

EXTENSION AND ADVISORY TEAM

# THINNERS AND GROWTH REGULATORS GUIDE

A guide to thinners and growth regulators for apple orchards in Nova Scotia



**Discard old editions of the pesticide spray guide. Each year, the Perennia Tree Fruit Specialist updates the pesticides and information contained in this publication.**

**Editor and Production**

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*Note: Perennia offers supplemental guides for pome fruit, stone fruit and organic production on our website at [www.perennia.ca](http://www.perennia.ca) > Agriculture > Commodity Information > Fruits > Tree Fruit*

## Emergency and First Aid Procedure for Pesticide Poisoning

- Become familiar with the chemicals you are using. Keep a list of common and active ingredient names in case of accidents or emergencies. This information can be found on product labels and cross-referenced in this publication.
- If poisoning from exposure to a pesticide by swallowing, inhalation or contact with skin or eyes is suspected, read the product label of the pesticide container and carry out first aid treatment as suggested.
- If a person is seriously injured, call **911** immediately.
- Emergency advice on pesticide poisoning is available 24 hours/day from the IWK Regional Poison Information Centre, Halifax, NS. Phone: 1-800-565-8161 (NS & PEI).

### Sources of Information on Pesticides

Information Service of the Pest Management Regulatory Agency

Phone: 1-800-267-6315

Web Site: <http://www.hc-sc.gc.ca/cps-spc/pest/index-eng.php>

Pest Management Regulatory Agency –Electronic Labels: Search Tool

Web Site: <http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>

Ontario Pesticides Classification Database

Web Site: <https://www.lrcsde.lrc.gov.on.ca/PCDWeb/showSearch.action>

National Pesticide Information Centre

Web Site: <http://npic.orst.edu/>

Environmental Emergencies – Nova Scotia

Pesticide and Chemical spills

Phone: 1-800-565-1633

Organic Agriculture Centre of Canada

Web Site: <http://www.organiccentre.ca/>

# Table of Contents

<b>1. Pesticide Handling and Application</b> .....	<b>4</b>
Registration of Pesticides .....	4
Applicator Pesticide Certification .....	4
Environmental Stewardship .....	4
Food Safety .....	4
Buffer Zones .....	4
Pesticide Formulation Abbreviations .....	5
<b>2. Products Listed in this Schedule</b> .....	<b>6</b>
Growth Regulators .....	6
Thinners .....	6
<b>3. Thinning and Growth Regulation Apple Orchard Calendar</b> .....	<b>7</b>
Dormant to Bud Swell .....	7
Bloom .....	7
Late Bloom/Early Petal Fall .....	8
Petal Fall/Calyx .....	8
Early Fruitlet Development at 5-14 mm Diameter .....	9
Pre-Harvest .....	10
<b>4. Chemical Thinner Product Guide</b> .....	<b>11</b>
Product Preparation Guide .....	11
Method of Application .....	13
Process for Successful Thinning .....	14

# 1. Pesticide Handling and Application

## Registration of Pesticides

A pesticide that is used in Nova Scotia must be registered by the Pest Management Regulatory Agency (PMRA) of Health Canada, and be approved for use in the province of Nova Scotia. All registered pesticides may be re-evaluated and are subject to discontinuation if they do not meet current standards. The pesticide product label is a legal document, and all label directions must be followed.

- To search for product labels, visit the Health Canada website: <http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>
- To download the smartphone application, search for the app “Pesticide Labels” by Health Canada.

## Applicator Pesticide Certification

Applicators must hold a valid applicator certificate of qualification to apply a commercial class pesticide in Nova Scotia. The regional offices for Nova Scotia Environment offer certificates, approvals, exams and exam study materials.

