

# Thinning Peaches with 1-ACC (Accede™) and other methods

John A. Cline

Professor of Pomology

University of Guelph, Simcoe Research Station

[Jcline@uoguelph.ca](mailto:Jcline@uoguelph.ca)



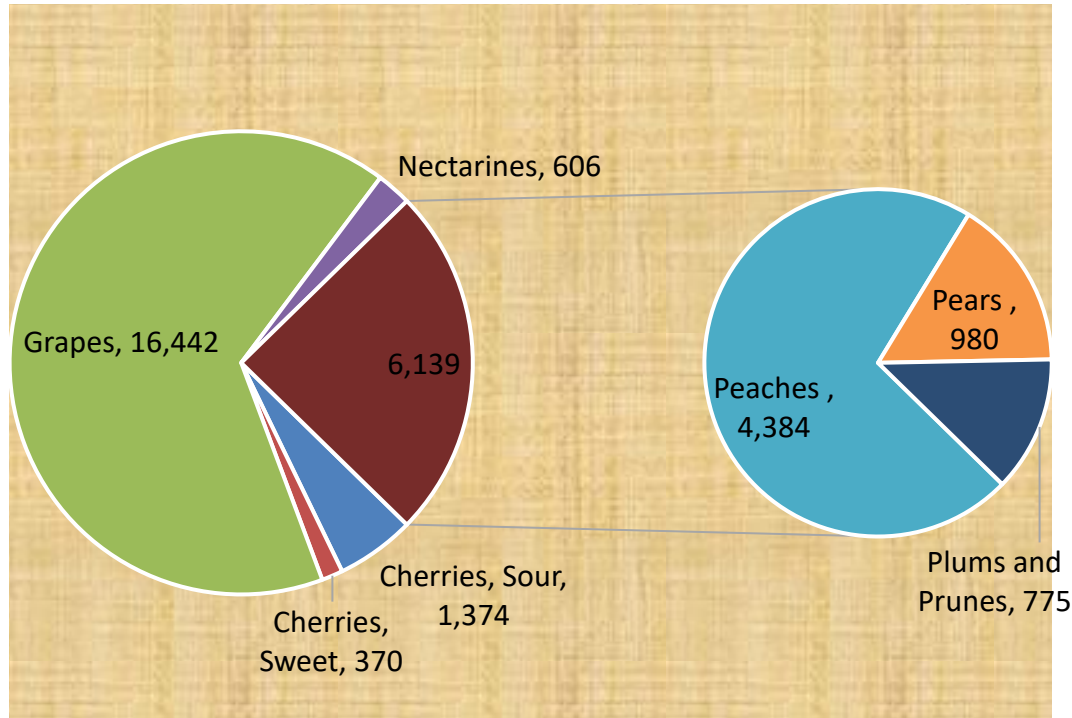
# University of Guelph, Simcoe Research Station



# Simcoe Research Station

- Apples
- Sweet and Tart Cherries
- Peaches

# Ontario Grape, Pear and Stone Fruit Production (acres) (2002)



- Ontario has ~500 acres of peaches and nectarines
- over 50% of Canadian tender fruit production
- 4% of location sold on-farm retail, 95% wholesale
- ~30% of market supply (70% of tender fruit are imported)

Source: Fruit and Vegetable Survey, Statistics Canada; Ontario Tender Fruit Producers' Marketing Board Annual Report, Grape Growers of Ontario Annual Report



# The Niagara Peninsula is the primary tender fruit production in Canada



# Learning Objectives

- Importance of thinning
- What is ACC and how does it work?
  - Physiology
  - Leaf development of peach
- ACC research data from Canada and elsewhere
- Review Valent USA Accede product Label
  - Rates, species, guidelines, precautions key points
- Factors affecting the thinning response
- Grower recommendations for adopting Accede™ (ACC)use



# Importance of Thinning Stone Fruits

Hand thinning is:

- Timing: the only current and widely practiced method to reduce the crop load of peaches
- Late: completed at the end of phase I of fruit development (~50+ days after bloom)
- Labour cost
  - \$17.45/hr and growing (2018 Ontario Tender Fruit Grower's)
  - Wage rates will continue to rise
- Labour scarcity and availability
- Lack of experienced labour
- Other thinning methods have not largely been successful or widely adopted

Ontario minimum wage (1965-2023)

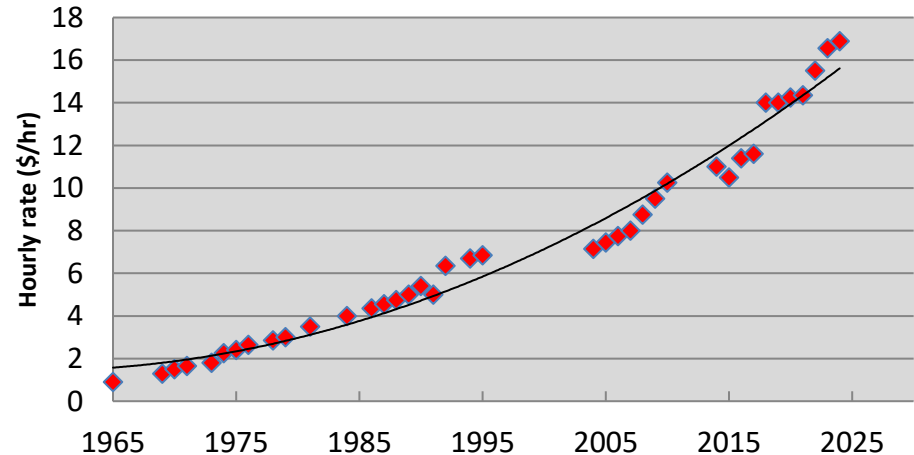
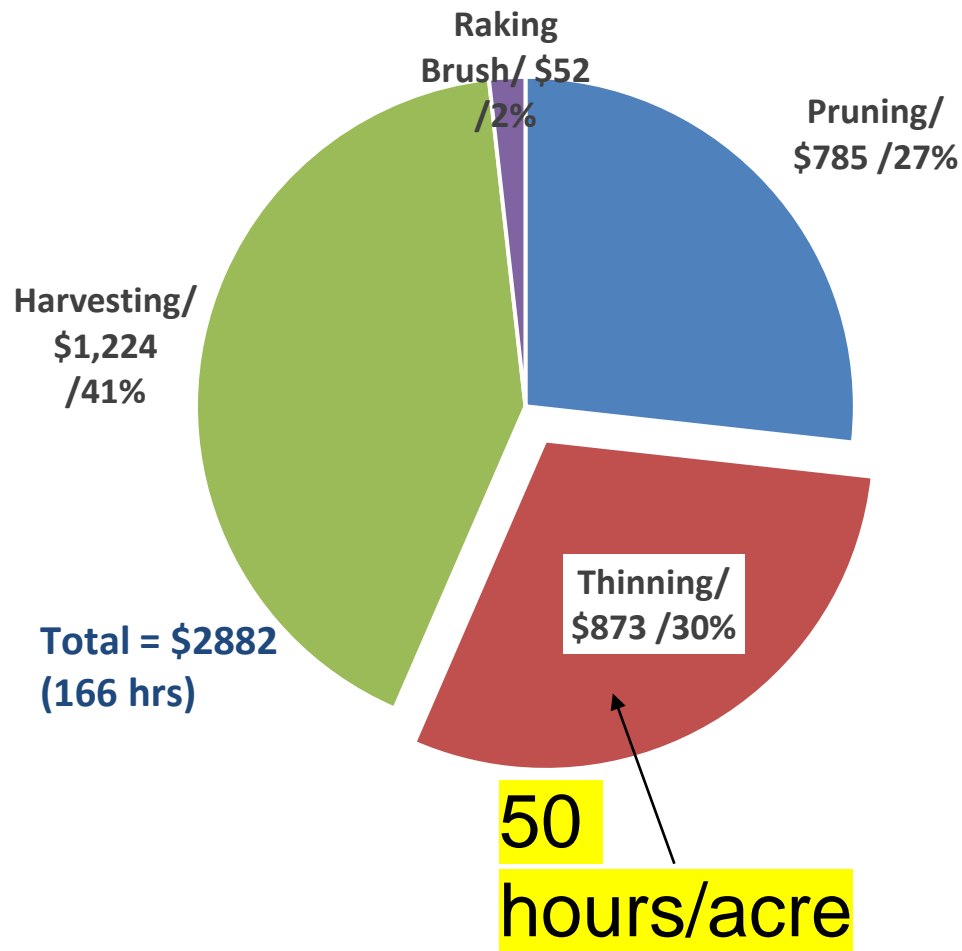


Photo credit: J. A. Cline



# Estimated hand labour per acre for a mature peach/nectarine orchard in Ontario



Crop	Trees per Acre	Establishment Period
Peach – Fresh Market	242	4 ½ years
Nectarines	242	4 ½ years
Sour Cherries	145	6 ½ years
Plum - European	201	6 ½ years
Plum - Japanese	201	8 ½ years
Apricot	201	8 ½ years
Pear – Standard Fresh	201	8 ½ years
Pear – High Density Fresh	1117	7 ½ years

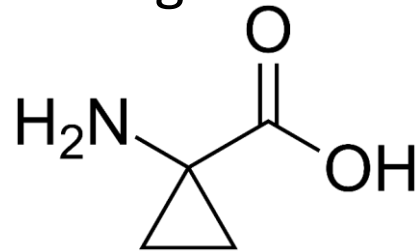
Hired Labour, which is usually offshore labour, was charged at \$17.45 per hour which is comprised of minimum wage plus benefits (worker's compensation, employment insurance, Canada pension plan and an allowance for additional costs of air flight, housing and local transportation). Minimum wage in Ontario is now tied to Ontario's Consumer Price Index (CPI). Minimum wage increases are announced by April 1 each year, and are in effect on October 1 of the same year. Employer Health Tax is not included based on an 80-acre tender fruit orchard payroll model.

Harvest Labour was charged at \$18.00 per hour which is comprised of minimum wage plus benefits as above and includes vacation pay.



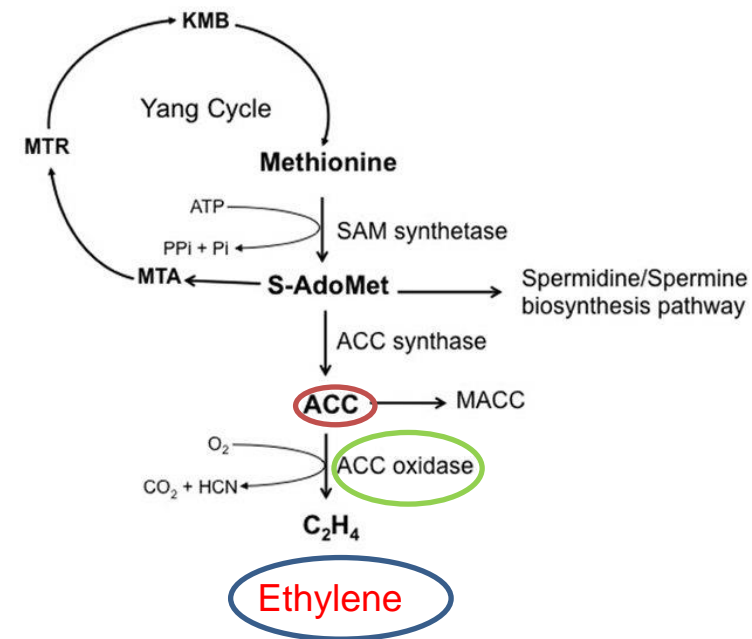
# What is 1-ACC

- Chemical Name: 1-Amino-cyclopropane -1-carboxylic acid
- Naturally occurring amino acid found in plants



- 1-ACC, discovered in 1979, is a precursor of ethylene in the ethylene biosynthesis pathway (Adams and Yang, 1979)
- In sufficient concentrations, ethylene accelerates flower and fruit drop, enhances fruit colour and ripening
- Is xylem and phloem mobile (Morris and Larcombe, 1995)

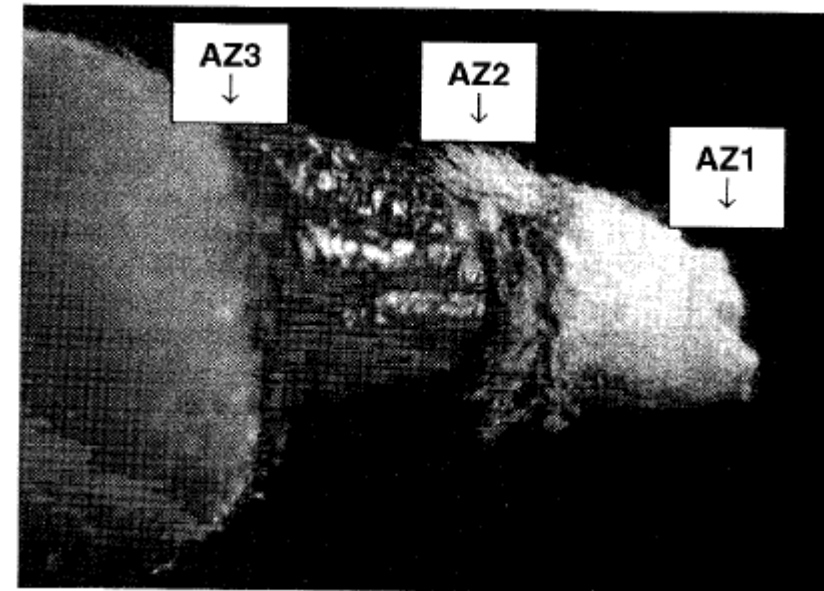
## Ethylene Biosynthesis Pathway



Arc et al, 2013

# ACC Physiology

- ACC oxidase (ACO) in the plant cell converts ACC to ethylene in a temperature dependent biochemical reaction.
- The rate of ethylene release following an ACC application reaches a maximum after 2-3 days, and ethylene declines to background levels around 10 days after application.
- No residues at harvest
- No gummosis in peaches/nectarines, in contrast to other ethylene releasing compounds such as ethephon.
- Can cause leaf yellow and leaf drop
- In peach, fruit drop is dependent on the activation of one of three abscission zones (AZ). AZ1 is responsible for the abscission of buds, flowers and young fruits (early June-drop) and AZ-2 and 3, in succession, are activated in mid and late June-drop ( Rascio et al., 1985).



