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Applications of Endothalic Acid, Pelargonic Acid, and Hydrogen Cyanamide for Blossom Thinning in Apple and Peach

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ADDITIONAL INDEX WORDS. Dormex, 1-naphthyl-*N*-methylcarbamate, carbaryl, Sevin, NAA, Thinex, Endothal, NAA, *Malus domestica*, *Prunus persica*

SUMMARY. Blossom thinning of 'Early Spur Rome' apple (*Malus domestica* Borkh.) and 'Redhaven' peach (*Prunus persica* L.) with hydrogen cyanamide (Dormex, 50% a.i.), endothalic acid [(Endothal, 0.4 lb a.i./gal (47.93 g a.i./L)], and pelargonic acid (Thinex, 60% a.i.) was studied in 1995 and 1996. Full-bloom applications of hydrogen cyanamide at 2 pt formulation/100 gal (1288 mg a.i./L) and 2.5 pt formulation /100 gal (1610 mg a.i./L) or endothalic acid at 1 pt formulation/100 gal (59.9 mg a.i./L), once at 70% bloom and again at full bloom, reduced apple fruit set. Pelargonic acid was only effective in thinning apple blossoms when applied twice—at 40% bloom and again at full bloom—at 1.5 pt formulation/100 gal (1.12 mL a.i./L) per application. Pelargonic acid marked apples in 1995 but not 1996. Neither hydrogen cyanamide nor endothalic acid marked apples. A single full-bloom application of hydrogen cyanamide, endothalic acid, or pelargonic acid effectively thinned peach blossoms in 1995; however, in 1996, only hydrogen cyanamide at 2.5 pt formulation/100 gal effectively thinned peach blossoms. Peaches did not show fruit marks with any of the peach blossom thinners.

Early thinning of apples is important because of its impact on fruit size and the next season's flower bud initiation. In the past, apple cultivars were often sprayed with the blossom thinner sodium dinitro-ortho-cresol (Elgetol, 19% a.i.) during full bloom, followed by a postbloom application of a fruit thinner such as 1-naphthyl-*N*-methylcarbamate (carbaryl) with or without naphthalene acetic acid (NAA) (Williams and Edgerton, 1981). Carbaryl and NAA are effective postbloom fruit thinners for 4 to 5 weeks after full bloom (Byers et al., 1990; Byers and Carbaugh, 1991; Williams and Edgerton, 1981). Gibberellin A_{4+7} and 6-benzylamino purine are also effective postbloom fruit thinners for 'Delicious' apples (Byers and Carbaugh, 1991; Ferree, 1996; Greene, 1984; Greene and Lord, 1985). Elgetol was removed from the market in 1989 because of the high cost of reregistration. Full-bloom sprays of sulfcarbamide (Wilthin, 79% a.i.), pelargonic acid (Thinex), and endothalic acid (Endothal) or petal fall applications of carbaryl (Sevin XLR Plus) were developed as replacements for Elgetol and were reported to result in a satisfactory thinning and fruit set in 'Delicious' apple (Williams, 1993, 1994).

Hydrogen cyanamide and other chemicals have been used to eliminate or to reduce chilling requirements of peaches grown under the warm desert conditions of southwestern Arizona (Fallahi et al., 1990). Hydrogen cyanamide applied at "pink bloom" stage reduced the number of open blooms. Based on this observation, hydrogen cyanamide at different concentrations was sprayed at prebloom and full bloom on 'Florda Prince' peach in southwestern Arizona (Fallahi et al., 1990). Under the climatic conditions of that experiment, applying hydrogen cyanamide at 8 pt formulation/100 gal (5152 mg a.i./L) at full bloom signifi-

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cantly reduced fruit set. Hydrogen cyanamide also was found to be an effective blossom thinner for plums in Idaho (Fallahi et al., 1992). Effectiveness of hydrogen cyanamide and sulfcarbamide in blossom thinning of 'Law Rome Beauty' apple was recently reported by Fallahi et al. (1997).

The objective of this experiment was to study effects of hydrogen cyanamide, endothalic acid, and pelargonic acid as blossom thinners on 'Early Spur Rome' apple and 'Redhaven' peach.

