Influence of Gibberellic Acid (GA_3) on Fruit Quality of Sweet Cherries

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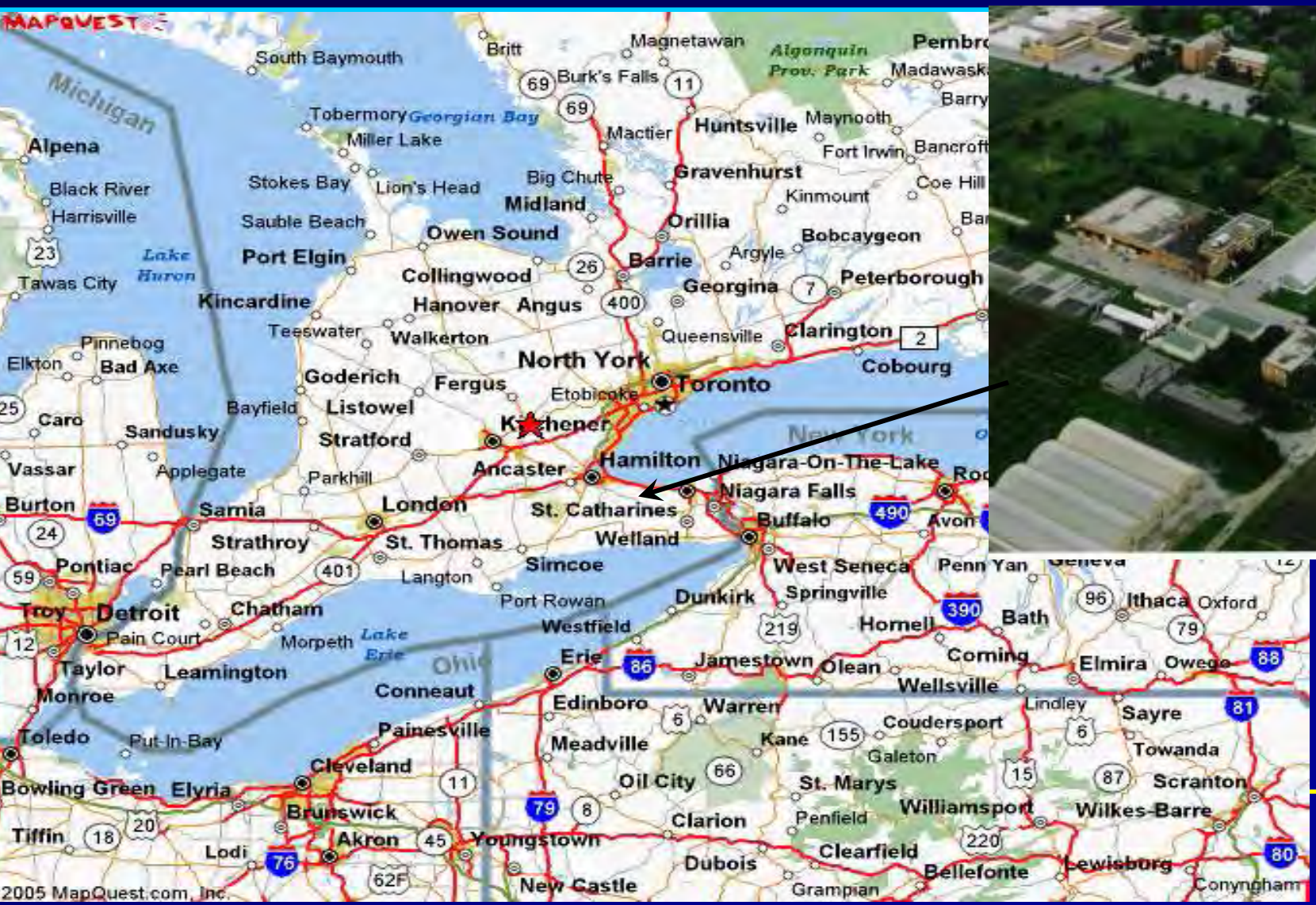
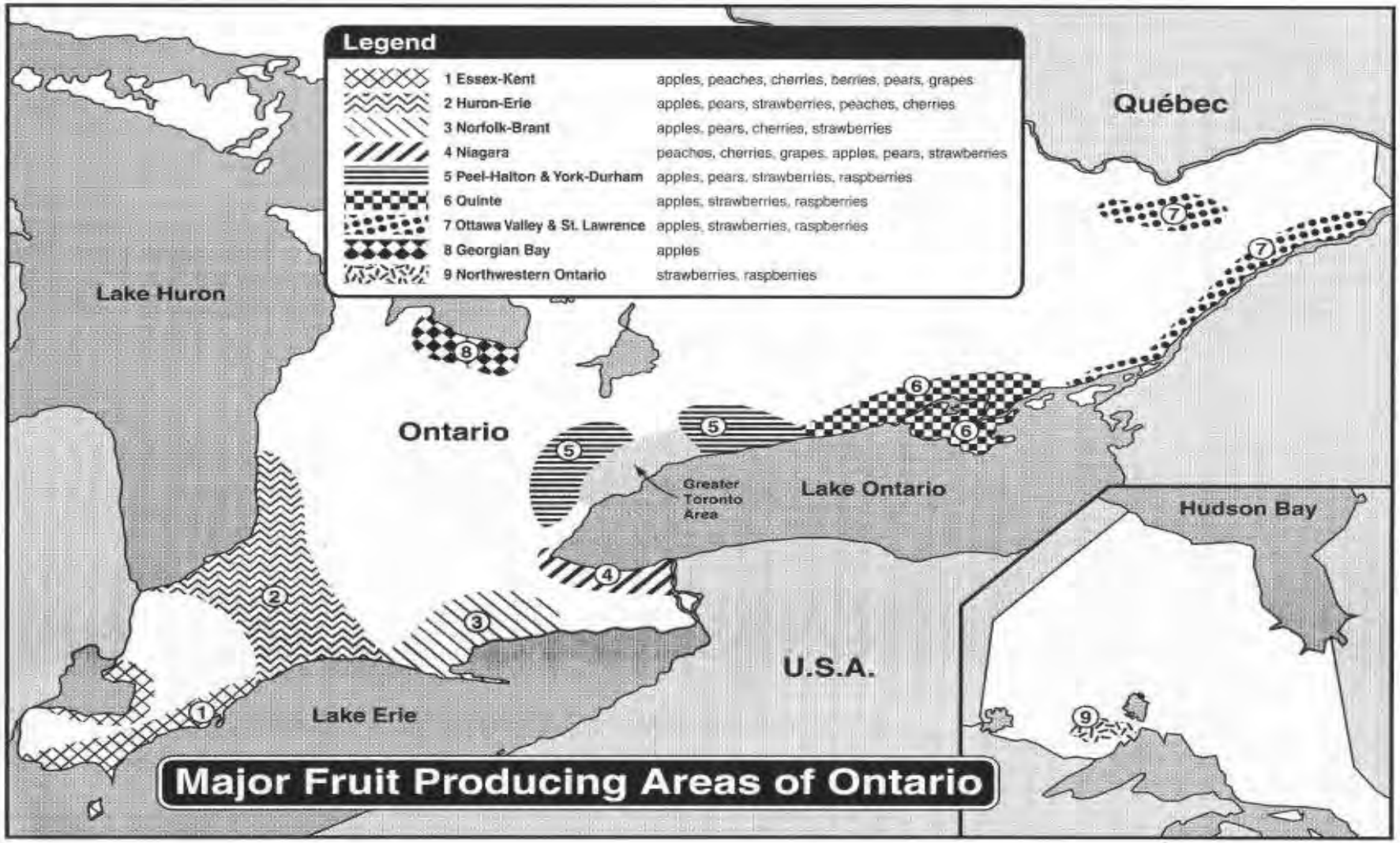
Presentation Outline

