MANAGING BLOOM TIMING IN ‘FRENCH’ PRUNE, 2009

F. Niederholzer

PROBLEM AND ITS SIGNIFICANCE

Consistent cropping is essential for economically sustainable prune production.

Virtually all commercial prune production in California is limited to a single variety (‘Improved French’), and the full bloom “window” throughout the state can be limited to a single week. Consequently, the entire California prune industry is at risk of serious crop damage from even a short spike of extreme weather (cold or hot) at bloom.

Bloom temperatures above 80°F severely limited prune fruit set in the southern Sacramento Valley in two out of the last three years (2005, and 2007) and in the entire state in 2004. Temperatures above 75°F in later blooming regions of the southern Sacramento Valley reduced fruit set relative to earlier blooming dates in 2008. Low production 4 of the last 5 years has negatively impacted the entire industry, raising doubts about the future of commercial prune production in this state.

<u>California prune growers need a strategy to implement in existing orchards to reduce production risk from extreme weather at bloom</u>. High rates of horticultural oil (4-5 gallons/acre) in the dormant spray has long been used to advance or tighten prune bloom, with a general window of late December through the middle of January targeted to advance bloom. This timing window was identified over time, with no published information available to explain field experience and potentially maximize effect.

Research based practices from other orchard crops in California and other fruit growing regions could help California prune growers maximize benefit from sprays intended to manipulate bloom timing. California sweet cherry growers routinely apply dormant sprays to “break” dormancy, advance bloom and hence harvest timing for logistics and marketing purposes. Dormant applications of horticultural oil, fertilizer, or plant growth regulator are timed after a certain amount of chilling has accumulated. Chilling accumulation is measured using the ‘Dynamic Model’. This model was developed to track chilling accumulation in regions with warmer winters (Mediterranean climates) and has been extensively tested in Israel and South Africa.

OBJECTIVES

1. Test a range of rest-breaking chemicals, including nitrogen fertilizers, horticultural oil, and a range of surfactants to advance bloom timings in ‘French’ prune, improve fruit set, and advance harvest date (fruit maturity).

2. Continue to test the Dynamic Model for assessing when to spray rest breaking agents, timing

applications of rest-breaking chemicals to a sequence of accumulated chill portions.

PROCEDURES

The 2008-2009 study was conducted in a mature prune orchard in Yuba County. Oil was eliminated from commercial dormant sprays in the study block by arrangement with the grower. Chill portions were calculated from temperature data recorded by a datalogger in the study orchard. Seventeen treatments were established between fall, 2008 and early February, 2009 (Table 1). Several sources of N fertilizer were tested in combination with 2% Activator 90 non-ionic surfactant (NIS) to determine if low N/acre treatments were more cost effective than the CAN17+NIS tested in previous year. In addition, a new treatment combination – CAN17 (1% v/v) + Erger-G® (1.5% v/v) was added All treatment materials and rates appear in Table 2. All treatments were applied with a Stihl mistblower to individual trees using a spray volume calculated to be equivalent to 100 gallons per acre. A completely randomized block design with four single tree replicates per treatment was used.

In early March, 2009, three branches, 0.5-1.0 inch in diameter and of similar orientation, from each replicate tree were chosen from each of three locations in the canopy prior to flower bud break. One branch was selected on the western, southern, and north-east sides of the canopy at approximately 6' above the orchard floor. Buds (average = 96 buds/branch) were counted prior to flowering. Bloom progression over time, starting at first flower open and ending with the last open flower was measured by counting open flowers at 2-3 day intervals from March 13 to March 27. Fruit set was determined May 1 (Table 2).

Dates on which each treatment achieved 50% bloom were estimated using the logit transformation after averaging flower opening data from the three branches per tree. These data were then used in an ANOV to determine if bloom dates were significantly different for each treatment.

RESULTS AND DISCUSSION

<u>Bloom date</u> was significantly advanced by some treatments. Treatment material and/or timings affected response (Table 2).

- Only treatments applied at 30 or 41 CP (oil or CAN17+NIS) and the CAN17+Erger-G® treatment, only, at 53 CP significantly advanced 50% bloom compared to untreated controls.
- Fall sprays of urea, zinc sulfate, or urea + zinc sulfate did not change 50% bloom date compared with control.
- Nitrogen fertilizer materials applied at 53 CP, excepting CAN17+Erger-G® treatment, did not significantly advance 50% bloom timing compared with control bloom timing.
- Early oil (20 CP, December 9 application date) did not advance 50% bloom date compared with controls.

In 2008, all oil and N fertilizer + NIS treatments applied between CP 30-60 significantly advanced bloom compared to untreated controls. In 2009, differences in treatment response between early (30-41 CP) and later (53-65 CP) treatments may be explained by differences in January temperatures in 2008 and 2009. In 2008, late December and January was consistently cool, with little heat accumulation occurring between 30 and 60 CP. Once internal plant dormancy is ended by oil or nitrogen fertililzer, then heat is needed to push bud development. In 2008, limited heat accumulation between treatment dates may explain the lack of differentiation between the treatments. Internal plant dormancy (technically termed endodormancy) may have been ended by the oil or nitrogen + NIS, but there was no heat to give the earlier treated trees an advantage over the later treated trees. In 2009, there was a heat accumulation difference between 41 CP and 53 CP and this may account for difference in bloom time for the different treatments.

