Regional Almond Variety Trials for Cultivar Evaluation in California

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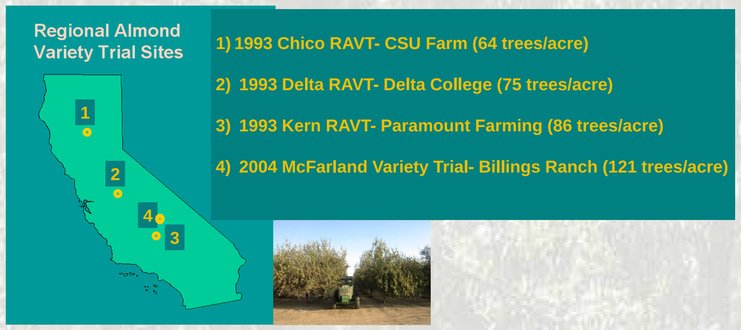

Background

Regional Almond Variety Trials (RAVTs) were designed to evaluate newer varieties in a semi-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 are growing 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).

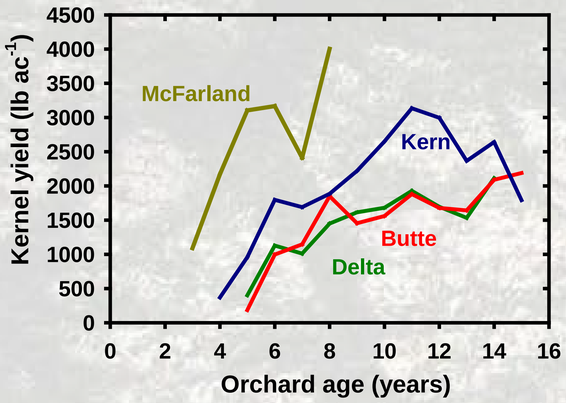

Fig. 1. Average annual yield for all varieties and selections combined at each trial by orchard age.

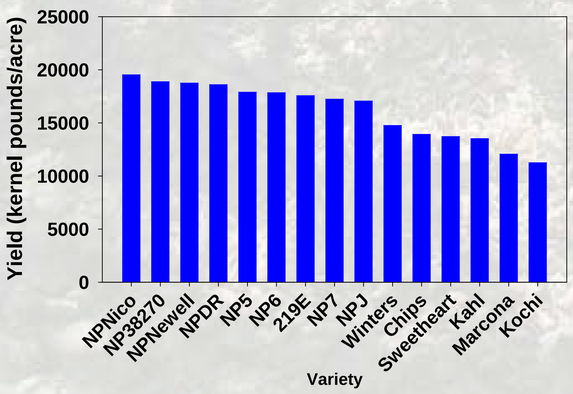

Fig. 2. Average cumulative yield (2006-2011) by variety for McFarland trial.

Kern- McFarland Variety Trial

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

Varieties	Nonpareil clones
Selection 2-19e	Nonpareil- 3-8-2-70
Chips	Nonpareil- 5
Kahl	Nonpareil- 6
Kochi	Nonpareil- 7
Marcona	Nonpareil-Driver
Sonora	Nonpareil-Jones
Sweetheart	Nonpareil-Newell
Winters	Nonpareil-Nico

Table 1. Yield and shelling percentages by year and variety. For 2010 and 2011, yield per unit light (PAR) intercepted is also presented.

