

Almond Board of California  
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**Project No.:** 92-L19 - Field Evaluation of Almond Varieties and Rootstocks

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**Objectives:** 1) Continue data collections and observations from new and selected older varieties in the Butte and Delta RVTs. 2) Finalize plans for and plant three RVTs in early 1993 to evaluate new varieties that were not included or adequately tested in current plots. These trials will be strategically located throughout California's almond growing districts. 3) Make further cross-pollinations to identify the pollen compatibility of newer varieties. 4) Continue collection of yield, nut quality and tree size data from the rootstock evaluation plots in Fresno and Merced Counties. Continue obtaining compatibility and production information on varietal compatibility and/or interstem studies with Marianna 2624 plum in Colusa and Butte Counties. 5) Summarize and analyze data associated with this project and publish and otherwise disseminate this information as appropriate.

**Abstract**

Production was good to excellent for most varieties in both the CSU, Chico and S.J. Delta College RVTs. Price showed alternate bearing tendencies in both trials while Sonora showed this tendency in the Chico but not the Delta College plot. Locations for three new RVTs were secured. Varieties were selected and propagated for these new trials and trees will be planted in early 1993.

The pollen compatibility group for Wood Colony has been confirmed and probably the group for Rosette identified but further confirmation will be needed. 1992 results also questioned the cross-compatibility of Butte and Monterey.

Results from two rootstock plots differed by scion variety and location. In a seven-year-old Western Fresno County plot hybrid rooted trees were larger and, while differences were usually not significant, tended to out produce those on peach rootstocks with both Nonpareil and Fritz.

However, in a trial on sandy soil in Merced County there were no differences after three years in tree size between hybrid and peach rooted trees. In the fourth season in this plot there were no differences in yield among the rootstocks with a Nonpareil scion but with Carmel hybrid rootstocks tended to slightly out produce trees on peach.

### **Experimental Procedure:**

The procedures used for variety and rootstock evaluation, including graft compatibility of almond varieties on Marianna 2624 rootstock were the same as used in previous years as were those for studying pollen cross-compatibility.

### **Results and Discussion:**

**Regional Variety Trials.** Production and nut quality data was again collected from many, but not all varieties in the older RVT's at California State University at Chico and San Joaquin Delta College (Manteca). Yields in 1992 generally ranged from excellent to good depending on variety and location. However a few varieties yielded poorly.

In the California State University at Chico plot, most of the varieties that were evaluated in the original planting yielded well with Price, Norman, Ne Plus Ultra and Butte all produced 3000 meat pounds or more per acre. These varieties were followed closely by Sonora, Nonpareil and Carrion (table 1). Padre and Fritz were the lowest yielding, producing a little under 2000 meat pounds per acre. In this trial Price and Sonora are both showing the alternate bearing tendencies for which they are noted, as they yielded well this year after producing poorly in 1991. In 1987 four varieties were added to this plot. Of these, Mono was the highest yielding in 1992 (table 1). Aldrich and Ne Plus Ultra gave 12% double kernels with all other evaluated varieties being 4% or less. All varieties had under 10% worm damage.

At the San Joaquin Delta College RVT, production was also generally good. In the original planting, the highest producing varieties evaluated were Mono, Sonora, LeGrand, Livingston and Ruby while the poorest yielding were Carmel, Price, Peerless (shelled basis), Tokyo and Fritz (table 2). It is interesting to note that in this trial while Price is alternate bearing (heavy crop in 1991 and poor production this year), Sonora has now produced four consecutive large crops. Seven varieties were added to this planting in 1984. Of these Rosetta was the highest yielding while Pearl produced very poorly and Wood Colony and Jeffries had only fair production in 1992. Valenta, Dottie Won, Pearl, Monterey and Peerless had 10% or more double kernels while the other varieties being evaluated were all below 10%. The following varieties had 10% or more worm damage (mostly Navel Orangeworm): Pearl, Dottie Won, Thompson, LeGrand, Sauret #1 and Jordanolo.

