Project No: 97-JE-o0 FINAL REPORT

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Objective:

1) **Dual Variety Rows** - evaluate the effect on yield of alternating two varieties (Mission and Padre) down the same row versus solid rows of each variety.

2) **Low Volume Irrigation System Comparison** - evaluate the performance of three types of LV irrigation systems (surface drip, microjet, subsurface drip) and their effect on production of Nonpareil, Butte, Carmel and Monterey.

3) **Almond/Marianna 2624 Performance** - compare the productivity, tree growth and survivability of four almond varieties (Butte, Padre, Mission and Ruby) when planted on Marianna 2624 rootstock in a dense hedgerow.

Results:

1. *Dual Variety Rows*

Our strategy here is simply to alternate two compatible cultivars down the same hedgerow and compare yields of the same two cultivars planted in solid hedgerows. Solid rows of Padre are compared to solid rows of Mission versus rows alternating with Padre and Mission (M•P•M•P). Solid rows of Butte border all treatment rows as a pollinizer. All trees are planted to Lovell peach rootstock at 15' x 20' spacing for 145 trees per acre on Class II soil.

This years harvest represents the first year in five that we have not gained in production from the alternating design. Both varieties, Padre and Mission, did not yield significantly more when planted in dual variety rows. (See Table I).

TABLE I.

TWO VARIETY ROWS -- YIELDS - LBS/AC

Year / *Leaf*	*1993* *5th*	*1994* *6th*	*1995* *7th*	*1996* *8th*	*1997* *9th*	*Accumulative*
Mission	1652	1789	1709	1720	2114	7332
Padre	2010	1763	1702	1966	2340	9781
M•P•M•P	1921	1948	1916	2000	2236	10021
Difference	+5%	+10%	+12%	+8.5%	0%	1455 lbs

*** Difference** = Percentage or lbs./Ac difference between Mission + Padre/2 vs. M•P•M•P.

Pollinating conditions during bloom this spring were nearly ideal. Temperatures stayed in the 70's throughout this period with only one day of rain. Possibly these ideal conditions for cross-pollination allowed the solid variety rows to increase set and attain near optimal production. Generally, we have found the dual variety advantage to be greatest on poor pollination years. Loss of nutlets during "June Drop" also could have leveled out differences.

Also, the effect of the 50% Butte pollenizers in this planting may be important. The benefit of alternating two varieties down the same row would likely increase if only two varieties were planted in the block. Here, where Buttes are planted in every other row, the Butte pollen may be responsible for much of the Mission/Padre set thus masking the effect of alternating varieties. Future work will attempt to determine the Butte effect on crop set and production.

Unfortunately, due to the stick tight tendency in harvesting the Padre variety late, we cannot accomplish a once over harvest operation. Padre nuts require earlier shaking than the Mission to obtain acceptable nut removal. Two passes down the same row with the shaker is required on the alternating M•P•M•P rows. Sweeping and pickup operations are accomplished as a single pass combining the two varieties.

Special efforts (ie staking, prune to insure balanced scaffold weight, develope broad and deep root system) should be made to prevent Padre trees from leaning and eventually toppling over.

2. *Low Volume Irrigation Systems*

Micro-irrigation systems are in widespread use throughout all central valley almond

districts. Controversy continues as to the relative merits of the different types of systems--surface drip, microsprinkler/jet and subsurface drip. To evaluate these systems under commercial conditions a 22 acre replicated field trial was established in 1990 planted to Nonpareil (⅓), Butte (⅓), Carmel (1/6) and Monterey (1/6). Eight irrigation designs are under evaluation:

1. Surface drip single hose 4-1 gph emitters
2. Surface drip - double hose - 8-0.5 gph emitters
3. Micros - single fanjet - 10.5 gph
4. Micros - double fanjet 2@ 5.25 gph
5. Micros @ 1.5 Et double fanjet 2 @ 7.9 gph
6. Subsurface drip RAM single hose 4-1 gph emitters
7. Subsurface drip RAM double hose 8-0.5 gph emitters
8. Subsurface drip Geoflow double hose 8 - 0.5 gph emitters

(Note that two new treatments were converted from standard micros this season, #4 double microjets and #5 double microjets @ 150% ET.)

An analysis of the 1997 yield data (Table I) shows that microsprinklers produced higher yields than any drip system tested in one of the four varieties - Monterey. Also found was a trend towards higher yields from microjets for Butte and Nonpareil. This yield advantage has occurred in prior years in this test, but remains inconsistent between varieties and seasons. The shallow, coarse textured soil at this site most likely exaggerates this advantage of micros over drip in this test. Furthermore, 1996/97 winter rainfall of 15" may have supplied more available moisture to the microjet irrigated trees than was captured by the restricted root systems of the drip irrigated trees.