2006

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel lbs/acre
2-19e	6852 a	0.94 g	53.0 d	14.2 a	1718 a	1718 a
Winters	6648 a	0.87 h	53.4 d	12.7 a	1540 a	1540 a
Marcona	3611 bcd	1.31 a	30.7 f	10.4 b	1258 b	1258 b
Nonpareil-Ni	4246 b	1.09 cde	67.2 a	10.2 b	1232 bc	1232 bc
Nonpareil-5	3713 bcd	1.12 bcd	67.9 a	9.1 bcd	1110 bcd	1110 bcd
Nonpareil-D	3867 bc	1.07 def	63.4 abc	9.1 bcd	1103 bcd	1103 bcd
Nonpareil-3827C	3848 bc	1.07 cde	64.6 ab	9.1 bcd	1101 bcd	1101 bcd
Nonpareil-New	3815 bc	1.07 cde	67.7 a	9.0 bcd	1086 bcd	1086 bcd
Nonpareil-6	3886 bcd	1.12 bc	67.0 a	8.9 bcd	1075 bcd	1075 bcd
Nonpareil-J	3717 bcd	1.08 cde	64.0 abc	8.8 bcd	1066 bcd	1066 bcd
Chips	3623 bcd	1.02 f	53.8 d	8.1 bcde	985 bcde	985 bcde
Kochi	3134 cd	1.16 b	59.9 c	8.0 cdef	965 cdef	965 cdef
Nonpareil-7	3288 bcd	1.08 cde	65.1 a	7.8 def	940 def	940 def
Kahl	3139 cd	1.06 ef	47.8 e	7.3 def	889 def	889 def
Sweetheart	2777 d	0.95 g	67.8 a	5.8 f	588 f	588 f

2007

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel lbs/acre
2-19e	13149 a	0.78 e	54.3 d	22.8 a	2756 a	4474 a
Winters	11972 ab	0.83 de	60.2 b	21.8 ab	2634 ab	4173 a
Nonpareil-Newl	10659 bc	0.90 bc	67.3 a	20.9 abc	2536 abc	3626 b
Nonpareil-Nico	9260 cde	0.92 bc	66.0 a	18.8 abcde	2279 abcde	3511 b
Nonpareil-Driver	9793 cd	0.91 bc	65.6 a	19.6 abcd	2370 abcd	3474 b
Nonpareil-3827C	9340 cde	0.92 bc	66.3 a	18.9 abcde	2291 abcde	3393 b
Nonpareil-5	8905 cdef	0.95 b	67.0 a	18.6 abcde	2251 bcde	3323 bc
Marcona	6938 fg	1.08 a	29.8 f	16.5 defg	1995 defg	3252 bcd
Kahl	9594 cd	0.91 bc	47.6 e	19.3 abcd	2332 abcd	3222 bcd
Nonpareil-J	9137 cde	0.89 bcd	65.5 a	17.8 bcde	2152 bcdef	3218 bcd
Nonpareil-6	8396 def	0.94 b	67.1 a	17.4 def	2103 def	3178 bcd
Nonpareil-7	9517 cd	0.92 bc	67.9 a	19.3 abcd	2332 abcd	3140 bcd
Chips	7681 defg	0.87 cd	54.4 d	14.7 efg	1780 efg	2766 bcd
Kochi	6006 g	1.08 a	59.4 bc	14.3 fg	1729 fg	2694 de
Sweetheart	6767 fg	0.89 bcd	66.6 a	13.1 g	1588 g	2165 e

2008

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel lbs/acre
2-19e	13472 a	0.93 g	54.3 d	27.4 cd	3321 cd	7795 a
Nonpareil-Nico	13879 a	1.10 cd	66.0 a	33.5 a	4056 a	7567 ab
Nonpareil-New	11916 bcd	1.09 de	67.3 a	28.6 cd	3456 cd	7110 bc
Nonpareil-3827C	12506 bcd	1.17 cd	66.3 a	30.7 b	3714 b	7106 bc
Nonpareil-Driver	12729 abc	1.07 de	65.6 a	29.8 bc	3611 bc	7085 bc
Nonpareil-5	12883 ab	1.08 de	67.0 a	30.5 b	3692 b	7001 bc
Winters	9872 e	1.02	60.2 b	22.1 g	2670 fg	6843 c
Nonpareil-7	13250 ab	1.06 de	67.9 a	31.1 ab	3763 ab	6802 c
Nonpareil-6	10707 de	1.16 c	67.1 a	27.3 cd	3300 cd	6478 cd
Nonpareil-J	11071 d	1.09 cde	65.5 a	26.6 de	3224 de	6442 cd
Kahl	10720 de	0.96 fg	47.6 e	22.6 fg	2733 fg	5954 de
Chips	11465 cd	0.97 fg	54.4 d	24.4 ef	2956 ef	5722 e
Sweetheart	13149 ab	0.82 g	66.6 a	23.9 ef	2893 ef	5059 f
Marcona	4721 f	1.39 a	29.8 f	14.4 h	1748 h	5001 f
Kochi	5882 f	1.28 b	59.5 bc	16.5 h	2002 h	4996 f

