
Survey of Navel Orangeworm Control Strategies

Project No.: ENTO25.Gordon

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A. Summary

The survey was successfully implemented at seven UCCE commodity crop meetings between January and March 2020. Unfortunately the COVID-19 pandemic prevented us from attending two meetings in the southern San Joaquin Valley. While we got a good response rate at each meeting, the population sizes were too small to examine interactions between grouping categories, which were the responses to demographics questions. However, we did find interesting results. PCAs were more likely to report using monitoring methods, as well as mating disruption and pesticide sprays. There was an increase in the use of monitoring and management tools as the number of managed acres increased. Those who had been managing NOW for fewer years were less likely to use some monitoring methods. Orchard access was the most cited barrier to using sanitation, possibly because of heavy attendance at a north San Joaquin Valley almond meeting skewing results. Equipment/labor availability and late maturing varieties were the most cited barriers to utilizing timely harvests. Respondents selected high costs, low cost effectiveness, unclear efficacy, and small acreages as barriers to using mating disruption. Barriers to pesticide useage were selected at much lower frequencies than the other three management practices, however pesticide cost and regulatory restrictions were the most commonly selected barriers to spraying pesticides.

B. Objectives

1. Determine the adoption rate of various NOW monitoring and management practices across the three nut crop industries
2. Determine barriers to implementing NOW sanitation, mating disruption, timely/early harvests, and pesticide use

C. Results and Discussion

Table 1 summarizes average responses to the monitoring and management questions. Adoption of sanitation was as high as pesticide use, which we found to be surprising, however we did not ask about specific sanitation practices (e.g. “do you destroy mummy nuts once they are on the ground?” “Do you ensure that there are less than two mummy nuts per tree after shaking?”). It is possible that respondents partially sanitize, or sanitize a percentage of their blocks, which would spur them to select, “yes.”

Table 1: Responses to monitoring and management questions, averaged across all included respondents.

Response options	Do you evaluate mummy nuts?	Do you use egg traps?	Do you use pheromone traps?	Do you use Peterson traps?
Yes, multiple/yr	47%	N/A	N/A	N/A
Yes, once/yr	27%	57%	64%	35%
Yes, some years	6%	6%	5%	7%
No	20%	37%	31%	58%

Response options	Do you use biofix and degree days?	Do you use mating disruption?	Do you sanitize?	Do you use pesticides?
Yes, once/yr	68%	27%	78%	79%
Yes, some years	5%	11%	13%	12%
No	27%	62%	9%	9%

Unsurprisingly, more PCAs reported using monitoring and management tools than orchard owners or managers (Figure 1 shows selected data). This is likely due to their main role as hired pest consultants; their main role is to write recommendations for pests that they find when scouting, and those who provide ineffective management recommendations will not be hired back. PCAs also tended to report the same barriers to management practices as their clients (responses to sanitation are reported in Figure 2) though they may select barriers at higher rates than their clients. This indicates that they have a keen understanding of their clients' struggles.