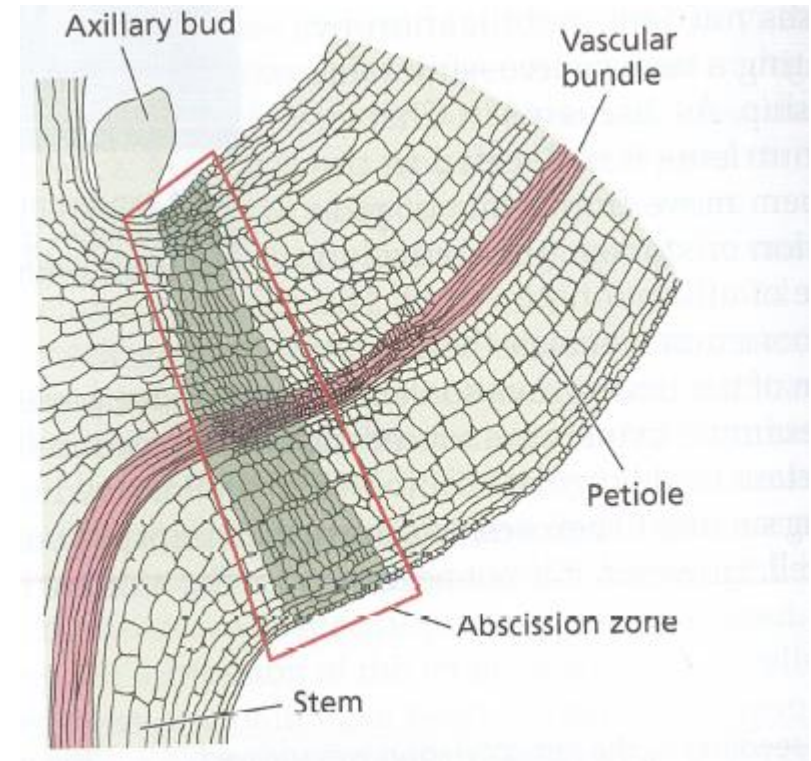
Byers, R.E., Costa, G. and Vizzotto, G. 2003. Flower and fruit thinning of peach and other Prunus. p.351-392. In: Horticultural Reviews 28 (Janick J. ed), Wiley J. & Sons Publishers, New Jersey, USA.  
<https://doi.org/10.1002/9780470650851.ch7>



Photo credit: J. Cline

# Leaf abscission zone

- A specific cell layer in the leaf and fruit stem
- As the cell walls and vascular connection break down, the organ drops (abscises)

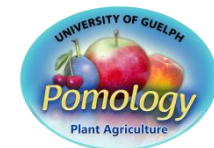


ACC manufactured by Valent BioSciences.  
Commercially formulated as Accede®



- First new chemical thinner for stone fruit
- Accede® applied during pink bud stage to petal fall will reduce fruit set and reduce, but not eliminate, the need for hand thinning.
- A second application of Accede® can further reduced fruit set.

Crops listed on label: apple, apricot, sweet and tart cherry, nectarine, peach, chicksaw plum, Japanese plum, plumcot, fresh prune plums



# Accede<sup>®</sup> Benefits



- Reduces hand thinning
- Delivers early crop load management to improve fruit size (indirectly to improve colour and quality)
- Helps reduced tree and limb damage by heavy crop loads
- May improve harvest management by advancing and compressing fruit maturity



# Accede<sup>®</sup> Rate and Timing Trials

## Peach (*Prunus persica*)

- Redhaven: 2018, 2019, 2022
- Vivid: 2021, 2023
- Harrow Dawn: 2021, 2023



## European Plum (*Prunus domestica*)

- Vibrant: 2023



## Japanese Plum (*Prunus salicina*)

- Early Golden: 2023



# Research Objectives

- Determine the optimal rate and timing of foliar applications of 1-ACC to thin peach trees
- Measure any negative effects of 1-ACC on tree health, including leaf yellowing and leaf drop
- Measure the effects of 1-ACC on fruit quality – including fruit size, size distribution, and maturity
- Conduct a cost-benefit analyses
  - Costs: product cost, potential negative effects on the tree
  - Benefits: reduced hand thinning, improvement in fruit size



# Experimental Plan – Harrow Dawn/Bailey

Harrow Dawn: early season cultivar (Aug 5)  
Trees planted: 2018 (4-yr-old)  
Spacing: 10' x 18 ft (242 trees/acre)  
Treatments applied to single trees using a commercial air blast sprayer to tree row volume dilute (761 L ha<sup>-1</sup>)  
1 'guard' tree was left between sprayed trees

System: Open vase, free standing  
Treatments: 8  
Replications:5  
Experiment design: RCBD

Tree were trickle irrigated





# Thinning Treatments

Treatment (mg L <sup>-1</sup> / ppm)	Application timings/fruitlet diameter	Date of application	Days before/after full bloom
Hand thinned control		Jun 22	47.0
300 ACC	Pink	Apr 27	-10
600 ACC	Pink	Apr 27	-10
300 ACC	Pink and FB	Apr 27, May 6	-10, 0
300 ACC	Shuck split	May 27	21
600 ACC	Shuck split	May 27	21
300 ACC	19 mm	Jun 07	32
600 ACC	19 mm	Jun 07	32

All 1-ACC sprays included 0.05% (v/v) Agral 90 non-ionic spray adjuvant (Syngenta Canada Inc., Guelph, Canada)



Pink bud



Full bloom



Shuck split



19 mm

# Measurements

## Thinning

Fruit set

Crop load

Number of fruit per tree

Number of fruit removed during hand thinning

Time to thin trees

## Leaf Phytotoxicity

Leaf yellowing

Leaf drop



## Fruit

Number of fruit per tree

Yield per tree

Average fruit weight

Fruit size distribution

Proportion of fruit harvested on each harvest date



## Fruit Quality

Firmness, soluble solids, juice pH, titratable acidity

## Economics

Value of fruit per tree

Cost of thinning

## Vegetative growth

Trunk cross section area

Shoot growth

Detailed data are required to assess ACC performance. Fruit set and percent reduction in hand thinning is not sufficient to measure product performance.

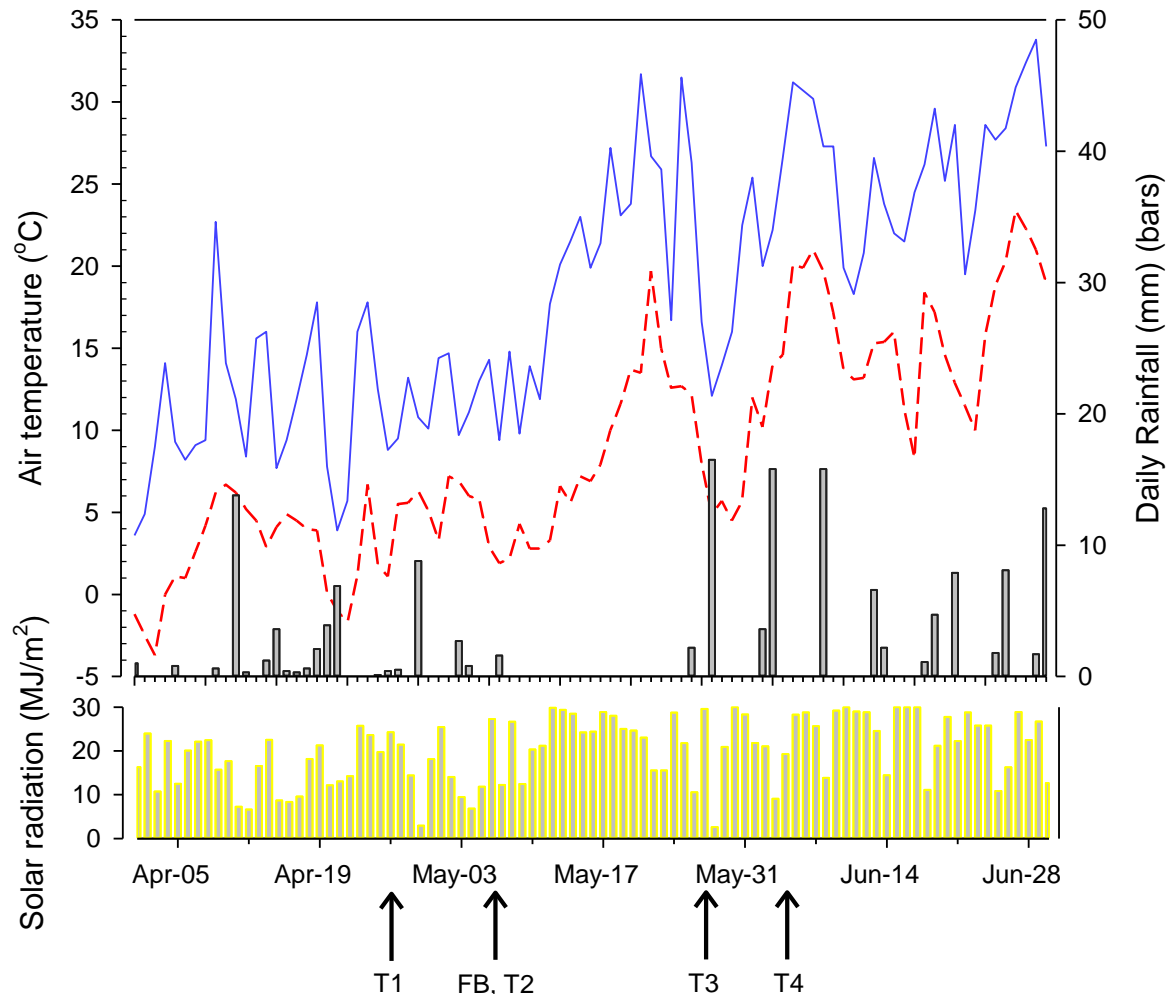


# 1-ACC effect on flowers (cv. Harrow Dawn)



Flowers on distal portion of branch appeared more affected by ACC  
10-14 days to observe a response after spraying  
There was very little leaf drop or leaf yellowing when applied at bloom