Materials and methods

Hydrogen cyanamide (Dormex, 50% a.i., D.K. International, Inc., Marietta, Ga.), endothalic acid [Endothal, 0.4 lb a.i./gal (47.93 g a.i./L), Elf Atochem, N.A., Philadelphia], and pelargonic acid [Thinex, 57% pelargonic acid (4.2 lb pelargonic acid/gal; 0.5 kg pelargonic acid/L) and 3% related fatty acids as active ingredients (total a.i. = 60%), Mycogen Corp, San Diego, Calif.] were used as blossom thinners for 'Early Spur Rome' apple and 'Redhaven peach. Polyoxyethylenepolypropoxypropanol (Regulaid, 90.6% a.i.) was used with all pelargonic acid treatments, and modified phthalic glycerol alkyd resin (Latron B-1956, a.i. 77%) was used with all hydrogen cyanamide treatments as surfactants in apple and peach experiments in 1995 and 1996. Endothalic acid sprays were not mixed with any surfactant.

APPLE THINNING TRIALS. The study was conducted during the 1995 and 1996 growing seasons. Six- and seven-year-old 'Early Spur Rome' apple trees on M.26 EMLA rootstock with 'Delicious' interstems at a 12 × 18-ft (3.65 × 5.5-m) spacing in a commercial orchard near Parma, Idaho, were used. In 1996, a different set of trees in the same orchard as 1995 was used. Trees in 1995 and 1996 were in full production without any freeze injury. Except for blossom and fruit thinning, cultural practices in this orchard were similar to those of commercial orchards. The experimental design in each year was a completely randomized design with six one-tree replications per treatment. On different sides of each tree, four 5.9-ft (1.8-m) limbs were arbitrarily selected and tagged and all flower buds (mixed buds) were counted ≈2 weeks before bloom (before any treatment application). All fruit on the tagged limbs were counted after June drop on 1 June 1995 and 12 June 1996, and the number of fruit per 100 flower clusters was calculated.

Apple trees were in full bloom (≈85% to 90% of all blooms open) on 3 May 1995 and 30 Apr. 1996. Trees were at ≈70% bloom on 30 Apr. 1995 and at ≈40% bloom on 26 Apr. 1996. Apple trees were sprayed to runoff with a hand-gun sprayer at 100 psi. The volume of liquid sprayed was ≈1.3 gal (4.9 L) per tree at each application. This volume was equivalent to ≈262 gal/acre (≈2451 $L \cdot ha^{-1}$).

Treatments for the apple experiment in 1995 and 1996 are listed in Tables 1 and 2. Control trees received no chemical or hand thinning. In the hand-thinning treatment (only in 1996), fruit were hand thinned (no chemical thinning) to one fruit per cluster when the fruit diameter was ≈0.70 inches (18 mm) on 12 June 1996. Fruit set in this treatment was determined after hand thinning. In the postbloom and hand-thinning treatment, fruit were thinned with a postbloom application of carbaryl [Sevin XLR Plus, 4 lb a.i./gal (0.48 kg a.i./L)] mixed with Regulaid in 1995 and with carbaryl mixed with NAA [NAA-200, 0.44 lb/gal (52.7 g a.i./L)] and Regulaid in 1996 at the rates described in Tables 1 and 2. In this treatment, fruit on the tagged limbs were counted before hand thinning to determine the effect of postbloom fruit thinners alone on fruit set. Fruit on the whole tree were then hand thinned to one fruit per cluster on 9 June 1995 and on 12 June 1996. This treatment is similar to the current commercial thinning practice. In 1995, postbloom thinner was not applied to trees that had received a blossom-thinning treatment. In 1996, however, trees in certain blossom thinning treatments received a mixture of postbloom chemical thinner at the rates described in Table 2.

Table 1. Effects of blossom thinners on fruit set, fruit weight, and yield of 'Early Spur Rome' apple in 1995.[z]

