COMPREHENSIVE PROJECT REPORT
1990-91

Project No. 90-H2: Effects of Water Supply and Irrigation Strategies on Almonds

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Objectives: (1) Determine the relationship between seasonal consumptive water use and the growth, yield and quality of almonds. (2) Evaluate irrigation strategies to maximize plant performance given limited water supply on a short term and sustained basis. (3) Further define crop coefficients (K_c) to be used for advanced irrigation scheduling techniques.

Interpretive Summary:

Almond orchards in California are highly dependent upon adequate irrigation to produce acceptable and consistent yields of a quality crop. The quantity and proper timing of irrigation water to provide adequate moisture for the orchard is of paramount importance in maximizing not only yield and quality but orchard longevity, while minimizing the effects of disease and insect pests.

Incentives for enhanced irrigation management from a grower's perspective lie in reduced energy use and maximizing the use of the available water supply. These incentives have been reemphasized by drought conditions in the mid-1970's and over the past few years.

Recent reports of studies on grapes and other deciduous trees indicate that providing less than full consumptive water use can have minimal impact on sustained production and quality. To be successful, a deficit irrigation strategy must be defined which can provide water in the sensitive vegetative and reproductive growth stages. This project directly addresses these topics.

Determining the relationship between consumptive water use and almond performance on a sustained basis requires imposition of treatments and evaluation over four seasons. This study is conducted in cooperation with San Joaquin Delta College using a portion of their teaching farm orchard near Manteca, California. The soil is a sandy loam irrigated by a solid set sprinkler system able to irrigate individual plots. A 10-acre block of 10-year-old trees composed of equal numbers of alternating varieties (Peerless, Price and Nonpareil) was used for the study. All measurements were made on the Nonpareil variety.

Treatments imposed included: those providing for full consumptive water use (100% ET); four additional treatments providing less than full water use on a seasonal basis (70% and 50%) each timing the imposition of water deficits during mid-season or postharvest. The sixth treatment utilized leaf water potential as an indicator of plant water status to schedule irrigations through mid-season and post harvest (plant indicated irrigation, PII).

Table 1.

Treatment	Percent Seasonal Use	Consumptive Water Use (in)	Average Yield (lbs of kernels/acre)	No. of Hull-Tights per 1,000 Nuts	Percent Hullsplit 7/24/90	Percent Hullsplit 8/9/90
1 (100% use) (incl. postharvest irri.)	100	35.8	3,512	3 A*	45	95
2 (70% use)	72	25.7	3,008	0 A	36	83
3 (70% use) (incl. postharvest irri.)	68	24.4	3,229	183 AB	28	70
4 (50% use)	54	19.4	3,757	18 A	34	85
5 (50% use) (incl. postharvest irri.)	52	18.5	3,094	300 B	3	25
6 (PII) (incl. postharvest irri.)	64	22.8	3,480	10 A	26	76
P-value			0.14	0.046	0.000:	0.00
C.V.			14%	208%	55%	36%

* Common letters among means within runs denote no significant difference at $P \leq 0.05$.

The results of the first year (1990) indicate yields were not significantly affected by irrigation amount or strategy. It is apparent that the hullsplit and the number of hull-tights are influenced by the trees' midseason water status. Trees receiving postharvest irrigation in lieu of midseason irrigation exhibited more hull-tights. Although increased numbers of hull-tights were found in treatments suffering midseason water deficits, industry standard grading indicated no off-grade (shrivel) in any treatment. The effect of late season water deficit on the first year's plant performance seems negligible although subsequent plant performance may be affected.

Other quality parameters measured on the 1990 harvest included worm, mold, and damage shrivels and doubles. No significant differences were found to exist between treatments (Table 2).

Table 2.

Treatment	Percent				
	Worms	Mold	Ant Damage	Shrivels	Doubles
1	3.75	0.25	0.00	0.00	1.50
2	1.75	2.00	0.75	0.00	0.75
3	3.75	0.50	0.25	0.00	1.25
4	2.25	0.00	1.00	0.00	0.50
5	1.00	0.00	0.00	0.25	0.50
6	4.00	1.25	1.25	0.00	0.50
	n.s.	n.s.	n.s.	n.s.	n.s.

n.s. denotes no significant difference between means at $P \leq 0.05$.

Measurements of the 1991 season bloom indicates no significant reduction in bloom as measured by the number of blossoms per 60 cm branch length.

Table 3.

Treatment	Bloom Count (No./60 cm)	
	Nonpareil	Price
1	57	57
2	40	49
3	47	45
4	35	44
5	32	28
6	45	44
	n.s.	n.s.
P-value	0.13	0.47
C.V.	33%	39%

Figure 1.