RESEARCH HIGHLIGHTS

Apple Fruitlet Thinning Gala with Metamitron Applied in Sequence, Tank-mixed, and at Different Timings

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Introduction

Crop load management of apple trees through chemical or hand thinning is one of the most important practices growers can use to improve fruit quality. Reducing fruit set improves fruit size and colour, and thinning early can increase return bloom in biennial bearing cultivars. Additionally, successful thinning through chemical means can help mitigate the high labour costs that comes with hand thinning orchards after June drop.

However, effectively reducing crop load to a desired level with chemical thinning is inconsistent and hard to predict. In 2026, a new chemical thinner, Brevis™ 150 SC (PCP 35694; active ingredient is metamitron), has been approved for use on apples and pears in Canada. Brevis™ has been registered previously for thinning apples in many European and Asian countries, and several studies have been conducted in Canada and the United States to evaluate its efficacy.

To add to several years of ongoing research on Brevis™ in Simcoe, a trial was initiated in the spring of 2025 to test the thinning performance of Brevis™ when applied as a late thinner, when applied in two treatments sequentially, and when tank-mixed with other common chemical thinners.

Experimental details

In 2025, a 4-year-old research orchard of 'Crimson Gala'/M.9 T337 rootstock located at the University of Guelph, Ontario Crops Research Centre – Simcoe was used for this study. 'Gala' was selected due to its prominence in the Ontario apple industry and because it is a moderately difficult to thin cultivar. Trees were spaced at 1.2 m x 3.75 m (2222 trees/ha; 899 trees/acre) and trained using a high-density spindle system. The experimental design consisted of a randomized complete block design with six replications and 14 treatments. Table 1 demonstrates the treatments that were applied to two tree plots.

Commercial products used in this study:

- Carbaryl - Sevin XLR Plus, Tessenderlo Kerley, Inc., Phoenix, USA
- 6-BA – Maxcel, Valent Canada, Guelph, Canada
- NAA – Fruitone L, AMVAC Chemical Corporation, Los Angeles, USA
- Metamitron – BREVIS 150 SC, ADAMA Canada Ltd., Winnipeg, Canada
- Nonylphenoxy polyethoxy ethanol - Agral 90, Norac Concepts, Guelph, Canada

All spray treatments included the non-ionic surfactant Agral 90 at 0.05% (v/v). Treatments were applied using a commercial air blast sprayer (Turbo-mist model M3PT19P airblast sprayer with 19-60SS tower, Penticton, Canada); to minimize treatment interference caused by spray drift, experimental units were separated by at least one guard tree.

At the pink bud stage of bloom, trees were assessed for uniformity of bloom, and trees which were atypical in size, bloom, or health were excluded from the trial. The trees were in full bloom on 12-May, 2025. The 6-7 mm fruitlet diameter treatments were applied between 7:30 am and 2:30 pm on 26-May (14 days after full bloom; DAFB), and the 15-17 mm treatments were applied between 12:21 pm and 12:43 pm on 7-June (26 DAFB). Based on measurements taken on days most closely

Table 1. Treatments applied to 4-year-old Crimson Gala in 2025

	Treatment
1	Untreated control
2	Hand-thinned control (flower clusters were singled, fruit spaced ~10 cm apart)
3	'Industry standard' 1500 mg/L carbaryl tank-mixed with 75 mg/L 6-BA applied at 6-7 mm fruitlet diameter
4	498 mg/L (1.8 L/ha) metamitron applied at 6-7 mm fruitlet diameter
5	637 mg/L (2.3 L/ha) metamitron applied at 6-7 mm fruitlet diameter
6	804 mg/L (2.9 L/ha) metamitron applied at 6-7 mm fruitlet diameter
7	498 mg/L (1.8 L/ha) metamitron applied at 15-17 mm fruitlet diameter
8	498 mg/L (1.8 L/ha) metamitron tank mixed with 75 mg/L 6-BA applied at 6-7 mm fruitlet diameter
9	498 mg/L (1.8 L/ha) metamitron tank mixed with 10 mg/L NAA applied at 6-7 mm fruitlet diameter
10	498 mg/L (1.8 L/ha) metamitron tank mixed with 1500 mg/L carbaryl applied at 6-7 mm fruitlet diameter
11	498 mg/L (1.8 L/ha) metamitron applied at 6-7 mm fruitlet diameter, followed by 498 mg/L metamitron applied at 15-17 mm fruitlet diameter
12	498 mg/L (1.8 L/ha) metamitron tank mixed with 75 mg/L 6-BA applied at 6-7 mm fruitlet diameter, followed by 498 mg/L metamitron applied at 15-17 mm fruitlet diameter
13	498 mg/L (1.8 L/ha) metamitron tank mixed with 10 mg/L NAA applied at 6-7 mm fruitlet diameter, followed by 498 mg/L metamitron applied at 15-17 mm fruitlet diameter
14	498 mg/L (1.8 L/ha) metamitron tank mixed with 1500 mg/L carbaryl applied at 6-7 mm fruitlet diameter, followed by 498 mg/L metamitron applied at 15-17 mm fruitlet diameter

preceding and following the days treatments were applied, king fruitlet diameters on 26-May were 6.4-7.2 mm (n=50) and on 7-June were 14.2-17.5 (n=50). Hand-thinned control trees were thinned on 24-June by removing all but 1 fruit per cluster and spacing fruit ~10 cm apart. The average number of fruit removed by the hand-thinned trees (n=12) was 101 fruit.

