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Regional Almond Variety Trials for Cultivar Evaluation in California

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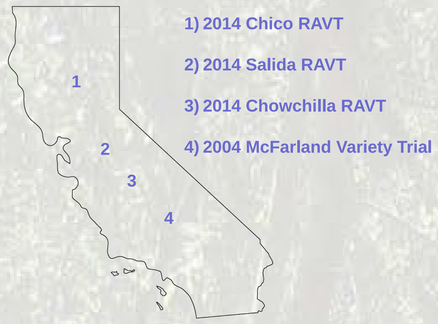

1) 2014 Chico RAVT
2) 2014 Salida RAVT
3) 2014 Chowchilla RAVT
4) 2004 McFarland Variety Trial

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 pollenizers.

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). It is irrigated with double line drip. The soil is Class I McFarland loam and Wasco sandy loam. Trees in this trial grew rapidly with Nonpareil yields from 4600 to near 5000 kernel pounds per acre in the eight leaf. The budwood for the Sonora variety was a mixture of several other varieties and hence will not be reported on here. Kernel yield for this trial continues to be well above that for any of the 1993 trial yields (Fig. 1).

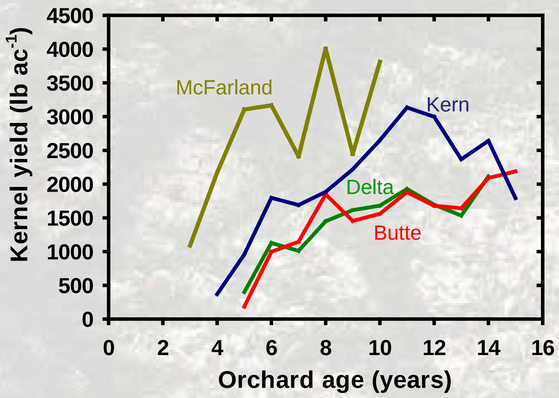

Fig. 1. Average annual yield for all varieties and selections combined at each trial by orchard age.

2014 Regional Almond Variety Trials

Plantings are planned for 2014 near Chico, Salida and Chowchilla. The Chico, Salida and Chowchilla trials will be on Krymsk 86, Nemaguard and Hansen 536 rootstocks respectively. Tree spacing will 18' x 21'. There will be 4 replications of each of 30 varieties and selections with Nonpareil making up the other 50% of the plantings. The material to be planted is listed below.

#	Variety	Source	Provides Bud wood
1	Nonpareil	Fowler	Fowler
2	Capitola	Burchell	Burchell
3	Supareil	Burchell	Burchell
4	self-fruitful P15.044	Burchell	Burchell
5	Self-fruitful P10.001	Burchell	Burchell
6	Booth	Burchell	Burchell
7	Sterling	Burchell	Burchell
8	Folsom	Wilson	Wilson
9	Bennett	Duarte	Duarte
10	Durango	Fowler	Fowler
11	Jenette	Fowler	Fowler
12	Winters	UCD	Fowler
13	Eddie	Bright's	Bright's
14	Sweetheart	UCD	Fowler
15	Marcona	Spain	Gradziel

#	Variety	Source	Provides Bud wood
16	Y121-42-99	USDA	Ledbetter
17	Y117-86-03	USDA	Ledbetter
18	Y116-161-99	USDA	Ledbetter
19	Y117-91-03	USDA	Ledbetter
20	Aldrich	Fowler	Fowler
21	2-19E (Kester)	UCD	Gradziel
22	2-19E (Kester)- hyb	UCD	Gradziel
23	UCD3-40	UCD	Gradziel
24	UCD18-20	UCD	Gradziel
25	UCD1-16	UCD	Gradziel
26	UCD8-160	UCD	Gradziel
27	UCD8-27	UCD	Gradziel
28	UCD1-271	UCD	Gradziel
29	UCD1-232	UCD	Gradziel
30	UCD7-159	UCD	Gradziel
31	UCD8-201	UCD	Gradziel

McFarland Replicated Variety Trial

Selection of new and old pollenizers + Nonpareil clones

- Planted 2004
- Eight almond varieties and eight Nonpareil clones replicated six times
- 20' X 18' planting distance
- 121 trees per acre
- Irrigated with double line drip
- Class 1 McFarland loam/ Wasco sandy loam

Selection 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

Kern - McFarland Variety Trial

Table 1. Yield, shelling percentages, and yield per unit PAR intercepted by year and variety for 2008-2013 seasons. * 2013 Nonpareil samples were inadvertently mixed in processing. Yields values were calculated from kernel weight subsamples taken across all Nonpareil selections.

