)	Height (meters)	Circ (cm)	Height (meters)
Marcona	42.8 bc	4.75 gh	75.4 bc	7.66 a
Nonpareil 7	43.4 ab	5.27 a	74.9 bc	7.38 b
Nonpareil 6	42.5 bc	5.14 abc	75.7 bc	7.34 b
Nonpareil 38270	43.1 bc	5.01 cdef	75.8 bc	7.20 bc
Kochi	44.5 a	4.65 hi	82.6 ab	7.07 cd
Sweetheart	43.7 ab	5.12 abcd	77.5 bc	7.04 cd
Nonpareil Nico	42.4 bc	5.22 ab	74.6 bc	7.01 cd
Nonpareil 5	42.5 bc	5.04 bcde	74.7 bc	7.00 cd
Nonpareil Newell	42.5 bc	4.85 fg	88.2 a	6.91 de
Nonpareil Dr	41.9 cd	4.99 cdef	73.9 bcd	6.74 e
Nonpareil J	40.0 e	4.84 fg	73.3 bcd	6.69 e
Kahl	41.0 de	5.16 abc	63.1 d	6.69 e
Chips	40.4 e	4.40 j	67.5 cd	6.43 f
2-19e (Kester)	42.1 cd	4.93 ef	67.7 cd	6.37 f
Winters	42.1 cd	4.58 i	69.1 cd	6.09 g

afternoon. Winters, 2-19e (Kester), Chips and Kahl all tended to be shorter than Nonpareil (Table 3).

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. Data collection will start at these sites in 2016.

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	

*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


Butte RAVT- Sept. 23, 2015


Stanislaus RAVT- July 2, 2015


Madera RAVT- July 29, 2015

Acknowledgements

Thanks to the Almond Board of California, the Billings Ranches, Chico State University (Jeff Boles), the Salida School District (Lane Parker), and Creekside Farming Company for supporting this work.