

July 2020 Orchard Task List for Pistachios
By Bob Beede, U.C. Farm Advisor, Emeritus

Author's Note: *After 35 years of UC service, I am honored and privileged to remain affiliated with my Alma Mater as an Emeritus. I continue to serve the UC Mission as best I can through continued education efforts such as this monthly task list, which I have now written for 25 years. However, my Emeritus status does not allow me to represent the Land Grant College in any way; thus, readers must be aware that the content of these task lists represents my personal experiences, opinions and distillation of research I and others within the University have performed for the betterment of the agricultural industries we serve.*

Field Budding Time Approaches: As we aggressively cultivate recently planted pistachio rootstocks to achieve the necessary size and vigor for successful budding, I am reminded of a personal slogan shared with me by one of the most successful tree fruit producers in the San Joaquin Valley; “God loves a fair deal.” This was how he finished an interesting discussion about the challenges of tree fruit culture, labor management, and marketing. This personal slogan segues into the pledge of allegiance we Americans make to the Republic in which we are so fortunate to reside; “One nation, under God, with liberty and justice for all.” Rest assured; it is not my intention to be pastoral in referencing these two poignant statements. Rather, I use them to remind us that our dealings with one another were deemed by the fathers of our Constitution and its citizenry as being overseen by defining powers far greater than ours. These powers were referenced as guiding lights to accomplishing the very purpose of colonialization. By subscribing to them, our United States of America has flourished in principle and the people have prospered. I share these thoughts and principles with you because of the iniquity created within the pistachio industry by growers, out of ignorance or forethought, who do not honor the \$1.00 per budded tree **ROYALTY REQUIREMENT** due the University of California for the patented varieties: Golden Hills, Lost Hills, Randy, Tejon, Famoso, Gumdrop, and future releases. Kerman and Peters are public domain and are not subject to royalty surcharges. It has become exceedingly apparent that the failure of some propagators to require payment of the royalty has placed them in a more competitive position for securing employment for their budding crews, at the expense of others who have faithfully collected the royalty for the UC varieties. The adversely affected propagators are now complaining loudly to UC about those choosing to be disobedient. This, obviously, is NOT a fair deal! It also places UC in the undesired position of having to regulate the offenders. UC has made it clear to the pistachio industry that your Land Grant College was never meant to be a regulatory institution; rather, its Mission is to develop new knowledge and educate the youth so that we can continue to thrive in this great nation. Nevertheless, I understand that UC Davis has brought this problem to the attention of its attorneys, is in the process of investigating these matters, and is taking steps to ensure that the propagators comply with their obligations, including the royalty requirements.

Without the efforts of UC personnel breeding new pistachio varieties, our industry will not continue to prosper. Those perceiving of the royalty as excessive should realize that the \$1.00 is recovered from 250 marketable nuts per tree in just ONE harvest season! The improved yield and split percentages provided by such new varieties as Golden Hills more than compensates the grower for the one-time cost. I therefore appeal to all growers to be fair to all those contributing to our highly successful industry, and to subscribe to the principles that make our country one of the most desirable nations.

Crop Update: This year’s crop is estimates range from 750 to around 950 million pounds. Like 2018, this year’s cool spring suggests harvest is going to be later than “normal”, since early season photosynthesis and carbon fixation is not optimized under cool temperatures. Comparison of the degree day accumulation (using a 40⁰ F minimum threshold, and no upper) for 2020 between March 10 and June 20 **to the 30-year average** suggests that 2020 is 89D⁰ ahead of the historical average. Last year was 124D⁰ ahead of the historical average. In 2018, we were 84D⁰ ahead. In 2017, we were ahead 180D⁰, and in 2014, a very early maturing year, we were 300D⁰ ahead. **The best way to assess the effect of spring weather on crop development is by monitoring the completion of shell hardening, and the beginning of kernel fill.** It would stand to reason that late blooming flowers would be slower to complete both of these important crop development indices than flowers that bloomed early. Noting the date of shell hardening and kernel fill annually provides a reference for comparing previous years, whose harvest date is known. It also tells you when your nitrogen, potassium and water need to be optimized to avoid reductions in kernel growth rate and increased nonsplit nuts. My 2020 Kerman shell hardening estimate is June 22, about 14 days behind “normal” years. Harvest will be late. You really need to cut nuts for shell hardening and kernel fill!

To assess kernel filling, 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 then 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, 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 (a bloody mess!). Rate the cut nuts for percent of complete kernel fill, and then place them in 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 at least every two weeks will tell you a great deal about what to expect at harvest relative to maturity and crop load. It will also tell you if the large bugs are having lunch at your expense by the presence of misshaped kernels or tiny dark spots in the kernel or on the funiculus. If the kernel appears to be drying up, look around the base of the nut, which is much softer and easier for the insects to probe.