2009				Kernel pounds per			
Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	unit PAR int.	Tree	Acre	Cumulative kernel yield (lbs/acre)
Nonpareil-Nico	13773 ab	1.05 bcd	74.7 ab	69.3 abcd	31.8 ab	3851 a	11417 a
Nonpareil-Newell	14513 a	1.03 bcd	74.8 ab	72.8 abc	33.1 a	4004 a	11090 a
2-19e	14706 a	0.84 f	65.6 f	71.6 abc	27.1 c	3285 c	11080 a
Nonpareil-Driver	13856 ab	1.08 ab	75.8 a	76.1 ab	32.9 a	3977 a	11062 a
Nonpareil-3-8-2-70	13756 ab	1.04 bcd	74.6 ab	71.8 abc	31.4 ab	3798 ab	10905 ab
Nonpareil-7	13051 ab	1.03 bcd	72.6 abc		29.5 bc	3571 bc	10606 abc
Nonpareil-5	12070 bcd	1.08 ab	74.2 ab	68.5 abcd	28.7 bc	3476 bc	10577 abc
Nonpareil-6	13505 ab	1.02 bcd	71.2 cd	68.9 abcd	30.2 abc	3661 abc	10139 bc
Nonpareil-J	12803 abc	1.04 bcd	71.6 bcd	63.4 bcde	29.0 bc	3513 bc	9955 cd
Winters	9434 ef	0.96 bcde	61.6 g	63.8 bcde	20.0 e	2415 e	9258 de
Kahl	11035 cde	0.87 ef	59.1 g	79.2 a	21.1 de	2559 de	8513 ef
Chips	9771 ef	0.93 def	58.6 g	55.9 de	20.0 e	2422 e	8144 fg
Sweetheart	12798 abc	0.85 ef	73.3 abc	59.6 cde	24.0 d	2906 d	7965 fg
Marcona	8977 fg	1.07 abc	32.5	77.7 a	21.2 de	2562 de	7563 gh
Kochi	7252 g	1.17 a	68.9 de	52.6 e	18.7 e	2259 e	6955 h

2010				Kernel pounds per			
Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	unit PAR int.	Tree	Acre	Cumulative kernel yield (lbs/acre)
Nonpareil-Nico	9521 abc	1.24 abcdef	72.5 ab	49.7 a	25.9 a	3141 a	14558 a
Nonpareil-Newell	8429 cde	1.31 ab	73.6 a	45.2 abc	24.2 a	2931 a	14022 ab
Nonpareil-3-8-2-70	8823 bcd	1.28 abcd	72.3 ab	47.1 ab	24.9 a	3011 a	13916 ab
Nonpareil-Driver	8368 cde	1.28 abcd	71.0 ab	46.2 abc	23.6 a	2849 a	13911 ab
Nonpareil-7	10611 ab	1.16 bcdef	69.8 ab	49.4 a	27.1 a	3282 a	13510 abc
Nonpareil-5	9410 abc	1.24 abcde	72.3 ab	50.8 a	25.8 a	3130 a	13708 abc
Nonpareil-6	9498 abc	1.21 abcdef	71.8 ab	48.7 ab	25.5 a	3081 a	13220 bc
2-19e	6832 efg	1.10 bcdef	56.1 e	33.7 def	16.7 bc	2020 bc	13100 bc
Nonpareil-Jones	8315 cde	1.23 abcdef	70.9 ab	43.8 abc	22.6 a	2737 a	12691 c
Winters	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	10953 d
Sweetheart	10915 a	0.80 g	71.8 ab	42.2 abcd	23.4 a	2839 a	10803 d
Kahl	7587 cde	1.01 f	56.5 de	43.4 abcd	16.9 b	2048 c	10561 d
Marcona	3902 i	1.40 a	64.4 bcd	23.5	12.1 bc	1466 bc	8421 e

2011				Kernel pounds per			
Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	unit PAR int.	Tree	Acre	Cumulative kernel yield (lbs/acre)
Nonpareil-Nico	18776 a	0.99 bcde	68.0 abc	86.7 a	41.0 a	4964 a	19523 a
Nonpareil-3-8-2-70	17744 abc	1.05 bc	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	17078 abcd	0.83 e	69.2 abc	76.1 ab	31.4 a	4555 a	18443 abc
Nonpareil-5	15745 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
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 e	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

