Effects of fall applications of urea and zinc sulfate to >Bing= sweet cherry spring budbreak, 2006

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Summary:

Treatments of zinc sulfate + urea applied in late October and early November, 2005 at 1, 5 and 8 chill portions (CP) were found to slightly advance truss bud opening in 2006. Truss bud death and fruit set were not changed by treatment, nor was fruit maturity, although truss bud death was numerically decreased and fruit set increased by the two latter treatments. Treatments at 1 and 5 chill portions numerically advanced fruit maturity. In two previous trials we found that similar chemical treatments advanced and compressed bloom compared to the control, with treatment at 3 CP giving the best result. In those trials hand defoliations on the same dates as chemical applications tended to delay bloom and increase truss bud (and to some degree, vegetative bud) death. Bloom occurred over a very long period in 2006; after 21 days the untreated control had only reached 83% of full bloom and chemical treatments were at full bloom. In 2005 the untreated control reached full bloom in 9 days.

Problem and its Significance:

Hand defoliation has been used to induce bloom and leafing out in a low-chill peach by reducing the depth of bud dormancy (Lloyd and Firth, 1990). Defoliation of peaches combined with withholding water and application of rest-breaking agents in Israel improved both floral bud break and vegetative bud break (Erez and Lerner, 1990). We have tested both hand defoliation and applications of zinc sulfate + urea at rates lower than typically used for sweet cherry defoliation for potential rest-breaking activity.

Trials from 1996-2005:

- 1995-1996 and 1996-1997: Zinc sulfate + urea (10 and 15 lb per acre, respectively) in San Benito
    - improved pollen viability in these ‘low chill’ years (with chill portions of 58 and 52, respectively, and chill hours of 695 and 424, respectively)
    - Pollen viability appears to be reduced when chill accumulation is inadequate (Weis et al., 1996)
    - These treatments were not evaluated in 1996 or 1997 for effects on bloom advance or duration, or on fruit maturity and quality

- 1997-1998: Zinc sulfate + urea (10 and 15 lb per acre, respectively) at Morgan Hill
    - compressed the bloom period slightly
    - had no effect on bud break, bud death, leaf out, fruit quality or fruit maturity

- 2002-2003: Hand defoliation vs zinc sulfate + urea (20 lb per acre each) in 2002-2003 in Winters – various rootstocks
    - zinc sulfate + urea tended to advance bloom and increase the percentage of reproductive buds that opened
    - Applications were October 16, 23 and 30 at 0, 1 and 3 chill portions, and the last timing resulted in the greatest number of open buds and the greatest advance in bloom
    - Hand defoliation tended to reduce the percentage of open-flower truss buds, tended to delay bloom and increase both vegetative and reproductive bud death
- 2004-2005: Hand defoliation vs zinc sulfate + urea (20 lb per acre each) in Lodi – Gisela 6 rootstock
    - applied on 25 October at 3 chill portions advanced bloom from 4% to 73% in 5 days (March 3 to March 7), compared to the control (0-40%)
    - Hand defoliation tended to result in a bloom progression that was equivalent to, or delayed, compared to the untreated control.
    - Effects on fruit maturity not measured

Objectives: Evaluate the effects on budbreak, truss bud death, fruit set and fruit maturity in >Bing= sweet cherry.

Plans and Procedures:
The experiment was carried out in a mature commercial orchard west of Lodi, CA, in a block of >Bing= cherries (*Prunus avium* L.) on Mahaleb rootstock. Treatments consisted of an unsprayed control and zinc sulfate + urea treatments applied as single treatments on 28 October, 8 or 18 November. Chemical treatments were 20 lbs fertilizer grade urea + 20 lbs basic $ZnSO_4$, applied in combination using a Stihl mistblower at approximately 100 gallons per acre. Treated trees were separated by guard rows and guard trees within two treated rows. Treatments were applied to single trees randomized within a replicate

'block'; four replicate blocks were used for data collection. The Dynamic Model was applied to climatic data collected by Watchdog data-loggers placed in the orchard (Fishman et al., 1987a, b).

