

August, 2018 Orchard Task List for Pistachios
By Bob Beede, U.C. Farm Advisor, Emeritus

I Misinformed You!: At this year's American Pistachio Growers Annual Conference, I made a presentation about navel orangeworm mating disruption, and used the successes in Mating Disruption of codling moth and Oriental fruit moth (OFM) as support for implementation of this technology for NOW control. I thank Brad Higbee, formerly with Wonderful Farms, and now with Trece (Field Research and Development Manager), for alerting me to the fact that **mating disruption of NOW does not presently use false trail following** as the mechanism for disruption, which is the method shown by years of research to be successful in codling moth and OFM control. Instead, a single but primary component of the NOW pheromone is released by the dispensers. This single component interferes with pheromone response by one or more mechanisms that include desensitization of the male moth antennae or changes in behavioral response. The false trail method could be employed for NOW in the future if researchers find a way to stabilize the four-component blend used to attract and monitor male NOW in the Delta trap. However, at this time, the pheromone dispensed for NOW mating disruption is NOT attractive to male moths. I do not know of any research in pistachios which has tested the efficacy of the NOW disruption method at various population densities. It is very important that no adult moths are caught in the Delta traps, and that egg trap counts remain low. Mating disruption is not a stand-alone program! Well timed and executed insecticide sprays are needed to further suppress the NOW population. The amount of insecticide sprays depends upon how many years your orchard has been under mating disruption, and how much NOW pressure you have experienced in past years. Mating disruption is another important tool to suppress the NOW population. Winter orchard sanitation is critical for effective NOW management. Thank you, Brad, for correcting my understanding!

Crop Update: In 2016, the onset of kernel filling was as early as June 15. In 2017, the beginning of kernel filling was closer to July 1. Depending on your location, kernel fill began around June 25 this year. Kernel fill assessments made by Carl Fanucchi and I indicate that the higher chilling areas are as much as 10 days ahead of areas having received marginal winter chilling. As I have mentioned in earlier task lists, orchards in lower chilling areas also have a wide range in kernel filling, from nuts with embryos the size of a pin head to ones 50 percent filled. I think chill portions and its effect on leaf out and bloom could slow maturity in some orchards by 10 days or more.

If I had a pistachio orchard, you could bet your last dollar that I would be out cutting nuts NOW and recording the range in kernel development. This information will prove very valuable in estimating what percentage of your crop might be harvestable on the first shake. Cutting nuts closer to harvest will also help you decide how long you might have to wait to perform the second shake. Monitoring kernel filling also tells you if the blank nut percentages are unusually high, which could be a nutrition or pollination problem. One also is alerted to insect problems and high early split nut levels which contribute to navel orangeworm pressure at harvest.

Assessment of kernel filling should be performed as follows; randomly collect 10 ENTIRE clusters from a selected area of the orchard in a five gallon bucket, making sure that they represent fruit borne from each of the four tree quadrants (north, south, east, and west). Find a comfortable, shady area to work, because you are going to be there for 45 minutes. Strip the nuts off the rachises, and place the nuts in a container you

can easily access. With a pair of hand shears, cut EVERY nut in half. Those preferring to cut them horizontally should hold the base of the nut while they remove the upper, more tapered tip. I prefer to cut the nuts lengthwise, because it makes viewing the developing green embryo at the tip of the funiculus easier. However, cutting lengthwise must be done with greater care to avoid catching the flesh of your index finger in the shears. Rate the cut nuts for kernel fill, and place them under one of five categories labeled 0 to 5 (0=no fill, 5=completely filled) written on a piece of cardboard, or large coffee cups. When you are finished cutting all the nuts, count the number in each category, and do the basic math to determine the percentages of each. **WRITE DOWN** the results! Performing this task every two weeks will tell you a great deal about what to expect at harvest relative to maturity and crop load.