- Introduction
- Historical perspective of gibberellic acid (GA) use increase the firmness of sweet cherries
- Current labeled products and recommendations
- Other effects of GA
- Data from Ontario

University of Guelph - Simcoe and Vineland Research Stations



Major Fruit Producing Areas of Ontario (Source: OMAF)



PGR	Responses
Auxin	Cell enlargement, Apical dominance, Rooting promotion, Fruit thinning, Fruit drop prevention
Gibberellin	Firmness, cell enlargement, seedlessness, cause fruit set, flower induction, flower reduction (thinnig), break dormancy, Increase seed germination, delay of senescence, modify sex expression
Cytokinin	Cell division, Counteract apical dominance, Branching agent, Delay of senescence, Cause fruit abscission
Ethylene	Ripening agent, Causes leaf & fruit abscission, Promotes radical growth
Abscisic Acid	Promotes leaf & fruit abscission, Regulates dormancy in perennials, Controls hydric status through stomata opening control

Dr. Silvan Witwer

1970's

- Dr. Ed Proebsting of WSU was one of the first to report on the use of GA on sweet cherries to delay maturity and improve quality (firmness)
  (Proebsting, 1972 WSU Extension Multilith 3520)

Function	Products Available	Research Experience
1. Inhibit Flowering	GA_3, GA_4, GA_7	Apples, Peaches, Cherries
2. Promote Flowering	Ethrel, NAA	Apple
3. Influence fruit ripening and quality	GA_3, GA_4, GA_7, Ethrel, Retain	Cherries, Apples, Peach
4. Fruit thinning	Carbaryl*, NAA, BA, Surfactants,	Apple, Peach
5. Influence ethylene synthesis	Ethrel, MCP, ReTain	Apple, Peach
6. Fruit finish	GA, Koalin Clay*	Apple,
7. Change fruit shape	Benzyl adenine (BA)	Apple
8. Reduce Preharvest drop	NAA, ReTain	Apple, Peach
9. Reduce Vegetative growth	Apogee	Apple, Peach

* - these products are not plant growth regulators

Use Pattern

Timing:

- Late stage II, pit hardening (translucent green to straw colour)
- Use sufficient water volume to ensure thorough wetting

Concentration

- 42 – 126 ppm GA_3 (16-48 grams ai/acre)
- [$61 - $183/acre; 100 gallons/acre]

Other Effects/Precautions

- Avoid overdosing lower canopy
- Avoid unusually warm/cold days
- Less effective on early ripening cultivars
- Excessive concentrations can reduce return bloom

Benefits of GA on sweet cherries

GA has been shown to:

- Improve fruit firmness
- Increase soluble solids
- Increase fruit weight
- delay fruit maturity by 3-5 days
- Greener stems
- Improved storage life
- results on reducing rain-induced fruit cracking are contradictory

[Drake et al, 1978, Facteau, 1989, Looney and Lidster, 1980, Proebsting et al, 1973]

Mechanism by which GA affects cherries

- Various (100+) isomers of GA naturally exist in plants
- Commercially registered GA contains isomer **GA_3** that is very active in woody plant species including sweet cherries
- Delays maturity and influence ripening enzyme activity and function
- (GA_4 and GA_7 are used in apples)