# Air temperature, rainfall, solar radiation, Vineland Station (April 1 – June 30, 2021)



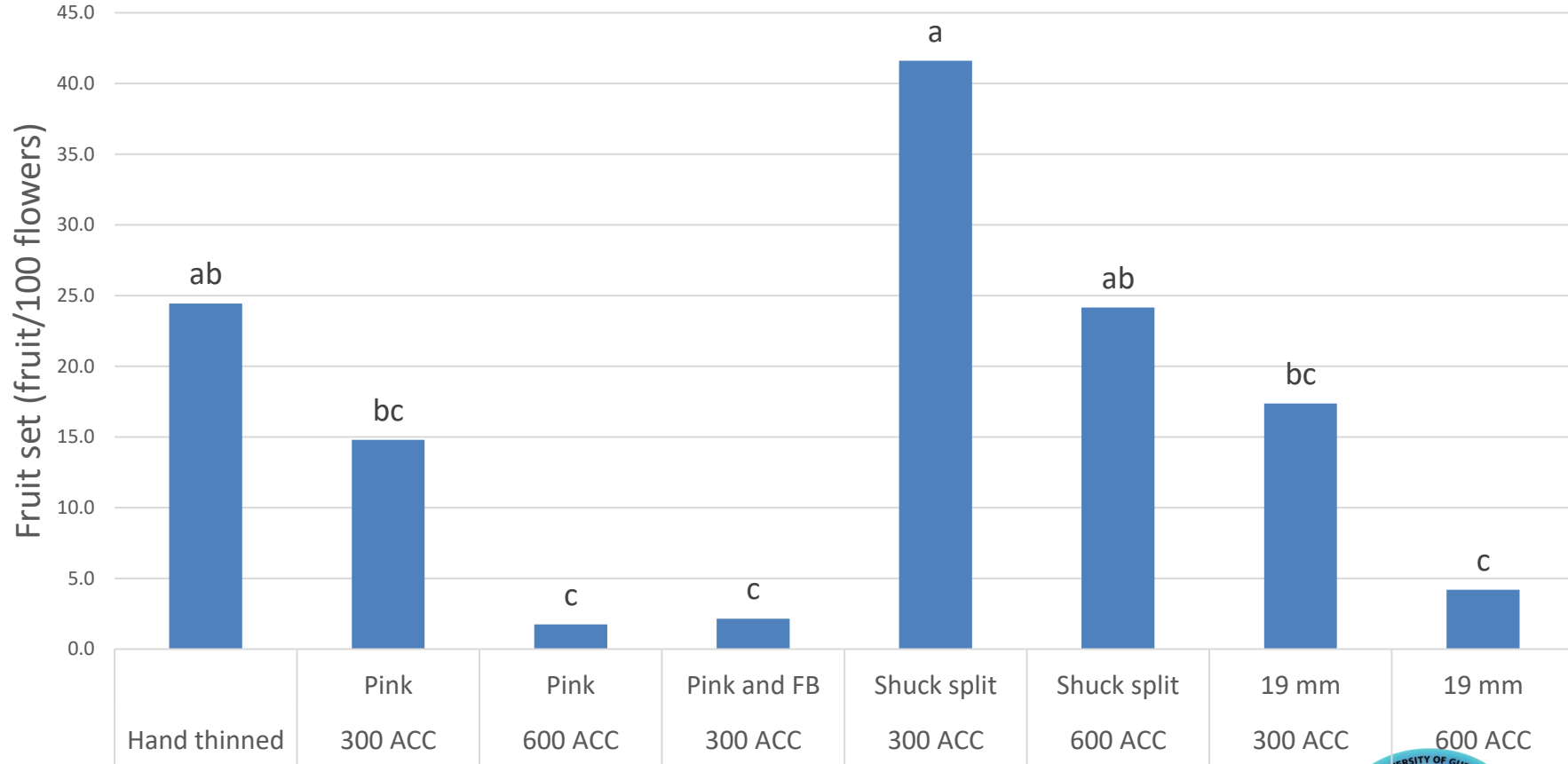
Atypical warm temperatures in late March advanced bud development predisposing the orchards to potential frost.

This was followed by cool weather around 20-Apr with minimum temperatures reaching as low as -1.7°C on 22-Apr.

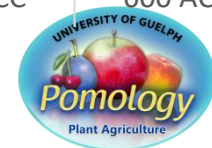
Figure 1. 2021 minimum (dashed line) and maximum (solid line) air temperature, precipitation and solar radiation at the Vineland, ON (1 Apr - 30 June). Arrows indicate the dates of full bloom 6-May (FB) and application of treatments on 27-Apr (T1), 6-May (T2), 27-May (T3) and 7-June (T4).



