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Project No.: 96-L23 - Field Evaluation of Almond Varieties & Rootstocks (cont. of Project 95-L22)

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Objectives:

1. Three new RVTs were planted in 1993; bloom, harvest and nut data to be collected in 1996. Observe and evaluate trees for growth, pest and disease susceptibility and noninfectious bud failure symptoms, as appropriate. Advise/assist grower cooperators for these trials on tree training and management decisions as needed.

2. Make further cross-pollinations to identify the pollen compatibility of newer varieties as well as important older varieties where this information is still lacking.

3. Continue collection of yield and tree size data from the rootstock evaluation plots in Fresno and Merced Counties. Continue obtaining information on varietal compatibility and/or interstem studies with Marianna 2624 plum in Colusa and Butte Counties.

4. Summarize and analyze data associated with this project and publish and otherwise disseminate this information as appropriate.

Abstract:

Three new Regional Almond Variety Trials (RAVTs) were planted in 1993 in Butte, Kern and San Joaquin Counties. This was the second harvest for the Kern trial and the first for the other two RAVTs. Yield and Harvest data are no longer being taken from the older RAVTs.

Production in the newer trials was at least somewhat affected by inclement bloom time weather; with the San Joaquin County trial the most affected and the Kern County plot the least affected. In the Kern RAVT Padre, Ruby, Butte, Mission, Plateau, Kahl and Yokut were the highest yielding, all producing more than 1300 kernel pounds per acre. The highest producing varieties at the Chico trial were Monterey, Carmel, Sonora and Wood Colony; each yielding over 700 kernel pounds. At the San Joaquin RAVT only about half of the plot was harvest because of low yields caused by the inclement bloom time weather. The highest

producing varieties in this trial were Chips, Ruby and Butte.

The inclement bloom time weather also caused a lack of nut set in the pollen cross-compatibility tests conducted in 1996, so that little was learned this year.

In two trials. trees on peach-almond hybrid rootstocks tended to be larger and generally out-produced those on peach rootstocks.

In trials to study the compatibility of varieties on Marianna 2624, Fritz, Le Grand, Mission, Monterey, Norman, Ripon, Ruby, Aldrich, Sonora and Wood Colony showed the best compatibility based on October ratings.

Experimental Procedures:

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

Results and Discussion:

Regional Variety Trials. Three new Regional Almond Variety Trials (RVT's) were planted in Butte, Kern and San Joaquin Counties in 1993. This was the first harvest from these trials in Butte and San Joaquin Counties and the second harvest from the one in Kern County. Yield and harvest data are no longer being taken from older RVT's.

Production in these newer trials was at least somewhat affected by inclement bloom time weather; with the San Joaquin County trial most affected and the Kern County plot least affected. All three trials are nearly identical in variety composition, with only a couple of differences; Fritz was not included at the Butte County trial (it was in the older trial at this location) and Dottie Won was added to the San Joaquin County plot. Varieties were planted on peach rootstock; Lovell for those in the Butte County plot and Nemaguard for trees in the Kern and San Joaquin Counties trials. However, one variety, Kapareil, is being grown on both peach and peach-almond hybrid rootstocks at all locations.

The Kern County trial is located in a Paramount Farming Company orchard near Shafter. A number of varieties in this trial had very good production for an orchard in its fourth growing season. Padre, Ruby, Butte, Mission, Plateau, Kahl and Yokut were the highest yielding varieties, all producing more than 1300 kernel pounds per acre (Table 1).

In this trial in 1996 only Kapareil had much worm damage. Kahl had the most blank nuts with 10%. However a number of varieties had considerable kernel shrivel; these were Ruby, Mission, Yokut, Plateau, Donna, Fritz and selection 2-19E. Monterey, Kahl, Donna and Plateau all had over 20% double kernels.

At the Butte County trial located at California State University, Chico's farm, production from most varieties was moderate for an orchard in its fourth growing season. Monterey, Carmel, Sonora and Wood Colony had the highest production at this location, all producing over 700 kernel pounds per acre (Table 2).

There was not much worm damage in this trial in 1996, with Kapareil and selection 13-1 having the most damage. Price had the most blank kernels with 10%; while selection 13-1 had a significant number of gummy kernels. Price, Yokut, Donna, Chips and Morley had a considerable amount of kernel shrivel. Only

Kahl had more than 20% double kernels.

In the San Joaquin County trial at San Joaquin Delta College Farm near Manteca inclement bloom time weather greatly reduced the crop to the point that only about half of the trial was harvested. Several varieties that were harvested really did not have an economically justifiable yield; and quite possible several varieties that were not harvested may have had greater production than some that were. The highest yielding varieties in this trial were Chips, Ruby and Butte (Table 3).