Kernel filling requires **lots** of water, nitrogen, potassium, and boron. Average water use in July is 9.8 inches (55 gal/tree/day, 150 trees/ac). August water use is 8.2 inches (50 gal/tree/day). Keep an eye on the temperatures and adjust your schedule accordingly to the heat and your tree spacing. If you do not have any soil moisture monitoring equipment in the orchard, be sure to auger occasionally to check for moisture below two feet. The surface can look mossy and wet, but the lower depths can be dry as chalk. Believe me, deficit irrigation sneaks up on you, and before you know it, your trees are stressed and limited in kernel filling rate! The amount of water applied must be greater than the tree's water requirement because of application inefficiency (70-80% efficient in basin or furrow systems, 85-90% in low volume). **Deficit irrigation, zinc or boron deficiency, and cool weather during kernel filling will dramatically reduce split nut percentages.** Orchards with a history of *Alternaria* should have received their second spray in mid-July. Waiting until symptoms to appear in August is too late for disease control. Continue to watch for leaffooted plant bug and stink bugs, which are difficult to detect after shell hardening. This is because the hull and shell **do not** develop the brown lesion characteristic of bug damage earlier in the season when the shells are soft. However, they will often show a tiny, clear bead of sap on the hull from where the stylet penetrated. It is not too late to apply nitrogen and potassium for kernel filling, providing you get it on by early August.

Dr. Siegel's research suggests that 1700, 2200, and 2700 Degree Days from January 1 are key times for **evaluation** (**neither** Dr. Siegel nor I are suggesting that these are automatic spray timings) of your NOW population, since they mark rises in NOW activity. As of July 16, this model suggests the degree day accumulation ranges from 1700 in Merced to 2200 in Arvin. Dr. Siegel's research (and that of Dr. Martin Barnes, UC Riverside in the 1970's) confirms that NOW cycles **MUCH** faster on new pistachios, so much so that they can complete a generation in 500-600 D⁰!. Hence, Dr. Siegel **suggests** orchards under **HIGH** NOW pressure may require treatment at 2200 **and** 2700 D⁰ from January 1. The need to do this in YOUR orchard is a decision between you and your crop consultant. There is **NOTHING** in this paragraph **TELLING** you to do anything! As of July 14, I have not found an orchard with numerous pea split pistachios. The orchards most recently scouted are on the west and east sides of Kern County, the growing regions most likely to develop early splits first, due to greater degree days. The absence or late arrival of early split nuts assists us in reducing NOW damage at harvest, because they are the link between the overwintering NOW generation surviving on the mummy nuts and the new crop. The arrival of early split nuts needs to be monitored by the grower, irrigator, and crop consultant to detect NOW egg laying activity. Although these pea-sized nuts typically get consumed by larva feeding on them before harvest, they serve as an excellent indicator of NOW activity, especially in orchards with mating disruption, where the adult traps are shut down. Make note of what stage of NOW development you find (eggs, tiny worms, large worms); this tells you how strung out their development is. Later in the season, NOW generations overlap, and all the stages seem about equal.

Watch out for citrus flat mite, a common pest in July that turns the rachis and hull tissue brown from feeding. Budding of newly planted orchards got into full swing in mid-July and will continue into mid-August. Trees can be budded in September, and the decision to push the bud or not is up to the grower and the adviser. Buds pushed late are tender and subject to early freezes. Follow the budder's instructions for irrigation and post-budding plant management. Tissue sampling should also be scheduled soon.

Soil and Water Management: Spread gypsum at one to two ton per acre if infiltration is becoming a problem. Calcium thiosulfate can be readily applied through the drip system, therefore reducing the time and equipment needed to respond to reduced infiltration rates. However, one pays a hefty price for this convenience, considering the fact that 95% ag-grade gypsum is presently about \$65 per ton, and the price I was quoted for a ton of calcium thiosulfate was \$410. There is also only about 120 pounds of actual calcium per ton of thiosulfate, compared to about 450 pounds per ton of 95% gypsum. Standing water increases your foliar disease risk due to greater humidity. Irrigate every other middle rather than stretching irrigations out to reduce standing water and tree stress. This is especially critical if you are on shallow soil with limited root mass. **Remember: no water = no splits = no money!** In the WORST cases, rip down the middle of the row with a single 24" shank to get water into the root zone. The stress caused from in-season root pruning is small compared to dry trees. Irrigate IMMEDIATELY after you rip! A professional soils and water adviser can assist you in assessing the need for such drastic action.