Fruit set was unaffected or decreased by treatments (Table 2).

- There was no statistical difference in fruit set between the untreated controls and all other treatments.
- Trees treated with oil from CP 20 – 53 had significantly more fruit set than trees treated with potassium nitrate + NIS or 28-0-0 + NIS.

In general, nitrogen treated trees showed leaf bud break earlier than oil treated or untreated trees. While it may be coincidental, it may be possible that there is some connection between early leaf bud break and lower fruit set when compared to trees with later leaf bud break.

CONCLUSION

Oil (4% v/v), applied between 30-40 CP accumulation, continues to be the most consistent means of advancing bloom of Improved French prune.

Erger-G® + CAN-17 should be tested further as an alternative to oil.

Table 1. Treatment materials, rates, and application timings measured as the number of chill portions at application during the 2008 – 2009 season. Yuba County.

		-----Chilling accumulated at spray timing----						
Treatment	Rate/acre in 100 gallons of water	**1 CP**	**2 CP**	**20 CP**	**30 CP**	**38 CP**	**50 CP**	**60 CP**
Urea[1]	20 pounds	X						
Urea[1]	42 pounds	X						
Zinc sulphate[2]	20 pounds 36% ZnSO4		X					
Zinc sulphate[2] + urea[1]	20 pounds 36% ZnSO4 + 20 lb urea		X					
4% oil[3]	4 gallons IAP 440 oil			X	X	X	X	X
CAN-17 + NIS[4]	25 gallons CAN-17 + 2 gallons Activator 90				X	X	X	X
1% Stilleto28-0-0[5] + NIS[4]	1 gallon Stiletto + 2 gallons Activator 90						X	
KNO_3 + NIS[4]	40 pounds KNO_3+2 gallons Activator 90						X	
CAN-17 + Erger-G®[6]	1.0 gallon of CAN-17 + 1.5 gallons Erger-G®						X	

1. Standard grade prilled urea. Yara USA.
2. Zinc sulphate 36%
3. IAP 440 horticultural oil
4. Non-ionic surfactant. Activator 90, Loveland Industries, Greeley, CO.
5. Stiletto foliar N triazone fertilizer 28-0-0 (Wilbur-Ellis Co.)
6. Erger-G® 8-0-0 liquid fertilizer. Nutrecology, Houston, TX

Table 2: The effect of spray treatments applied following certain chilling accumulation (CP) on the timing of 50% full bloom relative to untreated trees and %final set in French prune. Yuba County, 2009. Negative numbers in the "Days difference in bloom from control" indicate earlier bloom than the control. Positive numbers indicate later bloom. Estimated date of fifty percent bloom of control trees = March 22. Material details are the same as in Table 1. Data points in a column showing the same letter are not statistically different (95% certainty).

Treatment	Application Date	CP at application	Days difference in bloom from control.	% Set May 1
Urea (20#)	October 16, 2008	1	0.15 fg	17.33 abcde
Urea (42#)	October 16, 2008	1	-0.43 cdefg	18.50 bcde
urea + zinc (20#/20#)	November 4, 2008	2	0.40 g	16.72 abcde
zinc (20#)	November 4, 2008	2	-0.38 defg	18.77 bcde
Oil	December 9, 2008	20	-1.41bcde	20.42 cde
Oil	December 23, 2008	30	-2.84 ab	21.90 e
CAN17 + NIS	December 23, 2008	30	-1.84 abcd	15.39 abcde
Oil	January 6, 2009	41	-3.23 a	20.31 cde
CAN17+NIS	January 6, 2009	41	-2.71 ab	12.77 abcd
Oil	January 26, 2009	53	-1.44 bcde	21.15 de
CAN17+NIS	January 26, 2009	53	-0.94 cdefg	12.59 abc
KNO3+NIS	January 26, 2009	53	-0.25 efg	9.44 a
28-0-0+NIS	January 26, 2009	53	0.19 fg	10.67 ab
CAN17 +Erger-G	January 26, 2009	53	-1.90 abc	14.96 abcde
Oil	February 11, 2009	65	-1.21 cdef	17.20 abcde
CAN17+NIS	February 11, 2009	65	0.45 g	15.50 abcde
Control	---	---	0.00 efg	17.53 abcde

Table 3. Heat unit (GDH) accumulation from the December 1 to February 28, 2007-08, and 2008-09. Data from each year are from a different study site in the same general growing region. Heat units are calculated using equations provided by James Frisby, Utah State University.

Time	2007-08 GDH	2008-09 GDH
Nov 1-15	146	144
Nov 16-30	91	98
Dec 1- 15	59	27
Dec 16-31	31	20
Jan 1-15	35	54
Jan 16-31	32	75

Feb 1-15	64	65
Feb 16-28	71	90