Horticultural Measurements

Tree trunk circumference was measured at 30 cm above soil level at the beginning and end of the growing season to calculate trunk cross-sectional area (TCSA). To measure fruit set, two main scaffold branches – one on the east and one on the west side of the tree – were selected prior to bloom. On 02-May 2025, the number of flowering clusters per branch was counted on each selected limb. The number of fruit set on the limbs was counted again after June drop (08-July 2025). These data were averaged to calculate percent fruit set (number of set fruit divided by number of flower clusters)

Fruit were harvested on 15 and 16-September, 2025. During harvest, all fruit were picked from each experimental tree and the total weight and number of fruit per tree was recorded. Mean fruit weight was calculated by dividing total tree yield by number of fruit per tree. Additionally, a sample of 60 fruit per two-tree plot was randomly selected from throughout the canopy and kept in cold storage (1-3 °C) for grading on a commercial colour sorting grading line at the Norfolk Fruit Growers Association.

Graded fruit were designated as "marketable" or when they had greater than 50% surface red blush, a blush hue greater than 165° on a HSV hue angle map, were greater than 120 g, and were free of detectable scarring, bruising, or other defects. Fruit were separated according to individual weight into 15 size categories expressed as an average count size of number of apples required to fill a 20 kg box. The weight of total fruit in each of the count size categories was calculated for each tree based on the categories shown in Table 2.

Table 2. Weight categories and size calculation

Category	Weight (g)	Count Size
1	< 91	216
2	91 – 102	198
3	103 – 110	175
4	111 – 120 g	163
5	121 – 130 g	150
6	131 – 144	138
7	145 – 159	125
8	160 – 180	113
9	181 – 205	100
10	206 – 225	88
11	226 – 250	80
12	251 – 282	72
13	283 – 322	64
14	323 – 376	56
15	≥ 377	48

Results

Fruit Set

There was a significant treatment effect on fruit set ($P<0.0001$) (Figure 1). Trees that were treated with a single late application of 1.8 L/ha metamitron (MET), single applications of MET tank-mixed with 6-BA or carbaryl, and all sequential applications had significantly lower fruit set compared to the untreated control. Neither the hand-thinned control nor the industry standard treatments resulted in fruit set that differed from the untreated control. Similarly, all early treatments of MET applied alone (1.8, 2.3, and 2.9 L/ha at 6-7 mm) failed to lower fruit set. The single late application of 1.8 L/ha MET did reduce fruit set compared to the untreated control and the single early application of 1.8 L/ha MET, which could be due to differences in weather conditions at the times of application. Sequential MET applications (application at 6-7 mm followed by application at 15-17 mm, 12 days apart) reduced in fruit set compared to the untreated control and the single applications of both 1.8 and 2.3 L/ha MET. Applying MET tank-mixed with 6-BA reduced fruit set significantly compared to both the untreated control and the single early application of 1.8 L/ha MET. Further, 1.8 L/ha MET tank-mixed with carbaryl at 6-7 mm, and this same treatment followed by MET at 15-17 mm reduced fruit set the greatest of all treatments. The single application of MET tank-mixed with NAA had fruit set that was similar to the single early application of 1.8 L/ha MET, which was significantly higher than the other two single application tank-mix treatments.

Yield, Crop Load, and Fruit Size

Thinning treatments had a significant effect on total fruit yield per tree ($P\leq0.0001$), total number of fruit per tree ($P\leq0.0001$), mean fruit weight ($P\leq0.0001$), and crop load ($P\leq0.0001$) (Figure 2 and 3). Trees that were treated with a single late application of 1.8 L/ha MET, single applications of MET tank-mixed with 6-BA or carbaryl, and all sequential applications had significantly lower total yield per tree compared to the untreated control, all other treatments did not differ significantly in total yield. Similar to the fruit set treatment relationships, none of the single early applications of MET (1.8, 2.3, 2.9 L/ha) produced yields that differed from the untreated control, while the single late application of 1.8 L/ha MET and the sequential applications of MET alone did.

Again, all tank-mixed treatments also differed significantly from the untreated control in total fruit yield except for the single application of MET tank-mixed with NAA. Trees that were treated with a single early application of 1.8 L/ha MET (135 g), and a single application of MET tank-mixed with NAA (127 g) were the only treatments with fruit weights that did not differ from the untreated control (125 g) (Figure 2). All other treatments resulted in mean fruit weights that were significantly and some markedly higher than the untreated control. Every thinning treatment reduced the total number of fruit/tree compared to the untreated control except for the single application of MET tank-mixed with NAA (Figure 3). Untreated control trees ad on average 199 fruit/tree while the single application of MET tank-mixed with NAA had 173 fruit/tree, all other treatments ranged from 48 – 150 fruit/tree.