2009

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel lbs/acre
Nonpareil-Nico	13773 ab	1.05 bcd	74.7 ab	32.9 a	3977 a	11417 a
Nonpareil-Newl	14513 a	1.03 bcd	74.8 ab	33.1 a	4004 a	11145 ab
2-19e	14706 a	0.84 f	65.6 f	27.1 c	3285 c	11080 ab
Nonpareil-Driver	13856 ab	1.08 ab	75.8 a	32.9 a	3977 a	11062 ab
Nonpareil-3827C	13756 ab	1.04 bcd	74.6 ab	31.4 ab	3798 ab	10905 abc
Nonpareil-5	12070 bcd	1.08 ab	74.2 ab	28.7 bc	3476 bc	10494 bcd
Nonpareil-7	13051 ab	1.03 bcd	72.6 abc	29.5 bc	3571 bc	10393 bcd
Nonpareil-6	13505 ab	1.02 bcd	71.2 cd	30.3 abc	3661 abc	10139 cd
Nonpareil-J	12803 abc	1.04 bcd	71.6 bcd	29.0 bc	3513 bc	9955 de
Winters	9434 ef	0.96 bcde	61.6 g	20.0 e	2415 e	9258 ef
Kahl	11035 cde	0.87 ef	59.1 g	21.1 de	2559 de	8513 fg
Chips	9271 ef	0.93 def	58.6 g	20.0 e	2422 e	8144 gh
Sweetheart	12798 abc	0.85 ef	73.3 abc	24.0 d	2906 d	7965 gh
Marcona	8977 fg	1.07 abc	32.5 h	21.2 de	2562 de	7563 hi
Kochi	7252 g	1.17 a	68.9 de	18.7 e	2259 e	6955 i

2010

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per Yield/PAR	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel lbs/acre
Nonpareil-Nico	9521.8 abc	1.24 abcdef	72.5 ab	49.7 a	25.9 a	3141 a	14568 a
Nonpareil-Newell	8429.4 cde	1.31 ab	73.6 a	45.2 abcd	24.2 ab	2931 ab	14099 ab
Nonpareil-38270	8823.4 bcd	1.28 abcd	72.3 ab	47.0 abc	24.8 ab	3011 ab	13915 abc
Nonpareil-Driver	8368.2 cde	1.28 abcd	71.0 ab	46.2 abcd	23.5 ab	2849 ab	13910 abc
Nonpareil-5	9410.2 abc	1.24 abcde	72.3 ab	50.8 a	25.8 a	3130 a	13579 abc
Nonpareil-7	10611.8 ab	1.16 bcdef	69.8 ab	49.3 ab	27.1 a	3281 a	13510 abc
Nonpareil-6	9498.9 abc	1.21 abcdef	71.8 ab	48.6 ab	25.4 ab	3080 ab	13219 bc
2-19e	6832.8 efg	1.10 bcdef	56.1 e	33.7 defg	16.6 cde	2020 cde	13100 bc
Nonpareil-Jones	8314.7 cde	1.23 abcdef	70.9 ab	43.8 abcd	22.6 abc	2736 abc	12691 c
Winters	6601.3 efg	1.11 bcdef	60.7 cde	38.4 abcdef	16.0 de	1945 de	11203 d
Chips	9089.0 abc	1.15 bcdef	65.9 abc	48.3 ab	23.0 ab	2789 ab	10933 d
Kahl	7587.0 cde	1.01 f	56.5 de	43.4 abcd	16.9 cde	2048 cde	10561 de
Sweetheart	10915.5 a	0.80 g	71.8 ab	35.1 cdefg	19.3 bcd	2336 bcd	10300 def
Marcona	5072.7 gh	1.28 abc	26.2 g	36.8 bcdef	14.4 de	1745 de	9307 fg
Kochi	3902.2 h	1.40 a	64.4 bcd	23.4 g	12.1 e	1466 e	8421 g

