



May, 2019 Orchard Task List for Pistachios

By Bob Beede, U.C. Farm Advisor, Emeritus

Field Observations: Even though we received good winter chilling this year, the cool spring weather has delayed pistachio leaf out and bloom by five to seven days. This spring is a great example of how, even with good chilling, pistachio plant development can be delayed by cool temperatures. The overlap between Golden Hills and Randy looked very good. Randy is a very prolific male, even when young, and provides lots of pollen for young trees just coming into bearing. The overlap between Kerman and Peters was not quite as good; I rated Peters at only 10-15% bloom when Kerman was at 40% bloom. However, the flower clusters are developing nicely, and I have not seen any sign of poor pollination in mature orchards. The Peters males in young Kerman orchards have always lacked adequate pollen to maximize set in the more precocious females. The research attempts at documenting yield improvement using artificial pollination have also resulted in no measurable improvement. In addition to the complexities of harvesting, storing, and distributing the pollen, one has to remember that one or two artificial pollinations are single EVENTS, not PROCESSES! By this, I mean that natural pollination occurs 10-12 hours per day over a 7-10 day period. The presence of freshly emerged natural pollen has greater probability of landing on a newly receptive female flower stigma for rapid germination. Female flowers vary in their date of receptivity within the inflorescence, as well as throughout the tree. So, having adequate natural pollen present constantly is much different than attempting to augment the pollen load once or twice during the span of female flower receptivity. The occurrence of these artificial “events” does not appear to be sufficient to significantly increase fruit set. Placing branches of natural pollen in water buckets hung at the young male tree locations has shown some improvement, but pistachio shoots plug up their vascular system with resin quickly, and thus greatly reduce the life of the expanding male inflorescences. Preserving the cut male shoots by preventing resin plugging could help greatly in extending their life and pollination effectiveness.

During pruning, people talked about this being an off-year, but my visitations to many orchards, young and old, suggest there could be 750-800 million pounds out there! I have seen several orchards with crop loads I estimated at 5000 pounds, if most of the clusters set. At the time of this writing, we are now moving into the BB stage of nut development, and the canopies have leafed out sufficiently for the very important nutrient spray.

As I have written many times, leafing date and spring temperatures have a greater effect on harvest date than summer temperatures. This is because spring temperatures have a greater effect on the rate of carbon fixation. In the summer, the rate of carbon fixation is maxed out rapidly in the morning, and limited by temperatures exceeding that for optimal photosynthesis in the afternoon. During really hot days, considerable carbon could be expended in respiration. All of this physiology desperately needs to be researched, and I am shocked that there are no UC researchers interested in doing so.

I also have observed many orchards being irrigated too heavily too early. The cool spring weather and delayed leaf out has reduced the water use schedule for pistachios by about 10 days.

Nutrition: Early May is a good time for nitrogen fertilization. **The efficiency of nitrogen uptake from the soil during early leaf out is essentially zero, because nitrogen uptake occurs simultaneously with water use.** Consequently, applications made when the tree lacks about 50% foliage are subject to leaching beyond the main root zone at two to four feet, especially in production areas averaging 15 or more inches of rainfall. Drs. Rich Rosecrance, Steve Weinbaum and Patrick Brown, UC Davis (Rich is now at Chico), showed that pistachios beginning the off-year are lower in stored N than on-year trees, but uptake occurred primarily between mid-May to late August. **As I have said over and over, the “Grand Period of Growth” from bud break to leaf out is all driven by RESERVES stored within the tree, NOT what it is taking up from the soil!** Nitrogen applications in March are therefore very subject to loss past the root zone, depending upon rainfall or irrigation amount, and soil type. Obviously, sandy soil textures are less capable of retaining applied nutrients than heavier textured soils. Nitrogen uptake efficiency might reach 80% with multiple applications at low rates under drip or low volume compared to “slug” treatments. However, as much as 50% of the N applied by water-run can be lost from volatilization and leaching past the root zone. Save your rotten tomatoes to throw at me, but I think water-run nitrogen is old school, in tree crops. You will find this out when the State starts tracking nitrogen purchases and regulating the amount used. Lots of crop consultants have applied as much as 20 pounds of actual N per acre on pistachios by mid-April. Their concern is a fear that they will not have sufficient soil N to maximize early development – this early application is fine as long as you can guarantee it did not go anywhere with subsequent irrigations or rain. One major laboratory even claims relatively high applications of N in the fall and early spring mitigate alternate bearing. There is NO research to support this practice, and I am not advocating it! Until someone proves that the Grand Period Of Growth in deciduous trees is not driven by stored carbohydrates and nutrients, I will continue to advise you that these early fertilization practices can result in N leached past the root zone, and into the groundwater. I see more and more agricultural practices initiated without a stitch of properly conducted and analyzed research, and it is very disturbing to me. Show me the data to support this fertilization practice, and I’ll eat a pair of dirty underwear! **A 10ppm residual nitrate nitrogen per foot of soil provides 40 pounds of readily available N for uptake!**

