Project Title: Nickels Soil Lab Projects (listed as Micro-Irrigation Hedgerows in Proceedings)

Final Report to the Almond Board April 1999
Project No 98-JE-o0

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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 micro-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 survival 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 varieties down the same hedgerow and compare yields of the same two varieties 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) down the row. 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.

Yield results for 1998 show a 300 lb/Ac advantage for Padre when alternated with Mission down the row verses Padre in a solid row. (Table 1) However, Mission when alternated down the row did not respond positively this season.
The effect of Butte on Padre and Mission set must be significant in this block. We suspect that Butte pollen fertilizing Padre flowers in solid rows of Padre greatly increases yields and "masks" the real potential advantage of alternating Mission in the row. To examine this we used paternity testing with

the help of Plant Development International, Bakersfield, California.

Isozyme analyses of Padre nuts showed 55% Mission pollen parentage in alternating P.M.P. rows and only 30% in rows of solid Padre. (Table 2)

Only 5-10% of Padre were found by isozyme analysis to be set by outside pollen (likely Nonpareil). This leaves 35-40% Butte parentage for Padre in alternating rows and 60-65% Butte parentage in solid rows. Padre set in solid Padre rows was greatly affected by Butte. This supports our suspicion that Butte maybe limiting the positive effect of alternating varieties down the row.

But even with the equalizing effect of Butte in this test we still find that alternating varieties shows yield advantages. Rows planted with alternating M•P•M or P•B•P would likely show a greater yield advantage verses solid rows of 2 varieties than our test where a third variety, (Butte) is planted.

This orchard continues to experience poorly anchored Padres greatly due to the shallow soil use of a single hose drip system. Ratings made on individual trees this season showed 13% of all Padre trees leaned significantly while only 1% of all Mission leaned. Many of these will undoubtably fall over. Extra attention seems necessary with Padre to develop vertical trunks, well balanced canopies and strong roots to limit this tree loss problem or avoid the severe pruning necessary to retain trees.

Table 1.
Two Variety Rows
1998 Yields

Lbs. Per Acre

Padre Solid	2738 a
Padre-M	3051 b
	P<0.10
Mission Solid	1591
Mission•P	1309
	NS

Table 2.
Paternity Testing Results - Padre Nuts

Orchard Design	B	P	B	P	B
	B	M	B	P	B
	B	P	B	P	B
	B	M	B	P	B
	B	P	B	P	B
Pollen Source of Padres =		55% M 5-10% Non 40% B		30% M 5-10% Non 65% B	

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, SDI. To evaluate these systems under commercial conditions a 22 acre replicated field trial was established in 1990 planted to Nonpareil (1/3⅓), Butte (1/3⅓), Carmel (1/6) and Monterey (1/6). Eight irrigation designs are under evaluation:

1. Surface drip single hose 4-1 gph Netafim PC emitters
2. Surface drip - double hose - 8-0.5 emitters Bowsmith TFS-05
3. Micros - single - 10.5 gph Bowsmith fanjet E blue
4. Micros - double fanjet 2 @ 5.25 gph Bowsmith fanjet C orange w/ FJ-10
5. Micros @ 1.5 Et double fanjet 2 @ 8.4 gph C orange
6. Subsurface drip RAM PC single hose 4-1 gph emitters
7. Subsurface drip RAM PC double hose 8-0.5 gph emitters
8. Subsurface drip Geoflow double hose 8-0.5 gph emitters

The trial received about 32" of rainfall last season thoroughly wetting the soil profile to 4 feet. The amount of irrigation water applied was kept equal for all systems throughout the season. Flow meters measured seasonal applied water at about 0.9 Et_c. Tree moisture stress levels as monitored by pressure bomb readings were minimal except for short periods in August. Abnormal weather resulted in 2.0" of rain falling in each of the months of March, April and May.

Production for 1998 Nonpareil and Butte figures show about a 10% yield advantage to microjets over both drip and subsurface drip systems. Monterey yields show SSD below Drip and Micros which were equal. Again no differences in yields were found between any system for Carmels. The retrofitted microjet system applying 1.5 ET_c resulted in higher yields for the Butte and Monterey varieties but not for Nonpareil or Carmel when compared to micros applying 1.0 Etc. The 1.5 treatment was added in 1997 to double check the adequacy of our 1.0 ET_c calculated application rate. The data provide some indication that Butte and Monterey respond to moisture levels higher than our ET_c amounts at least under high yield conditions ie above 3000 lbs/Ac.

No difference in kernel size was found between any of the irrigation systems, for any variety.

A new development this season was the discovery of significant root intrusion in the subsurface emitters. Water flow rates were reduced for some SDI trees due to emitter plugging and root growth inside the buried tubing. High rate chlorine injections (250 ppm) failed to solve the problem. Trifluralin herbicide will be injected to correct this problem. Microjet orifices were also plugged repeatedly with insect eggs (Fullers rose weevil) resulting in increased maintenance expense.

Detailed soil moisture measurements were taken for trees irrigated with single drip hoses. Soil moisture levels declined predictably in the densely rooted soil beneath emitters. Soil moisture some nine feet out from the drip hose (beneath row middles) also declined from March to July. The pattern of decline indicates that tree roots extracted water far out beyond the confined root zone irrigated in summer.

This confirms the idea that even drip irrigated trees can widely access winter stored moisture. It also suggests that micro irrigated trees may not always have a big advantage in this regard. Typical rainfall for this location is 16-17" vs. 32" this season. Apparently, spring and fall root growth has extended rooting far beyond summer irrigated zones.

MICRO-IRRIGATION
ALMOND YIELDS
1998

Lbs/Acre

System	VARIETY				Average
	NonPareil	Butte	Carmel	Monterey	
Drip	2419 b	2822 bc	1727	2243ab	2283bcd
Drip Double	2342 b	2767 bc	1841	2005bc	2239bcde
Micros	2736 a	2984 b	1891	2295ab	2476ab
Micros Double	2387 b	3016 ab	1826	2208ab	2359bc
Micros Double 1.5	2745 a	3514 a	1953	2404a	2654a
Subsurface Drip-Netafim Single	2337 b	2505 c	1525	1847c	2053e
Double	2349 b	2495 c	1596	1815c	2064de
Geoflow Double	2310 b	2792 bc	1607	2102abc	2203cde

Fisher's LSD P=0.10

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 218 trees/ acre.

Yields continued to climb in this 10th leaf test orchard (Table I.). All varieties exceeded 2000 lbs./Ac., with Padre highest at 3226 lbs./Ac. Mission again lagged behind with 2251 lbs./Ac. 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.

For the second consecutive year, M2624 production levels exceeded those of the same varieties on Lovell rootstock planted nearby at 15' x 20' on somewhat deeper soil. Also, Padres on M2624 are not leaning over in these short statured trees like Padres on Lovell as reported in the Dual Variety Test.

The leaf scorch symptoms reported previously for the Butte variety on M2624 did not develop this season. Usually, beginning in June, 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 -- 1991-1998

Year	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
Leaf	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*
Mission	177	780	1772	1596	1619	1555	2256	2251
Padre	252	973	2097	1706	1305	2302	2785	3226
Ruby	178	936	1857	1843	1682	2055	2514	2557
Butte	361	1229	1893	1695	--	1945	2427	2808

TABLE II.

KERNEL SIZE

	kernels/oz	gms/K
Padre	28	.99
Butte	32	.89
Mission	26	1.07
Ruby	24	1.16