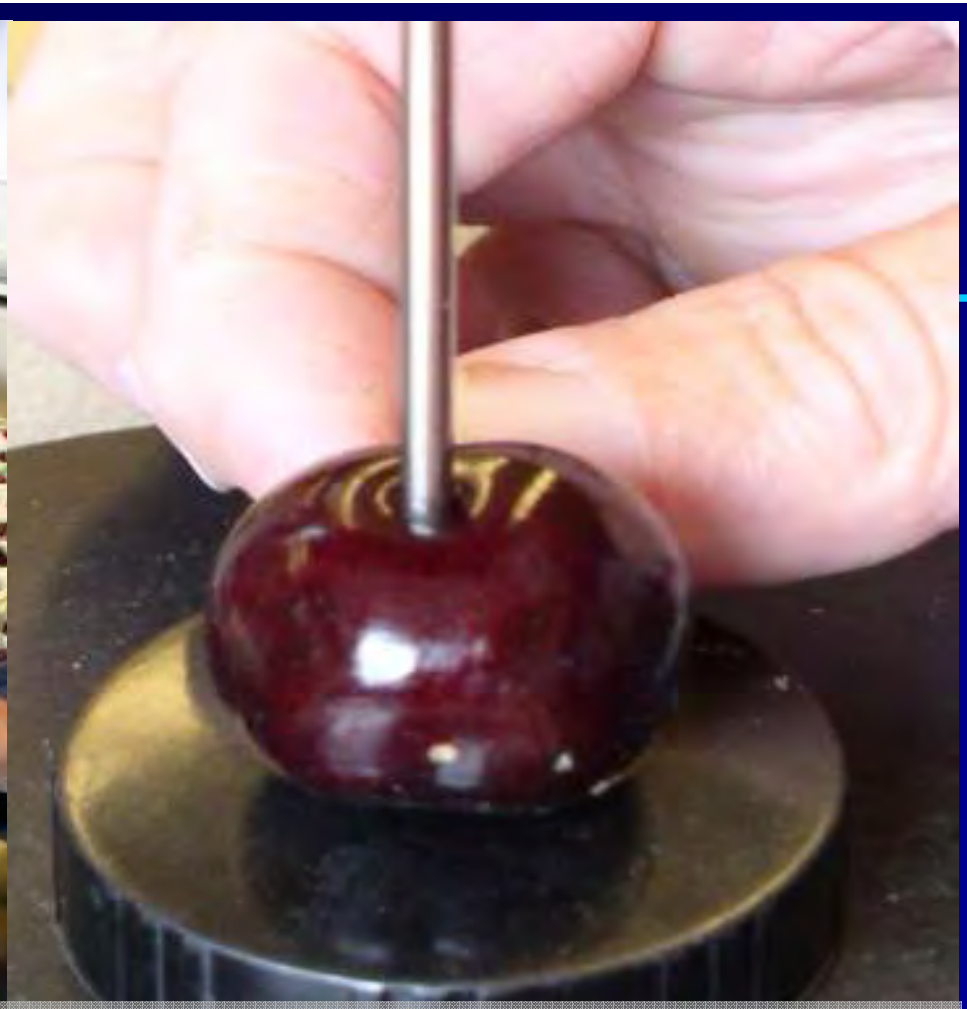
Materials and Methods - 2004

Plant Material

- 19-Yr old Terhanivee, Vandalay
- 6.5 x 7.5m free standing
- Sprays applied by handgun to drip

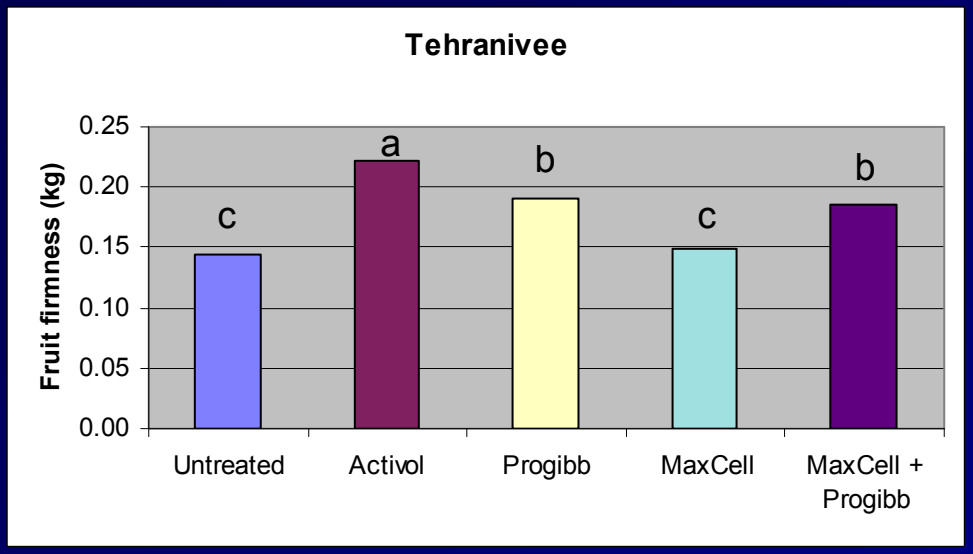
Treatments

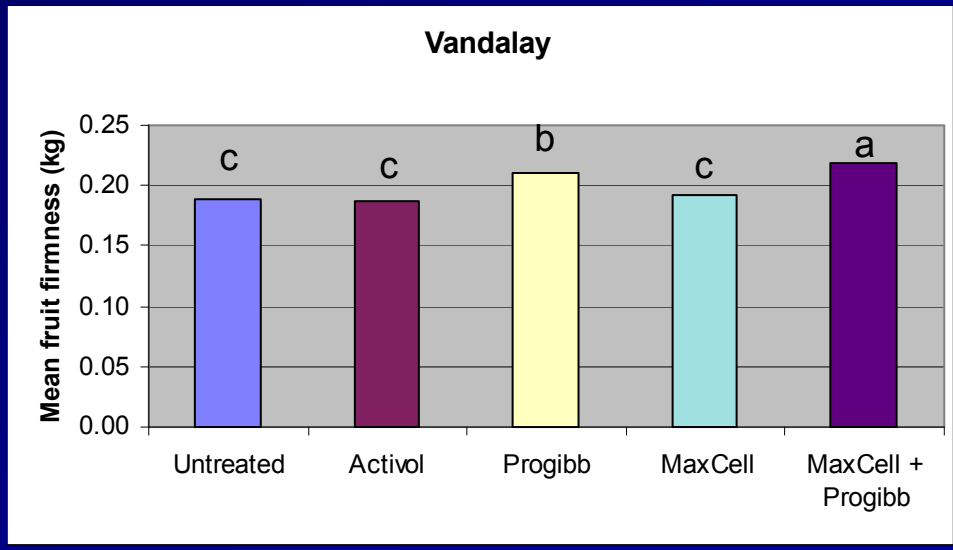
1. Untreated
2. Activol (20 mg/L GA_3)
3. ProGibb (20 mg/L GA_3)
4. MaxCell (50 mg/L 6-BA) applied twice
5. Treatment 3 & 4



