Project Number 81-HS
Project Title: Harvest and Timing Associated with Navel Orangeworm

81-HS

Annual Report - Project 81-HS

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Objectives

Early harvest is being examined closely as one solution to the NOW and other problems associated with allowing almonds to fully dry on the tree. While it is clear that early harvest can save growers money in seasons when NOW is a serious problem it is also apparent that the earlier one harvests the greater the number of nuts left in the tree. This, of course, reduces a grower's yield and provides potential over-wintering sites for NOW.

Research aimed at understanding factors that could lead to improved early nut removal is important to both the economic and pest management sides of the early harvest concept. This year's work has been aimed at determining the effects of varied water management practices on nut maturation, nut removal, and kernel size. Because of the potential of deleterious affects of water stress on return bloom and subsequent yield this will be examined in 1982.

Interpretive Summary

Studies were carried out in two locations (Durham and Bakersfield). An attempt was made to create a condition of mild water stress in trees at different times during the development of almond fruits and measure the effect of this stress on nut maturation. While we were not as successful as we would have liked in controlling tree water status (see Discussion) the treatments did suggest some potential for control of nut maturation through water management (Table 2). Whether this can be put to use as part of an early harvest scheme remains to be seen.

Limiting water in June advanced the time of 100% hull-split relative to normal irrigation practice or to limiting water in July. None of the treatments appeared to adversely affect the size of kernels (Tables 3, 4) and, since treatments were "applied" after fruit set, there was no reduction in the number of nuts per tree. In spite of the accelerated maturation caused by the June water cut off there appeared to be no clear effect of this treatment on early nut removal (Fig. 1).

It was clear, however, that "excessive" water could reduce nut removal during early harvest. The Bakersfield orchard in which we worked was flood-irrigated. One end of the rows stayed wet between irrigations whereas most of the trees dried out. Nut removal from trees in the wet end was only 60-70%, compared to 90-95% for dry trees, during early harvest.

Because there was no clear effect of water limitation on advancing nut removal we cannot recommend this as a cultural practice at this time. The one exception to this is in situations

where "excessive" water in the orchard during the last month of nut development would tend to reduce nut removal.

Procedures

In general the approach taken was the same as has been described in previous reports. Nonpareil trees were harvested at weekly intervals and counts were made to determine the percentage of nuts removed. Samples of nuts were collected and hulls and kernels were dried to constant weight to determine moisture contents and dry weights.

Evaluations of nut maturity were based on a rating of hull dehiscence and drying ranging from 1 (hull green and unsplit) to 8 (hull fully-opened and dry).

The orchard in Bakersfield was flood-irrigated; in Durham, water was applied using solid-set sprinklers. Attempts at creating temporary periods of water stress were based on the schedule shown in Table 1. Soil water status was measured using the neutron probe. Tree water status was measured using the pressure bomb. These determinations were made weekly.

Results

Starting in late July we checked nut maturity in relation to the various treatments. It was clear (Table 2) that at least by the criterion of hull split nuts on trees that had received no irrigation in June were more mature than nuts from trees in other treatments. Data from both Durham (Table 3) and Bakersfield (Table 4) indicate that the limited water stress we induced had little effect on kernel size. Nuts from the wet end of the Bakersfield control row (referred to earlier) were considerably larger than nuts from the rest of the control row or from the other treatments (Table 4; compare the second of the paired numbers, under "control," for the July 30 and August 6 harvest dates with the other data).

Figure 1 shows nut removal for the various treatments at the Durham plot. No clear differences in nut removal are indicated. Figure 2 shows similar data for the Bakersfield plot. The curves on the left side of Figure 2 suggest that the stress treatments result in better removal than for the "fully-irrigated" trees. This is misleading. Variation in the nut removal data for the control trees (harvest dates July 30 and August 6) was quite high because of the poor removal from trees at the wet end of this row. If these trees (two for July 30 and one for August 6) are removed from consideration the curve on the right half of Figure 2 is generated for the control. Thus, as for Durham, the treatments appeared to have little significant effect on nut removal.

Table 1. Irrigation schedules.

	Bakersfield (1st harvest - 7/30)	Durham (1st harvest - 8/6)
June Stress - JS	No irrigation between 5/13 and 6/22, then irrigated until 7/17	No irrigation 5/31 till 7/11, then irrigated until 7/27
Late Stress - LS	No irrigation after 7/16	No irrigation after 6/29
Control - C	Irrigated regularly until 7/25	Irrigated every two weeks until 7/27

Table 2.

	Nut Maturation (% Hull Split) (Durham - 1981)		
Sample Date	June Stress	Late Stress	Control
July 28	82	73	67
August 5	99.8	95.5	93.5
August 12	--	100	98.8

Table 3.

	Kernel Dry Weight (g/kernel) (Durham - 1981)		
Harvest Date	June Stress	Late Stress	Control
August 6	1.47	1.50	1.52
August 12	1.47	1.47	1.52
August 20	1.52	1.42	1.53

Table 4.