Hand-thinned control trees and those treated with the single late application of 1.8 L/ha MET, single applications of MET tank-mixed with 6-BA or carbaryl, and all sequential application treatments had significantly lower crop loads than the untreated control. Relationships in the mean differences of crop load are very similar to those of previous parameters

like total fruit yield per tree; single early applications of MET (1.8, 2.3, 2.9 L/ha) did not differ from the untreated control, but the treatments of the single late application of 1.8 L/ha MET and the single application of MET tank-mixed with 6-BA produced crop loads more similar to an ideal crop load of ~7 fruit per cm2 TCSA alongside the hand-thinned control. The single application of MET tank-mixed with carbaryl and the sequential applications of MET alone and MET tank-mixed with 6-BA followed by MET applied at 15-17 mm all resulted in crop loads of 5.6 fruit/cm2 TCSA that may indicate slight overthinning relative to a desired target crop load of 6-8 fruit/cm2 TCSA, but didn't differ significantly from the more optimal hand-thinned control. However, the treatment of MET tank-mixed with carbaryl followed by MET applied at 15-17 mm resulted in a crop load that was significantly lower than both the untreated control and the hand-thinned control (3.5 fruit/cm2 TCSA) indicating overthinning.

Despite relatively cool weather conditions during and following early applications at 6-7 mm (maximum daily temperature of 19 ˚C on 26-May, ranging from 14-23 ˚C for 5 days following), multiple treatments demonstrated thinning efficacy. It is generally not recommended to use hormonal thinners like 6-BA and NAA when temperatures are below ~20 ˚C, however MET's photosynthetic inhibition mode of action may provide more flexible environmental conduction in contrast to hormonal thinners.

Fruit Size Distribution and Marketability

Thinning treatments had a significant effect on fruit size distribution except for fruit in the 64- and 72-count box size categories (Figure 4). Fruit from the untreated trees had the greatest distribution of fruit in multiple size categories. Most fruit of the untreated control peaked in the 138-count size category. Trees of the hand-thinned control peaked in the 113-count size category as did most other treatments, excluding the single early application of 1.8 L/ha metamitron (MET), the single application of 1.8 L/ha MET tank-mixed with NAA, the single application of 1.8 L/ha MET tank-mixed with carbaryl, the sequential application of 1.8 L/ha MET applied alone followed by MET, and the sequential application of 1.8 L/ha MET tank mixed with carbaryl followed by MET. Applications of 1.8 L/ha MET applied alone and a single application of 1.8 L/ha MET tank mixed with NAA had most of their fruit peak in smaller fruit size categories, 125- and 138-count box size respectively, with distributions more similar to the untreated control. The treatments of the single application of 1.8 L/ha MET tank mixed with carbaryl, the sequential application of 1.8 L/ha MET applied alone followed by MET, and the sequential application of 1.8 L/ha MET tank mixed with carbaryl followed by MET all had most of their fruit in the larger, 100-count box size category, though they did have notably lower total yields compared to other treatments. The untreated control trees also had more undersized fruit (box sizes 175-216) compared to all other treatments in the 175-count size category, all treatments except the single application of 1.8 L/ha MET tank mixed with NAA in the 198-count size category, and all treatments except the early application of 1.8 L/ha MET applied alone and the single application of 1.8 L/ha MET tank mixed with NAA in the 216-count size category.

Thinning treatments also had a significant effect on the percent of marketable fruit ($P \leq 0.0001$) (Figure 5). The only treatments that did not differ significantly from the untreated control, which had 51% marketable fruit, were the early single applications of 1.8, 2.3, and 2.9 L/ha MET, which had 67, 71, and 74% marketable fruit respectively, the single application of 1.8 L/ha MET tank-mixed with NAA, which had 50% marketable fruit, and the sequential application of MET tank-mixed with NAA followed by a late application of MET, which had 78% marketable fruit. All other treatments had a markedly higher percentage of marketable fruit compared with the untreated control treatment, which the former ranged from 80 – 85%.

Key Conclusions

- Tank-mixing metamitron with other chemical thinners like 6-BA and carbaryl appears to have an additive effect on the thinning efficacy in 'Gala'.
  - Despite relatively cool weather when applied, metamitron tank-mixed with other thinners still resulted in a thinning response.
  - For unknown reasons that require further investigation, metamitron when tank-mixed with NAA had reduced thinning efficacy.
- Metamitron was efficacious as a "late" thinner when applied at 15-17 mm as a single application, or as a sequential treatment to earlier thinners.

- Sequential applications that included metamitron appeared to cause over-thinning in ‘Gala’, as indicated by excessively low crop loads and yields. Treatments containing metamitron tank-mixed with carbaryl caused overthinning at the rates used.
- In general, treatments that reduced fruit set also reduced crop load; treatments like 1.8 L/ha metamitron applied at 15-17 mm and 1.8 L/ha metamitron tank-mixed with 6-BA resulted in crop loads that were very similar to the hand-thinned control.
- Multiple tank-mix and sequential treatments with high thinning efficacy resulted in a higher percentage of marketable fruit and larger count size apples.
- Crop load must be balanced with yield and cannot come at the expense of a reduced marketable yield and crop value.

Overall, this study demonstrates that metamitron was an effective apple fruitlet thinner when applied at 15-17 mm, sequentially, or in combination with other chemical thinners, but only a mild thinner when applied alone at 6-7 mm. We anticipate that in commercial orchards rates of 6-BA, carbaryl and NAA for tank mix and sequential sprays can be adjusted to avoid overthinning.