Use of single hose subsurface drip generally resulted in lower yields than other systems. Double hose subsurface production, however, equaled that of surface drip (except for Monterey).

TABLE I. 1997 YIELDS -- LBS/AC

	NONPAREIL	BUTTE	CARMEL	MONTEREY
Micro 1.5 ET	2524 a	2832 N.S.	2123 N.S.	2076 ab
Micro	2179 ab	2513	1888	2252 a
Micro double	2176 abc	2601	1803	2095 ab
Drip	1991 bcd	2468	2002	1948 bc
Subsurface Geoflow double	1930 bcd	2329	1819	1769 bcd
Subsurface RAM double	1762 cde	2514	1829	1660 cd
Drip double	1739 de	2492	1841	1784 bc
Subsurface RAM single	1383 e	2211	1814	1446 d

N.S. = Yields not significantly different, numbers followed by the same letter are not significantly different, Fisher's LSD P=0.10.

Water Meters indicate the total amount of irrigation applied for the season was 39 inches. Scheduling was based on meeting ET as determined by the Colusa CIMIS station data. Micros received 2-3 irrigations per week while all drip types operated 5-6 days per week.

The tendency of 1.5 ET micros to out yield the 1.0 ET micros (although inconsistent) may indicate that our water application rate for micros is inadequate. Maintaining equal water application rates between drip and micro systems is necessary to conduct a scientifically sound system comparison. However, this requirement may be limiting the performance of micros in this test. Applying equal amounts of water for all systems would favor the most efficient type (drip) and result in less water supplied to the roots of the less efficient system (micro). Adjusting water rates optimally for each system would allow a more useful commercial evaluation of these systems for almond production.

Other information gathered this year includes ratings taken for navel orangeworm damage on the Monterey kernels which showed no difference in reject levels between the irrigation systems. Measurements also showed that trunk growth was equal between the systems and related to yield. Butte trees with the most crop grew the least while other varieties grew more in proportion to lower crop loads. Aerial photography clearly showed a larger and more densely developed canopy for most microjet irrigated trees verses drip and subsurface drip trees. Ratings for Carmel bud failure/crazy top generally showed Micros to be less affected, drip more affected and subsurface drip most affected. Again this year weeds were more troublesome in the microjet areas and required two more herbicide sprays than drip. Harvest raking was not required for the subsurface drip irrigated plots.

3. ***Almond-Marianna 2624 Performance***

Prior research at Nickels Soil Lab suggested that many almond cultivars can be quite productive when planted on Marianna 2624 plum rootstock. But, this rootstock has a considerable dwarfing effect on most almond varieties and requires tighter tree spacing to realize its maximum bearing potential. Mission, Ruby and Padre cultivars have shown excellent compatibility with M2624. However, the Butte cultivar has shown inconsistent performance on M2624.

This test planting was established in 1989 to evaluate 4 almond cultivars in a close planted hedgerow on M2624 rootstock. Commercially harvestable replications were designed into the test for yield data collection. Butte, Mission, Ruby and Padre almonds were planted as single rows at 10' x 20' spacings for a 218 trees/ acre.

Yields continued to climb in this 9th leaf test orchard (Table I.). All varieties exceeded 2000 lbs./Ac., with Padre highest at 2785 lbs./Ac. Mission again lagged behind with 2256 lbs./Ac. For the first time, these production levels exceeded those of the same varieties on Lovell rootstock planted nearby at 15' x 20' on somewhat deeper soil. Kernel

sizes were normal and presented in Table II.

All four varieties have continued to perform satisfactorily on M2624 rootstock, with few tree losses occurring. Some canopy expansion is still required to adequately fill allotted space and reach optimum bearing potential. The twenty feet distance between rows for M2624 may prove to be too wide given the shallow soil at this test site and dwarfing effect of plum rootstock. A more appropriate row width would be 18 feet. Suckering (typically troublesome with M2624) has been reduced by deeper tree planting. Growers considering M2624 blocks may want to special order trees high budded to allow deeper planting to help prevent root suckers.

The leaf scorch symptoms reported previously continue to show only in the Butte variety. Beginning in June, this marginal leaf necrosis occurs on random limbs in scattered trees. Affected trees appear smaller in size while individual limbs affected show reduced vigor and defoliate before harvest. No disease organism, salt, fertilizer, chemical, or other cause has been found to explain this symptom.

TABLE I.

YIELD LBS/AC -- 1991-1997

Year	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*
Leaf	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*
Mission	177	780	1772	1596	1619	1555	2256
Padre	252	973	2097	1706	1305	2302	2785
Ruby	178	936	1857	1843	1682	2055	2514
Butte	361	1229	1893	1695	--	1945	2427

TABLE II.

KERNEL SIZE

	kernels/oz	gms/K
Padre	30	.94
Butte	31	.91
Mission	28	1.0
Ruby	24	1.2