- Central Region: Halifax and Hants Counties, (902) 424-7773
- Western Region: Kings, Annapolis, Digby, Yarmouth, Shelburne, Queens and Lunenburg, (902) 679-6086

## Environmental Stewardship

Environmental stewardship and food safety programs are important components of best management practice for fruit production. Guidelines and fact sheets have been developed under the Nova Scotia Environmental Farm Program for the best means to store, handle, and apply pesticides. Factsheets on the NS Federation website (<http://www.nsfafane.ca/efp/resources/factsheets/>) include:

- On-farm Pesticide Use
- Pesticide Storage and Handling
- Air-Blast Sprayer Calibration for Orchard and Vineyards
- Tree-Row Volume: Concept, Calculations and Application

## Food Safety

The CHC CanadaGap on-farm food safety manual provides procedures and guidelines with regard to the safe handling, storage and record keeping for tree fruit pesticides and fertilizers: <http://www.canadagap.ca/manuals/downloads/>

## Buffer Zones

Most pesticide labels have a required distance between site of spray application and a buffer zone. A buffer zone is the distance between the point of direct pesticide application and the nearest downwind boundary of a sensitive habitat. A buffer zone is a no-spray area because the sensitive habitat contains organisms that are affected by the pesticide being applied. A sensitive area may be aquatic, terrestrial (shelterbelts and woodlots) or a combination (wetlands, marshes etc). It is the applicator’s responsibility to identify the sensitive areas within and adjacent to treated fields.

## Pesticide Formulation Abbreviations

DF	dry flowable	SG	soluble granules
DP	dispersible powder	SN	solution
DU	dust	SP	soluble powder
EC	emulsifiable concentrate	SU	suspension
F or FLO	flowable solution	SURF	surfactant
GR or G	granular	W or WP	wettable powder
OD	oil dispersible	WSP	water soluble pouch
SC	spray concentrate	WDG or DG	water dispersible granules

## Warning

Please note that we make no warranty or guarantee of any kind, expressed or implied, concerning the use of products listed in this publication. The user assumes all risks, whether recommendations are followed or not. This publication is intended as a guide only.

For specific product information always refer to and follow directions on the label.

## 2. Products Listed in this Schedule

This listing includes all the registered growth regulators and thinners detailed in the Management Guide. Always read the label before using any pesticide. Where differences between the label and this guide occur, label information prevails. **Please note: Red text is new to this guide in 2021**

Active Ingredient	Product	Group Name	Mature apples	Non-bearing apples	Apple nursery	Mature pears	Non-bearing pears	Rainfast (hours)	Preharvest Interval (days)	Re-Entry Interval (REI)	Management Activity for REI	Growth Regulation
<b>GROWTH REGULATORS</b>												
6-Benzyladenine, Gibberellins A4 & A7	Promalin SL	Plant growth regulator	✓	✓	✓	✓		6	28	12 h		Growth modification, reducing physiological russetting, fruit shape, fruit set after frost, increase pear fruit set and branching
<b>Gii</b> berellins A4 & A7	<b>Novagib</b>	<b>Plant growth regulator</b>	✓					<b>6</b>	<b>28</b>	<b>12 h</b>		<b>Reducing physiological russetting</b>
Prohexadione calcium	Apogee	Plant growth regulator	✓	✓				8	45	12 h		Vegetative growth suppression
Aviglycine hydrochloride	ReTain	Plant growth regulator	✓					8	7	12 h		Harvest management
1-Methylcyclopropene	Harvista	Plant growth regulator	✓					1	3	4 h		Harvest management
<b>THINNERS</b>												
Ammonium thiosulphate	ATS	Liquid fertilizer containing 12% nitrogen and 26% sulphur	✓					-		when dry		Desiccation resulting in blossom thinning. Note precautions.
Carbaryl	Sevin XLR	Carbamate insecticide (Group 1A)	✓	✓				-	<b>75</b>		<b>High Density</b> Hand thinning, hand-line irrigation <b>4 d</b> Hand pruning, scouting, pinching, tying, training <b>Low Density</b> <b>10 d</b> Hand thinning, hand-line irrigation <b>0.5</b> Hand pruning, scouting, pinching, tying, training	Petal fall /7-14 mm average king fruitlet diameter. Note the new PHI and REI.
1-naphthaleneacetic acid	Fruitone L	Plant growth regulator	✓	✓				-	5	when dry		Petal fall /7-12 mm average king fruitlet diameter
6-benzyladenine	MaxCel	Plant growth regulator	✓	✓	✓	✓		-	<b>86</b>	12 h		Petal fall /7-14 mm average king fruitlet diameter, up to 20 mm
6-benzyladenine (aka 6-benzylaminopurine)	Cilis Plus	Plant growth regulator	✓	✓	✓	✓		-	28	12 h		5-10 mm up to 20 mm average king fruitlet diameter

### 3. Thinning and Growth Regulation Apple Orchard Calendar

A guide to thinners and growth regulators for apple orchards in Nova Scotia.