Pest Management: Hull discoloration (epicarp lesion) typical of plant bug feeding **prior** to shell hardening does not occur **after** hardening. Hence, nuts observed now with external lesion symptoms are old damage. Do not forget to look for new damage **at the base of the nut** where it attaches to the stem. This is the "Achilles' heel" of pistachio since it remains softer and the insects somehow know this! Feeding at this site can cause loss of the developing kernel. Big bug feeding elsewhere on developing kernels causes distortion, sunken areas and black lesions in the meat (kernel necrosis). Carry a pair of hand shears during orchard monitoring. Select nuts randomly and cut them open to examine evidence of recent kernel damage. *Stigmatomycosis*, a fungal yeast infection resulting in wet, slimy kernels is also transmitted by the big bug mouthparts penetrating the kernel. Keep your UC/Pistachio industry insect guide handy for reference in the field.

August-only treatments may not provide sufficient NOW control in orchards with high populations. By August, NOW development is strung out and generations are overlapping. Hence, a single treatment is unlikely to provide sufficient residual to reduce damage by much more than 50%. NOW eggs are also often imbedded in early maturing hull tissue in August and thus they avoid insecticide exposure unless they hatch and wander over it prior to boring into the hull tissue. Deciding on the necessity for multiple treatments depends largely on damage history, the abundance of old "mummy" nuts and early splits, the projected harvest date, and the presence and condition of surrounding orchards, especially almonds. When first laid, NOW eggs are white. Within a day, they turn a salmon-color, which becomes a reddish-orange just prior to hatch. Mean egg hatch is 100 degree-days from the time they are laid (about three to four days in the summer). In addition to egg color, note the size of any NOW larvae you find. This helps determine how strung out the NOW flight is in the orchard. Harvest after September 15 greatly increases your risk of NOW and often requires use of an insecticide to reduce damage. Insecticide choice will depend on your projected harvest date, and the pesticide pre-harvest and reentry interval. Monitor shriveled and split nuts weekly to obtain some feel for how much NOW is present. Also take note of any sources of beet armyworm (cotton, alfalfa, pigweed), which can also attack maturing pistachios. Gary Weinberger has seen as much as 0.5% damage due to this pest.

Pacific mite infestations occasionally occur in pistachios. Unlike citrus flat mite, pacific mite can cause damage at low populations (3-5 per leaflet). Defoliation during kernel filling can greatly reduce crop quality. Research suggests pacific mites do not thrive on pistachio. Six-spotted thrips are very effective predators. My research on various miticides in 2000 indicated oils of all types were as effective as synthetic compounds. Observations also indicate the addition of spreader-stickers to oils is not advised due to possible russetting of the hull tissue which could increase the potential for *Alternaria* infection later. Slight phytotoxicity may occur with oil applications made close to wettable sulfur.

Botryosphaeria may appear in August in some orchards. Orchards with past BOT infections benefit from two sprays; one in mid-June, and another close to mid-July. The strobilurins remain very effective against

BOT, because the sexual stage of this disease is not present in pistachios, and its genetics remain very stable. This is NOT the case for *Alternaria*, whose genetic makeup is constantly changing, and thus it develops resistance to new fungicides within a couple of years, depending on the frequency of application. Treatment timing for *Alternaria* is the same as that for BOT. Do not wait to treat for *Alternaria* in August when symptoms appear, because it is then too late. High humidity and dense canopies both favor buildup of *Alternaria* inoculum. Look for patches of brown necrotic tissue on the leaves with black sooty material that rubs off on your fingers.