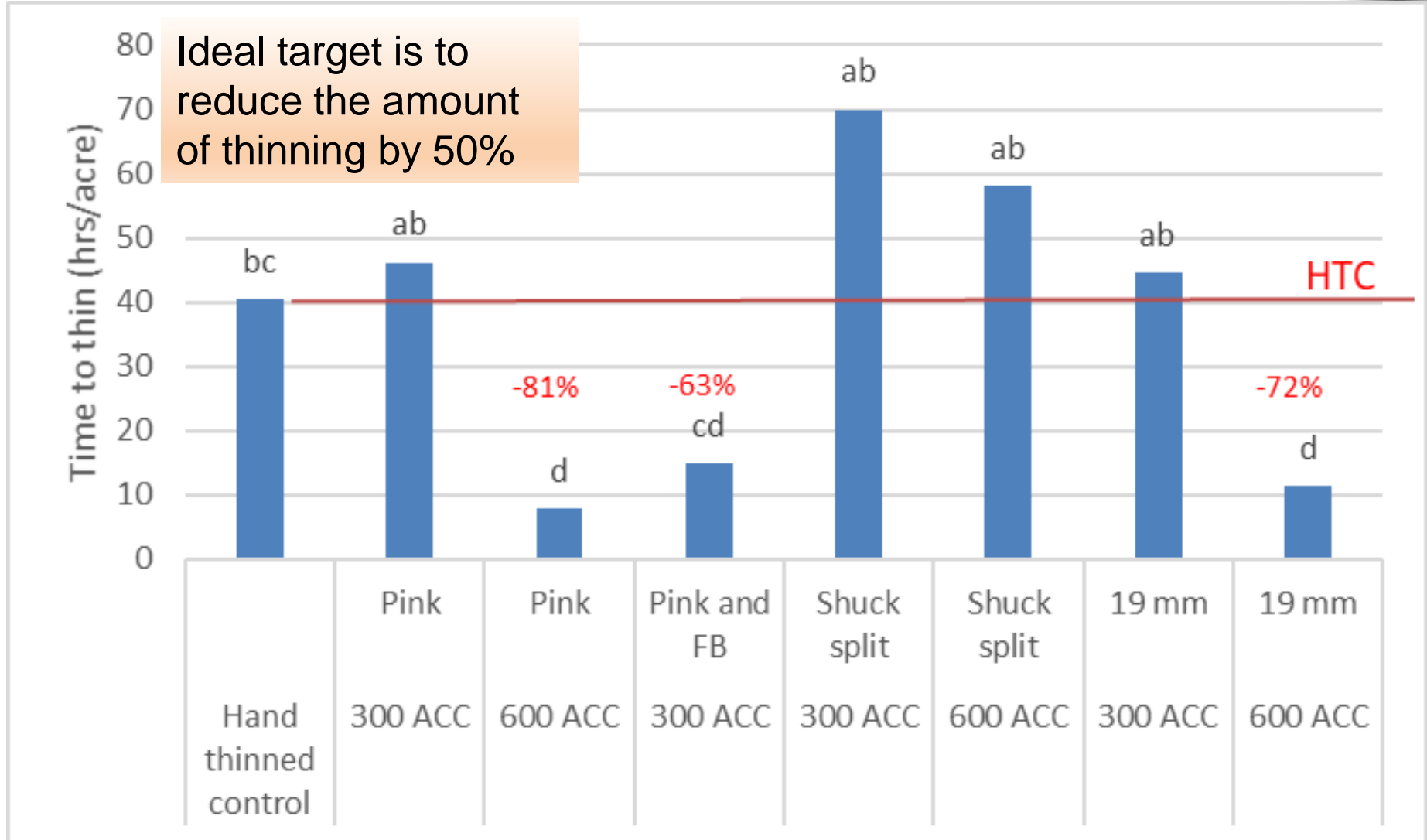
# Harrow Dawn Results – Fruit set



Accede applied at 19 mm is 'off' label



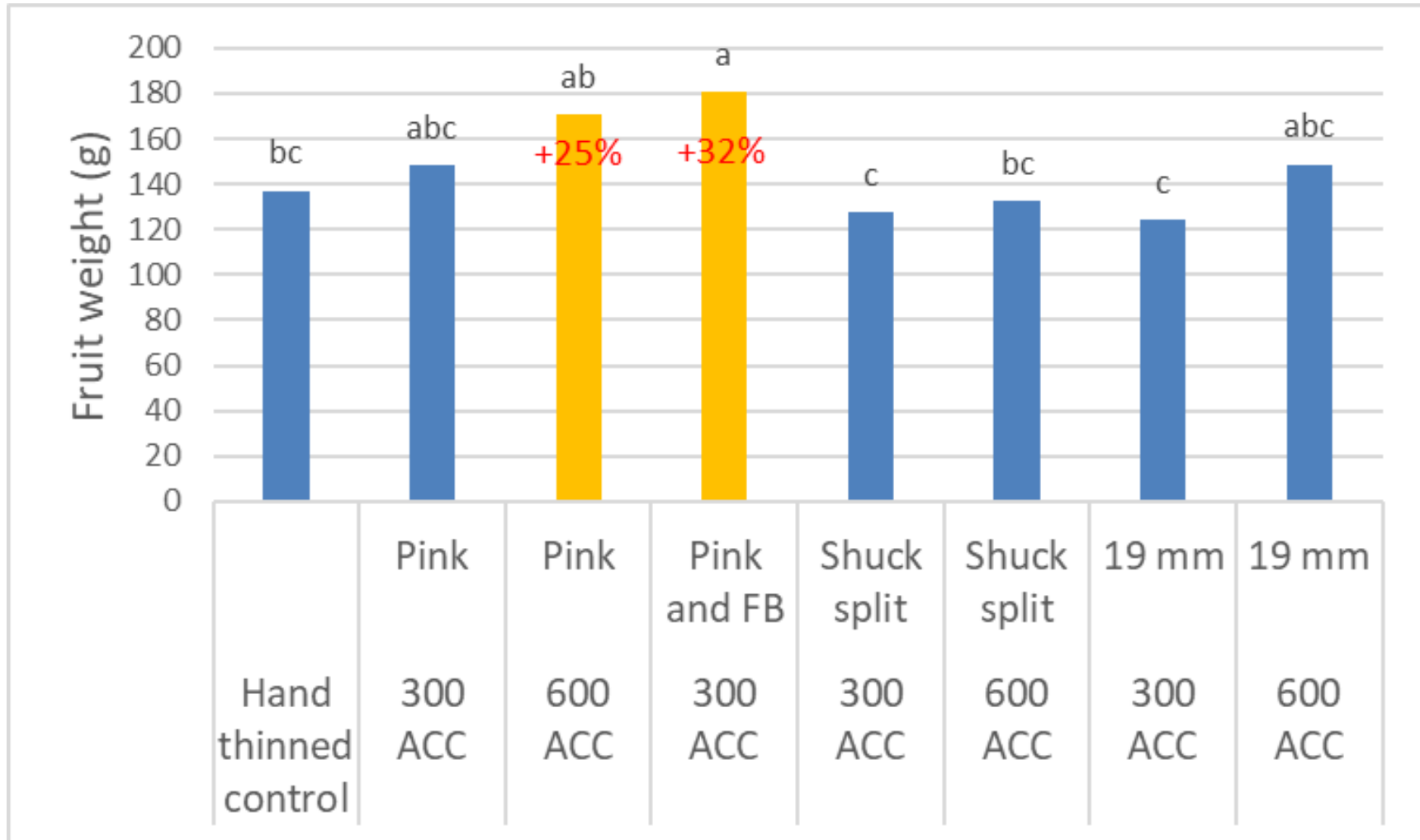
# Harrow Dawn Results – Time to Thin



Accede applied at 19 mm is 'off' label

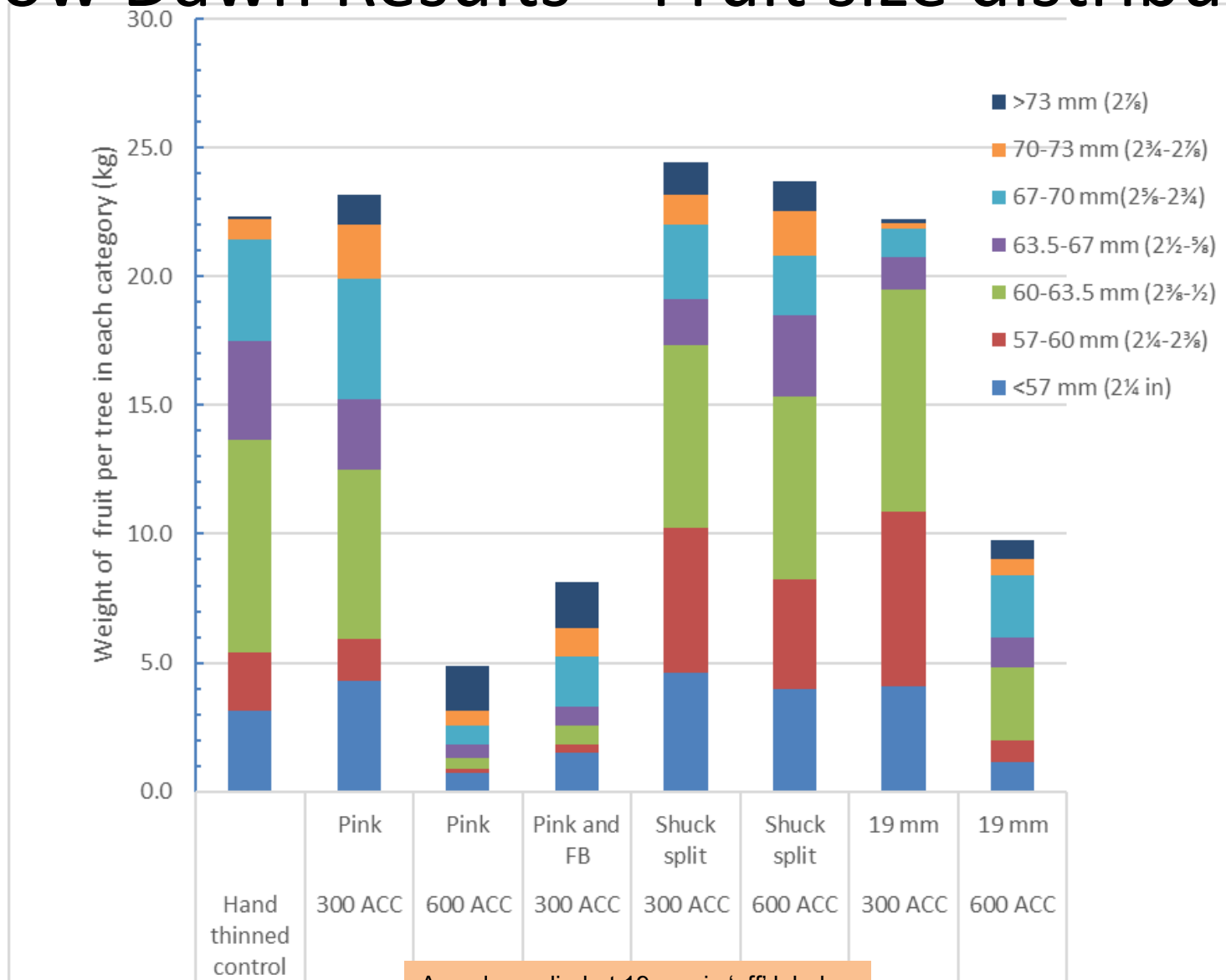


# Harrow Dawn Results – Fruit size



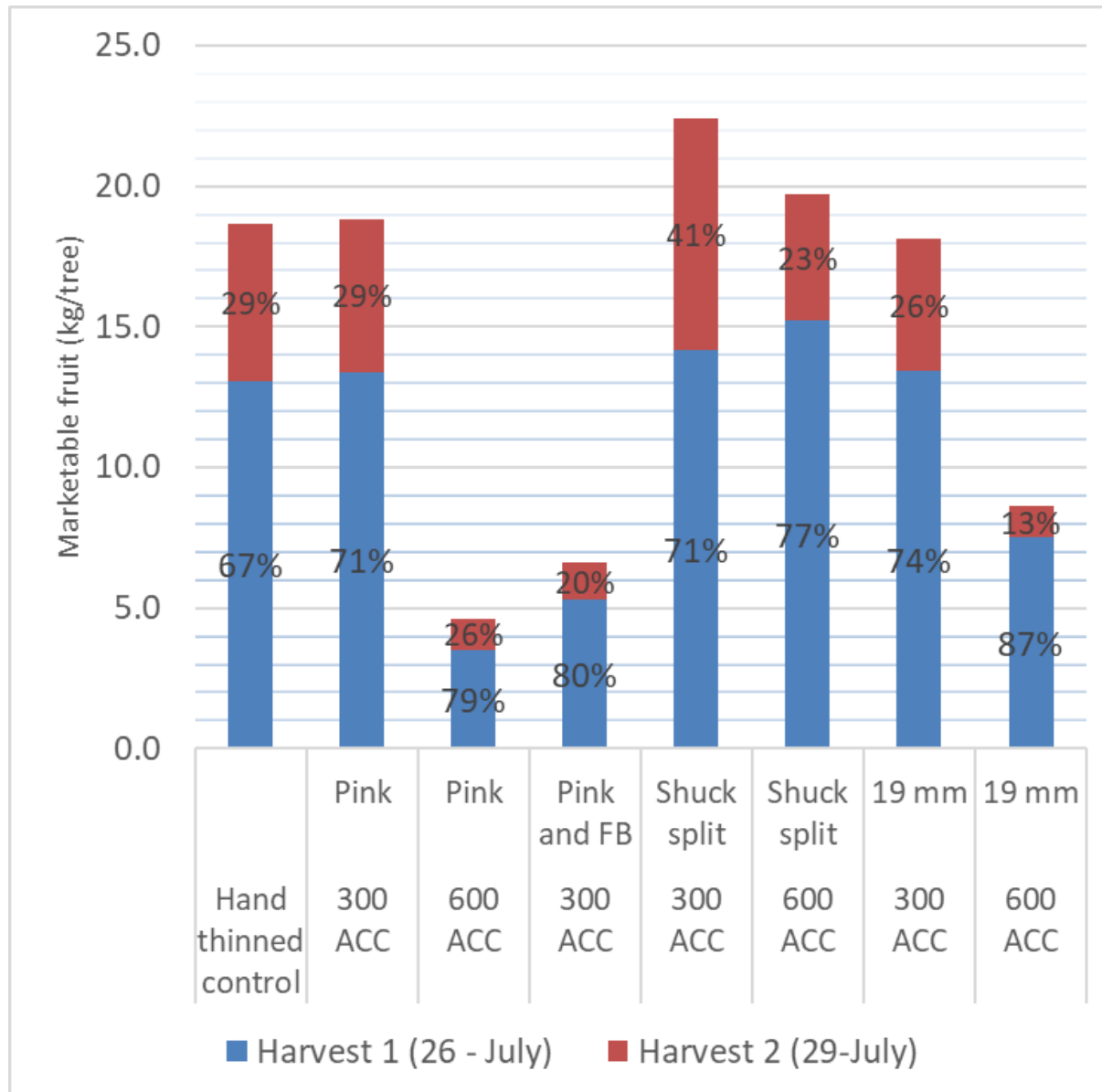
Accede applied at 19 mm is 'off' label

# Harrow Dawn Results – Fruit size distribution

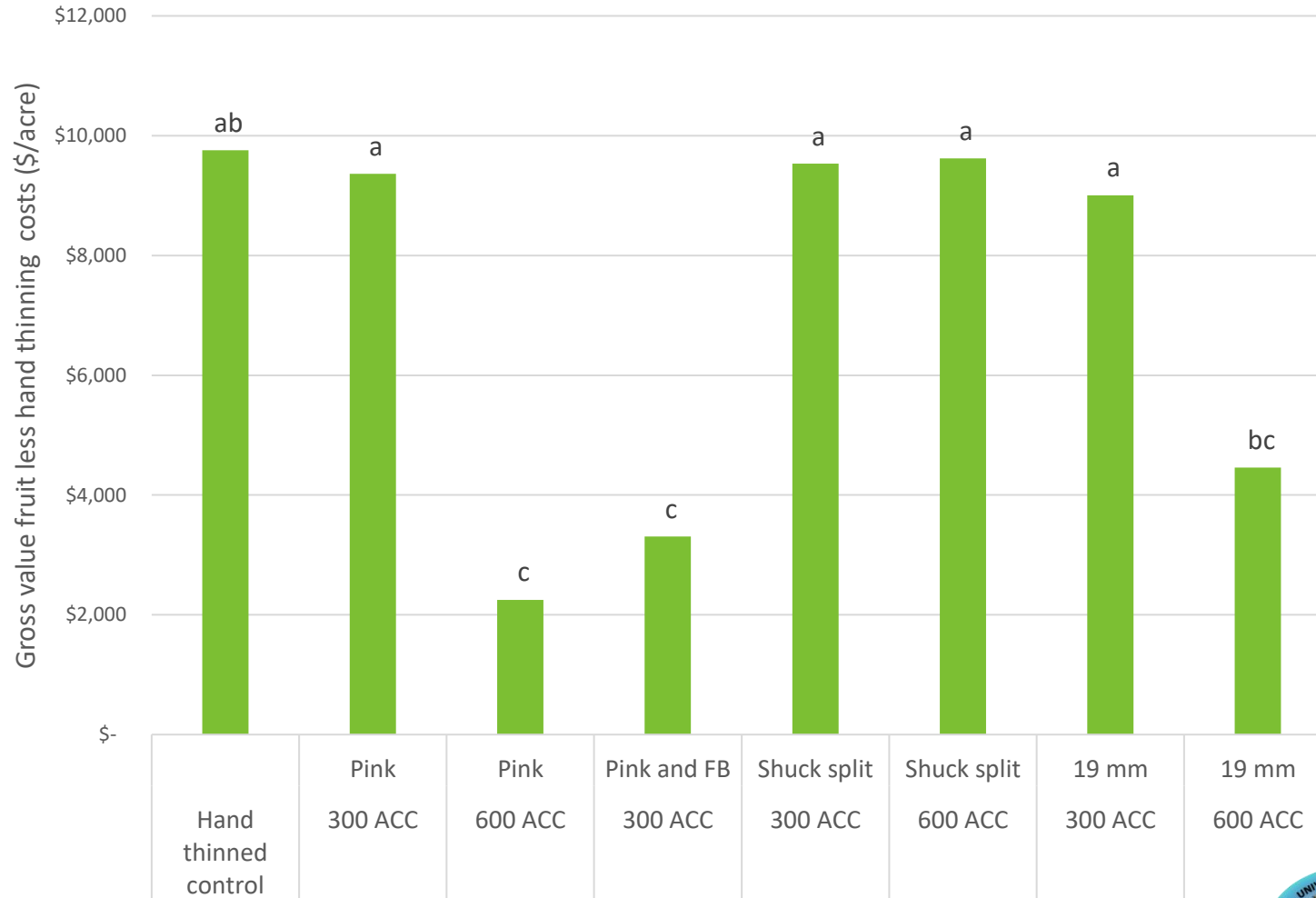




# Harrow Dawn Results – Maturity



# Harrow Dawn Results – Economics



# Experimental Plan – Vivid/Bailey

Vivid: early season cultivar (Aug 20)  
Trees planted: 2017 (5-yr-old)  
Spacing: 10' x 18 ft (242 trees/acre)  
Treatments applied to single trees using a commercial air blast sprayer to tree row volume dilute (761 L ha<sup>-1</sup>)  
1 'guard' tree was left between sprayed trees



System: Central Leader, free standing  
Treatments: 4  
Replications:4  
Experiment design: RCBD

