MANAGING HEAT AT BLOOM IN 'FRENCH' PRUNE, 2012

F. Niederholzer
R. Buchner
C. DeBuse
W. Krueger

PROBLEM AND ITS SIGNIFICANCE

Excessive heat at bloom is linked to significantly reduced prune production in key California growing regions in three of the last six crop years (2004, 2005, and 2007). 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 those three years, 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, personal communication), California prune growers must develop 1) critical heat damage thresholds for crop damage at bloom and 2) management strategies to mitigate heat damage at bloom to remain economically viable.

Recent research results show that temperatures >75^{o}F begin to negatively affect pollen tube growth rate and viability. However, research has not identified temperature thresholds for actual crop damage based field conditions.

OBJECTIVES

Determine bloom-time temperature thresholds for crop damage.

PROCEDURES

Glenn, Tehama, Yolo and Sutter Counties:

Temperature and relative humidity sensors were placed in commercial orchards in Glenn, Tehama, Yolo, and Sutter Counties. Sensors were located at 5-6' feet off the ground in exposed sites between trees in the tree row, and were not placed in tree canopies. Temperatures in each block were continually recorded during bloom at all sites.

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 or July.

RESULTS AND DISCUSSION

Cool (54^{o}F) to relatively warm (71^{o}F) temperatures occurred at full bloom across California's prune growing regions had no negative effect on fruit set (Table 1). Several periods of

significant rainfall occurred during bloom in all locations (March 13-17; March 24-April 2, and April 10-13). Figure 1 shows timing of bloom temperatures, percent bloom progression, and rainfall from the middle of March to the first week of April in one orchard in Sutter County (orchard #2).

Prune bloom, 2012, generally lasted 10-14 days – an extended period. A wide range of bloom stages – from green bud to small fruit – existed in many orchards in early April. Prune bloom was generally late, ranging from March 21 to April 9, depending on location (Table 1).

Weather and fruit set in 2012 differed significantly from that in 2004, 2005, and 2007 when virtual prune crop failures occurred in some or all regions of the Sacramento Valley. Field data from the 2005 and 2007 bloom seasons, when very low set levels occurred in Sutter and Yuba Counties, show that maximum temperatures at full bloom were between 80-85^{o}F for 2-3 consecutive days. In those years, flowers were exposed to 11 (2007) or 13 (2005) total hours of temperatures over 80^{o}F, with continuous exposure to >80^{o}F temperatures ranged from 3-6 hours per day. No rain occurred in prune orchards at bloom in 2004, 2005, or 2007. In 2012, temperatures over 80^{o}F at full bloom were not recorded (Table 1), and several inches of rain were recorded during bloom.

CONCLUSIONS

Alternating rainfall and warm days with no hours above 80^{o}F produced a good crop set in 2012 throughout the Sacramento Valley (Table 1). Many orchards required thinning.

Table 1. Average prune fruit set (May counts), full bloom dates, and maximum temperatures in orchard at full bloom for individual orchards in Yolo, Solano, Sutter, Glenn and Tehama Counties, 2012.

Orchard	Date of Full bloom	Maximum Temperature at 80-100% full bloom	Total Number of Hours Above 80°F during full bloom	% Fruit Set (mid-May)
Tehama-Red Bluff	April 1	63	0	20%
Tehama-Los Molinos	April 6	63	0	50%
Tehama-S. Los Molinos	April 6	61	0	19%
Tehama-South Corning	April 4	61	0	29%
Tehama-East Corning	April 4	60	0	31%
Tehama-W. Red Bluff	April 7	65	0	32%
Tehama-Tehama	April 4	63	0	22%
Tehama-S. Red Bluff	April 4	59	0	45%
Tehama- Jelly's Ferry	April 9	70	0	37%
Glenn #1	March 31	60	0	27%
Glenn #2	March 29	64	0	25%
Glenn #3	March 38	58	0	34%
Glenn #4	March 25	54	0	35%
Sutter #1 West Yuba City	March 21	71	0	31%*
Sutter #2 Oswald	March 23	62	0	28%*
Sutter #3 LoMo	March 30	69	0	24%*
Yolo/Solano-Winters West	April 5	65	0	48%
Yolo/Solano-Winters East	April 3	71	0	52%
Yolo/Solano-Woodland	April 6	64	0	27%

*July fruit count data

Figure 1. Bloom weather (average temperature in degrees F) and percent bloom with time in Sutter orchard No. 2, 2012. Blue bars at the bottom of the graph indicate periods of accumulated precipitation in south Sutter County. Total rain accumulation = 2.48" in those rain events.