

May 2020

Unusual Pistachio Tree Bloom and Leaf Canopy Development in Kern County

In late April and early May, my phone was ringing constantly in regard to the unusual bloom and leaf out (called foliation) that has been occurring in the southern San Joaquin Valley. People have been seeing trees like those I show in Photos 1 and 2 in this newsletter. Obviously, this is not the way we are accustomed to seeing our trees in the spring. The bloom and foliation of the canopy, for both male and female trees, was delayed and varied with location in the tree canopy. Generally, the bottom half of the tree canopy fared better than the top half. Trees that were 4 to 8 years old showed the worst symptoms, although not only bloom and foliation, but nut set appears to have been affected to some degree in many older orchards as well. The male 'Peters' was hard hit in particular. With time, we should be able to get a better idea of how badly we think yield will be affected. But what happened? Hopefully, this article will shed some light on this situation.



Photo 1. Delayed leaf-out and flower bud push, especially in the upper canopy, of Golden Hills trees near Buttonwillow, Kern County, April 2020 (Photo by Craig Kallsen)



Photo 2. Sparse leaf canopy and inflorescence development of pistachio trees in early May along Highway 65 in Kern County (photo by Craig Kallsen)

Those of you that read my last newsletter (March 2020) may remember that I was highly positive about what I was seeing related to very early bloom in my cultivar evaluation trials scattered around Kern County. I, normally, pay close attention to a trial located about 5 miles southeast of the intersection of Highway 155 and Highway 65 in Kern County. This trial is located in the low foothills on the east side of the San Joaquin Valley, which is in the warm ‘citrus belt’. In these eastern foothills the winter rest period (i.e. ‘chilling’) is often borderline for pistachio, based on the symptoms I see during bloom. In this trial this spring, the buds of the early-blooming cultivars, such as Golden Hills, Lost Hills and some experimental selections, were just beginning to push in mid-March 2020, which was about 12 days ahead of last year at this same location. This early bud push was very even around the circumference of the tree canopy. Early bloom and buds pushing early and evenly on both the north and south sides of the tree, generally, signal that we had good ‘chill’ the previous fall and winter.

I hope that this early positive report in my newsletter did not jinx the industry, because shortly thereafter it started to rain and rain and temperatures cooled. During bloom, at this trial site we had a few temperatures go below 40 °F and many temperatures were in the low 40s. Daytime temperatures, often, did not exceed the mid-60s. Not only was it cold, but the rain was almost continuous during bloom in some areas. It was hard to imagine how the pollen could dehisce and stay dry enough to blow to the female flowers. Last year’s situation (2019) was more normal. Last year, at this site, the period from early bloom, when the first inflorescences began to flower, to full bloom, took approximately 7 days for Golden Hills/Lost Hills (April 8 – April 14) and 7 days for Kerman (April 10 – April 16). However, this year, in 2020, the time to go through these same bloom stages took up to twice as long. For Golden Hills/Lost Hills it took from March 31 – April 11 (12 days) and for Kerman from April 2 to April 15 (14 days). Peters, the pollinizer for Kerman, was particularly badly affected, and many inflorescences had still not flowered in early May. Flower growth and development are heat related and it was cool.

For a crop like pistachio that has a high chilling requirement, the temperatures required for normal bloom, are frequently separated into two physiological stages. The first stage is called ‘endodormancy’. Endormancy is characterized by a winter ‘rest’ or ‘dormancy’ requirement that is met by what we in the industry typically call chilling. The amount of chilling is somehow measured physiologically within the

tree and normal flowering is not triggered until sufficient chilling has been measured. So with endormancy, we like to see some cooler temperatures. We attempt to model the amount of chilling received by the tree using models such as accumulating the number of hours that are below 45°F during the period from late fall through the end of February or by doing calculations that measure something called ‘chill portions’.