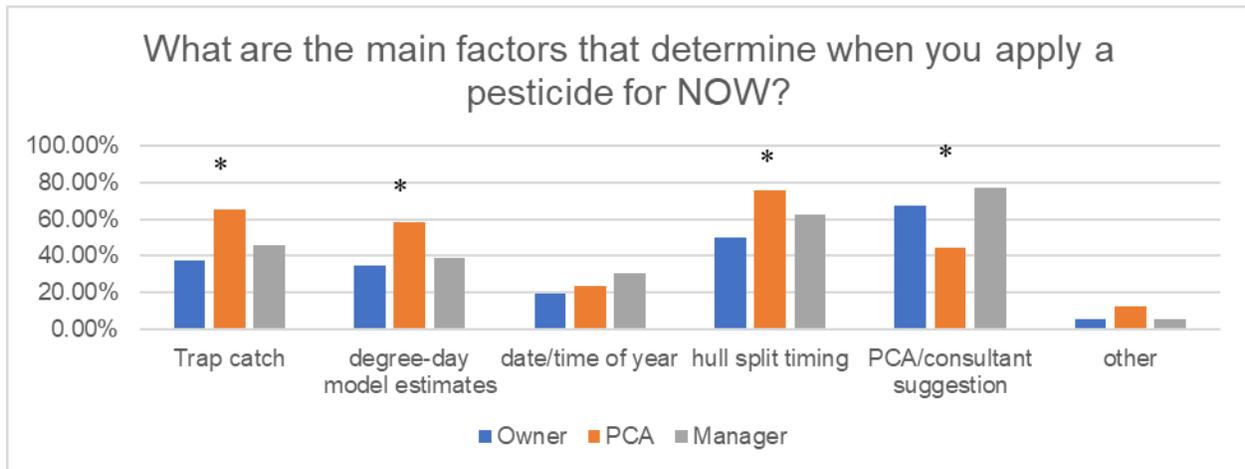


Figure 1: Responses marked with an asterisk are when contingency table analyses resulted in significant differences based on industry role. This question was a "Select all that apply," thus percentages do not add up to 100%.

There were some areas where there was disconnect between PCAs' responses and their clients: PCAs tended to report higher spray useage than their clients (Figure 2). This could be due to a difference in spray classification, for instance a grower would classify a May spray as controlling one pest, whereas a PCA may recommend a product that will also control NOW, and would classify that spray as *also* controlling NOW. An alternative explanation is that

growers that are certified to write their own recommendations may make fewer NOW sprays. A third explanation is that a PCA's response may be skewed by the practices of one of their clients rather than reporting on the plurality of their clients. Their responses to sanitation struggles may be explained by this; if only one of their clients decides to not use mating disruption due to cost, for instance, they may report mating disruption costs being a barrier to implementation, regardless of whether the rest of their clients are affected by this (data not shown).

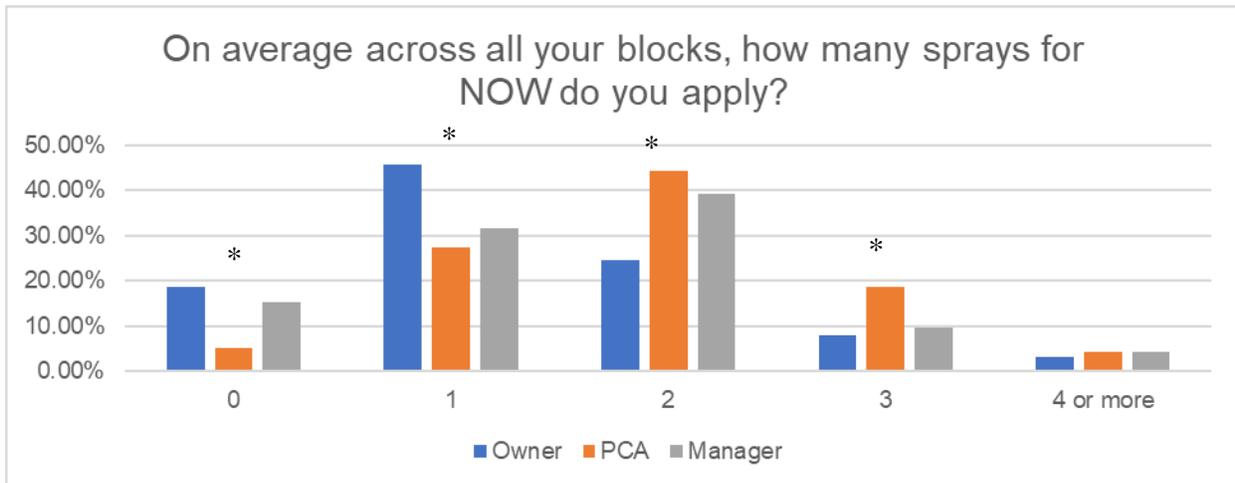


Figure 2: Responses marked with an asterisk are when contingency table analyses resulted in significant differences across industry role.