These datasets are preliminary and therefore must be interpreted with some caution as thinning responses can vary based on weather, tree age, cultivar, and other factors. This trial will be repeated in 2026.

Acknowledgements

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Disclosures

Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of Guelph of the products named and does not imply criticism of similar ones not mentioned.

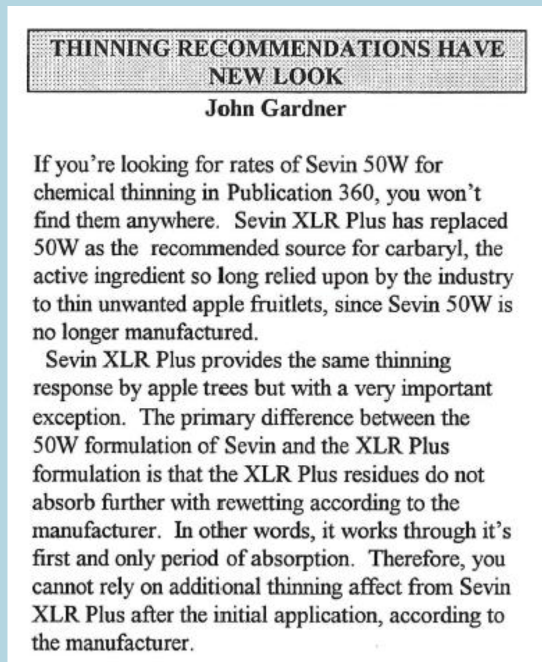
Pearls of Wisdom

We’ve been on a thinning roll this issue, so why stop now?

In 1998 apple growers were informed about the new Sevin formulation – Sevin XLR Plus. While a different product is being used today, the active ingredient remains the same.

As research advances and scientific understanding improves, chemistries continue to be refined and updated.

Although products and recommendations evolve over time, the need for effective thinning in remains a consistent and central consideration in apple production.



THINNING RECOMMENDATIONS HAVE NEW LOOK

John Gardner

If you’re looking for rates of Sevin 50W for chemical thinning in Publication 360, you won’t find them anywhere. Sevin XLR Plus has replaced 50W as the recommended source for carbaryl, the active ingredient so long relied upon by the industry to thin unwanted apple fruitlets, since Sevin 50W is no longer manufactured.

Sevin XLR Plus provides the same thinning response by apple trees but with a very important exception. The primary difference between the 50W formulation of Sevin and the XLR Plus formulation is that the XLR Plus residues do not absorb further with rewetting according to the manufacturer. In other words, it works through it’s first and only period of absorption. Therefore, you cannot rely on additional thinning affect from Sevin XLR Plus after the initial application, according to the manufacturer.