Three new Regional Variety Trials (RVT's) will be planted in early 1993. These will be located at California State University at Chico, San Joaquin Delta College in Manteca and Paramount Farming in Kern County. Varieties to be included in these plantings are Nonpareil and Mission as standards; Butte, Carmel, Fritz, Monterey, Padre, Price and Sonora as "new standards"; 17 varieties (mostly newer ones) that have not been tested or not adequately tested in current RVT's and 6 numbered selections.

**Pollination.** Studies on the cross-compatibility of a number of varieties were continued. This year's data confirmed that Wood Colony is in the Thompson group and is not pollen compatible with any members of this group. Also there was a strong, though not conclusive, indication that Rosetta is in the Ne Plus Ultra group.

Results from 1992 also questioned the cross-compatibility of Butte and Monterey; thus, until the compatibility between these two varieties is clarified it is suggested that they not be included in the same planting without provision for pollination by additional varieties.

**Rootstock Plots.** In a test plot in western Fresno County, Nonpareil on Hansen peach-almond hybrid significantly out-produced this variety on either Nemaguard or Lovell peach, with trees on Bright's hybrid intermediate and not statistically different than the other stocks (Table 3). The Hansen and Bright's Hybrid rooted Nonpareil trees were significantly larger than those on the two peach rootstocks. With Fritz there were no statistically significant differences in yield among these four rootstocks; although, trees on hybrid stocks tended to produce more than those on peach rootstocks. Tree size for Fritz was smallest with Nemaguard and largest with the two peach-almond hybrid rootstocks. Fritz trees on Lovell were also significantly larger than those on Nemaguard.

On a sandy soil in Merced County six rootstocks (Nemaguard, Red-Leafed Nemaguard, Lovell and Halford peach, and Hansen and Bright's peach-almond hybrids) are being compared. After three years there was no differences in tree size as affected by rootstock. During their fourth growing season these six rootstocks gave no statistically significant differences in production of Nonpareil (Table 4). However Carmel trees on the peach-almond hybrid rootstocks tended to slightly out-produce those on peach rootstocks with trees on Bright's Hybrid significantly out-yielding those on Lovell.

Yield (1992, 1991 and 1985-90 cumulative) and number of the original trees that are still alive from a 1982 planting of 13 almond varieties on Marianna 2624 rootstock are given in Table 5. These performance factors along with the compatibility ratings listed in the 1991 report need to be considered when evaluating compatibility. Yield can be greatly influenced by weather and other conditions, thus, a six year average is given in addition to both the 1992 and 1991 data. Monarch, Planada and Sauret 2 show signs of biennial bearing in this plot; however, this may be related to variety rather than to graft compatibility. Tree survival is certainly an important factor in compatibility and significant tree loss has occurred with Mono, Livingston, Dottie Won and Sauret 2. Based on all factors it appears that Mono, Livingston and Dottie Won are incompatible on Marianna 2624. Monarch, Planada, Ripon and LeGrand, while apparently compatible, have other faults that limit their usefulness in commercial plantings (based on information gained from Regional Variety Trials).

The 1992 and 1990-92 cumulative yields for nine almond varieties grown on Marianna 2624 rootstock and planted in 1986 are shown in Table 6. While Solano was the highest yielding variety this year, its three year total yield was only mediocre. It has also shown off-color foliage and early defoliation, which are symptoms of incompatibility. For the three year period of 1990-92 Aldrich, Monterey, Wood Colony and Butte were the highest yielding. While Solano is the only variety showing definite incompatibility with Marianna 2624, the graft union on Wood Colony needs to be watched closely over the next few years. All trees on Pearl, a tenth variety originally in this planting, died several years ago.