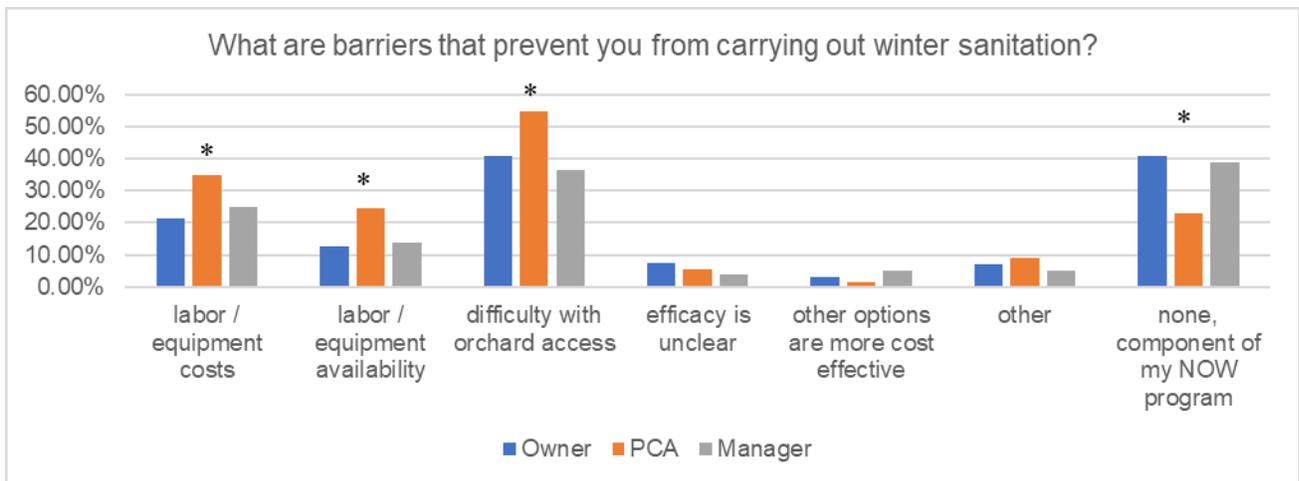


Figure 3: Responses marked with an asterisk are when contingency table analyses resulted in significant differences across industry role. This question was a “Select all that apply,” thus percentages do not add up to 100%.

In general, there were fewer questions where years of experience resulted in significant differences between response groups. However, when there were differences, adoption of monitoring (examining mummy nuts, use of biofix dates,) and management (use of pesticide sprays and the number of sprays per block) increased with years of experience (data not shown). This could be because NOW managers could realize that relying on a small number of tools is insufficient to control NOW as they become more experienced. Years of experience did not heavily influence barriers however there were some differences: those who had been

managing NOW for 1 to 5 years were less likely to report unclear efficacy and low cost-effectiveness when reporting barriers to mating disruption, as well as more likely to report that pesticide cost was a barrier. They were less likely to say that pesticide use and early/timely harvests were a regular part of their NOW program (data not shown).

The number of managed acres heavily influenced survey responses. In general, the use of monitoring and management tools decreased as managed acres decreased from 2000+ to <50 (Figures 4a and b, 5, and 6 show selected results). This could be due to a skew from PCA responses, as a high proportion of PCAs also managed more than 2000 acres. However, it could also indicate other issues. One possibility is that those managing smaller acreages have less capital available, and must reduce NOW management intensity. An alternative explanation is that those managing the smallest acreages are doing so part time and cannot devote as much time to farming as those who farm full time.

Orchard size had no influence on the use of sanitation, though those managing smaller acreages were less likely to report issues with orchard access (data not shown). Small acreage was overwhelmingly the most important barrier for those managing less than 50 acres (figure 5), and equipment and labor availability was also an issue for those managing smaller acreages, though interestingly those managing 501-2000 acres had the fewer issues than those managing 2000+ acres (Figure 6).

Small farmers are a large proportion of California farms; 64% of farmers (not specific to nut crops) manage fewer than 49 acres (2017 Agricultural Census for California). More time and energy needs to be spent understanding why their management and control practices are less intense, whether it is lack of NOW management education, insufficient incentive, or lack of access to all effective control measures.

