



May, 2014 Orchard Task List for Pistachios

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

Field Observations: Reports from Kern County and both sides of the Central Valley indicate orchard leaf out was extremely variable, regardless of whether or not oil was applied. Since I have yet to speak with growers who have actual temperature data for their specific site, it is impossible to develop supporting evidence to show chill portion accumulation differed sufficiently by location to explain the great variability. However, there is little doubt in my mind that inadequate rest satisfaction is the primary cause for protracted development. It is very common to see only three leaflets per leaf this season, rather than the normal five. Dr. Julian Crane, late UC Davis Pomology Professor, reported this in the early 1980's. Also, literature dating back to the 1930's describes high vigor, one-year-old wood in the upper part of tree canopies as requiring more chilling than older, less vigorous wood. As you know, the tipped whips at the top of the pistachio tree canopy are 10-14 days behind the lower portion in many orchards. Hindsight being 20/20, it is too bad we were unable to mount a campaign to record temperatures and leaf out rates, since it could have proven useful to refining our present estimates of chill portions, using the Dynamic Model. If some of you have such data, please let me know, so that we could make an attempt to get it summarized. Temperatures without regular estimates of leaf out and bloom development are not helpful, unfortunately, so save yourself a phone call if you only have one of the two.

As mentioned last month, an oiled orchard in east Madera County leafed out almost three weeks ahead of other orchards in the area. Unfortunately, the Peters male trees were two weeks behind the Kerman. We know Peters has a higher chill requirement than Kerman, but the fact that the Kerman females pushed so much earlier suggests that they received adequate chilling, and were further accelerated by the oil and above average spring temperatures. The extended delay in Peters leaf out suggests their rest requirement was substantially less than adequate, and neither oil nor warmer temperatures were sufficient to overcome this inadequacy. I suggested the possibility of higher bud temperatures in the Peters due to it having larger flower buds with slightly darker color and thus, greater absorption of solar radiation, but there is no data to support this hypothesis. We also do not have sufficiently detailed reports from the field to tell us whether or not males in low areas pushed sooner than those at higher elevation. Such reports have been forthcoming from Kern County, where growers and consultants report normal leaf out and overlap for Kerman and Peters on the Valley floor, but delayed development in orchards on elevated alluvial fans east of Highway 99. Several reports of extremely delayed leaf out have also been received from Westside growers. One orchard north of State Highway 198 (Harris Ranch Turnoff from Interstate 5), and another in the Lost Hills area still have only 50% canopy and flower bud emergence.

Craig Kallsen, UCCE Subtropical Crops Advisor, Kern County, recently shared an interesting observation about pistachio female inflorescences "waiting" for pollen. As you know, Craig has been leading the field efforts in new variety development and evaluation for many years, in concert with Dr. Dan Parfitt, UC Davis Professor, and Joe Maranto, UC Farm Advisor, Retired. Craig described bagging female flowers for the purpose of introducing selected male pollen, which was not always synchronous with its female counterpart. Consequently, the female flowers remained bagged for 10-14 days before the selected male was introduced. Craig has found the female florets to still be very green and sticky, and he has harvested

20-40 nuts from these flowers which have been delayed in pollination. I found this both interesting and exciting, because it provides hope for those growers whose Peters trees were delayed in leaf out. It would be most helpful if growers experiencing significant delays in Peters bloom share yield data with us after harvest, so that we could be more confident about the effect in the future.

UCB-1 Clonal Issues: Due to the seriousness of this subject, I have chosen to mention it now in the task list, for fear that your Batman Comic book is already beckoning you. Last season, a substantial number of newly planted clonal UCB-1 rootstocks showed low vigor and compressed internode distances, resulting in a bush-like appearance similar to severe zinc deficiency. Trees with these symptoms also proved very difficult or impossible to bud. A sundry of hypotheses were offered as possible explanations for these “bushy top” trees, but it was not until late in the fall of 2012 that a small group of Kern County growers and consultants enlisted the assistance of Dr. Jennifer Randall, Professor of Plant Pathology at New Mexico State University, to test the effected plants for pathogens. Industry leaders were first made aware of this private effort at the February Research Proposal meeting, at which she presented some **very preliminary** data to suggest **possible** involvement of a phytoplasma-like organism. Obviously, public disclosure of her early findings was out of the question at that time, due to the infancy of her investigation, and advice from Dr. Randall and other plant pathologists that positive confirmation could be difficult. Then, on April 7, 2014, Craig Kallsen published a newsletter in conjunction with Dr. Randall, indicating that the bacteria, *Rhodococcus fascians*, had been recovered from plants with the “bushy top” symptoms http://cekern.ucanr.edu/newsletters/Pistachio_Notes_Newsletter51195.pdf. This bacteria has been studied extensively by Dr. Melodie Putman, Oregon State University, who describes growth symptoms in other plants as identical to those observed in “bushy top” UCB-1 clonal rootstocks http://c.ymcdn.com/sites/www.oan.org/resource/resmgr/Digger2/Digger_201402_pp33-37_OSU.pdf. We have also observed second year trees on UCB-1 clonal stock whose bud union is quite swollen, and the bark deeply crevassed, like that of a cork oak tree. This condition is also **thought** to be associated with the *Rhodococcus* bacteria. **HOWEVER**, Craig and Dr. Randall wanted me to emphasize that **Koch’s Postulates have NOT yet been completed!** Koch’s Postulates confirms the suspected pathogen as the “causal agent” by introducing *Rhodococcus fascians* into “clean” plants, observing the same symptoms as those reported initially, **AND THEN RECOVERING THE INTRODUCED PATHOGEN FROM THE PLANT**. This effort is in progress, and will be reported to you as soon as possible. **Should** it prove to be pathogen related, it is possible that more than one could be causing the “bushy top” condition. Contrary to the pathogen hypothesis, one **nursery reports evidence of a mutation** within their clonal line as the cause for the abnormal growth pattern. Independent pathology testing has also not recovered *Rhodococcus fascians* from these plants suspected to be mutations. They have also not been able to induce the “bushy top” symptoms into “healthy” plant material by budding. A huge amount of effort is being expended by both private and public entities on determining the cause of this abnormal growth. Growers having planted clonal UCB-1 clonal trees in the past two years should review the newsletter and article links provided here. As you survey your orchard, be aware that “bushy top” trees are quite distinct, as are those with the highly swollen bud union shown in the photos included in Craig’s newsletter. Slow growing, normal looking rootstocks are **NOT** cause for defaulting to the idea that you have “bushy top” trees. Contact the nursery from which you purchased the plants for further information and assistance. They have been **VERY** receptive and responsive to their valued customers.