Treatment[y]	Application stage	Application rate formulation/ 100 gal (a.i./L)	Fruit set (fruit/ 100 cluster)	Avg. fruit wt (g) at harvest	Yield (kg/tree)	Return bloom (cluster no/ cm^2 limb)
Control (no thinning)	---	No thinning	376 a	143.4 d	130.0 a	0.35 c
Postbloom + hand[x] + Regulaid	Fruit 18 mm + June	1.5 pt (899 mg) 1 pt (1.13 mL)	338 a	241.3 a	76.9 cde	0.74 b
Hydrogen cyanamide + Larton B-1956	Full-bloom	2.5 pt (1610 mg) 13 oz (0.78 mL)	146 c	215.3 ab	60.7 e	1.28 a
Endothalic acid	Full bloom	1 pt (59.9 mg)	325 ab	202.1 bc	70.4 de	0.50 bc
Endothalic acid	Full bloom	1.5 pt (89.9 mg)	325 ab	195.5 bc	66.1 e	0.63 bc
Endothalic acid	70% + Full bloom	1 pt (59.9 mg)/stage	216 bc	202.8 bc	71.5 de	0.52 bc
Pelargonic acid + Regulaid	Full bloom	1 pt (0.75 mL) 1 pt (1.13 mL)	346 a	176.0 c	93.2 bc	0.29 c
Pelargonic acid + Regulaid	Full bloom	2 pt (1.5 mL) 1 pt (1.13 mL)	339 a	194.2 bc	88.8 bcd	0.39 bc
Pelargonic acid + Regulaid	Full bloom	2.5 pt (1.87 mL) 1 pt (1.13 mL)	327 a	192.7 bc	105.0 b	0.47 bc

[z]Mean separation within columns with Tukey's studentized test at $P = 0.05$.
[y]No follow-up postbloom thinner was applied after any of the blossom thinners in 1995.
[x]Postbloom + hand = Carbaryl (Sevin XLR Plus) at the 1.5 pt formulation/100 gal (899 mg a.i./L or 0.187% v/v) mixed with Regulaid at the 1 pt formulation/100 gal (1.13 mL a.i./L) was applied for postbloom fruit thinning when fruit were ≈18 mm in diameter. Fruit were then hand thinned to one fruit per cluster in June.

PEACH THINNING TRIALS. Twelve-year-old 'Redhaven' peach trees on peach seedling rootstock at a 18 × 18-ft (5.5 × 5.5-m) spacing in a commercial orchard in the Sunny Slope area, near Caldwell, Idaho, were used. In 1996, a different set of trees than that in 1995 was used. Trees in 1995 suffered a minor freeze damage before blossom thinning, but they still had moderately heavy bloom. Trees in 1996 had heavy bloom without any freeze injury. Except for blossom and hand thinning, other cultural practices in this experiment were similar to those of commercial orchards. The experimental design in each year was a completely randomized design with six one-tree replications per treatment. On different sides of each tree, four 4.9-ft (1.5-m) limbs were tagged and all flower buds were counted ≈12 days before bloom (before any treatment application). All fruit on the tagged limbs were counted after June drop on 2 June 1995 and 7 June 1996, and the number of fruit per 100 flowers was calculated.

Peach trees were in full bloom (≈ 85% to 100% of all blooms open) on 10 Apr. 1995 and on 9 Apr. 1996. Trees were at ≈75% bloom on 7 Apr. 1996 (application time for treatment 6, Table 3). Peach trees were sprayed to runoff with a motorized hand-gun sprayer. The volume of liquid sprayed per tree at each application was ≈2 gal (7.6 L). This volume was equivalent to ≈269 gal/acre (≈2514 $L\cdot ha^{-1}$).

Treatments of the peach experiment in 1995 and 1996 are listed in Table 3. In the hand-thinning treatment (only in 1996), fruit were hand thinned to maintain a 6 to 7-inch (15.2 to 17.8-cm) space between fruit before pit hardening stage on 7 June 1996. The fruit set in this treatment was determined based on the number of fruit after hand thinning per 100 flowers. This treatment did not receive any blossom thinner and is similar to the current commercial practice.

FRUIT YIELD AND QUALITY EVALUATION. Each year, yield per tree for apple and peach was recorded, and 30 fruit per tree were taken for weight and color measurements. Fruit color was measured with similar procedures as those described by Fallahi and Simons (1993). Since larger fruit were always heavier, fruit weight is used throughout the manuscript to also indicate fruit size. About 50 fruit per tree (if that many are available) were sampled and polished, and the percentage of fruit with severe marks was calculated for each year.