Soil and Water Management: 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). These water use estimates are for orchards whose soils are not salt affected. Recent research led by Dr. Daniele Zaccaria, UC Extension Specialist, Water Management, and Blake Sanden, UC Farm Advisor, Emeritus, Kern County, studied the effect of increasing soil salinity on pistachio orchard water use. **Table 1** shows the three levels of salinity studied, and its effect on reducing the percent shaded area (PAR) and seasonal water use relative to a non-saline affected orchard (ECe about 2 ds/m).

Table 1

Salinity Level (ECe) ds/m	Relative Reduction in PAR(%)	Percent Seasonal ET Reduction
4-5	10	19
6-8	35	26
8-11	50	40

These reductions in shaded area (tree size) and water use reflect the impact salt has on increasing the tension exerted by the tree to extract water from the soil. Management efforts to minimize this elevated tension by increasing the soil water content often lead to too low an oxygen level in the root zone, and subsequent root death. Hence, this research suggests that pistachios grown in salty soils have to “tough it out” with reduced water uptake, which limits tree size and overall productivity. Planting tighter spacing to compensate for the smaller tree size should increase the total light intercepted and improve yields. Growers

faced with saline soil conditions and no low-salt water to mitigate them should study the full report provided to the Pistachio Research Board by the researchers. It can be found online.

Keep an eye on the temperatures and adjust your schedule accordingly. If you do not have any soil moisture monitoring equipment in the orchard, be sure to auger weekly 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.**

Spread gypsum at one to two ton per acre if infiltration is becoming a problem. 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 and Disease Management: We have some real challenges in monitoring and assessing the need to spray for navel orangeworm (NOW). I do NOT consider myself the Guru or Prophet for NOW management. I am simply trying to "play the melody" for you growers and investors to help you understand that NOW is a VERY serious problem, and everybody has to do their part to try and suppress the population in your growing region. You have all heard about how important it is to winter sanitize, to the point that you are now deaf to it. You have also heard that it is "easier" to sanitize almonds than pistachios. This is true, because there are so many more pistachio mummies in the field, and their small size makes them difficult to destroy. Almond growers rightfully complain about the logistics, cost, and time it takes to approach the one mummy per tree goal. Almond farmers are stunned by a per acre sanitation bill that can run \$300, and they STILL have not reduced the mummy load to one per tree! Pistachio growers can spend just as much, if not more, to do a really thorough job. Because of the time and financial restrictions, growers are hoping that Mating Disruption (MD) will substitute for winter cleanup. In fact, MD DEPENDS on the best sanitation you can afford, because it is NOT A STAND ALONE SYSTEM! MD is JUST ANOTHER TOOL, and it WILL NOT suppress the NOW population on its own! I'm giving you all this boring background, because researchers DO NOT yet have a means of assessing the NOW population in your orchard, or your region. Growers without MD can now have trouble monitoring their in-orchard NOW activity, because the MD pheromone is affecting the adult moth catch in the NOW trap an estimated 2-4 miles away from the MD orchard! Thus, the PCA in the conventionally managed orchard has to rely more on their egg traps to assess activity. Researchers are developing phenyl propionate and kairomone lures which attract both male and female NOW, **even** when MD has the standard NOW lure shut down. The hope is to use these new lures to better assess the population and the need for an insecticide treatment to augment the MD. Remember; MD is NOT a stand alone system! You have to be monitoring your orchard and the nut crops surrounding your field to determine when an insecticide treatment is needed!

Dr. Siegel's research suggests that 1700, 2200, and 2700 Degree Days from January 1 are key times for **evaluation** of your NOW population, since they mark rises in NOW activity. **EVALUATION does NOT mean BLANKET SPRAYING!** Dr. Siegel's research confirms that NOW cycles MUCH faster on new pistachios, so much so that they can complete a generation in 500-600 DD⁰! Dr. Martin Barnes (Dr. NOW of the 1970's at UC Riverside) also reported this back in the 1970's. Hence, Dr. Siegel suggests orchards under **HIGH** NOW pressure may require re-treatment at 2200 **and** 2700 DD⁰ from January 1. The need to do this in YOUR orchard is a decision between you and your crop consultant, SO you need to get together

