

## MANAGING HEAT AT BLOOM IN 'FRENCH' PRUNE, 2015

F. Niederholzer  
R. Buchner  
L. Milliron

### PROBLEM AND ITS SIGNIFICANCE

Excessive heat at bloom is linked to significantly reduced prune production in key California growing regions in four of the last eleven years (2004, 2005, 2007, and 2014). Total grower economic losses in Sutter and Yuba Counties – with 40% of the prune acres in the state -- were in the range of \$240 million for 2004, 2005, and 2007, based on county ag commissioners' data. Overall economic damage to the regional economy was probably 1.5x that loss -- \$360 million. As the probability of heat in March appears to be increasing (Rick Snyder, UCCE microclimate specialist, personal communication), California prune growers must develop management strategies to mitigate heat damage at bloom to remain economically viable.

Recent research results show that temperatures  $>75^{\circ}\text{F}$  begin to negatively affect pollen tube growth rate and viability, but research has not identified temperature thresholds for actual crop damage.

### OBJECTIVES

- Determine bloom-time temperature thresholds above which crop damage occurs.

### PROCEDURES

#### Sutter and Tehama Counties:

In Tehama County, bloom timing was observed in three orchards; one in Red Bluff, one in south Red Bluff and one in South Los Molinos. In Sutter County, a single orchard was used. Bloom timing was manipulated within the orchard with either horticultural oil (rate of 4 gallons per acre on January 22) or Surround<sup>TM</sup> clay (rate of 35 lbs. per acre and 25 lbs. per acre on January 22 and February 12, respectively). Four trees were treated with oil and four others with Surround<sup>TM</sup>. The remaining trees received no oil or clay prior to bloom.

Temperature and relative humidity sensors were placed in commercial. Sensors were located at 5-6' feet off the ground in exposed sites between trees in the tree row. They were not placed in tree canopies. Temperatures and relative humidity in each block were continually recorded during bloom at all sites. Average hourly temperatures are reported, not maximum temperature for the day.

Bloom progression was measured by counting open flowers on short branches at roughly 6'

height around 3 trees in each orchard. Initial set was measured in May.

## RESULTS AND DISCUSSION

In the Sutter County orchard, warm temperatures peaking at 77°F on March 9 (full bloom for oil treated trees) and 77° and 80°F on March 13 and 14, respectively, for the trees that received no oil or clay (Mar 13) or clay (Mar 14) but did not reduce fruit set (Table 1). Full bloom in Tehama Co orchards occurred during even warmer weather with temperatures spiking into 84-87°F for a single day (Mar 9). However, fruit set remained at acceptable levels (above 15%) in all the Tehama County orchards. Fruit set in Sutter Co. in 2015 season was a strong 33-36% (Table 1)

Field data from the 2005 and 2007 bloom seasons, when very low set levels were observed, show that maximum temperatures at full bloom were between 80-85°F for 2-3 consecutive days. In those years, flowers were exposed to 11 (2007) or 13 (2005) total hours of temperatures over 80°F, with continuous exposure to >80°F temperatures ranged from 3-6 hours per day. In Sutter County in 2015, the average hourly temperature reached 80°F once – on March 14. In Tehama County orchards, there were no consecutive days above 80°F, but 5.5-6 hours of temperatures above 80°F were recorded on Mar 6 and Mar 9.

## CONCLUSIONS

Bloom temperatures did not exceed 80°F and crop set in Sutter County was not affected (Table 1). This result simply reinforces the experience from previous years that temperatures reaching 80°F, while very warm for prune bloom, don't reduce set. In fact, bloom temps reaching 80°F, assuming there is no wind, should be taken as the start of a good crop year and thinning should be considered.

However, the Tehama County data are noteworthy in that, while >80°F temperatures were reached on March 6 and 9, fruit set was commercially acceptable. The years of major crop loss from heat at bloom, at least two consecutive days with temps at or above 82°F were recorded. The temperature drop below 80°F on March 7 and 8, between the two days of high temps, may have saved the crop in Tehama County. Conclusion: sustained heat at bloom (at least two days with temperatures above 80°F for 10+ hours total) is linked to major crop loss.

Table 1. Average prune fruit set, full bloom dates, and maximum temperatures in orchard at full bloom for individual orchards in Sutter, and Tehama Counties, 2015. Rain fell on March 11 in all locations. For Sutter County, the underlined full bloom date is for trees treated with a rate of 4 gallons of oil per acre and the italicized bloom date is for trees treated with Surround™ clay.

| County | Site           | 3/4 | 3/5 | 3/6 | 3/7 | 3/8 | 3/9       | 3/10 | 3/11 | 3/12 | 3/13 | 3/14      | 3/15 | 3/16 | % Fruit Set  |
|--------|----------------|-----|-----|-----|-----|-----|-----------|------|------|------|------|-----------|------|------|--------------|
| Tehama | Red Bluff      | 70  | 72  | 80  | 78  | 79  | 87        | 71   | 61   | 76   | 78   | 74        | 71   | 63   | <b>20</b>    |
| Tehama | S. Red Bluff   | 69  | 72  | 81  | 76  | 78  | 84        | 70   | 61   | 75   | 77   | 74        | 68   | 63   | <b>60</b>    |
| Tehama | S. Los Molinos | 70  | 72  | 82  | 77  | 78  | 87        | 71   | 63   | 77   | 78   | 76        | 72   | 64   | <b>21</b>    |
| Sutter | Dingville      | 67  | 73  | 75  | 74  | 77  | <u>77</u> | 72   | 66   | 77   | 77   | <i>80</i> | 76   | 67   | <b>33-36</b> |

Figure 1. Bloom time temperatures (hourly average) and daily % bloom progression for individual orchard in Sutter County where trees were treated with oil or Surround™ in the dormant or untreated (no dormant). 2015