The second stage of normal flowering occurs after sufficient chilling has occurred and requires a certain amount of heat so that flowers may develop normally. All living things have minimum and maximum heat thresholds for normal growth and development. In Kern County, most typically, we have difficulty meeting the endodormancy requirement. However, usually by late March and early April, we have plenty of heat, and assuming the chilling requirement has been met, flowers develop normally. It is much more common for Kern County to get too much heat during bloom, and not too little. Too much heat is not good either. In some research work that I conducted a couple of years ago, results suggested that overly warm temperatures above 80°F, and especially 85 °F, during bloom, were highly correlated with decreased nut yield in the fall. However, this year, it appears, due to the cool temperatures and rain, we received too little heat. While the amount of heat required for normal flower development in pistachio is not well studied, we do know that the heat available for bloom development at this experimental site was much less this spring than in the past six years. In Table 1, in the columns in green, I have documented the amount of heat that was available in the time period from March 22 through April 25 over a 7-year period. This is the time period when bloom normally occurs beginning with the early bloomers and ending with Kerman. Available heat can be measured with a calculation called growing degree days (GDD). I calculated GDD in hourly increments, using a base value of 50 °F, based on 24 hourly measurements made by a temperature recorder located in this trial through the March/April time period given. No portion of a GDD was accumulated for a given hour until the base temperature was achieved for that hour. I summed each hourly calculation to give the total for the March/April time period each year as listed in Table 1.

Getting back to Table 1, note that for the year 2020, the heat available for bloom and vegetative flower push was only 300 GDD, compared to the 6-year average from 2014 – 2019 of 424.2. Three hundred GDD is almost 30% less than the previous 6-year average of 424. If we look at the chilling models in the yellow and gray columns in Table 1, it can be seen that this site had about 2% more chill portions (yellow) and 12% more accumulated chill hours (grey) than the previous 5 year average. These data suggest that what was deficient in 2020 was not winter chill, but the amount of heat available during bloom.

Table 1. Temperature related variables at an experimental pistachio trial site in Kern County					
Bloom period March 22 – April 25	Growing degree days ¹	Time period Oct. 1 – Feb. 28	Chill portions	Time period Nov. 1 – Feb. 28	Accumulated chill hours < 45° F ²
2014	441				
2015	447	2014-15	56	2014-15	549
2016	431	2015-16	64	2015-16	1031
2017	355	2016-17	60	2016-17	835
2018	436	2017-18	57	2017-18	886
2019	435	2018-19	66	2018-19	820
2020	300	2019-2020	62	2019-2020	934
Average for 2014-19	424.2	Average for 2014-19	60.6	Average for 2014-19	824.2

¹ Calculated on an hourly basis from a weather station located on site, Base 50 ° F
² Summed on an hourly basis from a weather station located on site.

The southern end of the San Joaquin Valley appears to have been the worst affected by poor bloom, and this, probably, is due to the direction of the storms that dropped temperatures and most of the precipitation. Many of the storms this spring came from the southwest, as opposed to the usual direction from the northwest. Areas inland of Los Angeles, instead of San Francisco, bore the initial brunt of some of these storms so it is not surprising that the south and west ends of the San Joaquin Valley showed more severe bloom effects than points further north in the SJV.

So, what we are looking at is not a disease. It is not Winter Juvenile Tree Dieback. I know nothing that can be done now to reduce the symptoms. It has been my experience that the trees will eventually leaf out. Most will have done so by the time you read this newsletter (especially since this article is so long). I think that yield will be severely impacted in some orchards, especially those that are or have fairly recently just started coming into bearing. However, the amount of loss due to the poor bloom conditions will be hard to estimate unless you know you have trees that remain unaffected in the same block. Another negative is that due to the extended length of the bloom period, the harvest period within a given orchard, likely, will be extended as well, which could translate into more shakes and/or more navel orangeworm. One positive aspect is that the carbohydrate that the tree had stored the previous year, and which won't be used this year in nut production, should be available for next year to boost production then. I expect that we are going to see an unusual amount of crop load adjustment (that is nutlet and whole rachis drop) this year beginning now and going well into May. Do not be tempted to blame this on small bugs, stinkbugs or leaf-footed bugs, unless you see lots of them. The poor pollination conditions this year is the likely culprit.

Botrytis Blossom and Shoot Blight Reported in Kern County this Spring

With all the rain, it is not surprising that we have had some *Botrytis* reported on male trees, especially the Randy male (see Photo 3). *Botrytis*, often infects pistachio branches through the flowers and Randy has a lot flowers. Most of these infections have occurred in orchards across from vineyards, which appear to have the capacity to produce an unending supply of *Botrytis* spores. A good review of *Botrytis* can be found at the following link:

<https://www2.ipm.ucanr.edu/agriculture/pistachio/Botrytis-Blossom-and-Shoot-Blight/>



Photo 3. Botrytis symptoms on a Randy male
(Photo courtesy of Justin Hayslett – Buttonwillow Warehouse Company)

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