In the Delta College trial several varieties had significant worm damage; including Donna, Sonora, Dottie Won, Monterey, selection 25-75 and Nonpareil. Selection 25-75, Donna and Livingston had more than 10% blank kernels; while Ruby, selections 1-87 and 1-102W, Wood Colony and Chips had a considerable amount of kernel shrivel. Dottie Won, Monterey and Aldrich had 20% or more double kernels.

Pollination. Studies on the cross-compatibility of a number of varieties, especially newer ones, were continued; however, because of inclement bloom time weather little was learned this year. Thus, these crosses will need to be repeated in 1997.

Rootstock Plots. Four rootstocks (Bright's hybrid, Hansen hybrid, Lovell peach and Nemaguard peach) were compared during their eleventh growing season in a test plot in western Fresno County. Based on trunk circumference, trees on the two hybrid rootstocks were of similar size and significantly larger than those on the two peach rootstocks (Table 4). In 1996 trees on the two hybrid rootstocks and Lovell peach significantly out-produced those on Nemaguard peach. However, when comparing data for the past seven years, trees on the two hybrid rootstocks have often yielded significantly more than those on either peach rootstock. Trees on the hybrid rootstocks have also been larger during this period and this greater tree size probably accounts for most, if not all, of the increase in production over trees on peach rootstocks. No further collection of yield data from this trial is planned.

Trees on six rootstocks growing in a sandy soil in Merced County were compared in 1996, their eighth growing season. The rootstocks compared were Nemaguard, Red-Leafed Nemaguard, Lovell, and Halford peach and Bright's and Hansen peach-almond hybrids. With Nonpareil there were no significant differences in production among trees on any of the rootstocks. However, with Nonpareil, trees on Bright's hybrid were significantly larger than those on all peach rootstocks except Nemaguard (Table 5). With Carmel, trees on the two hybrid rootstocks significantly out-produced those on all the peach rootstocks. Trees of Carmel on Red-Leafed Nemaguard yielded significantly less than those on all rootstocks except Lovell. Also Carmel trees on the two hybrid rootstocks were the largest in this trial with those on Bright's hybrid being significantly larger than trees on all peach rootstocks.

From these trials it seems that when comparing rootstocks for almond, scion variety, soil conditions and perhaps tree age can make a difference and should be taken into consideration.

Data are no longer being collected from the 1982 planting of thirteen varieties on Marianna 2624 at the Nickels Soil Laboratory. However, on October 11, 1996 trees were rated for compatibility based on premature defoliation and graft union characteristics by Dale Kester and Warren Micke. These ratings indicated the most compatible varieties were Fritz, Le Grand, Mission, Monterey, Norman, Ripon and Ruby. Sauret 2, Planada, Livingston and Monarch appeared intermediate in compatibility, while Mono and Dottie Won seemed incompatible. Regardless of their compatibility on Marianna 2624, Le Grand, Monarch, Planada and Ripon have undesirable characteristics that limit their usefulness in commercial plantings.

Since the trees in the 1986 planting of nine varieties on Marianna 2624 are mature, yield data is no

longer being collected. Six years of yield data have been compiled and were published in the 1995 report on this project conducted at the Nickels Soil Laboratory. In 1996 these trees were visually rated for compatibility based on premature defoliation, tree vigor and graft union characteristics by Dale Kester and Warren Micke on October 11. Based on these ratings the varieties that appeared the most compatible with Marianna 2624 were Aldrich, Sonora and Wood Colony. The next group of varieties that showed general compatibility were Monterey, Valenta, Butte and Bonita. In this trial only Solano seemed to do poorly on Marianna 2624. All trees of Pearl, a tenth variety originally in this planting, died when the trees were young.

In a 1989 planting at Nickels several selections of Marianna and other plum rootstocks have been tested with Nonpareil and Mission to determine compatibility. With Nonpareil none of these experimental rootstocks were any better, if as good, than Marianna 2624 (a known incompatible combination). Thus, the Nonpareil portion of this trial has been discontinued and removed.

The Mission trees on these rootstocks were rated for general growth, vigor and compatibility by Dale Kester and Warren Micke on October 11, 1996. Based on these ratings the best rootstocks in this trial appeared to be selections 69, 40, 65 and 64. All of the trees on these rootstocks seemed to be nearly as good, if not as good, as trees on Marianna 2624. These ratings generally agreed with previous years results. The poorest trees based on these ratings were on selections 30 and 9 and on P. salicina. Twenty-five percent of the trees on Corrotta Marianna died when they were young.

