Thinning McIntosh Apple Trees With Blossom Thinners, With and Without Post-bloom NAA: A Report to the New England Tree Fruit Growers Research Committee

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The objective of these studies was to test the efficacy of blossom thinners to replace carbaryl for obtaining selective thinning of McIntosh apples.

Evaluation in Maine

Materials & Method

Mature Rogers McIntosh/M.7 apple trees growing at Highmoor Farm, Monmouth, ME were selected for uniform bloom. Treatment plots were surrounded on all sides by one or more buffer trees, to prevent over-spray. All thinning treatments were applied with an airblast sprayer calibrated to apply 135 gallons of dilute spray per acre, with 70% of the spray delivered to the top half of the tree canopy. Blossom thinning treatments were applied May 12, 1998 when 70 to 80% of the blossoms were open. The weather at the time of application was sunny, temperatures was 72° F, with a 4 to 6 mph wind from the west. Blossom thinning treatments were:

1. Untreated control
2. Ammonium thiosulfate (National Chelating), 5 gallons per acre
3. Wilthin (Entek Corp.), 12 quarts per acre
4. Endothall (Elf Atochem), 2 pints per 100 gallons
5. NAA, 12.5 ppm

For plots that received post-bloom thinner, six ppm NAA was applied on May 27, 1998 when fruitlet diameter was 10 mm. The weather at the time of application was sunny, temperature 64° F, with a 1 to 2 mph west wind. The treatments were arranged as a split plot design. Blossom thinners were the main plot treatment, postbloom NAA was the sub-plot treatment, and there were five replications.

Fruit set was evaluated by limb counts and by cluster counts. All the flower clusters on one or two limbs per tree were counted at pink. The limb circumference was measured, and limb cross-sectional area (LCA) was calculated. The number of fruit on each limb was counted, and fruit set was calculated as the number of fruit per 100 clusters and as the number of fruit per LCA. Fruit counts were done shortly after petal fall and again in July to evaluate both initial and final set. Twenty-five flower clusters on each tree were tagged, and the number of flowers on each cluster was recorded. The number of fruit on each cluster was counted and fruit set was calculated as the ratio of fruit to flowers for each cluster.

Yield per tree was determined in a single picking

The Maine portion of this study was conducted at the University of Maine Highmoor Farm, during the time that Dr. Schupp was with the University of Maine.

at harvest. Fruit size distribution was categorized using a FMC Weight Sizer (FMC Corp. Lakeland, FL). The weight sizer was adjusted to divide the fruit into four diameter size categories: 57-63 mm, 64-69 mm, 70-75 mm, and greater than 75 mm. Twenty fruits of the 70-75 mm category were selected from each tree for fruit quality analysis. Red fruit color and russet were estimated visually. Fruit firmness was measured on the EPT-1 firmness tester (Lake City Technical Products, Inc. Kelowna, BC, Canada), with two opposing punctures per fruit. The soluble solids of the fruit were determined using an Atago PR-101 digital refractometer (Misco Products Divn., Cleveland, OH). Seed number was counted.

Results

Fruit set was reduced by all blossom thinners, while post-bloom NAA had no effect on fruit set (Table 1). Final fruit set was much less than the initial set, especially on control trees, however, the rankings of the treatments remained essentially unchanged. There were no treatment interactions on fruit set, yield or fruit characteristics between blossom thinners and post-bloom NAA in this study. Wilthin, endothall and NAA applied at bloom reduced yield (Table 1). Postbloom NAA had no effect on yield. There were no significant effects of thinners on fruit size distribution (data not presented). There were no treatment effects on fruit red color, fruit firmness, soluble solids concentration, or seed number (data not presented). Fruit from trees treated with Wilthin had higher incidence of russet than fruit from NAA- or endothall-treated trees (Table 1).

Discussion

Environmental conditions during bloom and for the following month were characterized by warm temperatures and high sunlight, making favorable

Table 1. Effect of ammonium thiosulfate (ATS), Wilthin, endothall, and NAA used as blossom thinners and NAA used as a postbloom thinner on fruit set and fruit size of ›Rogers McIntosh‹. Maine.

	Initial set		Final set			
Treatment	Fruit/cm^2 limb cross-sectional area	Fruit/100 blossom clusters	Fruit/cm^2 limb cross-sectional area	Fruit/100 blossom clusters	Russet Skin surface (%)	Yield/ tree (kg)
Blossom thinners						
Control	17 a	143 a	3.4 a	31 a	15 ab	67 a
ATS 5 gal/acre	8 b	91 b	2.5 ab	28 ab	13 ab	60 ab
Wilthin 12 qt/acre	4 b	43 c	1.5 b	17 c	28 a	50 c
Endothall 2 pt/acre	8 b	93 b	1.4 b	16 c	9 b	40 d
NAA 12.5 ppm	8 b	105 b	2.0 b	24 b	10 b	55 bc
Postbloom NAA						
None	9	95	2.1	22	12	52
NAA 6 ppm	9	95	2.2	24	18	57
Significance						
Blossom thinner (BT)	*	***	**	*	*	*
Postbloom thinner (PBT)	NS	NS	NS	NS	NS	NS
BT x PBT	NS	NS	NS	NS	NS	NS

conditions for initial fruit set. All the blossom thinners were effective in reducing the initial fruit set and number of fruit per flower cluster during this period. A prolonged period of heavy cloud cover from June 13 to June 17, 1998 resulted in heavy June drop for all the trees in this study. This episode of fruit drop commenced on June 23, and was more severe than the fruit drop caused by blossom thinners. Much of the potential effect of chemical thinners on yield and fruit characteristics at harvest was obscured by this natural fruit drop.

