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Project No. 92-14 - Effects of Irrigation Cutoff

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Objectives: 1) **Cutoff Experiment** - to evaluate flowering and fruit set following post-harvest irrigation ranging from 0.9 to 7.2 acre-inches/acre (hereafter referred to as inches).

2) Regulated Deficit Irrigation-to test 9 regulated deficit irrigation (RDI) strategies that apply seasonal totals of 34, 28, and 22 inches on cvs. Nonpareil and Carmel in a multiyear field study on relatively shallow rooted, microsprinkler-irrigated trees.

Results:

Project 1

After harvest in 1991, we initiated 6 post-harvest irrigation regimes on Non Pareil trees that had been fully irrigated through harvest. Thus, the only irrigation-related water stress imposed on these trees was due to post-harvest water management. Each post-harvest irrigation applied 0.9 inches and took place about weekly, with the exception of the early September period when the Carmels were being harvested. Applied water and the date of the last irrigation are shown in Table 1. Predawn leaf water potential (LWP) measurements were made periodically to evaluate the time course development of tree water stress.

In early March, 1992, individual branch measurements were made (4 per tree on each of 8 trees per plot) to determine flower density. Fruit density measurements were subsequently made on the same branches. The test trees were fully irrigated through 1992. At harvest, individual tree yields were taken and analysis of subsamples allowed us to calculate tree nut loads.

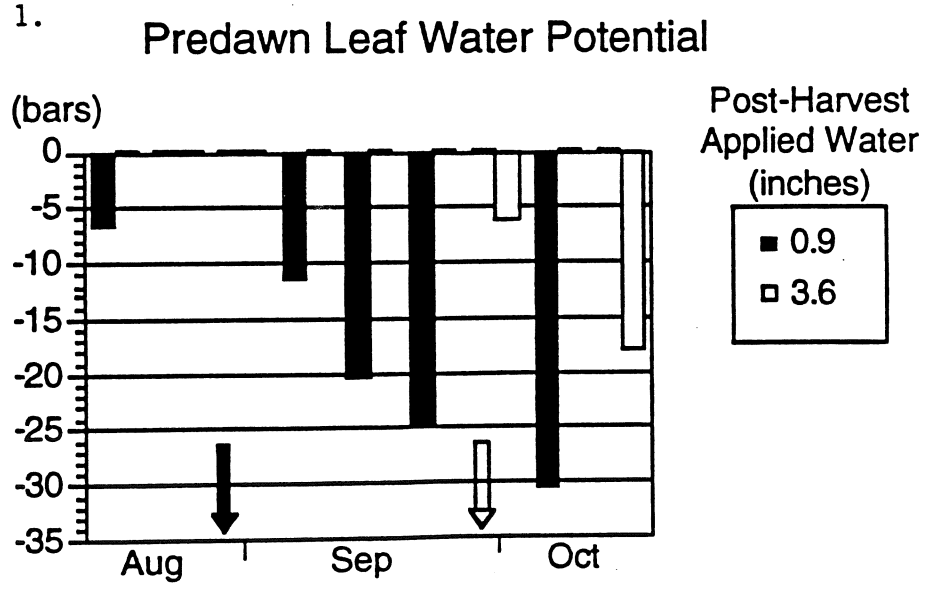
* 1991 Post-harvest Irrigation Regimes:

Post-Harvest Applied Water (inches)	Last Irrigation Date
0.9	Aug. 28
1.8	Sep. 4
2.7	Sep. 18
3.6	Sep. 25
4.5	Oct. 3
7.2	Oct. 29

TABLE 1.

For clarity and brevity, data for only the Non Pareil trees will be presented here. Even though evaporative demand is decreasing toward the end of the season, tree water stress developed rapidly in the trees deprived of full post-harvest water (Figure 1). For example, with only 0.9 inches of post-harvest water (none after Aug. 28), predawn LWP reached -25 bars in less than a month (vs. -4 to -6 bars for fully irrigated trees). Even when post-harvest irrigation cutoff occurred on Sept. 28, predawn LWP was -17 bars in about 3 weeks. Rapid stress development is due to both the relatively shallow root zone and location in the southern San Joaquin Valley.

FIGURE 1.



Arrows indicate date of last post-harvest irrigation for each treatment.

Flower density was generally not significantly different for trees receiving varied post-harvest irrigation amounts through Oct. 3 with the exception of the "control" trees; those which received full post-harvest water (Table 2). These trees had significantly higher flower density. However, fruit density was significantly lower for the early post-harvest cutoff regimes (Table 2). This was due to poorer fruit set; the evolution of the flowers into nuts, which ranged from 7.0% with 1.8 inches of post-harvest water to 48.8 % with 4.5 inches.

We believe that primarily due to differences in fruit set, tree nut loads and yields were significantly lower for trees receiving 3.6 inches of post-harvest water or less (Table 3). Tree nut loads, the most important yield component, are characterized as follows: for 1.8 inches (Sept. 4 cutoff) or less, about 2400 nuts/tree; between 2.7 and 3.6 inches (Sept. 18-25 cutoffs), about 5800 nuts/tree, and between 4.5 and 7.2 inches, about 7700 nuts/tree.

1991 Post-Harvest Applied Water (inches)	1992 Flower Density (#/60 cm)	1992 Fruit Density (#/60 cm)	1992 Fruit Set (%)
0.9	13.8 ab	1.5 a	11.5 ab
1.8	18.1 bc	1.5 a	7.0 a
2.7	15.5 b	3.2 ab	20.3 b
3.6	13.6 ab	4.5 b	34.2 c
4.5	9.8 a	4.5 b	48.8 d
7.2	22.9 c	10.0 c	43.7 cd

TABLE 2.

1991 Post-Harvest Applied Water (inches)	1992 Kernel Yield (lbs/acre)	1992 Nut Load (#/tree)
0.9	671 a	2814 a
1.8	436 a	1920 a
2.7	1285 b	5693 b
3.6	1365 bc	5936 b
4.5	1634 cd	7269 c
7.2	1727 d	8122 c

TABLE 3.

These results confirm that post-harvest irrigation under the conditions of this experiment is important for maintaining top tree production. We believe that tree stress within the one month period after harvest results in some problem with the flower buds that emerge the following season. We know that post-harvest stressed trees have buds where the stamen emerges well in advance of the petals. We are investigating whether this makes them unreceptive to pollen. Regardless, with relatively shallow rooted trees (whether due to soil conditions or the irrigation method) under high evaporative demand conditions, growers should not underestimate the value of adequate post-harvest irrigation.

Project 2

Based on the results of our work with almond, we believe that it's likely that the trees can be stressed at certain times of the year without reducing nut yields or quality. If successful, this type of irrigation scheduling would allow growers to save water. We've developed a project that will test regimes that will apply for the season 6, 12, and 18 inches less that the full potential tree water use (ie., 34, 28, and 22 inches applied). Three different strategies (that all apply the same seasonal water) will be evaluated for each irrigation level: biasing the application toward pre-harvest, post-harvest, and irrigating a reduced rates over the entire season.

We identified a site in McFarland in cooperation with Paramount Farming Co. for this work. In 1992, the site was developed; the irrigation system modified, and monitoring instruments installed. The irrigation regimes will be imposed in 1993.