Rosecrance, Weinbaum and Brown calculated the total N requirement for on-year trees was about 175 pounds for a 5,000 lb crop. This “calculation” was not simply an entertaining exercise performed on the back of a cocktail napkin at Shorty’s Biker Bar. It was the product of multiple years research in which isotopically labeled nitrogen was applied in measured amounts to the soil around individual trees prior to both on and off bearing years, and then the ENTIRE tree was dug out of the ground, cut into specific sections, weighed, chipped, dried, and analyzed for labeled N content. Knowing the amount applied to the soil allowed them to determine the labeled N translocated to current shoots and woody branches of various ages. Even the twelve inch diameter trunks were chipped and analyzed. This research suggests reducing off-year applications by one-third of the on-year rate. The **demand** for N and the tree’s capacity to take N up from the soil is greater in the on-year. In on-years **nitrogen uptake is largely driven by crop load since nut fill accounts for 90% (about 100 pounds,) of the accumulated seasonal nitrogen.** Since off-year trees are lower in stored N, one might consider applying half the season’s N prior to shell hardening and the remainder in July and August. (Weinbaum, et.al.,1988, 1991,1993,1995. California Pistachio Commission Annual Reports)

For on-year trees, **apply** between 175 and 200 pounds of actual N **depending upon crop load, tree size, vigor and method of application.** The most recent findings of Dr. Patrick Brown indicate 28 pounds of actual N are REMOVED from the orchard for every 1000 pounds of dry, inshell CPC weight pistachios. **This value DOES NOT take into account inefficiencies in application!** As mentioned in last month’s task list, this varies greatly with application method, especially if you are water running on a soil with low infiltration. An additional 25 pounds are required for tree growth. Using Dr. Brown’s values, a 5000 pound crop would require 140 pounds (5 x 28), plus 25 pounds for the tree itself. That equals 165 pounds at 100% application efficiency. We estimate that applications applied through well maintained low volume irrigation systems are about 75% efficient. Therefore, one has to apply 25% more than 165 pounds, or 206 pounds to meet the requirement of a 5000 pound crop. Monitoring of leaf tissue and soil levels is then necessary to determine if

each is rising or dropping. **Rising nitrate nitrogen levels in the soil indicates you are applying more N than the crop is using, and risking its loss past the root zone and into the groundwater.** Obviously, soil samples showing a trend in N depletion suggest an increase in fertilization rate is required to balance uptake with availability. **Irrigation water must also be sampled for nitrate N and considered in the amount applied, since 10 ppm nitrate nitrogen provides 27 pounds of actual N per acre foot of water applied!** Four acre-feet applied seasonally therefore meets most of the requirement of a 4000 pound crop!

Former UC Doctorate student Ismail Siddiqui and Dr. Brown have a prediction model to correlate May tissue sampling with our traditional August critical values of nitrogen and potassium. These guidelines are based upon extensive research in four high-yielding orchards across California from 2009-2012. These guidelines are based on specific sampling procedures which can be found at this web link:

http://ucanr.edu/sites/scr/Assessment_of_Nutrient_Status_in_Pistachio/PPM/. After receiving your tissue results, go to their prediction model (upper right corner on the same page) and enter your N and K values. A 3% N and 1.3% K level in May predicts that your orchard will have 2.62% N and 2.01% K in August. There is also a .PDF file discussing early season sampling and in-season nitrogen application for further reading. Adding high levels of N to the soil early in the season does not force the tree into greater uptake unless the tree is deficient. Available data indicates pistachio growth and yield is not improved with July tissue levels above 2.5 percent. (Weinbaum, et.al. 1988, 1995). **Plant N uptake is dependent upon root health, water management, soil temperature, crop load, and overall plant demand. Remember, uptake is driven by DEMAND, NOT by you over-feeding the tree!**

At present, it is recommended that Nitrogen (N) application through the drip system or by calibrated surface equipment begin in mid to late April, during early nut development. A suggested seasonal schedule for a 5000 pound crop (200 pounds of N) is; 25 in April, 50 in May, 50 in June, and 75 in July. This amount assumes a 75% application efficiency AND no nitrate N in the irrigation water.

Additionally, 125 pounds of potassium (K⁺) is applied annually due to the high potassium requirement of pistachios. A suggested K application schedule is as follows: 50 pounds in May, 50 pounds in June, and 25 pounds in July. These fertilization rates are typically achieved through liquid blends applied through the drip system during May, July, and August. Nitrogen is applied alone in April in the form of UN32. Table 1 provides the details of some commonly used nitrogen and potassium sources.