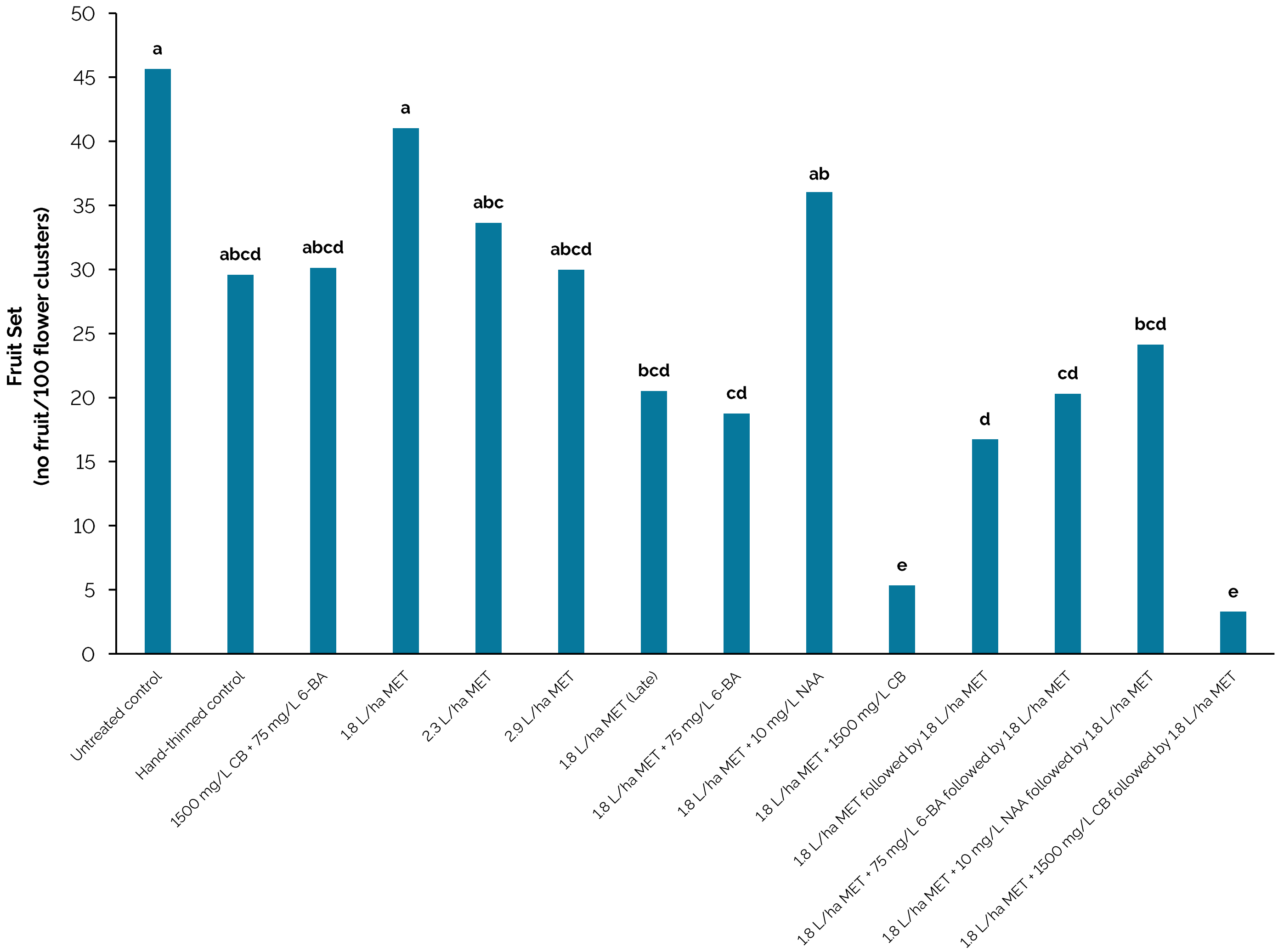


Figure 1. *Influence of metamitron (MET), carbaryl (CB), 6-benzyladenine (6-BA), and 1-naphthelenacetic acid (NAA) applied at various rates, timings, and combinations on fruit set of 'Crimson Gala' trees in 2025. Treatments including a "+" indicate the chemical thinners were tank-mixed for application. Treatments were applied at 6-7 mm king fruitlet diameter on 26-May 2025, and components of a treatment denoted with "Late" or "followed by" were applied separately at 15-17 mm king on 7-June 2025. Mean values with the same letter are not significantly different according to Tukey's HSD test at P=0.05. Note that counts were taken following hand-thinning, so fruit set values of the hand-thinned control treatment reflect that.*