Several selections of Marianna and other plum rootstocks were planted in 1989 to determine their compatibility with Nonpareil and Mission. While selections 16 and 75 have shown limited compatibility with Nonpareil they have not been any better if as good as Nonpareil on Marianna 2624, a reported incompatible combination. With Mission most of the experimental rootstocks have shown promise with trees having good vigor and leaf color. The exceptions were selections 30 and 9 as well as Salicina plum rootstock. Trees on these three rootstocks tended to show poor vigor (growth) and/or off-colored foliage with Mission (Table 7). In addition, three of twelve trees of

Mission on Corrotta Marianna rootstock have died. With Mission scions, all of these rootstocks produced far fewer suckers than did on Marianna 2624.

Two trials were initiated in Butte and Colusa counties in 1989 to determine if longer interstocks (8 to 10 inches or scaffold budding) of Havens 2B between Nonpareil and Marianna 2624 improved compatibility over shorter (4 inch) interstocks. A second objective was to determine if a long interstock of a compatible almond variety would work as well or possibly even better than Havens 2B. Field budding and grafting were completed this past season, and data collection will begin next year. However already most of the trees of Nonpareil directly on Marianna 2624 and those with a 8 to 10 inch interstock of Mission in the Colusa plot have either died or were doing poorly.

**Dissemination of Information:**

In an effort to make information developed from this project available to almond growers and others associated with the almond industry, at least eight presentations on varieties and/or rootstocks were made at grower/industry meetings during 1992. Three articles or reports were also published. Two chapters for new revision of Almond Orchard Management were prepared in part with information developed from this project: one on variety selection and the other on rootstock selection.

Table 1

Butte RVT Plot  
California State University, Chico (CSUC)  
Durham, California  
Yield Summary - 1992

Variety	No. of nuts/tree	Ave. wt. (gm)	Kernel no./ oz.	Weight	
				lb/ tree	l b / acre
<b>1976 Planting</b>					
<b>Early blooming varieties</b>					
Ne Plus Ultra	14246	1.37	21	42.9	3259
Sonora	12460	1.43	20	39.2	2977
<b>Mid blooming varieties</b>					
Price	22563	1.07	27	53.1	4038
Norman	20573	0.95	30	43.3	3288
Nonpareil	13856	1.24	23	37.7	2869
Carmel	13108	1.11	25	32.1	2442
Fritz	10947	1.04	27	25.0	1901
<b>Late blooming varieties</b>					
Butte	20621	0.90	31	41.1	3121
Carrion	14024	1.16	24	36.0	2733
Mission	14533	1.04	27	33.4	2537
Padre	11451	0.90	31	22.8	1731
<b>1987 Planting</b>					
Mono	8625	1.04	27	19.7	1499
Rosetta	4863	1.38	20	14.8	1128
Aldrich	6665	0.98	29	14.4	1098
Ruby	5348	1.15	25	13.6	1030

Table 2

San Joaquin RVT Plot  
Delta College  
Manteca, California  
Yield Summary - 1992

Variety	No. of nuts/tree	Ave. wt. (gm)	Kernel no./ oz.	Weight lb/ tree	Weight lb / acre
<b>1978 Planting</b>					
<b>Early blooming varieties</b>					
Sonora	13651	1.19	24	35.9	2730
Jordanolo	10261	1.34	21	30.4	2309
Ne Plus Ultra	10628	1.27	22	29.7	2254
Peerless	9224	0.97	29	19.6	1493
<b>Mid blooming varieties</b>					
Monterey	10562	1.22	23	28.3	2154
Sauret #2	10471	1.17	24	27.1	2059
Sauret #1	10367	1.12	25	25.6	1942
Nonpareil	9903	1.15	25	25.1	1905
Fritz	12159	0.84	34	22.6	1718
Price	7627	1.10	26	18.5	1402
Carmel	6596	1.17	24	17.1	1297
<b>Late blooming varieties</b>					
Mono	20707	0.91	31	41.4	3147
Le Grand	16062	1.00	28	35.6	2705
Livingston	15071	1.06	27	35.2	2675
Ruby	14086	1.06	27	33.1	2514
Padre	15136	0.90	31	30.2	2297
Thompson	13147	1.02	28	29.7	2254
Butte	14494	0.93	31	29.6	2247
Mission	13534	0.95	30	28.3	2150
Tokyo	7474	1.22	23	20.2	1533
<b>1984 Planting</b>					
Rosetta	9136	1.27	22	25.5	1940
Valenta	9587	0.94	30	19.9	1512
Aldrich	9037	0.98	29	19.5	1482
Dottie Won	7650	1.14	25	19.3	1465
Jeffries	5119	1.26	22	14.3	1085
Woods Colony	4338	1.41	20	13.5	1029
Pearl	2748	1.06	27	6.4	489