All rates are per hectare of mature ("standard") trees or full dilute volume of about 3,370 L of water/ha unless specified as 1,000 L. To adjust for smaller trees and higher density plantings, refer to Crop Adapted Spraying at <http://sprayers101.com/>. All rates are based on label rates. Always read the label before using any pesticide. Where differences between the label and this guide occur, label information prevails.

Please note: Red text is new to this guide in 2021

Growth Regulation	Products	Formulation	Rate	Notes
<b>DORMANT TO BUD SWELL</b>				
Growth modification	▶ Promalin	SL	100-166 mL/ 500 mL latex paint	Mix with latex paint and apply directly to buds with a brush or sponge uniformly covering bark surface. Apply to 1-year-old wood only. Apply when terminal buds have started to swell, but before bud break as this may result in injury to tender side shoot tips. Notching bark above the bud prior to treatment will greatly increase shoot elongation. Do not use when temperatures are below freezing, above 32°C or if rain is forecast within 6 hours.
<b>BLOOM</b>				
Russeting	May only reduce russeting caused by climatic factors affecting the fruit during the first 30-40 days of development. Will not reduce russeting caused by other factors (e.g. pest, diseased or chemical action).			
	▶ Promalin	SL	Maximum of four applications of 250 to 500 mL / ha	Apply at 7-12 day intervals beginning between full bloom and petal fall. Earlier applications, shorter intervals and higher rates are recommended when russet conditions are severe (long cold and wet periods during bloom). Do not use when temperatures are below freezing, above 32°C or if rain is forecast within 6 hours.
Blossom thinning	▶ Ammonium thiosulphate (ATS)		12.5 L of ATS / 1000 L of water	ATS thins by burning the stigma and pistils to prevent successful pollination. ATS should be applied towards the later part of full bloom (80-100% FB) when adequate pollination has occurred. The goal is to apply ATS when the king flower has been open for 24-48 hours and has been fertilized but prior to the lateral flowers becoming fertilized. This strategy always produces variable results but has been effective in the past on Honeycrisp. The advantages of blossom thinning with ATS are potentially increased fruit size and return bloom compared to later fruitlet thinning. ATS would be a good consideration for early thinning of small fruited varieties (e.g. Ambrosia, Gala, SweeTango) and biennial bearing varieties (Honeycrisp). The disadvantages of ATS are thinning with an unknown crop load and the potential for foliar spray injury.
Fruit shape	Improvements through fruit elongation and more prominent calyx lobes.			
	▶ Promalin	SL	1.2-2.3 L/ha in 500-1500 L/ha	Make a single application of 1.2 to 2.3 L of Promalin SL Plant Growth Regulator per hectare from early king bloom to the early stages of petal fall of the side blossoms. When the bloom period is prolonged, two applications give the best results. Make the first application of 0.6 to 1.2 L of Promalin SL Plant Growth Regulator per hectare at the beginning of the bloom period. Make the second application of 0.6 to 1.2 L of Promalin SL Plant Growth Regulator per hectare when the remainder of the canopy comes into bloom. Do not use when temperatures are below freezing, above 32°C or if rain is forecast within 6 hours.
Fruit set after frost	▶ Promalin	SL	1.2-2.3 L/ha in 500-1500 L/ha	Make a single application of 1.2 to 2.3 L Promalin SL Plant Growth Regulator per hectare. Apply within 24 hours after a frost event when the majority of the crop is between early bloom and full bloom. Do not apply to frozen foliage, blossoms or developing fruit. Allow trees to completely thaw prior to application. Do not use a surfactant.