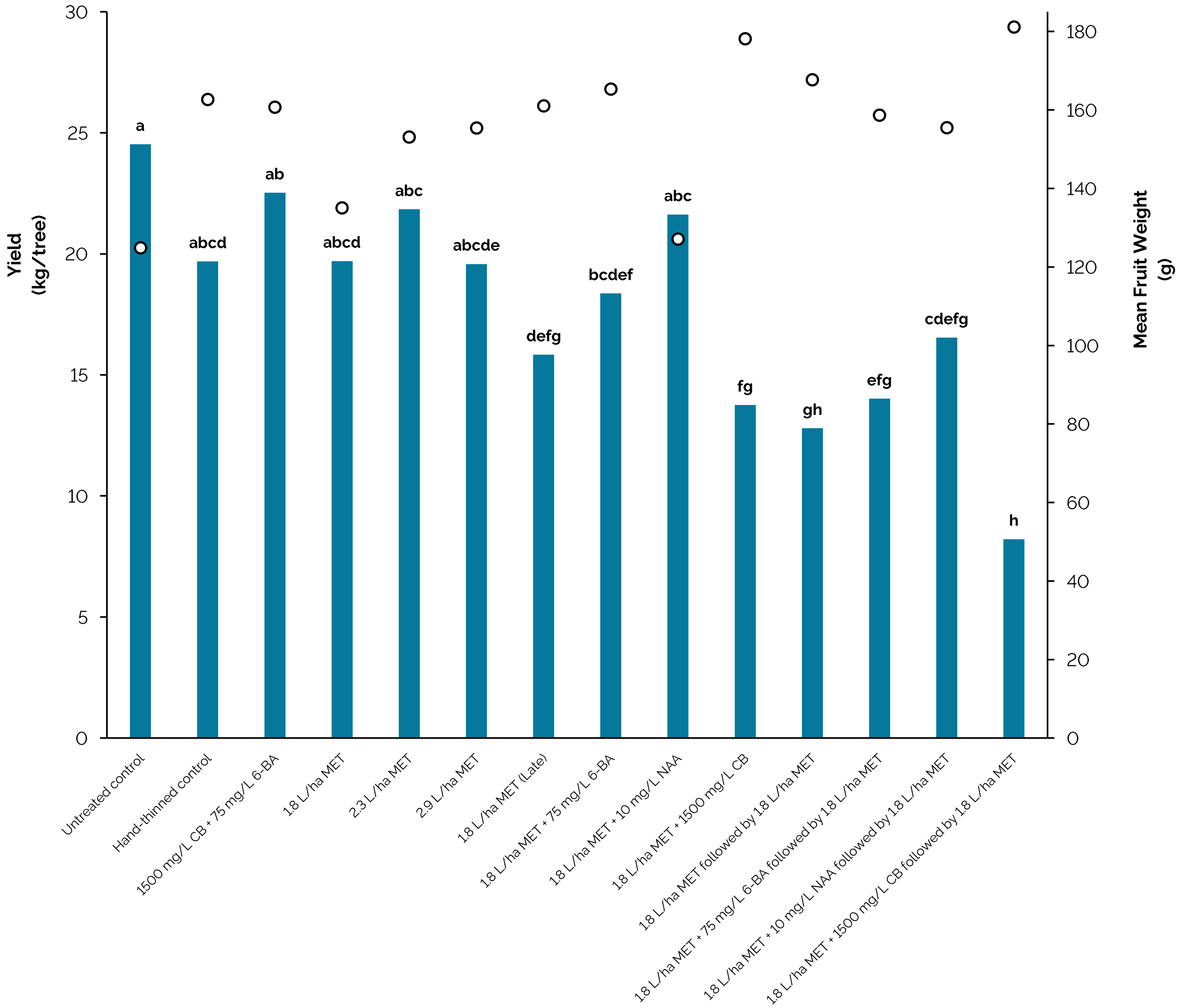


***Figure 2**. Influence of metamitron (MET), carbaryl (CB), 6-benzyladenine (6-BA), and 1-naphthelenacetic acid (NAA) applied at various rates, timings, and combinations on total yield per tree (bars) and average fruit weight (dots) of 'Crimson Gala' trees in 2025. Treatments including a "+" indicate the chemical thinners were tank-mixed for application. Treatments were applied at 6-7 mm king fruitlet diameter on 26-May 2025, and components of a treatment denoted with "Late" or "followed by" were applied separately at 15-17 mm king on 7-June 2025. Mean yield values with the same letter are not significantly different according to Tukey's HSD test at P=0.05.*

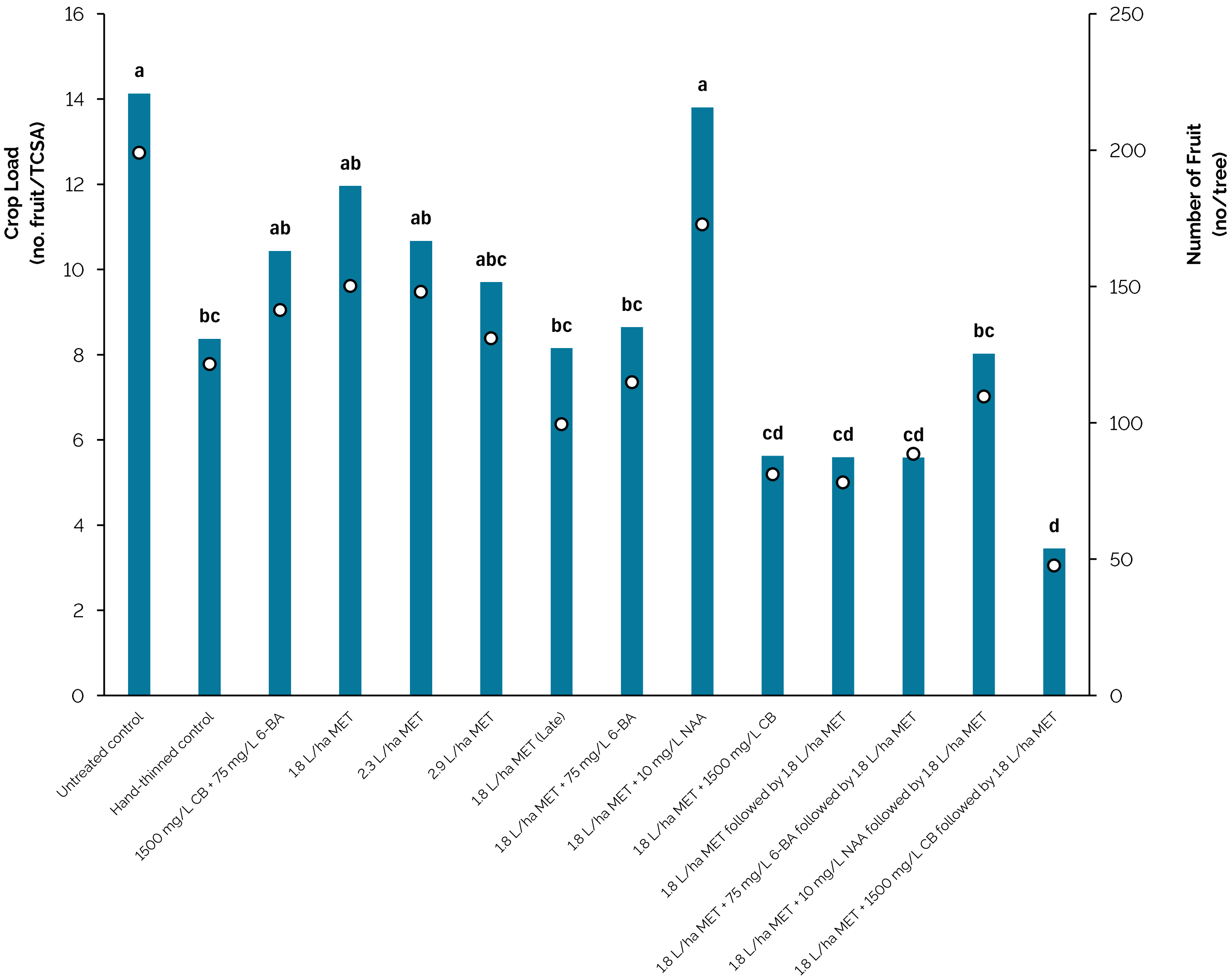


Figure 3. *Influence of metamitron (MET), carbaryl (CB), 6-benzyladenine (6-BA), and 1-naphthelenacetic acid (NAA) applied at various rates, timings, and combinations on crop load (bars) and number of fruit per tree (dots) of 'Crimson Gala' trees in 2025. Treatments including a "+" indicate the chemical thinners were tank-mixed for application. Treatments were applied at 6-7 mm king fruitlet diameter on 26-May 2025, and components of a treatment denoted with "Late" or "followed by" were applied separately at 15-17 mm king on 7-June 2025. Mean crop load values with the same letter are not significantly different according to Tukey's HSD test at P=0.05.*