Trees were not trickle irrigated



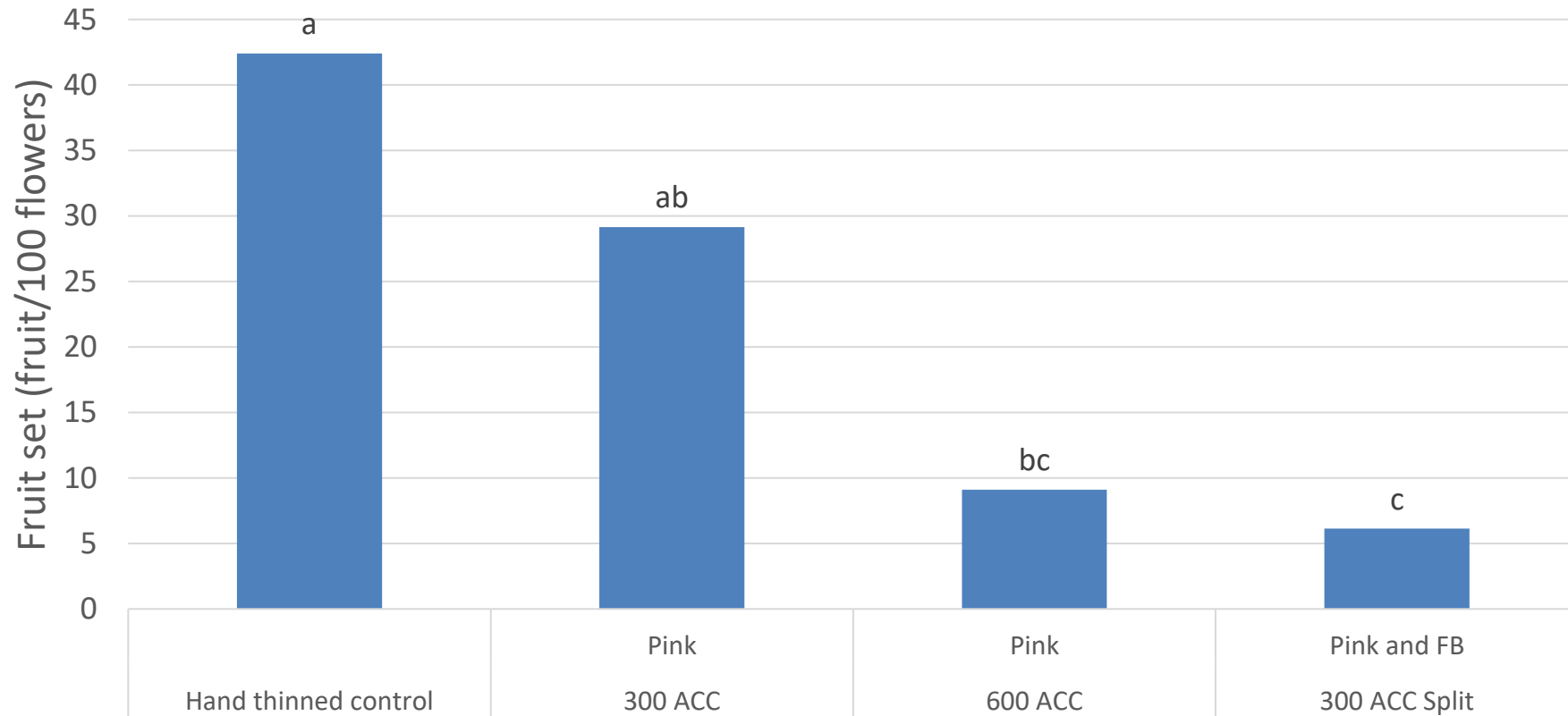
# Thinning Treatments

Treatment (mg L <sup>-1</sup> / ppm)	Application timings/fruitlet diameter	Date of application	Days after full bloom
Hand thinned control		Jun 23	47.0
300 ACC	Pink	Apr 27	-10
600 ACC	Pink	Apr 27	-10
300 ACC	Pink and FB	Apr 27, May 6	-10, 0

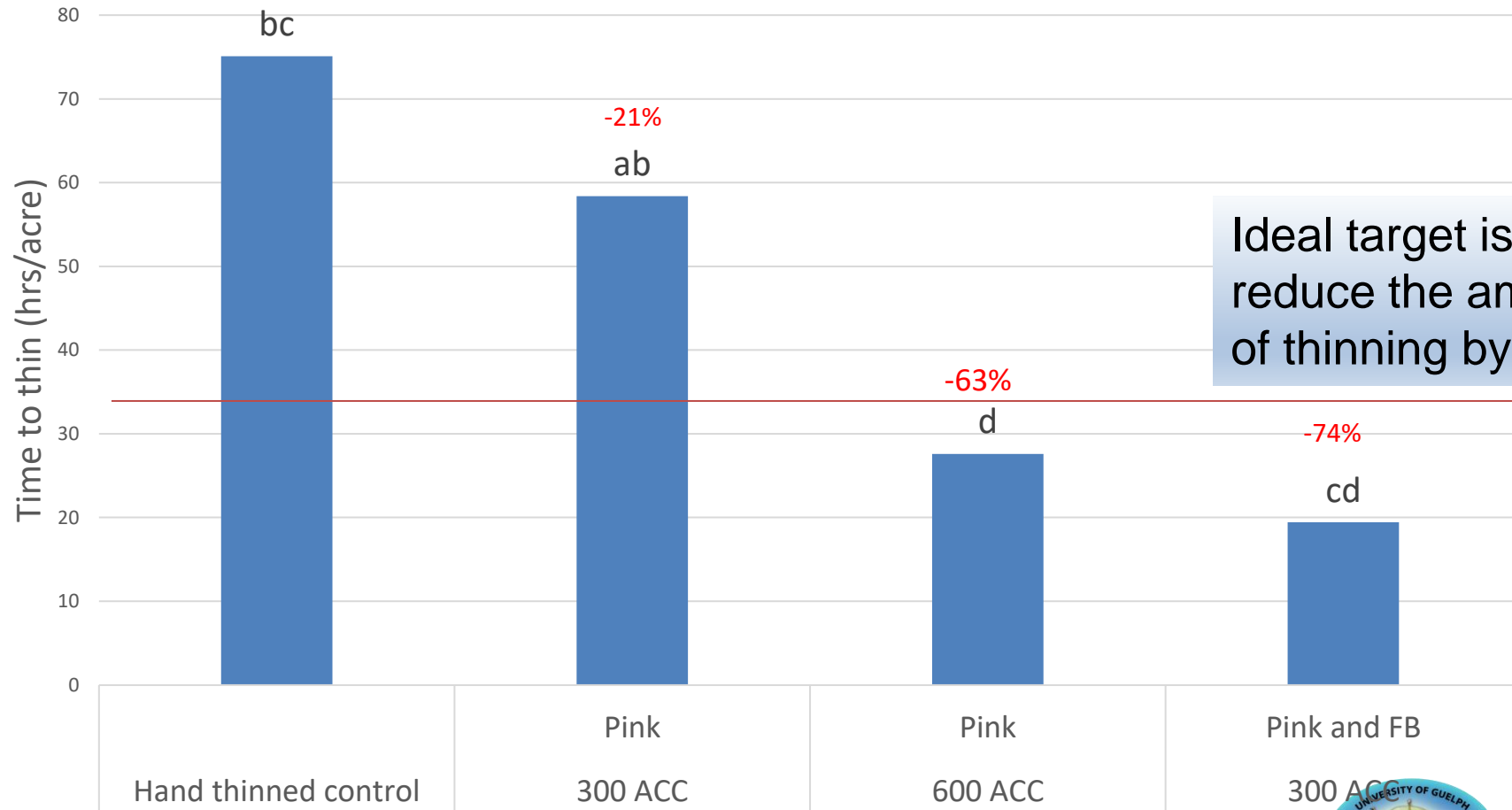
All 1-ACC sprays included 0.05% (v/v) Agral 90 non-ionic spray adjuvant (Syngenta Canada Inc., Guelph, Canada)