Fertilization: U.C. Davis research shows kernel filling is a period of high nitrogen demand. On-year trees took up 35 percent more nitrogen during kernel filling than off-year trees. The nuts accounted for more than 90 percent of the accumulated nitrogen for the entire season. The total nitrogen requirement for on-year trees was calculated at about 150 pounds. Research by Dr. Siddiqui and Dr. Patrick Brown indicate 28 pounds of N is required per 1000 pounds of ACP weight pistachios. Add 25 pounds of N during the on-year for tree maintenance. These guidelines do not include inefficiencies in application, which can run as high as 50% when applied by the water-run method. Off-year trees accumulate most of their nitrogen in the canopy branches. Yellowing of leaves adjacent to nut clusters is common in heavy bearing trees. This occurs even when tissue levels are considered adequate (2.5%). Some growers report less yellowing with higher nitrogen applications. This has not yet been researched. .

Potassium (K) uptake is also very high during kernel filling. Research by Drs. David Zeng and Patrick Brown indicate potassium applications up to 200 pounds actual K per acre applied in equal amounts over the months of May through August significantly increased yield, split nut percentages, nut weight and reduced blank and stained nuts. Reductions in staining were associated with less *Alternaria* leaf infections at harvest. Siddiqui and Brown indicate 25 pounds of K are required per 1000 ACP pounds of pistachios. The greatest response to K fertilization was on soil whose potassium availability was limited by either low soil K or high fixation within the soil. Young alluvial soils such as those on the west side of the San Joaquin Valley are very high in exchangeable K, and thus less likely to respond to potassium fertilization, unless confounded by salinity or extremely light texture. Zeng and Brown suggest the August tissue level for K should be about 1.7% for optimum plant performance. No elevation in chloride was observed in the leaf tissue from chloride-containing potassium sources after three continuous years of application. However, consideration of orchard health, soil permeability and stratification should be given prior to performing large-scale KCL applications.

New Trees: I do not advise tipping secondary branches in an attempt to develop tertiaries. My experience is that it only works on highly vigorous trees. Carl Fanucchi has shown me second-year trees with strong tertiary growth from secondaries tipped as late as early August in Buttonwillow. However, I have also seen insufficient growth from the same practice on the eastside in Pixley. Properly assess your orchard's vigor with your tree trainer before attempting this. There is always next year! Tying vigorous limbs into the desired upward position now prevents flat scaffolds in the winter. Above all, be careful about too much water. Also, be on the lookout for zinc, boron or copper deficiency, all common in young trees. They will stop new growth!

Thank you, Blake Sanden!: After 26 years serving the University of California Cooperative Extension system in Kern County, Soil and Water Farm Advisor, Blake Sanden, retired June 30, 2018. This is a huge loss for the University and California agriculture, because Blake was an extremely productive and knowledgeable advisor. Blake tackled some huge projects involving almond and pistachio irrigation, fertilization, soil modification, and salinity. These projects lasted six to ten years each, and required multiple measurements with sensitive scientific instruments. Analysis and interpretation of the data was also well beyond what most UC advisors had to deal with. He was also a very passionate and patient teacher. Educating farmers and farm advisors on soil chemistry and salinity management is very difficult, because the subject matter is complex and the concepts foreign. I don't know how an advisor as busy as Blake in such an important ag county found time to work so extensively with each of us. As a friend and

colleague, I wish Blake, his wife, Sue, and their family many glorious years of doing what they want to do when they want to do it! Hopefully, Blake will still stay in touch with us, so that we can continue to learn from him. It is not until people like Blake leave the daily ranks that we realize the big loss in information access and experience! Words cannot express our gratitude to you, Blake! You did an outstanding job, and we are all indebted to you for your research and education! Enjoy less stressful days!

Happy farming!