Growth Regulation	Products	Formulation	Rate	Notes
<b>LATE BLOOM/EARLY PETAL FALL</b>				
Vegetative growth suppression	▶ Apogee	27.5 WG	450g/1,000 L	Apogee can effectively suppress shoot blight by reducing shoot growth when applied at the right timing. Apply at 2.5 to 5.0 cm of new shoot growth. Subsequent applications can be made at 14-21 day intervals to a maximum of 4 applications per season. A reduction in shoot growth may be undesirable for young orchards. Refer to the label for specific information on vegetative growth control. <b>Note that loss of efficacy could result when Apogee and Promalin/Novagib are used during the same season. (Apogee inhibits gibberellins and Promalin/Novagib contains gibberellins.)</b>
Fruit shape	Use one of the products listed for fruit shape at Bloom.			
<b>PETAL FALL/CALYX</b>				
Russeting	<b>May only reduce russeting caused by climatic factors affecting the fruit during the first 30-40 days of development. Will not reduce russeting caused by other factors (e.g. pest, diseased or chemical action).</b>			
	▶ Promalin	SL	Maximum of four applications of 250 to 500 mL / ha	Apply at 7-12 day intervals beginning between full bloom and petal fall. Earlier applications, shorter intervals and higher rates are recommended when russet conditions are severe (long cold and wet periods during bloom). Do not use when temperatures are below freezing, above 32°C or if rain is forecast within 6 hours.
	▶ Novagib	SN	1.5 - 1.9 L of product/ha in no more than 935 L water/ha	<b>Make the first application at the beginning of petal fall. Repeat this at 7 – 10 day intervals for 4 to 5 applications in order to achieve optimal russet reduction. Works best if climatic conditions allow an extended drying period.</b>
Fruitlet thinning	Note the preharvest intervals for early maturing varieties such as Paula Red. For more information on rate of thinning activity and rates, refer to Table 3 on page 12.			
	▶ Sevin XLR Plus	SU	High density at 3.22 L/ha/year and low density at 2.15 L/ha/year	DO NOT APPLY SEVIN DURING BLOOM PRIOR TO 80% PETAL FALL AS IT IS TOXIC TO BEES. Sevin is classified as a mild, reliable thinner. For orchards that have transitioned to high density trellis production architecture (e.g., spindle or super spindle trees) apply 0.5 to 3.22 L/ha as a full coverage spray. For orchards that have not transitioned to high density trellis production architecture (e.g., dwarf, semi-dwarf and full sized trees) apply 0.5 to 2.15 L/ha as a full coverage spray. Do not apply more than 2 times per year. It is suggested that nozzles be adjusted to deliver 2/3 of the spray volume in the upper portion of a tree. Once fruit reach 6 to 7 mm in size the most satisfactory thinning is often achieved by making the application right before a period forecasted of at least 3 days of moderate (21°C to 25°C) temperatures. The preferred application temperature is between 21° and 24°C under slow drying conditions. Applications are not recommended below 16°C or above 27°C. Overthinning may occur when daytime temperature exceeds 29°C. Satisfactory thinning can be obtained under such conditions with lower rates.
	▶ Fruitone L	SN	39-310 mL/1000 L water (1-10 ppm)	Spray applications should be directed to the top two-thirds of the tree canopy for optimal performance. Thinning becomes increasingly difficult as fruit size increases. Adjust the rate of Fruitone L to obtain desired results. Application to fruit > 15 mm may result in misshapen or pygmy fruit in sensitive varieties. It is suggested that nozzles be adjusted to deliver 2/3 of the spray volume in the upper portion of a tree.
Defruiting young trees	Defruiting young trees can be accomplished with a combination of Sevin XLR at 2.5 L plus Maxcel at 5.0 L per 1000 L of water applied using dilute nozzles to the point of drip. A few litres of oil (10.6 L/1000 L water) can also be added as a spreader sticker to this combination. This mixture should cover more than an acre of young trees. Apply from petal fall until 8-10 mm. A second application can be done before 18 mm if additional thinning is needed. NAA can also be used to defruit young trees but tree stress from NAA and reduced growth may result.			

Growth Regulation	Products	Formulation	Rate	Notes
Branching	▶ Promalin	SL	125-500 ppm (62.5 - 250 mL per 10 L of spray solution)	For orchard trees (apples and non-bearing pears), apply at 1-3 inches of new terminal growth. For nursery stock (apples, nonbearing pears and non-bearing sweet cherries) treat after trees have reached a terminal height at which lateral branching is desired. Do not exceed 2000 mL of Promalin per hectare. Do not use when temperatures are below freezing, above 32°C or if rain is forecast within 6 hours.

## EARLY FRUITLET DEVELOPMENT AT 5-14 MM DIAMETER

**Fruitlet thinning** Note the preharvest intervals for early maturing varieties such as Paula Red. For more information on rate of thinning activity and rates, refer to Table 3 on page 12. When fruit size is used as the guide for application timing, measure a random sample of 10 king fruitlets from each of 10 trees throughout a block.