2011

Variety	No. of nuts/tree	Average kernel wt (g)	Shelling percentage	Kernel pounds per unit PAR int.	Kernel pounds per Tree	Kernel pounds per Acre	Cumulative kernel yield (lbs/acre)
Nonpareil-Nico	18776.9 a	0.99 bcde	68.0 abc	86.7 a	41.0 a	4964.2 a	19522.7 a
Nonpareil-3-8-2-70	17744.2 abc	1.05 bc	70.7 a	87.9 a	41.0 a	4962.3 a	18878.1 ab
Nonpareil-Newell	17790.9 abc	1.00 bcd	70.1 ab	81.0 ab	39.2 a	4744.7 a	18746.5 ab
Nonpareil-Driver	17943.0 ab	0.98 bcde	66.0 abcd	84.3 a	38.7 ab	4682.6 ab	18593.4 abc
Nonpareil-5	15744.6 de	1.03 bc	70.4 ab	78.0 ab	35.9 abc	4341.9 abc	17886.9 bcd
Nonpareil-6	16630.0 bcde	1.04 bc	70.0 ab	81.6 ab	38.1 ab	4618.5 ab	17838.3 bcd
2-19e	18253.3 ab	0.91 bcde	64.8 abcd	73.6 ab	36.8 ab	4459.7 ab	17560.0 bcd
Nonpareil-7	17078.8 abcd	0.83 e	69.2 abc	76.1 ab	31.4 bcd	3804.0 bcd	17235.0 cd
Nonpareil-Jones	16992.6 abcd	0.96 bcde	70.0 ab	81.6 ab	36.0 abc	4359.4 abc	17050.7 d
Winters	15979.0 cde	0.83 e	58.7 ef	76.3 bc	29.3 cde	3553.5 cde	14757.0 e
Chips	11900.6 f	0.94 bcde	60.3 de	51.4 de	24.6 de	2984.7 de	13917.8 e
Sweetheart	14989.2 e	0.86 de	64.1 bcde	52.5 de	28.2 de	3411.8 de	13712.5 e
Kahl	12420.0 f	0.89 cde	53.5 f	59.1 cd	24.4 de	2953.2 de	13514.3 e
Marcona	9633.4 g	1.07 b	30.8 g	51.8 de	22.7 e	2746.0 e	12053.7 f
Kochi	8701.4 g	1.22 a	63.5 cde	43.4 e	23.3 e	2825.2 e	11246.5 f

Table 2. Scab rating and hull rot strikes per tree for 2011 season by variety.

