TITLE : Project 75-A Navel Orangeworm Research Field Studies - Orchard Management

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I. OBJECTIVES AND GOALS: (1) Determine the effects of timing of dormant tree shaking on subsequent almond production. (2) Determine if there is any benefit from orchard sanitation (removal of mummy nuts from trees) when practiced in a small area (40 acres) surrounded by noncleaned orchards.

II. ABSTRACT: Almond trees can be shook with a trunk shaker on foggy-winter days as an effective and economical method for removal of mummy nuts that harbor the navel orangeworm. Some growers question the effect of this practice on subsequent crop production as some fruit buds are removed during shaking. Different groups of Nonpariel and Merced trees were shook in mid-December, early-, mid-, and late-January, and another group was used as a check (no dormant shaking). The crop from each of these trees was weighed at harvest time. No significant differences were found when comparing any of the shaking times with the check. This information confirms observations made under less controlled conditions that fruit bud removal during dormant tree shaking does not reduce the size of subsequent crops.

A Chico-area grower thoroughly cleaned all varieties in a 40 acre block with his own trunk shaker (= test). He cleaned the

Total reject figures for Nonpareil were 3.3% in the test and 7.0% in the check. There was no benefit due to orchard sanitation in the Neplus and Mission. The dollar loss per acre was $36 in the test and $43 in the check as the crop production was much larger in the test area. Had crop production been 1000 pounds per acre in both blocks, then the dollar loss per acre would have been $25 in the test and $53 in the check. This would give a net profit of $13 per acre after allowing $15 per acre for the dormant shaking costs.

was set up as completely randomized blocks - 5 treatments x 18 replicates (single tree reps) x 2 varieties (Nonpariel and Merced). The treatments were different shaking dates - Dec. 11 (high fog), Jan. 6 (high fog), Jan. 18 (very wet fog), Jan. 31 (clear and dry), and a check (not shook). Nonpareil trees were shook 10-12 seconds and Merced trees were shook 4-5 seconds with a Shock Wave tricycle monoboom shaker using almond harvest weights. The same operator did all the shaking. The trees were planted in 1961 on Nemaguard rootstock.

The Nonpareils were harvested on September 12 and the Merceds on October 8 by knocking with the cooperator's trunk shaker. The nuts from each individual tree were hand raked and weighed in the field. Samples (ca. 4 pounds for Nonpareil and ca. 6 pounds for Merced) were taken from the crop for each tree. The meats from these samples were weighed and counted to calculate the total meat weight for each tree and the number of kernels per ounce.

Ken Hench, Kern County Farm Advisor, G. Steven Sibbett, Tulare County Extension, Marvin Gerdts, Pomology Specialist, and William A. Duncan, Larry Liggett and other personnel at Superior Farming Company cooperated in this experiment.

A grower in the Chico area cleaned a 40 acre block (test) in his orchard with his own Shock Wave trunk shaker. All varieties (Nonpariel, Neplus, Drake, and Mission) were shook

to this grower was partially cleaned (all the Neplus, some of the Nonpareils, none of the Missions). Both blocks adjoined noncleaned orchards on three sides and were separated by a 40 acre block of the grower's walnuts. Blacklight traps were used to monitor NOW populations and pheromone traps were used to monitor PTB populations from early April to late October. A series of nut samples were taken from hull split to harvest to trace the rate of increase in infestation of the almonds. Twelve sample sites were selected in each block from which 100 nuts per site were taken on each of three dates (Aug. 15, Aug. 30, Sept. 13). A retest of the duplicate samples taken by the handler will be used to evaluate the effectiveness of orchard sanitation in a small area.

IV. RESULTS AND DISCUSSION: There were no statistically significant differences between any of the dormant tree shaking treatments and the checks for either Nonpareil or Merced (Tables 1 and 2). There was an indication of a decrease in Nonpareil crop size for the early and late dates. Such a decrease could be possible on the late date as fruit buds would be swollen at that time and might be knocked from the trees more easily. The indication of a large increase in crop size for both varieties on the early January shaking is interesting, but no explanation can be offered for this.

The Chico area orchard had a grade sheet total reject figure for Nonpareil of 3.3% for the test and 7.0% for the check (Table 3). This figure for Neplus was about equal 3.5%

stated that there were no"worms" in the walnuts. The series of samples taken by the researcher showed no real differences between the test and check. The blacklight trap counts (Fig. 1) showed that the NOW population was suppressed in the test area up through late August (accumulative catch of 120 in test and 220 in checks), but the catches in both areas went up rapidly at about the same rate throughout September and actually reached a higher total catch for the test area.

The Chico grower doesn't think the cleanup did much good since he had a larger crop in the cleaned area than in the noncleaned area. The larger crop was attributed to the presence of Drakes in the test area supplying good pollination under the weather conditions of last spring. As a result of this variation in crop size, the loss per Nonpareil acre was $36 for the test and $42.75 for the check (Table 4). The difference is not enough to pay the $15 per acre cost of dormant shaking. Another orchard owned by the same grower and also containing Drakes had about the same production per acre as the test area, but it had a $52.50 loss per Nonpareil acre. This discredits the grower's argument. Also, the researcher has tried and failed to show any statistical correlation between crop size and percent rejects for a large number of growers. Table 5 illustrates this point by showing the production per acre ranked from smallest to largest with the respective percent rejects for 12 of the Chico grower's neighbors plus the grower's test and check orchard.

in an orchard. If production had been 1000 pounds per Nonpareil acre (Table 4), then the cost benefit would have been $27.60 per acre minus about $15 per acre shaking costs.

V. CONCLUSIONS AND RECOMMENDATIONS: This year's results from the dormant tree shaking experiment, data from past years where year to year comparisons of crop size have been made, the data for the Chico area grower that had very similar yields for his cleaned and noncleaned orchards that contained Drakes and the many comparisons we will have from the Ballico project for hand-cleaned, shaker-cleaned and non-cleaned orchards should convince most growers that fruit bud removal during dormant tree shaking is not one of the problems with such an operation. Also, several Chico area growers practicing dormant shaking wuth trunk shakers have not indicated any problem with Ceratocystis canker as a result of this practice. Some growers in the Ballico area will not allow dormant tree shaking by machines because they fear that trees planted on certain shallow rooted rootstocks will be loosened in the ground causing them to fall or blow over. We feel that dormant tree shaking is a safe recommendation for the majority of orchards as far as tree damage goes. The main limitation is getting enough fog or rain to wet the trees for a long enough period to be able to complete a thorough removal of mummy almonds from the trees.

The data from this year's work in the Chico area and other data from 40 acre orchards indicate that orchard sanitation

should more than pay for itself even in small blocks in which the control cost would not exceed one-half the amount lost to rejects in past years.