# Vivid Results – Fruit set



# Vivid Results – Time to Thin

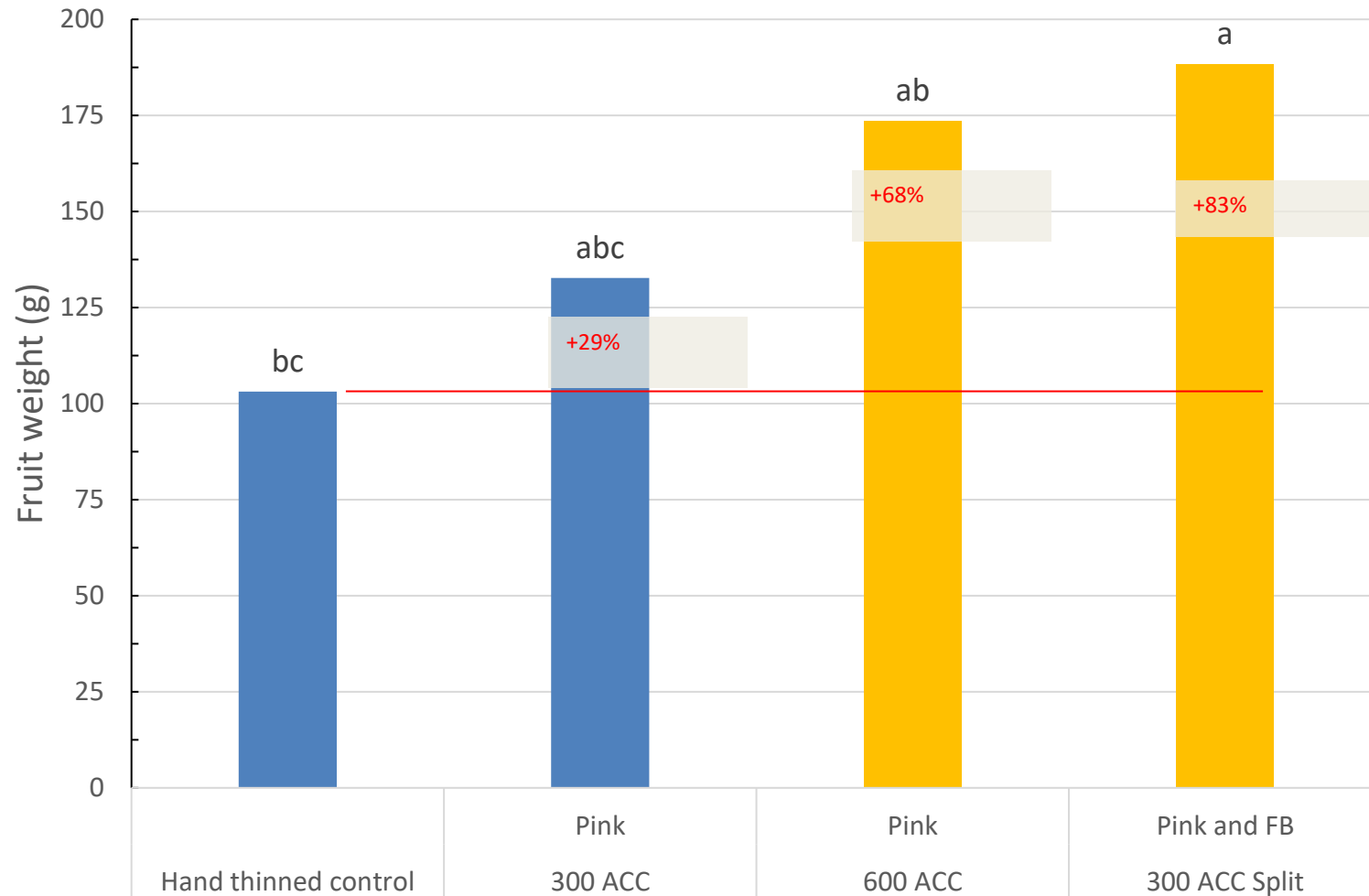


Ideal target is to reduce the amount of thinning by 50%

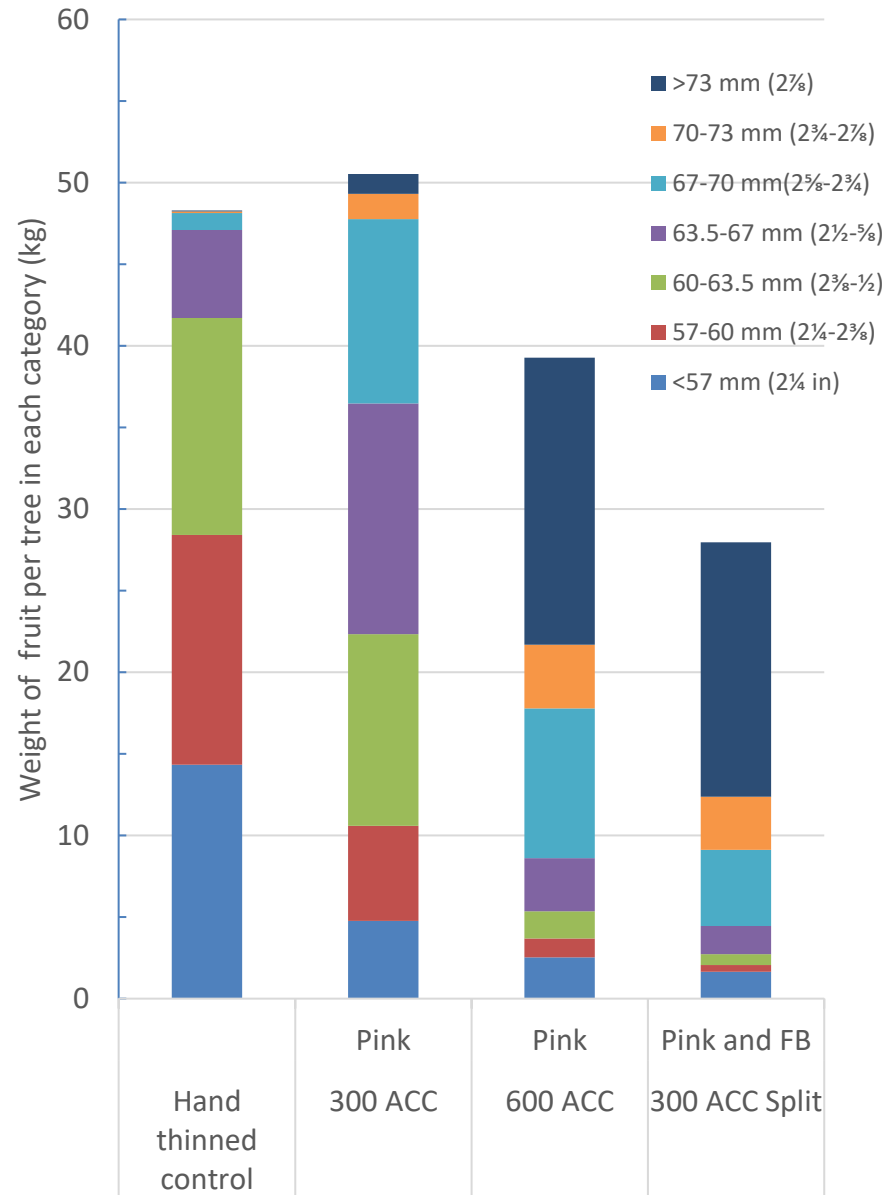




# Vivid Results – Fruit size

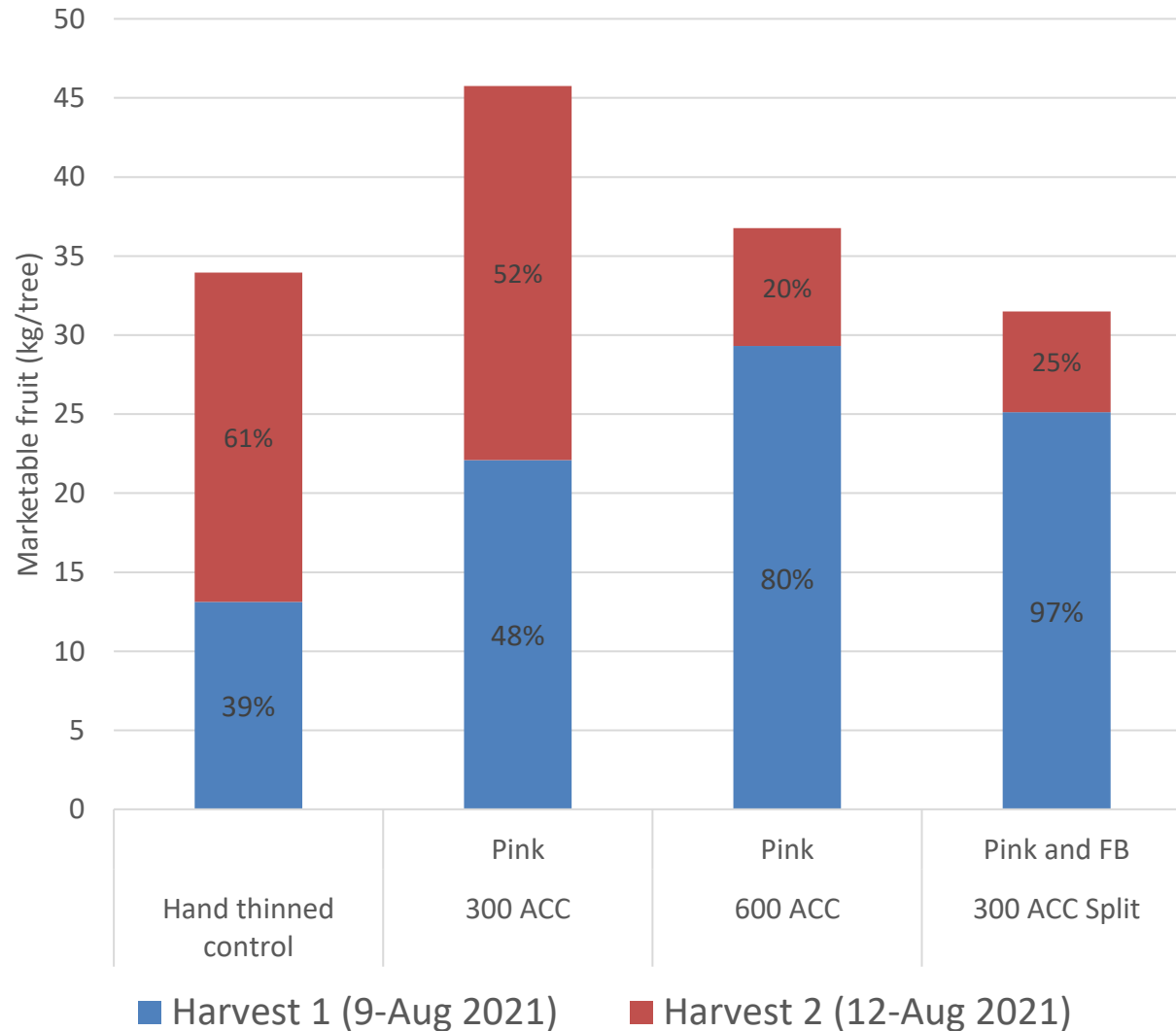


# Vivid Results – Fruit size distribution

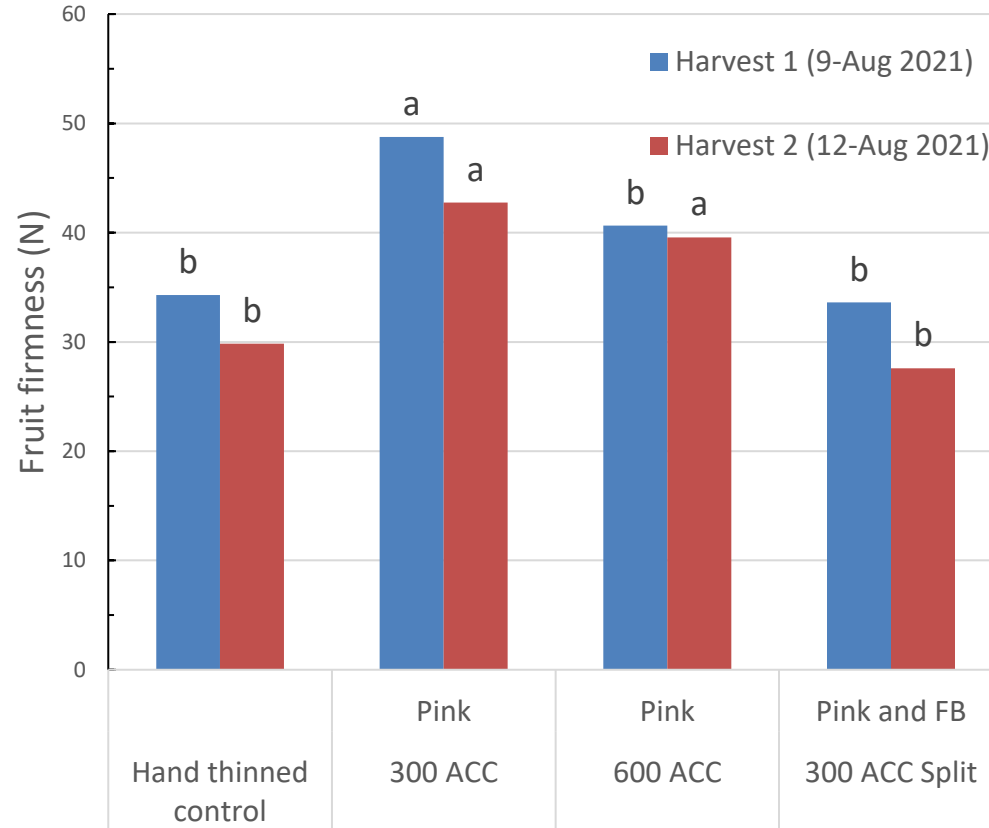




# Vivid Results – Maturity



# Vivid Results – Fruit quality (firmness)



Measurements made on similar size fruit

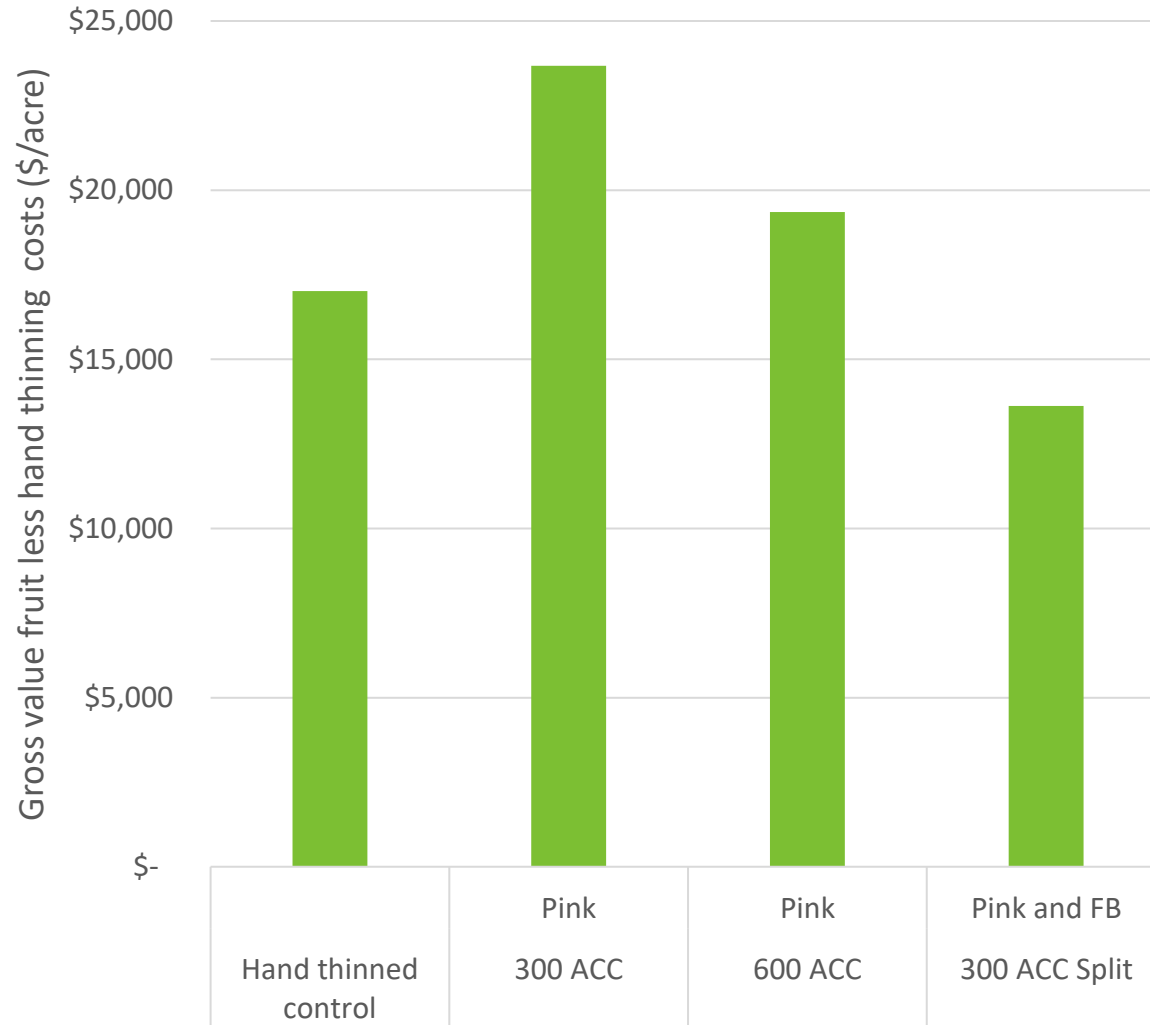
2 3/8" – 2 5/8"

1<sup>st</sup> harvest 153 g

2<sup>nd</sup> harvest 142 g



# Vivid Results – Economics



# 2021 Summary

Effect	Harrow Dawn	Vivid
1-ACC was effective in thinning	Yes	Yes
ACC spray timings	Pink to Full bloom	Pink and split application (Pink & Full Bloom)
Improvement in fruit size	Up to +32%	+29 to +83%
Time to hand-thin	63-81% reduction	21-74%
Gross fruit value less thinning costs	Decreased	Increase
Improved fruit firmness	No	Yes
Advanced maturity (more fruit picked on first harvest date)	Small	Significant
Leaf injury, leaf drop (phytotoxicity)	Very little	Very little



# 2022 Summary

- There was widespread winter injury to peach and nectarine trees resulting in lower flower density, especially in the lower tree canopy (temps dropped to -4°F in Jan 2022)
- Trees would not normally be treated with 1-ACC in this situation
- Objective: to study performance of ACC in a light flowering year