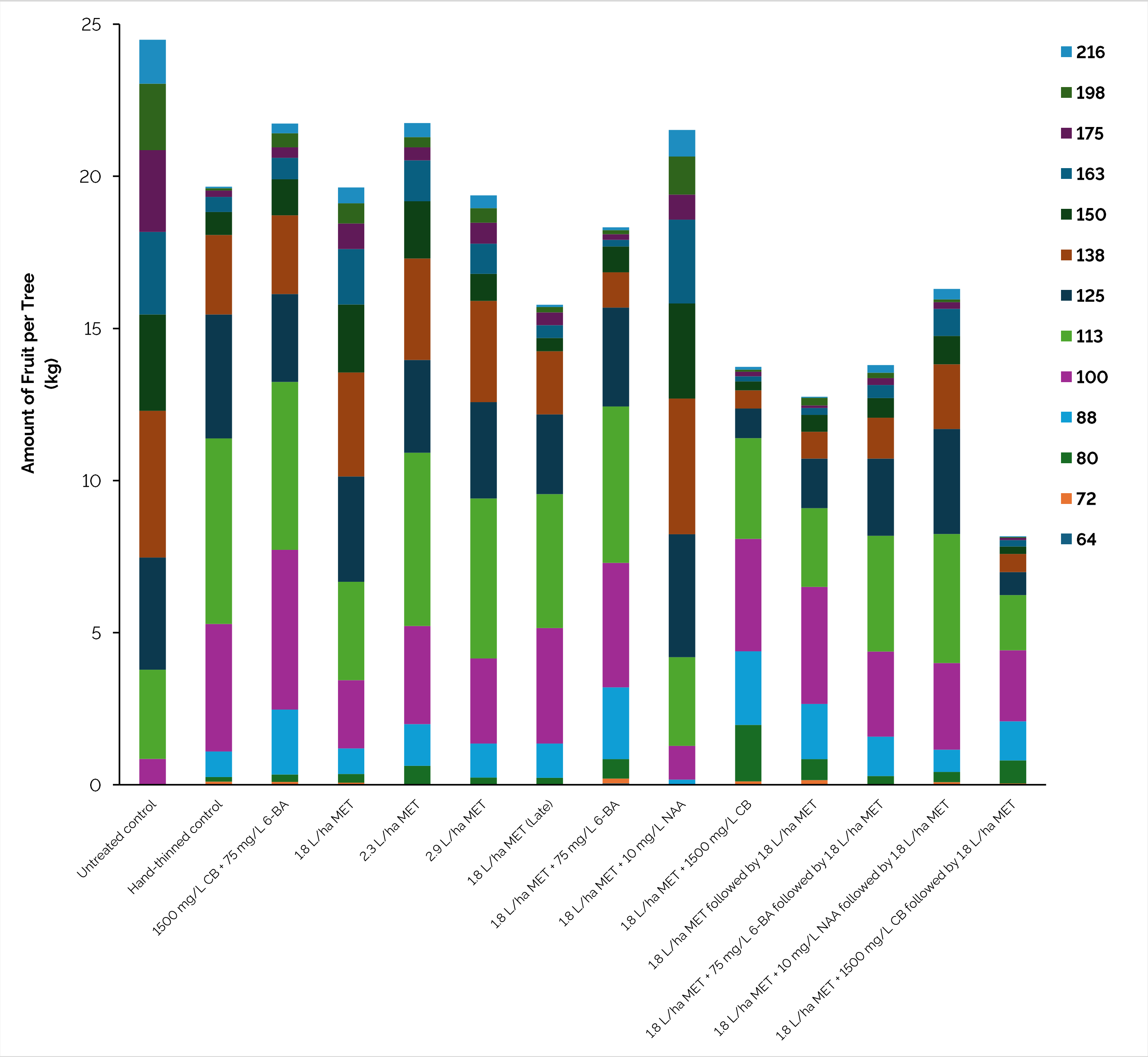


Figure 4. *Influence of metamitron (MET), carbaryl (CB), 6-benzyladenine (6-BA), and 1-naphthelenacetic acid (NAA) applied at various rates, timings, and combinations thinning treatments on size distribution of 'Crimson Gala' fruit in 2025 based on fruit count/box size categories. Fruit diameter equivalents for each count size: 48 = >98 mm (3 ⅞"), 56 = 95-98 mm (3¾-3 ⅞"), 64 = 92-95 mm (3⅝-3¾"), 72 = 89-92 mm (3½-3⅝), 80 = 84.5-89 mm (3⅜-3½"), 88 = 83-84.5 mm (3¼-3⅜"), 100 = 79-83 mm (3⅛-3¼"), 113 = 76-79 mm (3-3⅛"), 125 = 73-76 mm (2⅞-3"), 138 = 70-73 mm (2¾ -2⅞"), 150 = 67-70 mm (2⅝-2¾"), 163 = 64-67 mm (2½-2⅝"), 175 = 60-64 mm (2⅜-2½"), 198 = 57-60 mm (2¼-2⅜"), 216 = <57 mm (2¼"). Treatments including a "+" indicate the chemical thinners were tank-mixed for application. Treatments were applied at 6-7 mm king fruitlet diameter on 26-May 2025, and components of a treatment denoted with "Late" or "followed by" were applied separately at 15-17 mm king on 7-June 2025.*