Nutrition: **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 three 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.

Rosecrance, and Weinbaum calculated the total N requirement for on-year trees was about 175 pounds. 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 translocation 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. **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 ACP weight pistachios. Each tree uses about one pound of N. **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 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 rootzone 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! Those of you still reading this may be asking, “Why all the talk about nitrogen?”, but if you do not begin collecting some data on the ranch to assess your nitrogen program, you will soon find that was a mistake when it comes time to justify your usage with the Regional Water Quality Control Board.

Former UC Doctorate student Ismail Siddiqui and Dr. Brown have just completed 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). Because leaf out occurred 10 days earlier this season, the cuticular waxes on the leaf surface may be fully developed by 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!

Growers with **second** leaf trees should have finished their second training pass by the time they read this. That is right, **ALREADY TWO PASSES!** I recently talked to the Kern County Tree Training King, and he just shakes his head at people who tell him they are going to wait until the primaries are 24” before they make their first pass! There must not be enough oxygen to go around in Bakersfield. They are wasting SO

much growth that could be directed into productive secondaries. The first pass would have suckered the rootstock up off the ground about 14 inches. I still recommend pinching the remainder of the rootstock suckers 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! Primary branches on trees dormant headed at 42-44 inches have already grown 14 inches long, and they are therefore ready to be pinched back to 11-12 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 should be made every seven to 12 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!

Pest Management: Monitor newly set clusters for evidence of plant bug feeding, which will increase with hotter weather. Drying vegetation near the 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 more reports this year of darkling ground beetle and earwig damage to newly planted trees, so keep those feet in the furrows!

NOW Update: Yep, I know NOW is a pest, but it is such a BIG one, that it deserves its own section! Dr. Joel Siegel, USDA, and Brad Higbee, Paramount Farming, continue to plug away at the tedious task of NOW management. This pest has become an ever greater threat to our industry, because the tree acreage continues to rise in the Valley, and the biggest complaint (besides price) from the consumer is finding worms in their expensive bag of pistachios. The challenge of keeping NOW damage below 1% is a daunting one. Dr. Siegel reports that this year’s degree day accumulation from January 1 to April 25 is nearly **twice** that of 2010 (equivalent to 7 weeks!), due to above average temperatures. As of late April, his monitoring sites in Madera are two weeks ahead of 2013. Favorable weather for early NOW development combined with leaf out 10 days ahead of normal for many orchards, and the slow, erratic leaf out of those suffering insufficient chilling, creates a NOW spray timing challenge. The new crop will very likely become susceptible sooner than the normal early July treatment timing, so pay close attention to your traps, the date of shell hardening, and degree days. At this time, the orchards Dr. Siegel is monitoring do not appear to have greater NOW levels than last year. However, the same may not be true for your orchard, depending on how much crop was left in the tree last year, and what you did to reduce its ability to overwinter NOW. Fall sprays have been suggested and shown to reduce winter NOW survival. Sanitation has also been demonstrated by Brad Higbee to have benefits over the longer term. I personally have always questioned the wisdom of allowing the overwintering population to not be treated TWICE to cover the bulk of its emergence over the 1200 degree day period. I know most of you add a pyrethroid to the 50% leaf expansion nutrient spray, which brackets part of the overwintering population, especially if you are targeting the lower spray rig nozzles onto the berm to hit the mummy nuts. However, I wonder what would happen if you timed a second NOW treatment with a persistent insecticide, against the overwintering population, and did so based on wing and egg trap data? I have never understood why it was IPM blasphemy to blanket the overwintering population, in hopes that fewer sprays would be required against in-season generations that begin to overlap and create the constant NOW wave Joel speaks of. I will share any comments received from readers on this concept next month. I have been around long enough to remember Jim LaRue, UC Fruit Crops Advisor, Tulare County, writing about not treating the overwintering population of Oriental Fruit Moth, but when mating disruption began on this insect in the Kingsburg area, the only way some cling peach growers could keep from getting serious damage in May was to treat the overwintering emergence in late February to early March. This was initially highly frowned upon by UC folks, until the growers showed them their clean grade sheets.

Dr. Siegel recently sent me some interesting data suggesting that female NOW may avoid pyrethroid treated surfaces in the field. Tests involving thousands of nuts under controlled laboratory and field conditions indicates that in the field, NOW females were **twelve times** more successful in laying eggs on commercially treated nut surfaces than in the lab, where the eggs were placed on surfaces with a high pyrethroid concentration. This result was in contrast to the same test using Altacor, Belt, and Intrepid Edge (Intrepid + Delegate) where there was only a 2.4 fold greater emergence on field treated nuts. Comparison of untreated nuts under lab and field conditions essentially showed no difference in successful emergence. Remember, pyrethroid insecticides are used to **repel** ticks and mosquitoes, so maybe NOW is getting wise to the constant barrage of pyrethroid treatments? Happy Farming!