	Scab Rating		*Alternaria rating*		*Hull Rot Strikes*	
Chips	0.00 a	Price	0.66 a	Kahl	2.33 a	
Kahl	0.00 a	Nonpareil-Nico	0.67 a	Marcona	3.33 a	
Kochi	0.00 a	Nonpareil-7	0.67 a	Chips	5.00 a	b
Marcona	0.00 a	Nonpareil-J	0.83 a	b	Nonpareil-DR	10.33 a b
Nonpareil 3-8-2-70	0.00 a	Sweetheart	1.00 a	b	Nonpareil-Nico	10.67 a b
Nonpareil-5	0.00 a	Nonpareil-Newell	1.00 a	b c	Nonpareil-5	15.00 a b
Nonpareil-6	0.00 a	Nonpareil-5	1.00 a	b c	Nonpareil 3-8-2-70	22.00 a b c
Nonpareil-7	0.00 a	Nonpareil-6	1.00 a	b c	Nonpareil-J	26.67 a b c
Nonpareil-DR	0.00 a	Nonpareil 3-8-2-70	1.00 a	b c	Nonpareil-7	31.00 a b c
Nonpareil-J	0.00 a	2-19E	1.17 a	b c d	Nonpareil-Newell	34.00 a b c
Nonpareil-Newell	0.00 a	Nonpareil-DR	1.17 a	b c d	Nonpareil-6	39.67 a b c
Nonpareil-Nico	0.00 a	Chips	1.50	b c d	Sweetheart	48.67 a b c
Price	0.00 a	Marcona	1.67	c d e	2-19E	94.00 b c
Sweetheart	0.00 a	Kochi	1.83	d e	Winters	104.83 c
2-19E	0.17 b	Winters	2.33	e	Kochi	325.83 d
Winters	3.00 c	Kahl	2.33	e	Price	

Table 3. Bloom progression for McFarland Trial by variety for 2011 season.

Onset of Bloom		*Full Bloom*		*Petal Fall*	
Winters	13-Feb a	Marcona	23-Feb a	Marcona	5-Mar a
Sweetheart	16-Feb b	Sweetheart	23-Feb a	Sweetheart	5-Mar a
Nonpareil-J	16-Feb b c	Winters	27-Feb b	Price	6-Mar a b
Marcona	17-Feb b c d	Price	28-Feb b c	Chips	6-Mar a b
Nonpareil-Newell	17-Feb b c d	Chips	28-Feb b c d	Nonpareil-7	6-Mar a b c
Nonpareil-7	17-Feb b c d	Nonpareil-J	28-Feb b c d	Nonpareil-Newell	6-Mar a b c
Nonpareil-DR	18-Feb b c d	Kahl	28-Feb b c d	Nonpareil-5	6-Mar a b c
Nonpareil 3-8-2-70	18-Feb b c d	Nonpareil-Newell	1-Mar b c d	Kahl	6-Mar a b c
Nonpareil-6	18-Feb b c d	Nonpareil-7	1-Mar b c d	Nonpareil 3-8-2-70	6-Mar a b c
Nonpareil-5	18-Feb b c d	Nonpareil 3-8-2-70	1-Mar c d	Nonpareil-6	7-Mar b c
Nonpareil-Nico	18-Feb b c d	Nonpareil-6	1-Mar c d	Nonpareil-J	7-Mar b c
Price	18-Feb c d	Nonpareil-DR	1-Mar c d	Nonpareil-Nico	7-Mar b c
Chips	19-Feb d	Nonpareil-5	1-Mar c d	Nonpareil-DR	7-Mar b c
Kahl	19-Feb d	Nonpareil-Nico	1-Mar d	Winters	7-Mar b c
Kochi	22-Feb e	Kochi	3-Mar e	Kochi	9-Mar d
2-19E	24-Feb f	2-19E	4-Mar e	2-19E	12-Mar e

Summary

Yields at the McFarland Trial showed some decrease in 2010 but continued to increase in 2011 reaching average yields above those of any of 1993 trials at the same age (Fig. 1). This is in spite of the fact that 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. In 2010 and 2011, every other row middle was ripped and water penetration has been significantly improved.

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 2011, hull rot was severe in Kochi and Winters and moderate in the Nonpareil clones (Table 2). Hull rot was least severe in Chips, Marcona and Kahl (Table 2).

Yield per unit light (PAR) intercepted was very high in 2011 with most values being above 50 kernel pounds per unit light intercepted (Table 1).

Acknowledgements

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