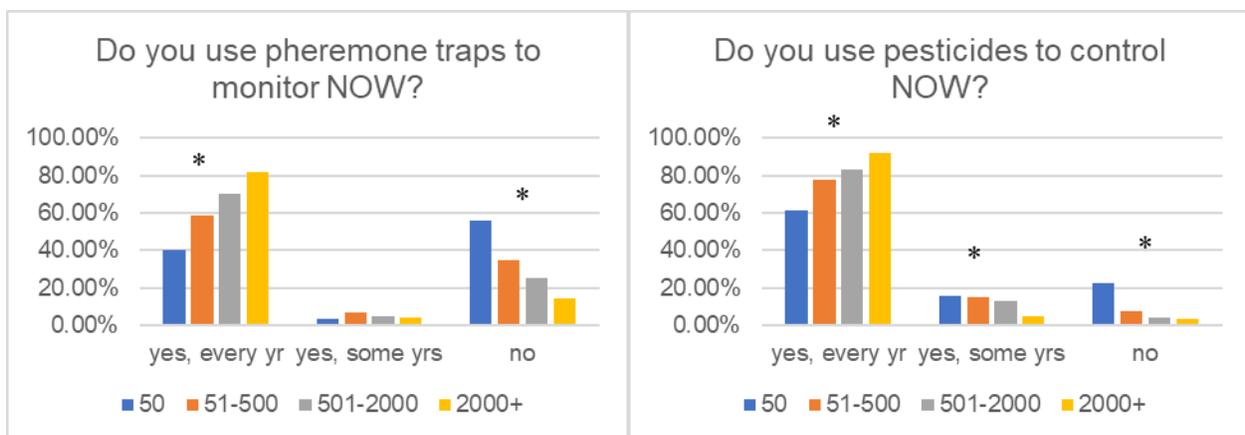


Figure 4a (left) and 3b (right). Responses marked with an asterisk are when contingency table analyses resulted in significant differences between orchard size and response rate.

In the last part of our survey, we asked where respondents got NOW management information. Respondents across all demographic groups overwhelmingly responded that they frequently relied upon PCAs/consultants. This is unsurprising. University and government personnel were the next important source, evidenced by percentage of respondents who selected that they frequently or occasionally rely upon this source of information. This was followed by

friends/neighbors and industry publications such as trade journals. Sales representatives were the least used source of NOW management information (Data not shown).

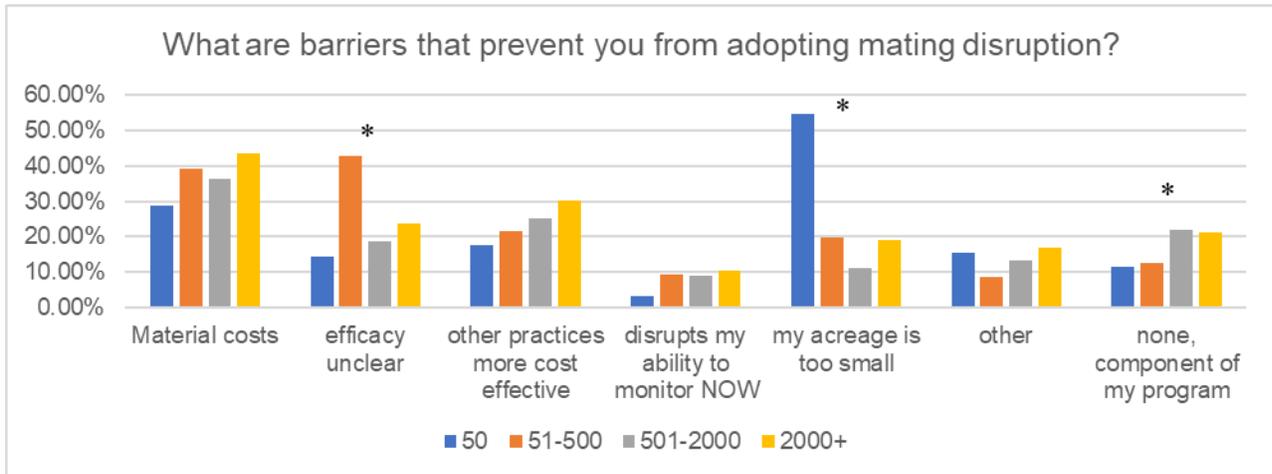


Figure 5: Responses marked with an asterisk are when contingency table analyses resulted in significant differences across the amount of acres respondents managed. This question was a “Select all that apply,” thus percentages do not add up to 100%.