Results and discussion

APPLE EXPERIMENT. Fruit set reduction with applications of postbloom fruit thinners alone (without any blossom thinner) before hand thinning was not significant in 1995 (Table 1) or 1996 (Table 2), perhaps because the rates of postbloom thinners was not high enough to thin effectively. In the postbloom + hand-thinning treatment, average fruit weight at the time of thinning (June) was slightly greater than that of nonsprayed control (data not shown). At harvest, fruit size in this treatment tended to be larger (and often significantly) than all treatments except those with hydrogen cyanamide spray at 2.5 pt formulation/100 gal in 1995 and 1996. Fruit set in this treatment was measured just before hand thinning, but harvest fruit weight was measured several weeks after hand thinning. Therefore, a combination of the slight initial fruit weight increase due to postbloom fruit thinners and subsequent hand thinning resulted in larger fruit at harvest.

Compared to control trees, applying hydrogen cyanamide at the 2 pt formulation/100 gal in 1996 and the 2.5 pt formulation/100 gal in 1995 and 1996 significantly reduced fruit set and increased fruit size (Table 1 and 2). In these trees, a significant reduction in the number of fruit led to a higher leaf-to-fruit ratio, resulting in larger fruit. Trees sprayed with hydro-

Table 2. Effects of blossom thinners on fruit set, fruit weight, and yield of 'Early Spur Rome' in 1996.[z]

Treatment	Application stage	Application rate formulation/ 100 gal (a.i./L)	Postbloom thinner[y]	Fruit set (fruit/ 100 clusters)	Avg. fruit (g) at harvest	Yield (kg/tree)
Control (No thinning)	---	None	None	156 a	113.0 d	101.4 a
Postbloom + hand.[xy] +Regulaid	Fruit 18 mm + June	See footnote[xy] 1 pt (1.13 mL)	Sevin + NAA	151 ab	202.4 a	49.0 b
Hand thin only	June	None	None	84 d	173.1 abc	64.0 b
Hydrogen cyanamide + Larton B-1956	Full bloom	2 pt (1288 mg) 13 oz (0.78 mL)	Sevin + NAA	87 cd	175.8 abc	74.0 ab
Hydrogen cyanamide + Larton B-1956	Full bloom	2.5 pt (1610 mg) 13 oz (0.78 mL)	Sevin + NAA	95 cd	179.9 ab	58.6 b
Endothalic acid	Full bloom	1 pt (59.9 mg)	None	121 abcd	115.6 d	83.5 ab
Endothalic acid	Full bloom	1 pt (59.9 mg)	Sevin + NAA	83 d	168.0 abc	58.0 b
Pelargonic acid + Regulaid	Full bloom	1.5 pt (1.12 mL) 1 pt (1.13 mL)	Sevin + NAA	137 abc	128.9 cd	59.6 b
Pelargonic acid + Regulaid	40% + Full bloom	1.5 pt (1.12 mL) 1 pt (1.13 mL)	Sevin + NAA	99 bcd	167.9 abc	57.8 b
Pelargonic acid + Regulaid	Full bloom	2.5 pt (1.87 mL) 1 pt (1.13 mL)	Sevin + NAA	124 abcd	145.4 bcd	63.9 b

[z]Mean separation within columns with Tukey's studentized test at $P = 0.05$.
[xy]Postbloom thinner (when applied) consisted of carbaryl (Sevin XLR Plus) at 1 pt formulation/100 gal (588 mg a.i./L or 0.125% v/v) mixed with NAA (NAA-200) at 1 oz formulation/100 gal (4.1 mg a.i./L or 78.1 ($\mu L\cdot L^{-1}$) plus Regulaid at 1 pt formulation/100 gal (1.13 mL a.i./L), applied when fruit diameter was ≈18 mm. In postbloom + hand treatment, in addition to the postbloom thinner, fruit were hand-thinned to one fruit/cluster in June.

gen cyanamide showed symptoms of leaf burning and chlorosis on spur leaves a few days after application. Most of the phytotoxicity symptoms dissipated as the foliage grew, and only minor symptoms were visible on spur leaves at the time of harvest. These symptoms did not have an adverse effect on yield or fruit size. Hydrogen cyanamide did not cause any fruit marks throughout this experiment.

Applications of endothalic acid at the 1 pt formulation/100 gal at 70% bloom and again at full bloom significantly reduced fruit set and increased fruit size in 1995 (Table 1). A single full-bloom application of endothalic acid at either a 1 or 1.5 pt formulation/100 gal in 1995, or at a 1 pt formulation/100gal in 1996 without any postbloom thinner, did not reduce fruit set (Tables 1 and 2). However, when a full-bloom application of endothalic acid at the 1 pt formulation/100 gal was followed by a postbloom application of carbaryl and NAA in 1996, fruit set and yield were significantly reduced and fruit size increased (Table 2). Applying endothalic acid, particularly at high concentrations, induced leaf burning, but the damage was dissipated by the end of growing season. Endothalic acid did not cause fruit marks in this experiment.