▶ Fruitone L	SN	39-310 mL/1000 L water (1-10 ppm)	Refer to comments listed for Fruitlet Thinning at Petal Fall/Calyx. Thinning applications with Fruitone L are typically most effective when the king fruitlets are 5 to 10 mm in diameter.
▶ Sevin XLR Plus	SU	0.5-2.0 L / 1,000 L water <b>Max app for</b> high density is 3.22 L/ha/year and low density is 2.15 L/ha/year	Refer to comments listed for Fruitlet Thinning at Petal Fall/Calyx. When fruit reach a size range of 7 to 14 mm they are most sensitive to thinner application and weather conditions particularly at 3 to 4 days after application will influence thinner response. Application made when temperatures are expected to be below 17°C may result in reduced and insufficient thinning. When temperatures are expected to exceed 27°C or when moderate temperatures are accompanied by an extended period (3 to 4 days) of cloudy weather, heavy or excessive thinning may be observed.
▶ Sevin XLR Plus	SU	0.5-2.0 L / 1,000 L water <b>Max app for</b> high density is 3.22 L/ha/year and low density is 2.15 L/ha/year	
& Fruitone L	SN	39-310 mL/1000 L water (1-10 ppm)	
▶ MaxCel		75 to 200 ppm	Do not apply more than twice in a season. Generally, only one application is recommended for fruit thinning. If a second application is desired to obtain additional thinning allow 7-10 days and apply when the average diameter of king fruitlets is 5-15 mm. Do not exceed a total of 22.5 litres (446 grams of 6BA) per hectare per season for all uses. Applications will be most effective when the maximum temperature on the day of application and for the following 2-3 days is 18°C or higher. Avoid spraying MaxCel Plant Growth Regulator when ambient temperatures exceed 30°C.
▶ Cilis Plus		50 to 200 ppm	Apply between 5-10 mm up to 20 mm average king fruitlet diameter. Apply with temperatures of 21-24°C before and after application. Do not exceed 446 grams active ingredient per hectare per season for all uses. Do not apply this product if the temperature is below 16°C. The products works best if climatic conditions allow an extended drying period.

**Growth Regulation****Products****Formulation****Rate****Notes****PRE-HARVEST****Harvest management**

▶	ReTain	SP	1 pouch of 333 g per acre (0.4 ha)	<p>Single Pick Harvest: Apply three to four weeks prior to the anticipated beginning of the normal harvest period of untreated fruit for the current season. ReTain applied three to four weeks before harvest will delay the harvest period up to 7 to 10 days. Multiple Pick Harvest: To improve the fruit quality and storage potential of later picked apples (2nd, 3rd, 4th picks) apply one pouch of ReTain per acre, one to two weeks prior to the anticipated beginning of the normal harvest period of untreated fruit for the current season. ReTain applied one to two weeks before harvest typically will not delay the start of the harvest (1st pick), but will help control the maturation rate of the later picks. Under difficult coloring conditions, color development of certain bi-color apple varieties such as Gala and Honeycrisp™ will be delayed when ReTain is applied at one pouch per 0.4 hectare (1 acre).</p>
▶	Harvista		5.9-17.7 L/ha	<p>An in-line chemical injector system, designed for use with this product, is required for application. Apply 3–21 days before anticipated harvest. Within the rate range, use higher rates for fruit that are at a more advanced stage of maturity. Since Harvista 1.3 SC can impact or delay the onset and extent of red color development, lower rates within the rate range should be used on bicolored apple varieties. Do not apply more than 17.7 L/ha per crop.</p>

## 4. Chemical Thinner Product Guide

Note important product use pattern amendments:

- Sevin XLR now has a maximum yearly application rate of 3.22 L/ha for trellised orchards and 2.15 L/ha for non-trellised orchards. In varieties that were typically thinned with combinations of Sevin XLR & Fruitone or Maxcel with a rate of Sevin exceeding these new yearly maximums, you may need to consider increasing the rate of Fruitone or Maxcel slightly to compensate.
- Note that Sevin has a PHI of 75 days and MaxCel a PHI of 86 days which is challenging on early varieties like Paula Red

### Product Preparation Guide

The label rates for the plant growth regulators Fruitone L, MaxCel, and Cilis Plus are written in parts per million (PPM). The PPM measurement describes the volume of product required in a volume of water to arrive at a certain concentration of active ingredient.

