Chemical Thinning of Apples Using Ethephon: Another Unsuccessful Year

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Chemical thinning with ethephon has potential as a rescue treatment when earlier applications were not effective. To understand the potential of ethephon and its risks, we have studied it as a late-season thinner for four years. Results from 2003 and 2004 were published in the Spring issue of *Fruit Notes* in 2005, and those from 2005 were published in the Spring issue in 2006. The first two years of study gave consistent results, with between 200 and 300 ppm ethephon resulting in adequate fruit thinning when applied more than one month after bloom (fruit diameter at approximately 1 inch). Treatment in this range also resulted in increased fruit size and greater return bloom. Unfortunately, the effects of ethephon in 2005 were disappointing, to say the least. Ethephon resulted in thinning, but even the highest concentration (400 ppm, 1.3 pints/100 gal.) did not give adequate thinning. We supposed that the lack of response relates to the cool temperature at the time of thinning and the following day.

The objectives of the work in 2006 included obtaining more experience with ethephon application to McIntosh and Macoun and also to begin understanding the relationship between thinning with ethephon and temperature.

Materials & Methods

The first study was conducted in 2006 in a block of mature Gatzke McIntosh trees at the University of Massachusetts Cold Spring Orchard Research & Education Center. Fifty trees were allocated among ten replications, based on initial fruit set. Within each replication, the five trees were distributed randomly among five thinning treatments. The first was an untreated control. The other four were treated on four different days (June 9, 12, 15, and 19, 2006), representing variation in temperature on the day of treatment and for a period after treatment. Figure 1 depicts the high and low temperatures in June and the dates of these four treatments. Table 1 summarizes the temperature conditions and fruit size associated with the four treatments. At all times, ethephon was applied

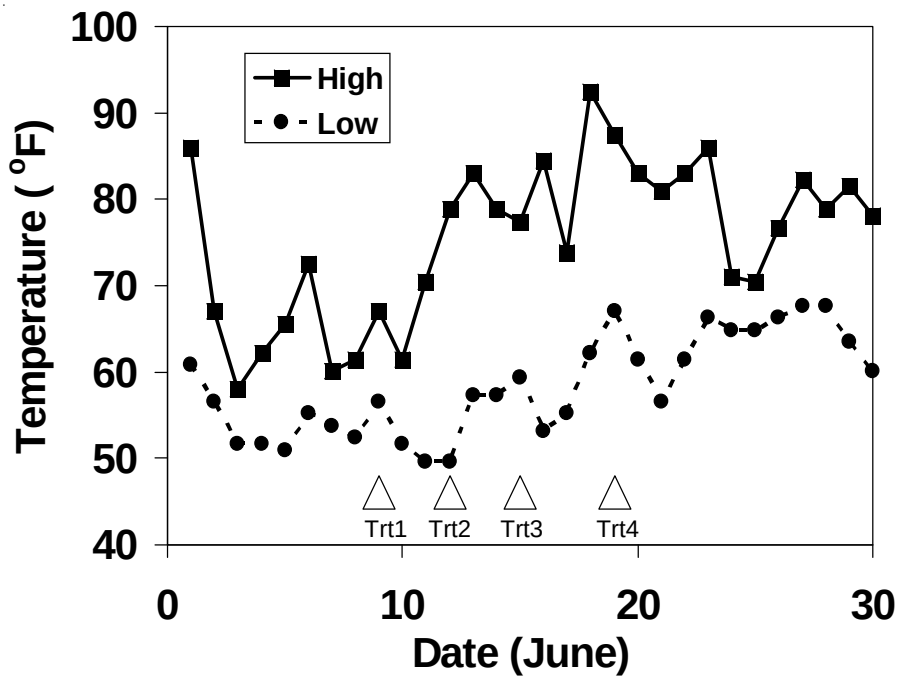

Figure 1. High and low temperatures in June, 2006, at the University of Massachusetts Cold Spring Orchard Research & Education Center. McIntosh treatments were applied as noted as Trt1, Trt2, Trt3, and Trt4. Macoun trees were treated on June 12 at the same time as McIntosh Trt2.

at 300 ppm (1 pint/100 gallons) with 0.1% Regulaid as a surfactant. Treatments were made with an airblast sprayer and at dilute volume. Twenty-fruit samples were harvested from each tree on September 18, 2006, and weighed to determine average fruit size. Ten apples were selected at random from each sample for the measurement of flesh firmness (two punctures per fruit), soluble solids concentration (juice collected from firmness measurements assessed with hand refractometer), and starch pattern (equatorially cut fruit dipped in iodine-potassium iodide solution and compared to Cornell Universal Starch Chart). In late April, 2007, return bloom was assessed.