Table 1. Pistachio Production Nitrogen and Potassium Fertilization Program

Fertilizer	Lbs/gallon product	Gallons/Ton Product	Lbs Nutrient/Gallon of Product	
			Nitrogen	Potassium
UN32	11.06	181	3.54	0
10-0-10	9.7	206	0.97	0.97
15-0-5	9.7	206	1.46	0.49
Application Date	Fertilizer Source	Gallons/Acre	Lbs Nitrogen/Ac	Lbs Potassium/ Ac
April	UN32	7.0	25	0
May	10-0-10	51.5	50	50
June	10-0-10	51.5	50	50
July	15-0-5	51.5	75	25
		Total	200	125

Young Tree Management: Dr. Patrick Brown and Qinglong Zhang were the first researchers to show good zinc uptake at 50% leaf expansion (late April to early May). Due to high uptake efficiency, only 2 pounds of zinc sulfate 36% are required. It is safe to also add one-half pound of Copper EDTA or one pound of Solubor to the foliar zinc sulfate rate. Buffering this mixture to a pH of about 5 improves zinc uptake by increasing the amount in solution. **Acidification should be done with citric acid (powder) rather than phosphoric buffer**

to prevent zinc phosphate precipitation. Many growers prefer to avoid the “Betty Crocker” mix and apply liquid materials formulated for pistachios. Check with your supplier for suggestions, but be sure they have adequate amounts of copper, boron, and zinc. **This is especially true of two and three year-old trees. They may require as many as three foliar treatments to insure continued rapid shoot growth.** Deficiencies severely limit canopy development and reduce early bearing potential. Zinc and boron deficiency is the most common problem I diagnose in young tree plantings! The calendar period for treating young orchards is longer than that for mature trees due to the extended period of young, tender growth. High pH soils tend to have more zinc deficiency problems. This soil condition is more the norm than the exception in the pistachio industry! There are many zinc-based, proprietary products available that suggest their carbohydrate transporter or exotic chelating chemistry moves zinc into the plant and translocate it through its vascular system like cocaine in a drug addict. I have YET to see ANY solid data on NUT CROPS to support the superiority of these higher priced liquids for Zn mobilization in the plant. There is evidence that some of these materials (Manni-Plex Zinc studied by Dr. Brown is one example) benefit from the additional compounds they contain which may help the product spread, stick and ‘humidify’ the leaf surface. Many growers also like liquid formulations for ease of handling and lower likelihood of mistakes. These benefits do not, however, imply better within plant movement. I am NOT stating that they do not provide adequate zinc nutrition. Instead, I am advising you that many claims appear to be made that are not supported by properly conducted research on tree nuts. Having done quite a bit of zinc research myself, I can assure you it is not easy to get significant differences between treatments. The project has to be conducted for a minimum of two years, and preferably four.

Growers with **second** leaf trees may have finished their second training pass by the time they read this. The first pass would have suckered the rootstock up off the ground about 14 inches. I still recommend retaining and pinching some rootstock growth to aid in trunk girth development, but I see that cultural practice is being dropped by many tree trainers. How about one of you guys doing some rows without stripping to compare tree growth? Maybe we would not have as much “muffin top” overgrowth at the bud union if you left more rootstock growth! When primary branches on trees dormant headed at 42-44 inches reach 15 inches in length, they are ready to be pinched back to 12-13 inches. Do not let the primaries get too long! Removing large quantities of shoot growth reduces the number of laterals that push, and costs time for secondary and tertiary growth. Pistachios on vigorous rootstocks grow so fast in warm weather that a training crew pass may need to be made every 10 to 14 days! In the best orchards, five passes are made between late April and mid-July, when the tipped secondaries are left to grow untipped the remainder of the season. **Do NOT tip the tertiaries!** It severely reduces branch diameter! Also, UC Farm Advisor, Craig Kallsen, Kern County, expresses caution in tipping Golden Hills shoots too early, because the vegetative bud within the leaf axil will not be visible, and thus not developed enough to produce a lateral shoot. So, before initiating tipping of your primary branches, examine the shoots to confirm that you can see a small bud at the base of the leaf petiole.

Pest Management: Monitor newly set clusters for evidence of plant bug feeding, which will increase with hotter weather. Drying vegetation near orchards will soon become unfavorable hosts for plant bugs, and the migration into your pistachios will begin. Many growers minimize this by application of a pyrethroid insecticide in late April in combination with their foliar nutrient spray. Be sure to watch for false chinch bug activity on weeds within young orchards. . Get rid of the London rocket and spotted spurge now! There are also reports of darkling ground beetle and earwig damage to newly planted trees, so keep those feet in the furrows!

Happy Farming!