Plant growth regulators are recommended in terms of concentration because the level of thinning action or other developmental response can be adjusted by increasing or decreasing the concentration. They are applied at very small concentrations, relative to fungicides and insecticides, because plant growth regulators produce major developmental differences at very small concentrations.

The labels for Fruitone L, MaxCel, and Cilis Plus all list the amount of product required in a spray solution to achieve a desired PPM. The following product amounts taken from the labels should not change the volume of product you would typically use in your thinning program. However, referring to the given PPM should help to standardize the language surrounding PPMs.

Table 1: Spray preparation chart for Fruitone L (1-naphthaleaneacetic acid or NAA) in parts per million (PPM) of NAA active ingredient.

Target concentration (ppm NAA)	Volume of spray solution			
	935 L	1871 L	2806 L	3742 L
1	30*	60	90	120
5	146	292	438	584
10	292	584	876	1168
15	438	876	1314	1752
20	584	1168	1752	2336

\* mL of Fruitone L product

Table 2: Spray preparation chart for Cilis Plus (2.0% weight of 6-benzyladenine or 6-BA) in parts per million (PPM) of 6-BA active ingredient.

Target concentration (ppm of 6-BA)	Volume of spray solution	
	200 L	1000 L
10	95*	475
25	240	1190
50	475	2390
75	715	3580
100	955	4770

<b>125</b>	1190	5960
<b>150</b>	1430	7160
<b>175</b>	1670	8350
<b>200</b>	1910	9540

\* mL of Cilis Plus product

Table 3: Spray preparation chart for MaxCel (1.9% weight of 6-benzyladenine or 6-BA) in parts per million (PPM) of 6-BA active ingredient.

Target concentration (ppm of 6-BA)	Volume of spray solution	
	380 L	1000 L
<b>10</b>	190*	470
<b>25</b>	475	1250
<b>50</b>	950	2500
<b>75</b>	1420	3750
<b>100</b>	1900	5000
<b>125</b>	2380	6250
<b>150</b>	2850	7500
<b>175</b>	3330	8750
<b>200</b>	3800	10000

\* mL of MaxCel product

### ***Product Guide Tips***

The following tips are based on observations and research results from field trials conducted in the Annapolis Valley of Nova Scotia. The tips were prepared by C.G. Embree and D.S. Nichols in 2013 and changes were more recently made to product names.

1. Sevin XLR can be applied at desired amount of water per hectare with a fungicide from calyx until 12 mm fruitlet growth stage.
2. Following Sevin XLR with a fungicide, assess fruit set when fruitlet is approaching 10 mm in diameter. If more crop-load adjustment is needed, use Fruitone or MaxCel/Cilis Plus in addition to the earlier application of Sevin XLR.
3. For the more aggressive thinning, use Sevin XLR at the high rate plus Fruitone (NAA) at 3 to 5 ppm at late petal fall. Trials with 100 ppm MaxCel + 5 ppm Fruitone has improved return bloom.
4. No set of king fruit will require a more aggressive thinning program.
5. MaxCel/Cilis Plus in combination with Sevin XLR is recommended for 8-12 mm fruitlet thinner for Northern Spy.
6. MaxCel/Cilis Plus and Fruitone alone are effective at reducing the crop-load on McIntosh. Fruit in the cull size category can be reduced from 40% to 15%. These products are not recommended for thinning Red Delicious.
7. When trees are over-spurred, i.e. leaf to fruit ratio is low, chemical thinners will only do part of the required fruitlet removal. Special attention when pruning will be needed to get the ratio vegetative and fruit wood in balance. Follow-up hand thinning in July will likely be necessary for desired fruit size and colour for cultivars with growth habit similar to Honeycrisp.

## **Method of Application**

### ***Uniform coverage***

The goal is to deliver an accurate amount of chemical with uniform coverage of each flowering spur throughout the tree. The hormonal thinners need to be dissolved or uniformly suspended in water in order to be absorbed by the foliage. Using large volumes of water under slow drying conditions would be recommended when applying NAA but this does not appear as important with carbaryl.