While there were not many suckers in this trial in 1996, Marianna 2624 appeared to produce more than other rootstocks, which agreed with previous years results. Sucker production is a major disadvantage with Marianna 2624. The most promising selections in this trial have no real advantage over Marianna 2624 for almond unless they produce fewer suckers. Thus, sucker production by these selections needs further evaluation.

In 1989 a trial was initiated to determine if longer interstocks (8 to 10 inches or scaffold budding) of Havens 2B plum 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 perhaps even better than Havens 2B.

Based on 1996 vigor ratings and premature defoliation, scaffold budding of Havens 2B appeared superior to 4 inch interstocks of this plum, while trees with 10 inch interstocks of Havens 2B were intermediate. Use of Havens 2B as an interstock provided a better tree than a compatible almond variety in the trial at the Nickels Soil Laboratory. In a similar trial in Butte County there seemed to be little difference between Havens 2B and compatible almond varieties as interstocks between Nonpareil and Marianna 2624.

At the Nickels trial Jordanolo was superior to Mission as an interstock of a compatible almond variety. Ten inch interstocks of Mission and Nonpareil directly on Marianna 2624 have produced the poorest trees.

Dissemination of Information:

In an effort to make information developed from this project available to almond growers and others associated with this industry, at least ten presentations on varieties and rootstocks were made at grower/industry meetings during 1996-97. A booklet on the 1996 results from the new RAVTs was published and distributed at the Almond Research Conference and other meetings (a copy is included with this report). Much of the information in the chapters on Varieties and Rootstocks in the recently published "Almond Production Manual" was obtained directly from this project. Several articles and reports related to this project have also been published.

Table 1. 1996 Yield Summary for the Almond Regional Variety Trial at Paramount Farming, Kern County. Planted in 1993.

Variety	No. of Nuts/Tree	Average Kernel Weight (g)	Shelling %	Kernel Pounds Per Tree	Kernel Pounds Per Acre[1/]
Early-Mid Blooming Varieties					
Plateau	5509	1.28	45.1	15.6	1340
Kahl	6321	1.10	45.4	15.3	1319
Yokut	5621	1.24	50.5	15.3	1316
Fritz	6474	1.03	51.5	14.7	1261
Carmel	5038	1.32	55.0	14.6	1260
13-1	6211	1.04	51.6	14.2	1224
Johlyn	5443	1.18	67.0	14.2	1221
Sano	4384	1.46	58.2	14.1	1209
Monterey	4376	1.38	45.5	13.3	1141
Wood Colony	4874	1.23	57.1	13.2	1136
Jenette	3944	1.27	61.5	11.1	952
Donna	5414	0.91	45.0	10.9	935
Chips	4664	1.00	50.4	10.3	882
Sonora	3537	1.26	70.3	9.8	843
Nonpareil	3396	1.22	62.4	9.1	782
Price	3230	1.22	60.5	8.7	746
Jiml	2376	1.39	61.0	7.3	626
Rosetta	1777	1.43	44.6	5.6	481
Aldrich	2030	1.19	62.5	5.3	459
Kapareil	590	0.98	64.7	1.3	110
Late-Very Late Blooming Varieties					
Padre	8609	1.00	51.6	18.9	1624
Ruby	6488	1.14	49.2	16.3	1406
Butte	7628	0.94	54.6	15.9	1364
Mission	6808	1.05	43.6	15.7	1353
2-43W	5043	1.08	58.3	12.0	1028
2-19E	4344	1.17	47.5	11.2	963
25-75	5293	0.81	57.0	9.4	808
Livingston	3114	1.29	61.1	8.8	760
Savana	3369	1.09	63.6	8.1	697
1-87	3262	0.98	50.8	7.1	607
1-102W	1714	1.43	59.8	5.4	464
Morley	1775	1.11	46.1	4.3	372

[1/]86 Trees per acre

Table 2. 1996 Yield Summary for the Almond Regional Variety Trial at C.S.U.-Chico. Planted in 1993.