The second study in 2006 was in a block of mature Macoun trees at the University of Massachusetts Cold Spring Orchard Research & Education Center. Thirty trees were allocated among 15 replications, based on initial fruit set. Within each replication, one tree was assigned randomly as an untreated control and the other was treated with 300 ppm ethephon (1 pint/100 gallons, with 0.1% Regulaid) in a dilute application with an airblast sprayer on June 12, 2006. On September 27, 2006, twenty-apple samples were collected from each tree, and fruit weight, flesh firmness, soluble solids concentration, and starch index value were measured as described with McIntosh above. In late April, 2007, return bloom was assessed.

Results

With the McIntosh experiment, one treatment was applied when high temperatures on the day of treatment and day after averaged only 64°F, with an overall average for these two days of only 58°F (Table 1). Another treatment was under much warmer conditions, with an average high temperature of 85°F and overall average of 73°F on the day of and day following treatment (Table 1). This nearly 20°F difference had no significant impact on thinning (Table 2). Because of the weather pattern, the first treatment was under the coolest conditions, and the last was under the warmest conditions. Therefore, fruit size was smallest at the first treatment and largest at the last treatment (Table 1). This may have impacted the results to some degree, but overall, ethephon did not reduce fruit set and did not affect fruit size or ripening (Table 2). The small increase in return bloom was not significant (Table 2).

Macoun trees were treated at optimal fruit size and under excellent weather conditions, with an average

Table 1. Conditions for ethephon treatments applied to McIntosh and Macoun trees in 2006. All ethephon treatments were at 300 ppm (1 pint/100 gallons plus 0.1% Regulaid) applied dilute to whole trees with an airblast sprayer.

		Temperature (°F)		
Treatment	Date of ethephon treatment	Average high for the day of and day after treatment	Overall average for the day of and day after treatment	Fruit diameter on the day of treatment (mm)
		McIntosh		
Control	---	---	---	---
1	June 9	64.3	58.0	20.8
2	June 12	80.9	67.2	24.6
3	June 15	81.0	67.8	26.6
4	June 19	85.2	73.2	30.5
		Macoun		
Control	---	---	---	---
Treated	June 12	80.9	67.2	26.1

Table 2. Effects of 2006 ethephon treatments on fruit set, fruit characteristics, and return bloom of McIntosh and Macoun trees. All ethephon treatments were at 300 ppm (1 pint/100 gallons plus 0.1% Regulaid) applied dilute to whole trees with an airblast sprayer.

Treatment	Bloom (clusters/ cm^2 LCA)	Initial fruit set (no./cm^2 LCA)	Final fruit set (no./cm^2 LCA)	Fruit weight (g)	Flesh firmness (lbs)	Soluble solids conc. (%)	Starch index value	Return bloom (clusters/ cm^2 LCA)
				McIntosh				
Control	13.8	12.5	7.9	165	14.1	10.8	6.1	11.0
1	12.7	12.5	8.8	161	14.3	11.2	6.3	13.4
2	12.5	12.5	8.0	159	14.2	11.1	6.3	15.0
3	13.0	12.5	7.8	153	14.0	11.1	6.2	13.8
4	14.1	12.5	7.8	158	14.2	11.0	6.3	13.4
				Macoun				
Control	12.3	8.3	6.2	183	15.4	12.1	4.3	13.2
Treated	10.5	8.3	5.8	171	15.3	12.2	4.5	13.2

high temperature of 81°F and an overall average of 67°F for the day of and the day following treatment (Table 1). As with McIntosh, ethephon did not affect fruit set, fruit ripening, or return bloom, but there was a small reduction in fruit size with the ethephon treatment (Table 2).

Conclusions & Future Research

In 2003 and 2004, we had consistent results and good thinning with ethephon. The best was from 200-300 ppm (2/3 to 1 pint/100 gallons). Treatments with 400 ppm ethephon overthinned. In 2005, ethephon resulted in thinning but not an adequate amount, even from 400 ppm. In 2006, we had no thinning from ethephon, even when applied during very warm conditions.

Where do we go now? The potential benefits from a late-season thinner are great, so we will continue to study ethephon. If we can understand why the results have varied, we may be able to tailor recommendations to adjust for varying conditions.

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