Bloom development was assessed by measuring numbers of truss buds open on 21, 23, 28 and 30 March, 3, 7, 11 and 14 April, on two limbs per tree tagged prior to bloom. Fruit set was calculated as [(#fruit/#truss buds per limb)/4], based on an average of four flowers per truss bud. Dead truss buds were counted on 14 April. Fruit maturity was evaluated by collecting all fruit on tagged limbs on 2 June; fruits were categorized by color. For statistical purposes, fruit were separated into categories of non-marketable (green, straw, colorbreak/pink and light red) or marketable color (dark red and mahogany) in each replicate sample. Percentage data was found to be normal and did not require transformation. Analyses of variance were performed with Proc GLM procedure of SAS (SAS Institute Inc., Cary, NC) and mean separations were tested by Duncan=s Multiple Range Test; $P = 0.05$.

Results and Discussion:

Treatments of zinc sulfate + urea applied in late October and early November, 2005 at 1, 5 and 8 chill portions (CP) were found to slightly advance truss bud opening in 2006 (Table 1). Truss bud death, fruit set and fruit maturity were not significantly different among treatments, although truss bud death was numerically decreased and fruit set increased by the two latter treatments (Table 2). Treatments at 1 and 5 chill portions numerically advanced fruit maturity (Table 2). In two previous trials (2002-2003, 2005-2006) we found that similar chemical treatments advanced and compressed bloom compared to the control, with treatment at 3 CP giving the best result. In those previous trials hand defoliations tended to delay bloom and increase truss bud (and to some degree, vegetative bud) death. Bloom occurred over a long, cold period in 2006; after 21 days the untreated control had only reached 83% of full bloom and chemical treatments were at full bloom. In 2005 the untreated control reached full bloom in 9 days.

Although results of these trials do not indicate the use of zinc sulfate + urea at these levels for bloom advance and fruit maturity advance alone in sweet cherry, they do suggest the possible use of zinc sulfate + urea in combination with RBAs applied at concentrations lower than those currently used in California. This may result in reduced risk strategies for growers.

Selected References

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Table 1. Bloom response in 2006 to 2005 fall applications of zinc sulfate and urea (each 20#/acre) to 'Bing' cherry, Lodi, California. Chill portions (CP)[y] are based on temperatures recorded hourly on site in trial orchard.

Treatment	CP	% Truss buds in full bloom + petal fall							
		21 Mar	23 Mar	28 Mar	30 Mar	3 Apr	7 Apr	11 Apr	14 Apr
Control		0.0 a[x]	3.5 a	44.1 a	59.2 b	69.0 a	77.3 a	80.5 b	83.3 b
Zinc sulfate + urea Oct 28	1	0.6 a	10.0 a	58.9 a	75.9 a	79.1 a	87.0 a	94.2 a	96.6 a
Zinc sulfate + urea Nov 8	5	0.0 a	2.4 a	50.9 a	73.4 ab	72.6 a	85.5 a	96.3 a	98.1 a
Zinc sulfate + urea Nov 18	8	0.0 a	3.8 a	49.8 a	66.1 ab	73.4 a	78.2 a	91.0 a	94.9 a

[x] Mean separation within columns by Duncan's Multiple Range Test, $P = 0.05$.
[y] Fishman et al., 1987.

Table 2. Responses in 2006 to 2005 fall applications of zinc sulfate and urea to 'Bing' cherry, Lodi, California: floral bud death, fruit set and fruit maturity. Chill portions (CP)[z] are based on temperatures recorded hourly on site in trial orchard.

Treatments	CP	%Dead truss buds	%Fruit set[y]	% Dark red + mahogany fruit at harvest June 2[x]
Control		7.1 a[w]	14.1 a	32.5 a
Zinc sulfate + urea Oct 28	1	8.9 a	16.6 a	40.0 a
Zinc sulfate + urea Nov 8	5	4.0 a	20.4 a	42.0 a
Zinc sulfate + urea Nov 18	8	4.6 a	19.5 a	24.9 a

[w] Mean separation within columns by Duncan's Multiple Range Test, $P = 0.05$.

[x]Fruit maturity was evaluated visually by assigning fruit to one of four color stages as follows: on a scale of 3-6 (light red-dark mahogany), with light red (3), dark red (4), mahogany (5) and dark mahogany (6), corresponding to CTIFL color chips 1, 3, 6 and 7, respectively. Less mature fruit were green, straw or colorbreak (pink).

[y]Fruit set was calculated as [(#fruit/#truss buds per limb)/4], based on an average of four flowers per truss bud

[z]Fishman et al., 1987a,b.