### ***Weather***

Weather conditions influence the rate of absorption of the thinner application. Absorption of product increases under warm temperatures and slow drying conditions (high humidity and minimum sunshine). Avoid applying these products under windy, cool (below 15°C) and fast drying conditions. Temperatures at 21-24°C are considered to be optimum. Rates of these products should be adjusted for weather conditions.

### ***Average fruit size***

When fruit size is used as the guide for application timing, a random sample of 10 king fruitlets from each of 10 trees should be measured. Fruitlets are most sensitive to chemical thinners between 7 and 12 mm king fruitlet diameter stage.

### ***Spray additives***

Surfactants (wetting agents) greatly enhance foliage absorption of hormone-type chemicals under unfavourable absorption conditions. A surfactant may reduce the amount of thinning variability caused by environmental conditions. The type and amount of surfactant used can affect the amount of chemical absorbed. A lower concentration of a hormone-type thinner plus a surfactant may be as effective as a high concentration of a chemical without the surfactant. Check the products label with regards to the need for and type of surfactant.

### ***Compatibility***

In most cases, combining chemical thinners with insecticides and fungicides is not recommended. The delivery spray pattern used for thinning sprays should differ from that used for pesticide application. When thinning, more spray should be placed in the upper portion of the tree where the fruit is more difficult to thin. When thinning, the whole block may not be treated because of the cultivar mix and possible variations in fruit set.

- Do not use NAA with Bordeaux or lime sulphur
- Urea probably decreases the effectiveness of hormone-type thinners

### ***Leave a control***

Remember in order to assess results there must be a comparison. Always leave five representative, unsprayed "control" trees at the edge of a block that can be used to compare natural fruit drop to the effect of your thinner. Flag the unthinned trees so they are easily identified. Also keep accurate records of factors such as cultivar, weather, dates, concentrations and level of fruit set.

In experimental work, it is common to increase fruit size at harvest as much as 20 percent by actual measurement, while the difference cannot be seen by visual assessment. It will not take long to measure a sample of 10 fruit from each of 5 trees that were sprayed and 5 trees that were unsprayed. Compare your average fruit size on sprayed and unsprayed trees. Alternatively, you could also track how long it takes the same crew member to hand thin sprayed trees versus unsprayed trees.

## **Process for Successful Thinning**

### **1. Assess crop load**

Estimate crop load by observing the developing fruitlets and their sepals. Unpollinated flowers will drop, and they can be identified by their sepals that bend back. Determine how much thinning is necessary.

### **2. Choose products**

Consider your variety and whether it is difficult, moderately difficult or easy to thin. Consider the stage of crop development by estimating the percentage of flowers in bloom or measuring fruitlet diameter. Choose products with proven thinning efficacy on your variety at its given growth stage.

### **3. Choose water volumes**

Determine water volume by considering tree size and spacing. Smaller tree size at a higher density will likely reduce the volume of tree canopy and require less spray. Calibrate the sprayer to wet the tree canopy to the point of runoff.

### **4. Observe and record weather conditions**

If possible, wait for the ideal weather conditions of warm temperatures at 21-24°C, no precipitation for 24 hours and calm winds. Keep in mind the narrow growth stage when fruitlets will respond to thinners. Record the temperature, wind speed, cloud cover and precipitation the day before application, the day of, and the day after. Adjust product concentration by considering the factors that influence thinning efficacy.

### **5. Apply thinners and leave untreated trees**

Apply thinners, leaving 5 unsprayed trees at the edge of a block to proceed with only natural fruit drop. If all trees are sprayed, there is no way to identify how use of a chemical thinner compares to natural fruit drop – making it impossible to adjust your practices based on your results.

### **6. Monitor fruit drop**

After 7-10 days, the effects of a thinner should be noticeable. Monitor fruit drop by gently running your hand through clusters to see how many fruitlets are easily dislodged. Revisit your unsprayed trees to record whether natural fruit drop was low, moderate or high. Revisit your sprayed trees to record whether chemical thinning (compared with natural fruit drop) was low, moderate or high. Fruitlets with yellow stems will drop.

### **7. Repeat steps if needed**

The aim of chemical thinning is to remove 75% of the excess fruit with the remainder being removed by hand thinning. Additional chemical thinning risks removing too much fruit. If additional thinning is required, repeat steps 1-6.