2012				Kernel pounds per			
Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	unit PAR int.	Tree	Acre	Cumulative kernel yield (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 fg	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	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	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 g	75.3 ab	28.8 de	18.2 bc	2201 bc	16416 d
Kahl	8830 b	1.05 f	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				Kernel pounds per			
Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	unit PAR int.	Tree	Acre	Cumulative kernel yield (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 e	49.4 bc	26.5 bc	3206 bc	16023 e
Kochi	7911 f	1.09 a	63.7 ab	33.5 e	19.0 d	2300 d	15651 e

Table 4. Disease ratings for the McFarland Trial by variety for 2013.

Scab Rating		Alternaria rating		Hull Rot Strikes	
Nonpareil-DR	0.0 a	Nonpareil-J	0 a	Marcona	2.83 a
Nonpareil-7	0.0 a	Nonpareil-DR	0 a	Kahl	3.33 a
Nonpareil-J	0.0 a	Nonpareil-7	0 a	Chips	9.50 a b
Nonpareil-5	0.0 a	Nonpareil-Newell	0 a	Winters	16.83 a b
Nonpareil-6	0.0 a	Nonpareil-Nico	0 a	Nonpareil-Nico	21.00 a b c
Nonpareil-Newell	0.0 a	Nonpareil 3-8-2-70	0 a	Nonpareil-6	21.50 a b c
Kochi	0.0 a	Nonpareil-5	0 a	Sweetheart	22.00 a b c
Nonpareil 3-8-2-70	0.0 a	Nonpareil-6	0 a	Nonpareil 3-8-2-70	22.67 a b c
2-19E	0.0 a	Kochi	0 a	Nonpareil-5	23.17 a b c
Sweetheart	0.0 a	2-19E	0 a	Nonpareil-7	24.17 a b c
Nonpareil-Nico	0.0 a	Sweetheart	1 a	Nonpareil-J	28.17 a b c
Chips	0.0 a	Chips	1 b	Nonpareil-DR	30.33 a b c
Kahl	0.2 a b	Kahl	1 b	Nonpareil-Newell	33.33 b c
Marcona	0.3 b	Marcona	1 b	Kochi	51.00 c d
Winters	1.2 c	Winters	2 c	2-19E	68.67 d

Results and Summary

Yields at the McFarland Trial showed some sign of alternate bearing in 2012 with average yield and yield per unit light intercepted similar to 2010 (Fig. 1). The orchard tends to go through fairly severe stress cycles as evidenced by the -15 to -18 bar midday stem water potentials seen in May 2009 (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 has been significantly improved.

Average bloom progression for 2006-2013 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 2006-2013 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 also been severe problems with *Alternaria* and hull rot in the orchard (especially in 2008) and both have generally been worse in the wetter trees so this will also be investigated. In 2013, hull rot again decreased in severity for Winters and was moderate in the Nonpareil clones. Hull rot was least severe in Marcona, Kahl and Chips (Table 4).

Yield per unit light (PAR) intercepted decreased notably in 2012 with most values being below 50 kernel pounds per unit light intercepted (Table 1).

Acknowledgements

Thanks to the Almond Board of California and the Billings Ranches for supporting this work in 2013

Figure 2. Average bloom progression for McFarland Trial by variety from 2006-2013.

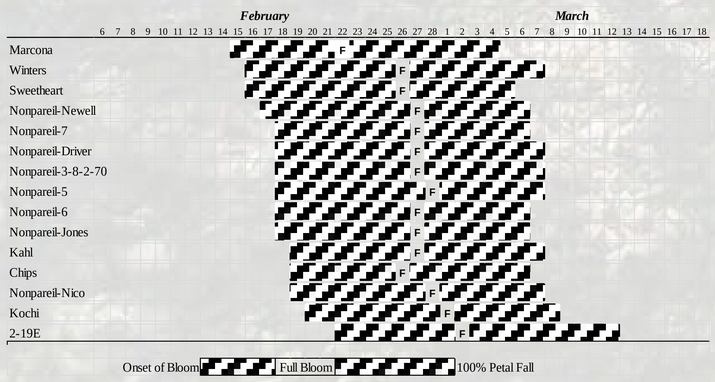

Figure 3. Average hull-split progression for McFarland Trial by variety from 2006-2013.