The most effective blossom thinner, Wilthin, caused severe phytotoxicity and fruit russet. Future studies should address this concern by evaluating the effect of lower rates of Wilthin. These data indicate that blossom thinners show some promise. More study is needed to select the best chemicals and to optimize their use.

Evaluation in Massachusetts

Materials & Methods

A block of mature Marshall McIntosh/M.26 apple trees growing at the University of Massachusetts Horticultural Research Center, Belchertown, MA were selected. Treatment trees were selected so that a buffer tree was located on each side of a treatment tree to prevent spray drift. Prior to bloom 2 limbs per tree, 10 to 15 cm in diameter, were selected and tagged. At

Table 2. Effects of Ammonium thiosulfate (ATS), Wilthin, endothall and NAA used as blossom thinner alone or combined with a postbloom NAA application.

		Fruit set		
Treatment	Postbloom NAA (6 ppm)	Fruit/cm^2 limb cross-sectional area	Fruit/ 100 blossom clusters	Fruit weight (g)
Control	-	6.9 a	66 a	146 e
NAA	+	5.9 a	55 a	158 d
ATS 6 gal/acre	-	1.9 b	23 b	175 abc
ATS 6 gal/acre	+	2.6 b	22 b	184 a
Wilthin 12qt/acre	-	2.6 b	28 b	170 bc
Wilthin 12 qt/acre	+	2.2 b	21 b	182 ab
Endothall 2 pt/100 gal	-	3.1 b	25 b	164 cd
Endothall 2 pt/100 gal	+	3.3 b	37 b	158 d
NAA 12 ppm	-	6.1 a	62 a	171 bc
NAA 12 ppm	+	5.7 a	61 a	177 ab
Significance				
Blossom thinner (BT)		***	***	***
NAA		NS	NS	**
BT x NAA		NS	NS	NS

Within columns, means not followed by the same letter are significantly different at odds of 19 to 1.

the pink stage of flower development all blossom clusters were counted on the two tagged limbs. Blossom cluster density was calculated using LCA. Trees were replicated based upon blossom cluster density. All thinning treatments were applied with an airblast sprayer calibrated to apply 125 gallons of dilute spray per acre. Blossom thinner treatments were applied May 4, 1998. Full bloom occurred about 0.5 day before application. Weather at the time of application was partly sunny and warm with temperature reaching 70°F soon after application. Blossom thinning treatments were:

1. Untreated control
2. Ammonium thiosulfate (National Chelating) 6 gallons/acre
3. Wilthin (Entek Corp.), 12 quarts per acre
4. Endothall (Elf Atochem), 2 pints per 100 gallons
5. NAA 12 ppm

For plots that received post-bloom thinner, 6 ppm NAA was applied on May 18, 1998 when fruit size averaged 9.0 mm. Weather at the time of application was sunny, warm and breezy with temperature at 76 to 78°F at application time and a high temperature of 80° F was reached later in the day. Treatments were arranged as a split plot design. Blossom thinners were the main plot treatment, postbloom NAA was the sub-plot treatment, and there were seven replications.

Fruit set was evaluated by first counting all persisting fruit on the tagged limbs at the end of June drop in July. The fruit set was calculated by dividing the number of fruit by the LCA. At the normal harvest time on September 10, 40 fruit from each tree were harvested randomly from around the periphery of the tree. The harvested fruit were then taken to the lab where total weight was taken and the average fruit size calculated. Observation of the harvested fruit indicated that there appeared to be no russet attributed to treatment.

Results

Soon after application phytotoxic effects were observed on the flower petals and leaves of all blossom-thinned trees except those receiving NAA. ATS, Wilthin, and endothall thinned significantly and comparably (Table 2). NAA did not thin when applied as a bloom thinner. NAA at 6 ppm did not thin when applied alone at the traditional postbloom timing or when applied following any of the blossom thinner treatments. All blossom thinning treatments increased fruit size. NAA, when applied as a bloom thinner, increased fruit size even though it did not significantly reduce crop load. Likewise, the postbloom 6 ppm application of NAA alone increased fruit size although crop load was not significantly reduced. There were no blossom thinner X NAA interactions.

Discussion

ATS, Wilthin, and endothall were used in previous years on apples at rates of 1%, 6 qts/acre and 1.5 pints/ 100 gallons, respectively, with disappointing results. Little phytotoxicity was noted and minimal thinning recorded. Higher rates were used this year in an attempt to locate a rate where some thinning would be achieved. Cool, damp, rainy weather immediately preceded the application of blossom thinners in Massachusetts. We speculate that the large amount of phytotoxicity was attributed to greater penetration of the thinner into the leaves because of the cool, cloudy, and rainy weather the week before application rather than due to an excessively high amounts of thinner. While we have noted for years that absorption following a cool wet period can be increased, this may be even more important when the thinner of choice, thins by burning.

It is also interesting to note that fruit size was increased significantly even though crop load was not reduced significantly. Crop load may have been reduced enough to increase fruit size. It is also interesting to note that early thinning at bloom time may actually increase fruit size more than by thinning later. Note fruit size on trees treated with post bloom NAA as compared with NAA used as a blossom thinner.

These data suggest that blossom thinning is a viable and effective way to reduce crop load. More study is necessary to select the best chemical and concentration to achieve appropriate thinning.

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