Effect	Redhaven
1-ACC at 200, 300, 400, 500 ppm	No
ACC spray timings	Pink to Full bloom
Improvement in fruit size	No effect
Time to hand-thin	No effect
Gross fruit value less thinning costs	Decreased
Improved fruit firmness	No effect
Advanced maturity (more fruit picked on first harvest date)	No effect
Leaf injury, leaf drop (phytotoxicity)	Very little

- Orchard variability was high
- Thinning was required (380 fruit removed in HTC)
- Fruit set data did not reflect final crop loads
- ACC did not cause over-thinning in a year when likely not recommended

# Preliminary 2023 Peach Results Summary

(Franzluebber and Cline)

## Objectives

- Rate treatments: HTC, 300, 400, 500 ppm ACC
- Timing: Full bloom, 20 mm fruitlet diameter
- Bloom period was unusually long (10+days) with cool weather
- Fruit set was good, trees required hand thinning

Effect	Harrow Dawn	Vivid
1-ACC was effective in thinning (300, 400, 500 ppm)	Effective at full bloom, not at 20 mm fruitlet $\emptyset$	Yes, at full bloom and 20 mm fruitlet $\emptyset$
Fruit weight	ACC increased fruit weight slightly compared with the hand thinned controls	Increased 11 to 63% compared with the HTC
Time to hand-thin	Up to 43% reduction	Up to 37% reduction
Advanced maturity (more fruit picked on first harvest date)	Yes, by up to 20% more fruit	Yes, by up to 30% more fruit
Leaf injury, leaf drop (phytotoxicity)	Very little at FB, moderate at 20 mm fruitlet $\emptyset$	Very little at FB, moderate to high at 20 mm fruitlet $\emptyset$

# Registration status, rates and timing of Accede™

- Registered in June 2021 in the USA by Valent USA
- 40% ACC (w/w) Granular formulation (liquid in California)
- Not approved for “organic” certification
- Label rates: 300 to 600 ppm
- Timing: pink bud to petal fall, no post-petal fall applications are recommended



Active Ingredient:  
1-aminocyclopropanecarboxylic acid (ACC) ..... 10.0%  
Other Ingredients ..... 90.0%  
Total ..... 100.0%

EPA Reg. No. 73049-517      List No. A560230-04-02  
EPA Est. No. 33762-IA-001      A50410680/R1

#### INDEX:

- 1.0 First Aid
- 2.0 Precautionary Statements
  - 2.1 Hazard to Humans (and Domestic Animals)
  - 2.2 Personal Protective Equipment (PPE)
  - 2.3 User Safety Recommendations
  - 2.4 Environmental Hazards
- 3.0 Directions for Use
- 4.0 Agricultural Use Requirements
- 5.0 General Information
- 6.0 General Application Instructions
- 7.0 Storage and Disposal
- 8.0 Warranty And Disclaimer Statement

#### KEEP OUT OF REACH OF CHILDREN CAUTION

FIRST AID	
1.0 If swallowed	<ul style="list-style-type: none"><li>• Call a poison control center or doctor for treatment advice.</li><li>• Do not induce vomiting unless told to do so by a poison control center or doctor.</li><li>• Do not give anything by mouth to an unconscious person.</li></ul>
HOTLINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-800-892-0099 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-6-Valent.	

#### 2.0 PRECAUTIONARY STATEMENTS

- 2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)**  
**CAUTION**  
Avoid breathing spray mist. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

#### 2.2 Personal Protective Equipment (PPE)

- Applicators and other handlers must wear:
- Long-sleeved shirt and long pants.
  - Waterproof gloves.
  - Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

#### 2.3 User Safety Recommendations

- Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
  - Remove clothing immediately if pesticide gets inside. Then, wash thoroughly and put on clean clothing.
  - Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

#### 2.4 Environmental Hazards

Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.

#### 3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the State/Tribal agency responsible for pesticide regulation.

#### 4.0 AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements in this labeling about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls.
- Waterproof gloves.
- Shoes plus socks.

# Peach phenology in relation to ACC spray timing

- There is relatively little leaf development at pink bud and full bloom.
- Post-bloom applications to peaches result in leaf yellowing and leaf drop. Phyto appears to be less on plum



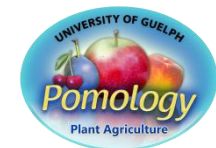
Pink bud



Bloom



20 mm fruitlet  
diameter





# Leaf Phytotoxicity with Post-bloom ACC Applications



500 ppm ACC applied 30 DAFB. Photo taken 10d after spraying (Vivid peach)



450 ppm ACC  
European Plum



# Accede™ product Label

## Precautions/Considerations

- Cultivars differ in sensitivity
- Use 300 – 600 ppm assuming 100 gallons/acre spray volume
- Spray with sufficient volume for complete tree coverage
- Do not apply when frost is expected
- Do not apply injured or stressed plants or fruits (e.g., drought stress, freeze injury, etc.)
- Application above 90°F (32°C) may increase result in over thinning and leaf yellowing and leaf drop
- Reduce rates when applied after or during a period of cold temperatures (< 40°F)
- Adjuvants: Use of a non-ionic surfactant with Accede will improve performance and response.
- Direct 80% of spray to the upper 2/3<sup>rd</sup>s of the tree canopy

## STONE FRUIT CROP GROUP 12 – FOR FRUIT THINNING

CROP/	OBJECTIVE/ BENEFIT	APPLICATION TIMING/ USE INSTRUCTIONS
Nectarine, Peach	Depending on cultivar, orchard conditions, application timing, and grower objectives, the following benefits will be associated with Accede SG • Fruit thinning	Apply 10 to 20 oz of Accede SG per acre (equivalent to 4.0 to 8.0 oz a.i. per acre or 300 to 600 ppm ACC assuming a spray volume of 100 gallons per acre) using sufficient spray volume to ensure complete tree coverage (refer to the dilution table for assistance). Accede SG rate will depend on the amount of fruit thinning required. Product performance can be impacted by factors such as cultivar, prevailing and anticipated climatic conditions, tree vigor, fruit set potential and orchard history. Accede SG can be applied from the pink bud stage to petal fall. Do not apply Accede SG prior to pink bud stage. In order to achieve the proper timing, targeting sprays between the upper and lower tree canopy may be necessary. Make the first application of Accede SG from pink bud to full bloom. Make a second application 3-10 days later if necessary. Do not exceed a total of 8.0 oz a.i. per acre (20 oz Accede SG per acre, equivalent to 600 ppm ACC assuming a spray volume of 100 gallons per acre) in a single application Do not apply Accede SG after petal fall. Do not apply when frost is expected.



# Accede<sup>®</sup> PGR How To Use — Peaches/Nectarines

<b>Rate</b>	300–600 ppm			
<b>Product Amount</b>	<b>Accede LC</b>		<b>Accede SG</b>	
	<b>Conc. (PPM)</b>	<b>fl oz/A (100 GPA)</b>	<b>Conc. (PPM)</b>	<b>oz/A (100 GPA)</b>
	300	34	300	10
	450	51.5	450	15
	600	69	600	20
<b>Spray Volume</b>	100 gallons per acre (GPA)			
<b>Adjuvant</b>	For optimal response, use a high-quality non-ionic surfactant at a standard rate of 6 fl oz per 100 gallons of spray solution (0.05% v/v)			
<b>Timing</b>	<ul style="list-style-type: none"><li>• Accede can be applied from the pink bud stage to petal fall</li><li>• Make the first application of Accede from early to full bloom<ul style="list-style-type: none"><li>– Not recommended, but the label allows for a second application 7–10 days later (up to petal fall)</li></ul></li></ul>			

# Cultivar Response to Accede®

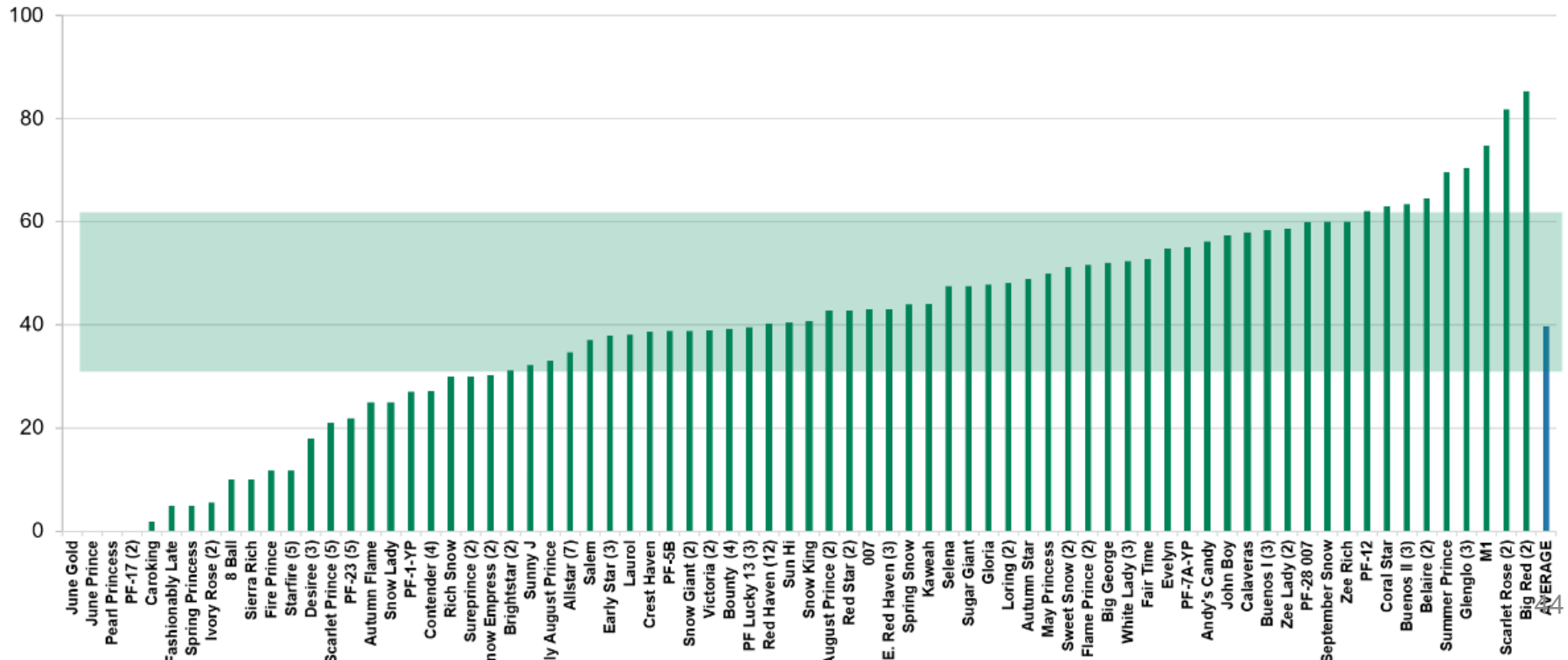
Expect cultivars to differ in response to ACC.

