EARLY IRRIGATION FOR ALMONDS

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IN SOME ALMOND PRODUCING areas of California, under-tree sprinkler irrigation is becoming increasingly popular for frost protection. Water applied for such frost protection during the early growth period has been observed to also have a marked effect on almond production that cannot be accounted for by frost protection alone. Among the effects noted have been increased yield, larger kernel (meat) size, greater shoot growth, and delayed nut maturity. A project was started in 1968 to determine whether these previous observations could be experimentally substantiated, since only limited evidence has been available to show that these factors were related to early-season moisture supply.

The experimental plot consisted of two irrigation treatments, each replicated four times. The check treatment received the grower's regular irrigation program which consisted of 24 to 30 inches of water applied during the growing season, starting about mid-May and being completed by approximately mid-July. The other treatment received early irrigation during the frost protection season in addition to the grower's regular irrigation program. In 1968, the early irrigation treatment received a 7-inch application of water in early March. Because of wet winters prior to 1969 and 1970 seasons, the early irrigations were delayed until mid-April, with 4 to 5 inches of water applied in a single application each year. In 1971, the early irrigation treatment was altered to more nearly simulate sprinkler frost protection practices with five applications of 1 to 2 inches each, made over a six-week period from late February through March (totaling about 8 inches of water). In addition to the irrigation water, about 20 inches of rainfall normally occurs in this area, mostly from October through April.

This study was conducted with the Nonpareil variety on almond rootstock. The soil was a deep, well drained loam. Frost protection for both treatments was provided by orchard heaters rather than by sprinklers.

The moisture status of the soil was followed by using gypsum blocks (soil moisture measuring instruments). As expected, the early irrigation increased the soil moisture supply early in the season and generally maintained better soil moisture later into the year as compared with the control treatment. However, all available soil moisture had usually been extracted by the roots in both treatments to a depth of 9 ft by November 1.

During the first year of this study, yield was not affected by the early application of water. However, in subsequent years the early irrigation increased yield (table 1). The large increase in 1971 may be due either to the cumulative effect of these irrigations over four years, the extended period of application this year (six weeks), or possibly both.

Each year, the weight per kernel from early irrigated plots has been 4 to 6% greater than from the control treatment (table 2). Kernels from trees receiving this early irrigation were longer and wider; however, the treatment did not affect kernel thickness.

In almonds, the shell (endocarp) begins to harden (pit hardening) during May, so by this time the maximum size to which the kernel can grow is essentially established. Therefore, the effect of soil moisture on kernel size may be greatest early in the season.

The increase in yield in 1969 and 1970 as a result of early irrigation was due mainly to larger kernels; however, in 1971 the increase was due to both larger kernels and greater numbers of nuts per tree. During the four years of this study, there has been no marked effect of this irrigation treatment on shelling percentage, stick-tights, or worm damage.

The trees receiving the early irrigation have consistently made slightly greater shoot growth each year. This increased growth could result in a potentially greater bearing surface, particularly with a crop like almonds which is normally lightly pruned, and could explain the increased number of nuts per tree that occurred in 1971.

Each year the nuts from trees receiving the early irrigation have been delayed in maturing. This result has been noted by several different measurements. Kernels from these trees developed more slowly, even though their final size was larger. Secondly, the nuts from early irrigated trees had a greater moisture content throughout the growing season, and even into harvest (approximately six weeks after the last irrigation). Also, when knocked on the same day, the nuts from the early irrigated treatment were often harder to remove from the tree.

Because of the higher moisture content in nuts at harvest from early irrigated trees, either knocking must be delayed a few days, or the nuts allowed to dry on the ground several days longer than usual. If these precautions are not taken, hulling efficiency can be reduced due to the leathery condition of partially dried hulls; also, excessive foreign matter and/or kernel moisture may be found in deliveries to handlers. In some years, nut removal can be so difficult that knocking must be delayed a few days to obtain satisfactory nut removal and to prevent excessive damage to the trees.

Most of the observed effects of early water applications have been substantiated by this work and there appears to be considerable potential for this practice with almonds. Increased yield and larger kernel size have a direct effect on increased production. Greater shoot growth also could augment production by providing additional bearing surface. These advantages may not be limited to almonds, but may also apply to other deep-rooted fruit crops.

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TABLE 1. ALMOND KERNEL (MEAT) YIELDS AS AFFECTED BY EARLY IRRIGATION

	1968	1969	1970	1971
	lbs/Acre			
Control	1690 a**	2464 a	2737 a	1996 a
Early Irrigation	1684 a	2561 a	2802 a	2321 b
Increase over control	–6	97	65	325

** Yields in each column with different letters are significantly different at the 1% level.

TABLE 2. ALMOND KERNEL (MEAT) WEIGHT AS AFFECTED BY EARLY IRRIGATION

	1968	1969	1970	1971
	gm per kernel			
Control	1.41 a*	1.32 a	1.41 a	1.58 a
Early irrigation	1.49 b	1.38 b	1.48 a	1.67 b
Percent increase over control	5.7	4.5	5.0	5.7

* Weights in each column with different letters are significantly different at the 5% level.