Applications of pelargonic acid at the 1.5 pt formulation/100 gal, once when 40% of blossoms were open and again at full bloom, followed by a postbloom application of carbaryl and NAA significantly reduced fruit set and yield and an increased fruit size in 1996 (Table 2). Reduced fruit set in the trees that received a single application of pelargonic acid at full bloom at rates of 1 to 2.5 pt formulation/100 gal was not significant in 1995 or 1996 (Tables 1 and 2). However, reduced fruit set in the trees sprayed with pelargonic acid at the 2.5 pt formulation/100 gal was drastic enough to reduce yield in 1995 and 1996 significantly and to increase fruit size in 1995. Fruit from trees treated with pelargonic acid, particularly from those with the 2.5 pt formulation/100 gal, had significantly higher fruit marks in 1995 but had no marks in 1996 (data not shown). Temperatures during full-bloom applications were 48 to 53 °F (8.9 to 11.7 °C) in 1995 and 60 to 65 °F (15.6 to 18.3 °C) in 1996. Maximum temperatures on the days of applications at full bloom were 65 °F (18.3 °C) in 1995 and 72 °F (22.2 °C) in 1996. The weather was calm and sunny during application days in both years. Thus, the presence of fruit marks in the trees sprayed with pelargonic acid in 1995 could be due to a slower drying condition in 1995 than in 1996.

In an one-season experiment with two rates of endothalic acid and pelargonic acid, Williams (1994) observed that full-bloom applications of endothalic acid at the 1 or 2 pt formulation/100 gal (119.8 mg a.i./L) or pelargonic acid at the 1 or 2 pt formulation/100 gal significantly reduced fruit set in 'Delicious' and 'Granny Smith'. In 'Fuji' apple, however, only endothalic acid at 2 pt formulation/100 gal or pelargonic acid at the 2 pt formulation/100 gal effectively thinned. Similar to 'Fuji', 'Early Spur Rome' is considered a hard-to-thin cultivar. Lack of effective thinning in the trees treated with a single spray of endothalic acid at the 1 pt formulation/100 gal or with pelargonic acid at the 1 pt formulation/100 gal at full bloom in this experiment agrees with the results in 'Fuji' (Williams, 1994).

Compared to all treatments, trees sprayed with hydrogen cyanamide at the 2.5 pt formulation/100 gal at full bloom in 1995 had significantly higher return bloom in 1996 because this treatment effectively reduced fruit set and yield in 1995 (Table 1). Nontreated control trees and those sprayed with pelargonic acid at the 1 pt formulation/100 gal in 1995 had the lowest return bloom in 1996. The heavy fruit set in 1995 resulted in biennial bearing in these trees.

Peach experiment. Full-bloom applications of hydrogen cyanamide, endothalic acid, or pelargonic acid at all rates significantly reduced fruit set in 'Redhaven' peach in 1995 (Table 3). Reduced fruit set in these treatments resulted in significantly reduced yields in 1995. Trees sprayed with hydrogen cyanamide at the 2.5 pt formulation/100 gal or with endothalic acid at the 1.5 pt formulation/100 gal had significantly lower fruit set than those treated with pelargonic acid and had significantly larger fruit than those of nonsprayed control trees in 1995.

Table 3. Effects of blossom thinners on fruit set, fruit weight, and yield of 'Redhaven' Peach in 1995 and 1996.[z]