Harvest Date	Kernel Dry Weight (g/kernel) (Bakersfield - 1981) June Stress	Late Stress	Control
July 30	1.28	1.31	1.22/1/38
August 6	1.29	1.33	1.20/1.42
August 13	1.25	1.28	1.27

Figure 1.

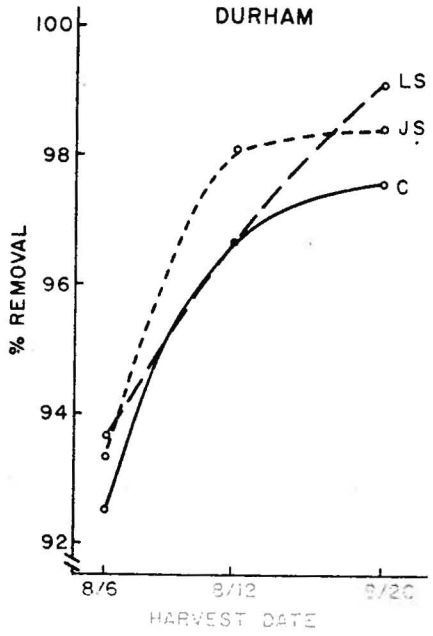
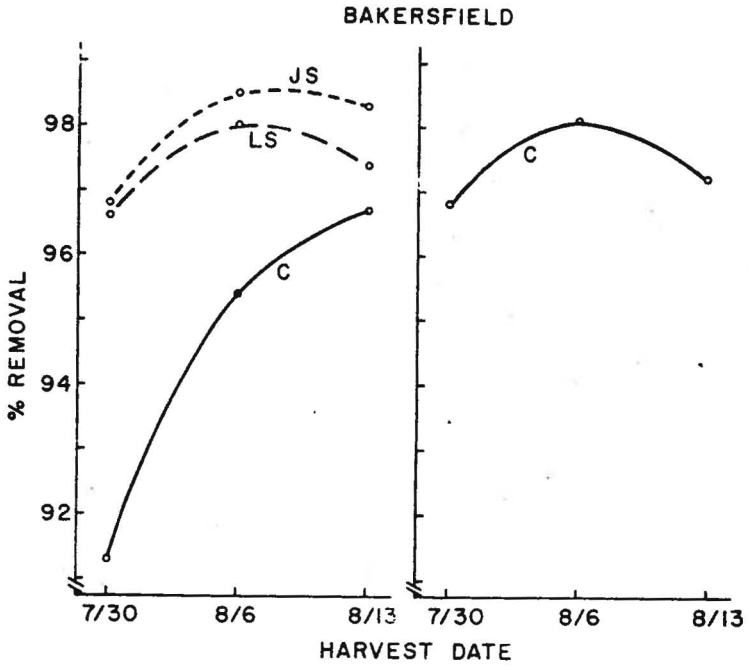


Figure 2.



Discussion

Because the water stresses to which trees were subjected had no measurable effect on nut removal during an early harvest we cannot recommend this as a cultural practice at this time. However, this approach may prove to be beneficial eventually. If so each grower will have to determine the correct approach for his orchard situation.

We conclude that all of the trees in our Bakersfield plot were experiencing water stress. Even the control row, which was "fully" irrigated benefited when additional water was available because kernels on trees in the wet end of this row were 10% heavier than those from other regions of the orchard (Table 4). The additional stress experienced by trees in the "June Stress" and "Late Stress" rows did not affect kernel size further. On the other hand, beneficial effects of mild water stress on nut removal might not have been seen because all trees were experiencing some water stress.

In contrast, trees in the Durham plot did not experience significant water stress (data not presented) even when irrigation water was eliminated for 5 or 6 weeks. Thus, we cannot rule out the possibility that stress would have promoted early nut removal (it did advance maturity, Table 2) because we failed to develop a situation in which trees would experience much stress.

An alternative approach to improving the economics of early harvest is suggested by a practice employed by the grower/cooperator at our Durham plot (Morris Keeney). He had early-

harvested trees shaken again at the time of pollinator harvest (mid-September). Estimates indicate that the additional nuts obtained paid for the extra harvest operation and yielded a small added profit. Thus, a grower could avoid NOW damage to most of the crop by harvesting early and then pick up the remainder (which, in bad NOW years, might be seriously damaged) later. In any case nuts remaining in trees should be removed as part of an effective satitation program.

Publications

One paper has appeared in "Almond Facts."

> "Early harvest of almonds: Maturation and quality," J. H. Connell, G. S. Sibbett, W. O. Reil, J. M. Labavitch and W. W. Barnett.

Another, based on this work, was prepared by Mario Viveros and appeared in "Kern Nut Crops" (U.C. Cooprative Extension).

> "Early harvest: An interrelated component of navel orangeworm management," M. Viveros, W. Reil, J. M. Labavitch, L. Beurmann, and E. Osgood.

Joe Connell, Christi Heintz and I are now putting together a set of three short papers to be submitted to "California Agriculture."

Acknowledgement

We wish to thank the many people who made this work possible. Chief among them are Herb Schulbach, Wilbur Reil, Abubakr Ali Abugoukh, Henry Rae, and, of course, grower/co-operators Morris Keeney and Martin Barnes.