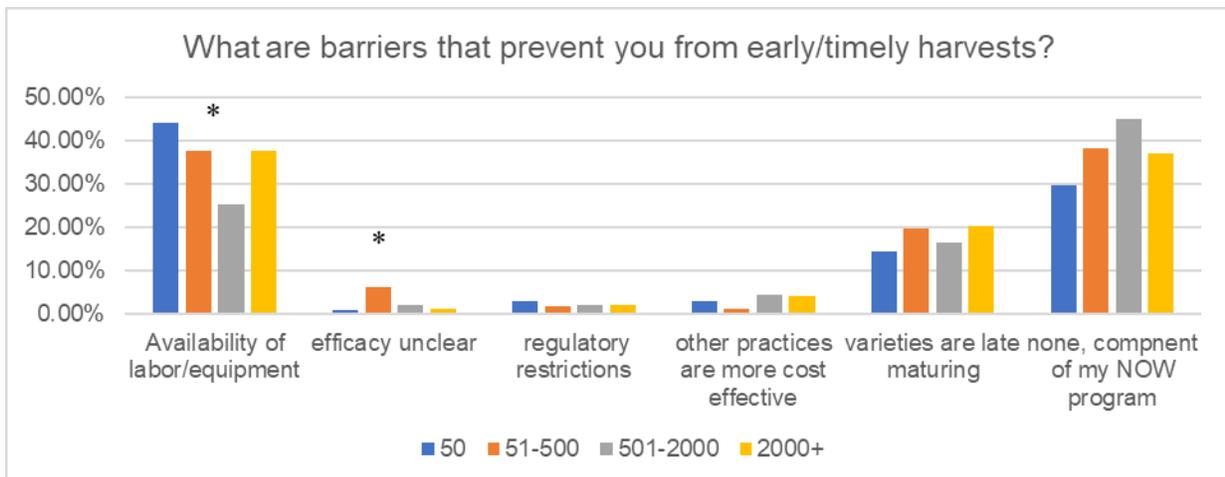


Figure 6: Responses marked with an asterisk are when contingency table analyses resulted in significant differences across the number of acres respondents managed. This question was a “Select all that apply,” thus percentages do not add up to 100%.

D. Outreach Activities

We have not participated in extensive outreach yet. Results have so far been presented at the Merced County Pest Management Education series. Results will be presented at Statewide Pistachio Day (January 12 and 13, 2021) and the North San Joaquin Valley almond day (January 14, 2021). We plan to write extension articles for several trade magazines and record a podcast episode for Growing the Valley.

E. Materials and Methods:

We gave this IRB exempt survey at seven UCCE extension meetings held across the Central Valley. We used clickers manufactured by Turning Technologies (Youngstown, Ohio,

USA) and a manufacturer-created plug-in for PowerPoint (Microsoft, Redmond, WA, USA). The survey was inserted into 30 minute slots in each meeting, before any pest management talks to avoid swaying audience responses. In order to encourage participating, we handed clickers to every audience member before inviting them to participate in the meeting. After all data were collected, they were analyzed using contingency table analysis with JMP 15 software (SAS Institute, Cary, NC, USA). Any respondent who was not a PCA, orchard owner, or ranch manager was discarded, as the sole purpose of this survey was to determine the practices of those who are directly involved with NOW management decisions.

In order to understand different NOW management approaches, the data was analyzed using responses from four demographics questions that were given at the beginning of the survey (Table 2). Each question was analyzed independently. If a respondent did not respond to one or more demographics question, their responses were discarded for that analysis. If a grouping category or low response to a certain answer resulted in an analysis with more than 20% of cells having expected counts of less than 5, groups were combined ensure an accurate analysis. Groups were only combined if a combined group gave valuable information that was similar to the original groups. For instance, the question “On average across all your blocks, how many NOW sprays do you apply?” had the options, “0, 1, 2, 3, 4, 5 or more.”. So few respondents selected “5 or more,” that it was combined with “4,” to create the answer “4 or more.”

Table 2. Asterisks denote “select all that apply” questions. Numbers in parentheses indicate the percent of respondents who selected a response.

Industry role?	# acres managed	Time spent managing NOW?	Crops managed*
Orchard Owner (50%)	< 50 (20%)	1 to 5 years (28%)	Almonds (75%)
Ranch Manager (20%)	51 – 500 (33%)	6 to 15 years (32%)	Pistachios (27%)
PCA (30%)	501 – 2000 (18%)	16+ (40%)	Walnuts (61%)
	2000+ (29%)		

F. Publications that emerged from this work

No publications have emerged from this project at this time.

This project was also funded by the California Pistachio Research Board and the California Walnut Board; much of the information presented in this report also appears in their final reports.