Treatment	Application stage	Application rate formulation/ 100 gal (a.i. /L)	Fruit set (fruit/100 clusters) 1995	Fruit set 1996	Fruit wt (g) 1995	Fruit wt (g) 1996	Yield (kg/tree) 1995	Yield (kg/tree) 1996
Control (no thinning)	---	---	6.04 a	5.21 a	177.4 c	107.3 b	189.0 a	97.0 a
Hand thinning (No chemical thinning)	Before pit hard	---	---	2.37 c	---	145.5 a	---	60.3 b
Hydrogen cyanamide +Larton B-1956	Full bloom	2 pt (1288 mg) 13 oz (0.78 mL)	---	4.83 a	---	114.0 ab	---	93.1 ab
Hydrogen cyanamide + Larton B-1956	Full bloom	2.5 pt (1610 mg) 13 oz (0.78 mL)	1.10 d	2.61 bc	265.2 a	138.4 ab	24.8 c	82.1 ab
Endothalic acid	Full bloom	1 pt (59.9 mg)	1.64 cd	4.19 abc	200.9 bc	111.8 b	56.3 c	81.1 ab
Endothalic acid	75% + Full bloom	1 pt (59.9 mg)/stage	---	4.57ab	---	112.5 b	---	84.3 ab
Endothalic acid	Full bloom	1.5 pt (89.9 mg)	1.20 d	---	205.3 b	---	42.0 c	---
Pelargonic acid + Regulaid	Full bloom	2 pt (1.5 mL) 1 pt (1.13 mL)	3.26 bc	4.58 ab	183.0 bc	112.9 ab	148.1 b	84.3 ab
Pelargonic acid + Regulaid	Full bloom	3 pt (2.25 mL) 1 pt (1.13 mL)	3.80 b	3.92 abc	182.6 bc	112.9 ab	150.0 b	101.2 a

[z]Mean separation within columns by Tukey's studentized test at $P = 0.05$.

Blossom thinners were less effective in 1996 than 1995 (Table 3), perhaps because of different pollination and fertilization conditions that existed during these 2 years. Temperatures during treatment applications were ≈48 to 51 °F (8.9 to 10.6 °C), with a daily maximum of 53 °F (11.7 °C), in 1995 and 65 to 70 °F (18.3 to 21.1 °C), with daily maximum of 80 °F (26.7 °C), in 1996. Excellent weather conditions, such as several calm and sunny days with maximum temperatures of 64 to 80 °F (17.8 to 26.7 °C), and good bee activity contributed to better pollination and fertilization in 1996 and, thus, lower response of blossom thinners. Applying hydrogen cyanamide at the 2.5 pt formulation/100 gal, even under these ideal pollination and fertilization conditions, significantly reduced fruit set compared to the control. Hydrogen cyanamide at this rate reduced fruit set to a level similar to the hand-thinned tree. Fruit weight from trees sprayed with hydrogen cyanamide at the 2.5 pt formulation/100 gal were only 7.1 g lower than those from hand-thinned trees in 1996 (Table 3). However, fruit from hand-thinned trees had more uniform color than those from chemically thinned trees due to a better fruit spacing and less fruit-to-fruit shading effects.

Similar to the situation in the apple experiment, applying endothalic acid, particularly at high concentrations, induced minor leaf burning in peach, but the damage was dissipated by the end of growing season. None of the blossom thinners at any concentration caused fruit marks (data not shown).

Conclusions

Time and temperature are very important factors influencing the effectiveness of blossom thinning in apple and peach. It is essential that blossom thinners be applied when some, but not all, fertilization has taken place. Also, the severity of frost damage must be considered before determining rates of any blossom thinner. Temperature affects bee activity and, subsequently, the number of fertilized flowers. Temperature also affects the chemical characteristics and the effectiveness of blossom thinners such as hydrogen cyanamide. Therefore, the effect of these blossom thinners should be tested for each geographical region and for each cultivar. Also, effectiveness of these blossom thinners, when sprayed with an air-blast sprayer, should be tested before applying the rates discussed in this paper at a commercial scale.

Under conditions of this study, hydrogen cyanamide was an effective blossom thinner for 'Early Spur Rome' apple and 'Redhaven' peach when applied at full bloom. Endothalic acid at the 1 pt formulation/100 gal was an effective blossom thinner for 'Early Spur Rome' apple if application was followed by a mixture of postbloom fruit thinner or when applied twice, once at ≈70% bloom and again at full bloom. Pelargonic acid at the 1.5 pt formulation/100 gal was also an effective blossom thinner in 'Early Spur Rome' apple if applied once at ≈40% bloom and again at full bloom. Pelargonic acid at other concentrations did not effectively thin apple blossoms. In 1 year out this 2-year study, pelargonic acid caused fruit marks in apple. Endothalic acid at the 1 or 1.5 pt formulation/100 gal or pelargonic acid at the 2 or 3 pt formulation/100 gal effectively thinned peach blossoms in 1 year of this experiment.

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