Table 3. Almond Rootstock Plot, Western Fresno County, Planted 1986, 1992 Yield and Tree size.

Rootstock	Nonpareil		Fritz	
	Yield lbs/Acre	Trunk X-Area cm <sup>2</sup>	Yield lbs/Acre	Trunk X-Area cm <sup>2</sup>
Bright's Hybrid	1606 ab	259 a	1459 a	243 ab
Hansen Hybrid	1778 a	268 a	1546 a	260 a
Nemaguard	1387 b	211 b	1357 a	210 c
Lovell	1476 b	215 b	1371 a	237 b

Table 4. Almond Rootstock Plot, Merced County, Planted 1989, 1992 Yield and Tree Size

Rootstock	Nonpareil		Carmel	
	Yield lbs/Acre	Trunk circ. (mm)	Yield lbs/Acre	Trunk circ. (mm)
Nemaguard	636 a	385 a	747 ab	368 a
Red-leaf Nemaguard	505 a	382 a	713 ab	370 a
Lovell	565 a	365 a	666 b	358 a
Halford	568 a	377 a	729 ab	370 a
Hansen Hybrid	554 a	372 a	775 ab	371 a
Bright's Hybrid	525 a	382 a	839 a	402 a



Table 5. 1982 planting to study almond variety compatibility in Marianna 2624.

Variety	Yield Pounds/Tree			Tree Survival
	1992	1991	1985-90	
Monarch	14	3	5	4/4
Planada	14	4	7	4/4
LeGrand	13	11	7	8/8
Mission	11	12	8	8/8
Fritz	11	12	9	8/8
Ruby	11	13	8	8/8
Monterey	10	16	9	8/8
Mono	10	10	6	5/8
Norman	10	10	5	8/8
Livingston	9	10	7	5/8
Dottie Won	7	6	4	6/8
Sauret 2	5	12	7	9/12
Ripon	5	5	6	8/8

Table 6. 1986 planting to study almond variety compatibility on Marianna 2624

Variety	Yield in pounds/tree	
	1992	1990-92
Solano	11	16
Wood Colony	9	21
Monterey	9	22
Sonora	9	19
Bonita	8	17
Aldrich	8	23
Butte	7	21
Grace	7	14
Valenta	6	13

Table 7. 1989 planting to study performance of Mission on Marianna selections and other plum rootstocks. Data collected in May 1992.

Rootstock	Trunk Circ. (cm)	% of trees with suckers	Union rating <sup>1</sup>	Tree Performance rating <sup>2</sup>	% of Trees alive
9	25	33	2.0	2.0	100
16	32	33	2.9	2.3	100
30	16	0	1.1	1.2	100
40	35	8	2.3	2.5	100
58	37	17	2.0	2.5	100
64	32	0	2.2	2.5	100
65	37	8	2.2	2.6	100
69	34	8	2.4	2.6	100
75	35	11	2.0	2.3	100
Corrotta Marianna	34	0	2.0	1.8	75
P. Salicina	20	0	1.7	1.3	100
Marianna 2624	37	100	2.2	2.5	100

<sup>1</sup>Union rating: 1 = bad; 2 = mediocre; 3 = good.

<sup>2</sup>Tree performance rating: 0 = dead; 1 = poor; 2 = mediocre; 3 = good.