The results below could be related to genetics as well as application timing, and tree and environmental factors

## Accede® PGR Peaches Thinning 2021–2022 Commercial Trials: % Reduction in Fruit Set by Variety



Source: Todd Burkdall, Valent



# Considerations for using Accede<sup>®</sup> for the first time

- Start with lower rates (300-500 ppm) in 2024
- Leave and flag untreated rows for comparison purposes
- Record pollination conditions and the weather before and after application
- Compare performance with neighbours
- Take detailed spray records of:
  - Cultivar differences
  - Leaf yellowing and leaf drop
  - When and where on the branch flowers drop
  - Labour savings for hand thinning
  - Effect on harvest maturity and number of harvest
  - Fruit size (weight) and yield at harvest

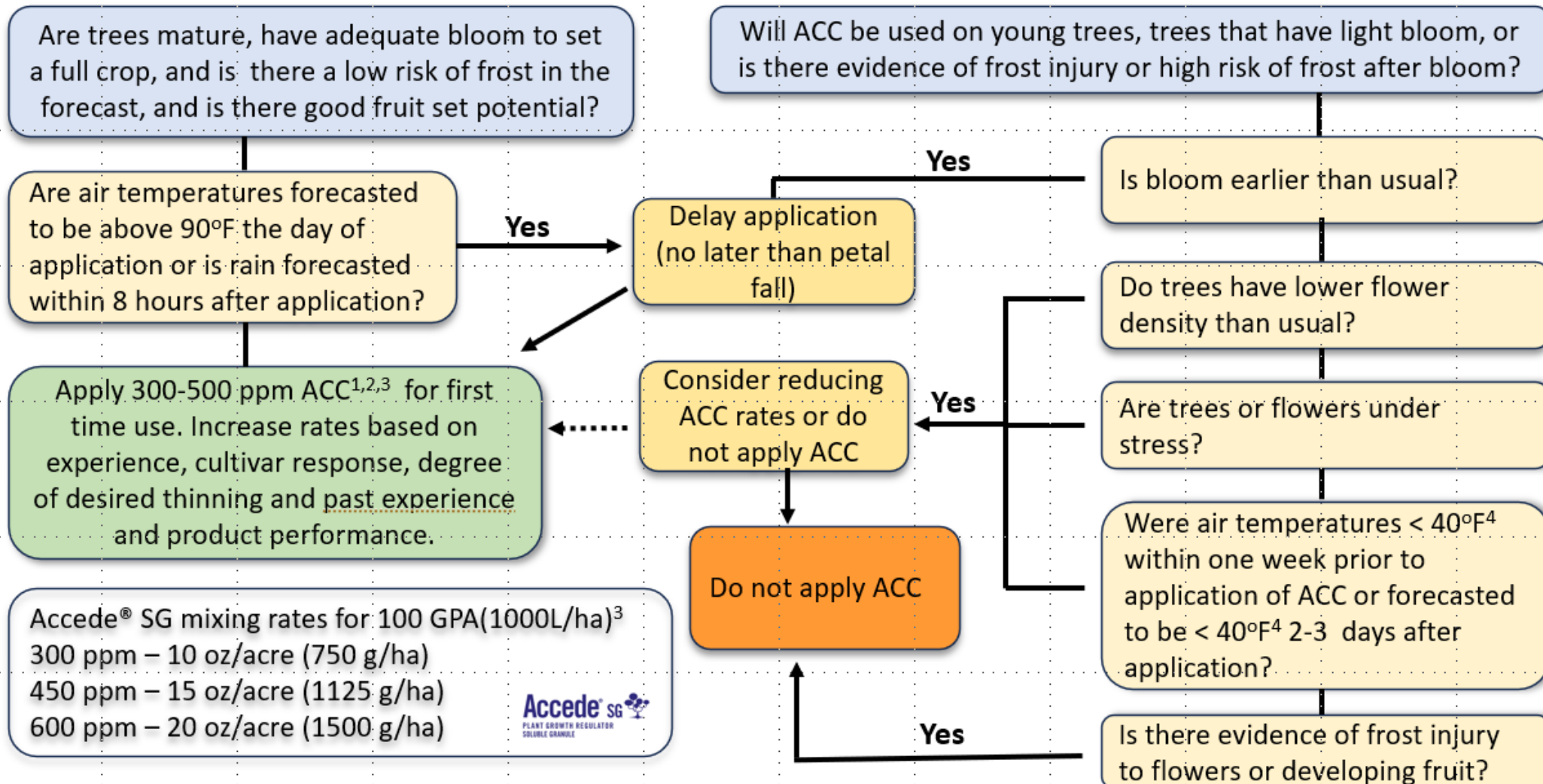


## Encouraging Observations

- When fruit set is light and bloom is reduced, ACC did not cause excessive thinning
- ACC is effective at temperatures below 50°F (which is unusual for a PGR)



# Decision support tree for 1-Amino-cyclopropane -1- carboxylic acid (ACC<sup>1</sup>) for new users (2024)



<sup>1</sup>ACC is formulated as Accede®, Valent Biosciences. The Accede SG formulation contains 40% ACC (w/w). Apply ACC between pink bud and petal fall.

<sup>2</sup>Accede® Apply enough water to ensure that flowers and foliage receive thorough spray coverage using calibrated spray equipment. Adjust water volumes based on plant size and spacing. Excessive spray application volumes resulting in spray runoff will reduce product efficacy.

<sup>3</sup>Consider using a non-ionic surfactant, such as Regulaid® at 0.05% (v/v).

<sup>4</sup>There is evidence that cool temperatures increase ACC efficacy, but the relationship between temperature and ACC performance is not fully known


# Various Strategies of Thinning Peaches

## A. Pruning (Marini, 2002. HortScience 37:642)

## B. Fruitlet Thinning

-  Elgetol (Dinitro-ortho-cresol)
-  Ethrel (Cline, Taheri, Coneva and others)
-  Tree shaking (Leuty & Miller)
-  Rope Thinning (Byers)
-  Blossom desiccant thinners (eg, Tergitol) (Coneva and Cline, 2006)
-  High pressure water (Cline, 2017)

## C. Flower Inhibition

-  Gibberellic Acid (Coneva & Cline, 2006 HortScience 41:1596)

thinning such cultivars until many of the split-pit fruits can be identified and selectively removed.

Late-maturing cultivars are thinned according to their individual requirements. Heavy-setting, hard-to-size cultivars such as Redhaven and Madison require heavier thinning than earlier-to-size types like Vivid and Loring. As a rule of thumb, however, late-maturing cultivars with a good, uniform set are usually thinned 10 to 13 cm apart. Distance between fruits is not too critical as long as clusters are broken up and fruits separated (Figure 2). If the set is spotty on the tree, more fruits may be left on heavy-set branches.



for example, may be used at 0.5 to 1.7 litres per 455 litres of water (1 to 3 pints per 100 gal) depending on cultivar. Trees under 5 years of age should not be chemically thinned.

**Mechanical** The trunk-shaker method supplemented by touch-up hand thinning is being employed by a few growers (Figure 3). Major drawbacks of this method are erratic thinning and the very real danger of overthinning. Stiff branches are easily overthinned, while willow or hanging branches are generally under-thinned. Recent experiments at Vineland clearly demonstrated that while a mechanical trunk shaker reduced thinning costs, the savings were often more than offset by losses in yield due to overthinning.



Figure 3. Mechanical thinning of peaches. Care must be taken to avoid overthinning.

If mechanical thinning must be practised, it is strongly recommended that an observer accompany the machine operator to help avoid overthinning. It will be necessary to leave more fruit than normal on some of the underthinned branches to compensate for excessive thinning on others.


### PLUMS

The dinitros will thin plums more easily than peaches. Where biennial bearing is occurring or where size is difficult to obtain, bloom thinning can be helpful. Elgetol at 0.5 litres per 455 litres of water is a suggested strength to try.

### Metric to Imperial Conversions

Sevin 113 g = ¼ lb  
340 g = ¾ lb  
454 g = 1 lb  
Water 455 litres = 100 Imperial gallons  
Elgetol 0.5 litres = 1 pint (approximately)  
1.7 litres = 3 pints (approximately)

This Factsheet has been reviewed and is endorsed by the Ontario Pesticides Advisory Committee.



Ministry of  
Agriculture  
and Food

ORDER NO. 80-005  
MARCH 1980  
AGDEX 210  
24

Factsheet

## THINNING TREE FRUITS

(Reprinted July 1983)

S. J. Leuty, Horticultural Research Institute of Ontario, Vineland Station, and  
S. R. Miller, Agriculture Canada, Smithfield

### APPLES

Thinning of apples is often required to improve fruit size and to control the alternate bearing habit of some cultivars (varieties). Thinning needs must be based on grower experience, taking into account the cultivars involved, the amount of bloom, bee activity, weather conditions during pollination, and previous thinning history of the orchard (Figure 1).

Chemicals available for thinning include naphthaleneacetamide (NAD), naphthaleneacetic acid (NAA), carbaryl (Sevin) and ethephon (Ethrel). The latter material should be used only experimentally at the present time.

NAD is a relatively safe material that is applied at petal fall at concentrations of 50 to 100 ppm depending upon cultivar and growing conditions. It may be concentrated but should be applied in at least 180 to 275 litres of water per hectare (40 to 60 gal per acre).

NAA can be a most effective thinning agent but amount applied, concentration, cultivars, timing, and weather conditions are all important factors affecting the response. NAA must be applied as a dilute spray, usually 7 to 10 days after petal fall.

"Days after petal fall" does not always provide a sufficiently accurate index for timing fruit-thinning sprays. Sensitivity to NAA depends on fruit development which, in turn, depends on environmental conditions. Average fruit diameter reflects these yearly variations in growing conditions. The following fruit sizes resulted in improved thinning of three apple cultivars in Eastern Ontario.

Cultivar	Average Diameter at NAA-sensitive Stage
McIntosh	8.0-9.5 mm (approx 3/8 inch)
Delicious	6.5-8.0 mm (approx 5/16 inch)
Spy	10.0-11.0 mm (approx 7/16 inch)

During a backward spring, fruits may require 12 to 13 days after petal fall to reach the NAA-sensitive stage, whereas during a warm spring, this stage may be reached within six days.

**Sampling Method** A total of 50 to 60 fruits of each cultivar should provide a good estimate of fruit

development in a reasonably uniform orchard block. Select the two largest developing fruits from each of 25 to 30 randomly selected clusters, measure the greatest width of each and determine the sample average. Vernier calipers or fruit-sizing rings provide a simple means for taking measurements rapidly and accurately.

**NAA can reduce fruit size without removing any fruit, if not applied correctly.**

Carbaryl can be applied over a wider time interval following petal fall than either of the above materials. Maximum response is obtained when carbaryl is applied at the most sensitive size outlined above; however, some thinning usually results from later applications up to four weeks after full bloom.

Treatments applied after the most sensitive time do not reduce fruit size. Carbaryl is used at rates of 840 to 3370 g active material per hectare (7.5 to 3 pounds active material per acre) depending upon cultivar and timing. It can be applied as a concentrate spray although the response is not always satisfactory.

**Carbaryl is extremely toxic to bees and certain beneficial predators.**

Ethephon is being used experimentally to thin certain apple cultivars. Sprays are applied approximately 25 days after petal fall after the set has been assessed, but prior to normal June drop. Rates of 150 to 300 ppm are effective on Red Melba and McIntosh Low-volume spraying has not been assessed.

Carbaryl plus NAA has been used on hard-to-thin cultivars such as Early McIntosh and Wealthy with considerable success. In general, a constant rate of carbaryl (340 g active ingredient per 455 litres of water) should be used with varying amounts (3 to 15 ppm) of NAA.

**Factors Influencing Response to Thinning Agents**

1. *Cultivar Sensitivity*
  - (a) Easy-to-thin cultivars include Delicious, Idared, and Spy.
  - (b) Hard-to-thin cultivars include Lodi, Duchess, Golden Delicious, Early McIntosh and Wealthy.



# Darwin Mechanical String Thinning

Designed by Fruit-Tec, Germany

Sold in North America by N.M. Bartlett Inc. <https://www.provideag.ca/>

Has front mount 3PH, fixed, or fork-lift mounts

Model evaluated Darwin 300





# Allstar

Tall spindle training system

Trees thinned at bloom

Goal was to evaluate:  
speed of rotation (RPM),  
string configuration and  
to compare with hand  
thinning



5-yr old, 6 ft (1.8 m) x 16 ft (4.8 m) (468 trees/acre)



# Mechanical Thinning Study

Conducted for two years

Cultivars: Allstar, Catherina

High density spindle orchard system

Ground speed: 2.1 miles/hr

Timing: Full Bloom



## Treatments

- 🍊 Hand thinned control
- 🍊 180 RPM, 18 strings
- 🍊 180 RPM, 9 strings
- 🍊 240 RPM, 18 strings
- 🍊 240 RPM, 9 strings



# Mechanical Thinning Peaches Results

Aim for approx. 50% flower removal

- substantially reduces initial fruit load
- does not over thin

Reduction in hand thinning

- Allstar: 21-50%
- Catherina: 10-50%

Mechanical thinning increased fruit size by 8 – 15%



Major Limitations:

- May damage the blossoms and leaves
- May expose the tree to additional disease
- Not selective or uniform throughout the tree canopy
- Requires a 2-D hedgerow narrow, 'V' or quad 'V' tree canopy leaving fruiting shoots within 24" from scaffold
- Will not be effective on open vase systems

## Funding Partners

Ontario Tender Fruit Growers

BC Fruit Growers' Association

UoG/OMAFRA Alliance Research fund

Valent BioSciences



## Technical Assistance

Sofia Franzluebbers, MSc Candidate

Amanda Beneff

Cathy Bakker

Summer students

## Grower Cooperators

- David and Barbara Hipple, Hipple Farms, Beamsville, ON
- Tom Platts and Doug Darling, Sunnydale Farms, Jordan, ON
- Chris Andrewes, Andrewes Farm, Beamsville, ON

Your questions and comments.

- John Cline – [jcline@uoguelph.ca](mailto:jcline@uoguelph.ca)
- Kathryn Carter - [Kathryn.Carter@ontario.ca](mailto:Kathryn.Carter@ontario.ca)