Variety	No. of Nuts/Tree	Average Kernel Weight (g)	Shelling %	Kernel Pounds Per Tree	Kernel Pounds Per Acre[1/]
Early-Mid Blooming Varieties					
Monterey	4365	1.22	47.8	11.7	749
Carmel	4272	1.23	53.2	11.6	741
Sonora	4326	1.20	79.1	11.4	732
Wood Colony	4419	1.16	50.9	11.3	724
Donna	3592	1.15	55.6	9.1	582
Price	3884	0.98	72.6	8.4	538
Johlyn	3062	1.24	67.3	8.4	537
Nonpareil	3004	1.19	61.4	7.8	498
13-1	2265	1.33	59.8	6.6	425
Sano	1834	1.44	53.0	5.8	372
Plateau	1748	1.46	47.7	5.6	360
Yokut	1822	1.40	56.0	5.6	359
Chips	2060	1.18	52.0	5.4	344
Jenette	1363	1.45	67.2	4.4	279
Aldrich	1660	1.18	54.5	4.3	275
Jiml	1346	1.38	55.6	4.1	262
Rosetta	1296	1.36	41.1	3.9	248
Kahl	1311	1.12	41.3	3.2	208
Kapareil	459	1.04	70.8	1.1	68
Kapareil/P.A.	257	1.09	74.0	0.6	39
Late-Very Late Blooming Varieties					
Padre	3631	1.06	52.9	8.4	541
Savana	3095	1.03	70.6	7.0	451
Ruby	2652	1.20	50.1	7.0	448
Butte	3125	1.01	54.0	6.9	443
Livingston	2662	1.13	60.9	6.6	425
Mission	2621	1.04	42.5	6.0	383
2-43W	1957	1.12	59.7	4.8	309
25-75	2502	0.87	56.3	4.8	308
2-19E	1817	1.08	46.3	4.3	276
Morley	1547	1.00	48.7	3.4	219
1-87	1413	0.96	51.3	3.0	190
1-102W	759	1.35	57.1	2.3	144

[1/]64 Trees per acre

Table 3. 1996 Yield Summary for the Almond Regional Variety Trial at San Joaquin Delta College, Manteca. Planted in 1993.

Variety[1/]	No. of Nuts/Tree	Average Kernel Weight (g)	Shelling %	Kernel Pounds Per	
				Tree	Acre[2/]
Early-Mid Blooming Varieties					
Chips	2136	1.19	59.7	5.6	420
Yokut	1014	1.50	61.0	3.3	251
Jenette	1014	1.35	70.9	3.0	226
Wood Colony	922	1.39	66.2	2.8	211
Donna	778	1.31	67.8	2.2	169
Monterey	653	1.42	53.3	2.0	153
Fritz	707	1.15	54.7	1.8	134
Sonora	505	1.48	80.2	1.6	123
Nonpareil	531	1.31	64.8	1.5	115
Carmel	491	1.41	64.9	1.5	114
Dottie Won	558	1.09	46.4	1.3	100
Aldrich	189	1.09	56.9	0.5	34
Late-Very Late Blooming Varieties					
Ruby	1897	1.34	56.0	5.6	419
Butte	1857	1.07	56.0	4.4	328
Padre	1054	1.27	54.0	2.9	221
Mission	1115	1.19	49.7	2.9	219
1-102W	1035	1.27	57.5	2.9	217
1-87	475	1.01	62.8	1.1	79
25-75	438	1.03	67.7	1.0	75
Livingston	374	1.18	68.9	1.0	73

[1/]Only about half of this trial was harvested in 1996 because of low yields.

[2/]75 Trees per acre.

Table 4. 1996 Yield and Tree Growth Data for Almond Rootstock Trial Planted in 1986, Harris Ranch, Coalinga, CA. Nonpareil Variety.

Rootstock	Yield Kernel Pounts/Ac.	Trunk Circumference (cm)
Bright's Hybrid	2,182 a[1]	85.7 a
Hansen Hybrid	1,939 a	87.8 a
Lovell	2,092 a	77.9 b
Nemaguard	1,502 b	75.4 b

[1/]Numbers within columns followed by the same letter are not significantly different at the 5% level.

Table 5. 1996 Yield and Tree Growth Data for Almond Rootstock Trial Planted in 1989, Arnold Farms, Atwater, CA.

	Nonpareil		Carmel	
Rootstock	Yield Kernel Pounds/Ac.	Trunk Circumference (cm)	Yield Kernel Pounds/Ac.	Trunk Circumference (cm)
Bright's Hybrid	1,576 a[1]	77.9 a	2,132 a	72.0 a
Hansen Hybrid	1,588 a	74.7 ab	1,759 a	69.8 ab
Nemaguard	1,322 a	71.4 ab	1,098 b	61.8 c
Red-leafed Nemaguard	1,446 a	68.3 b	549 c	62.5 c
Halford	1,265 a	67.6 b	1,201 b	63.6 bc
Lovell	1,119 a	67.6 b	814 bc	60.2 c

[1/]Numbers within columns followed by the same letter are not significantly different at the 5% level.