with your crop consultant NOW to discuss what they are seeing and what THEY recommend you do. According to the excellent Degree Day monitoring service Corteva Agriscience provides (Email: corteva@pestclues.net to get added to the weekly mailing list), the overwintering NOW generation should taper off about June 17. Dr. Siegel believes this year’s overwintering population is twice that of last year. It remains to be seen what the impact of this is as we approach harvest. The beginning of the second generation could fall right on top of the early suture development in almond, which could increase that crop’s insect pressure. It could also spill over into pistachios later when the almonds are harvested, so try to stay abreast of what your almond neighbor is doing to protect his crop. The 1700 DD timing is for assessment of pea splits and is typically the NOW flight that occurs in almonds in mid-July). Pea split nuts allow the overwintering generation of NOW to transition onto the “new crop”, and thus develop at a faster rate, due to the improved food source. Pea splits typically do not occur before the first week in July. Don Thomas, a crop scout for 30 years, tells me that 25 pea splits found in three minutes spells big trouble, so get out in the orchard and monitor for these! Don’t ask your crop advisor to do it all! There is no way they can spend the time scouting your field the way you can. Help them out, so you can help yourself get that 20-cent premium! The 2200 DD timing most often occurs in early to mid-August and 2700 DD occurs in early September. For those doing a double shake, there may be a need to treat between shakes in the neighborhood of 3,000 DD. These timings can be refined for an individual orchard with on-site temperature sensors/degree day monitors.

Dr. Joel Siegel has developed an outstanding table to ASSIST growers in their NOW management decisions. His table does NOT constitute a recommendation! Use this very valuable tool in your discussions with your crop advisor to customize your pest management program. Joel has also reminded me of published research by his University of Illinois colleagues, in cooperation with entomologist, Brad Higbee (formerly with Wonderful, and now with Trece), which showed pyrethroid resistance development. At the time of the study, NOW’s tolerance to pyrethroid was reportedly as high as 16 times the control group. I am told that field failure can begin when tolerance reaches 20-fold. Dr. Siegel’s colleagues at the University of Illinois also showed **resistance remained stable for at least 10 NOW generations** under laboratory conditions. Although pyrethroids are still effective in the field today, our heavy reliance upon them may come to an end due to resistance. Dr. Siegel states that there is also no new chemistry within the pyrethroid class to explore. This information makes timing and execution of treatments all the more important. Between the difficulty in thoroughly winter sanitizing pistachios, and the thousands of acres of nut crops now present in the southern San Joaquin Valley with varying degrees of NOW management, it is no surprise that attempts to apply IPM principles prove very difficult. I sure hope the implementation of area-wide Mating Disruption in pistachio and almond proves key to reducing our pesticide dependency.

Table 1. Suggested pistachio spray strategies for navel orangeworm. Dr. Joel Siegel, USDA/ARS. The materials chosen for 1700 DD all have a pyrethroid component for Hemiptera

Degree Days	Strategy 1 Single Mode of Action	Strategy 2 Single Mode of Action	Strategy 3 Double Mode of Action*	Strategy 4 Double Mode of Action*	Strategy 5 Heavy Pyrethroid Use@	Strategy 6 Heavy Pyrethroid Use@
1,700	LambdaCy	Bifenthrin	*Besiege*	LambdaCy	@LambdaCy	@LambdaCy
2,200	Intrepid	Altacor	Intrepid	Intrepid	Intrepid Edge	MinectoPro
2,700	Altacor	Intrepid	*Altacor+ LambdaCy*	*Besiege*	@Altacor+Bifenthrin	@Intrepid Edge
3,000- 3,200	Bifenthrin	Bifenthrin	*Intrepid Edge*	*Intrepid Edge*	@Intrepid+Bifenthrin	@Altacor+Bifenthrin Note this has a 10-day PHI

Maximum Label Rate Strategy-your choice:

For Altacor (IRAC 28) it is 4.5 oz/acre

For Besiege (IRAC 3A+IRAC 28) it is 12.5 oz/acre (this corresponds to 3.79 oz/acre of Altacor and the maximum rate of Lambda cyhalothrin; if you choose to maximize the Altacor component you can add Altacor at 0.71 oz/acre)

For Intrepid (IRAC 18) it is 24 oz/acre

For Intrepid Edge (IRAC 5+18) it is 19 oz/acre

For Lambda Cyhalothrin (IRAC 3A) {LambdaCy, Warrior II etc.} use 2.56 oz or 5.12 oz/acre depending on formulation. CHECK LABEL.

For Minecto Pro (IRAC 6+28) it is 12 oz/acre

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 when the shells are soft. Nuts observed now with external lesion symptoms are old damage. New feeding will often show a tiny, clear bead of sap on the hull from where the stylet penetrated. 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.

Watch for citrus flat mite, a common pest in July that turns the rachis and hull tissue brown from feeding. Pacific mite infestations also 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.

Orchards with past *Botryosphaeria* (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. Orchards with a history of *Alternaria* should be on their second spray by mid-July. Waiting until symptoms to appear in August is too late for disease control. 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. Research has not yet been conducted on this topic. .

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.

Happy Farming!