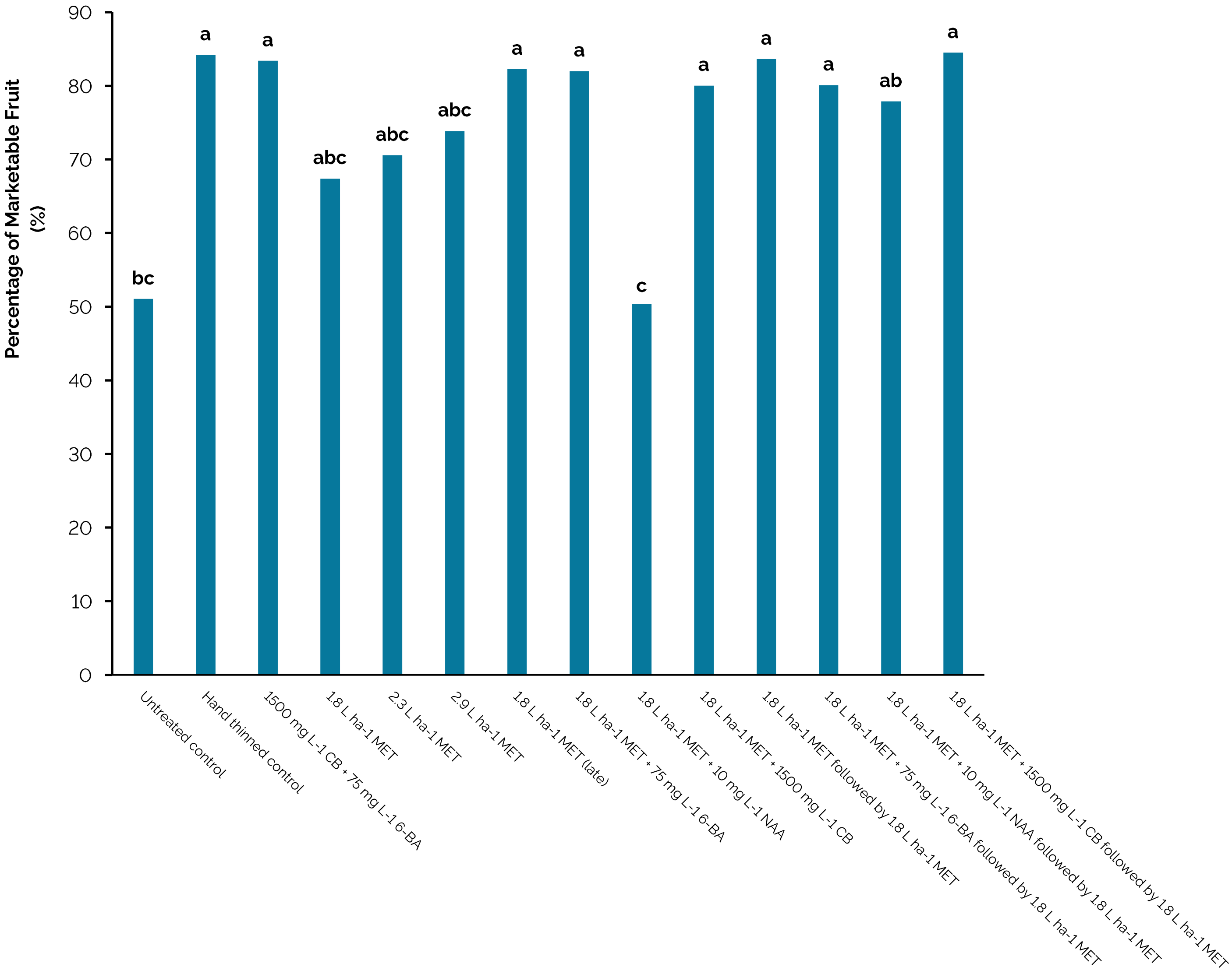


Figure 5. *Influence of metamitron (MET), carbaryl (CB), 6-benzyladenine (6-BA), and 1-naphthelenacetic acid (NAA) applied at various rates, timings, and combinations on proportion of marketable fruit of 'Crimson Gala' trees in 2025. Treatments including a "+" indicate the chemical thinners were tank-mixed for application. Treatments were applied at 6-7 mm king fruitlet diameter on 26-May 2025, and components of a treatment denoted with "Late" or "followed by" were applied separately at 15-17 mm king on 7-June 2025. Mean values with the same letter are not significantly different according to Tukey's HSD test at P=0.05.*