- Flesh firmness was measured on 25 fruit , 2 sides
- Fruit texture Analyzer Model GS-14, GÜSS, South Africa
- 3 mm probe, depth of 1mm (did not penetrate skin)

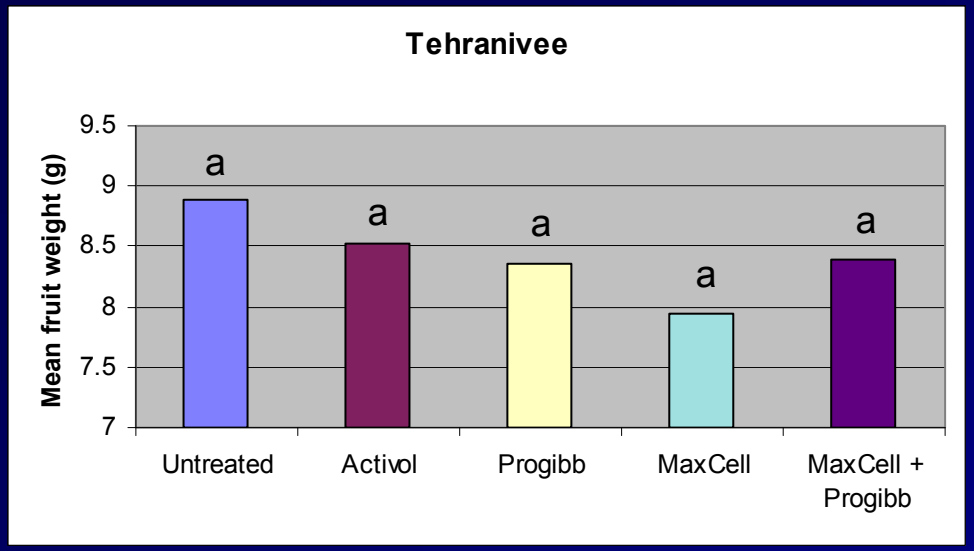
Firmness Results

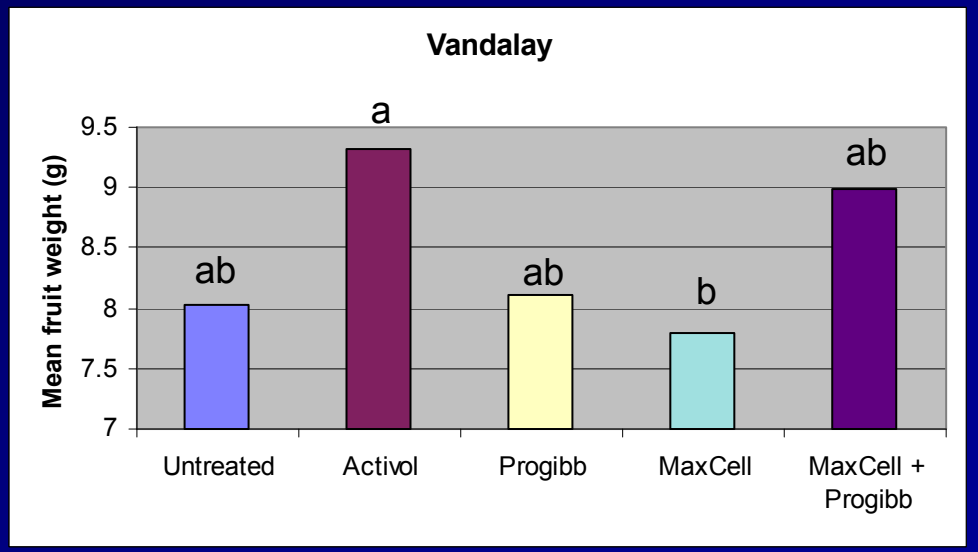




- Activol increased firmness of Terhanivee, but not Vanadalay
- Progibb increased firmness of both cultivars
- Fruit firmness was unaffected by Maxcel
- Combination of Progibb and Maxcel similar to Progibb alone

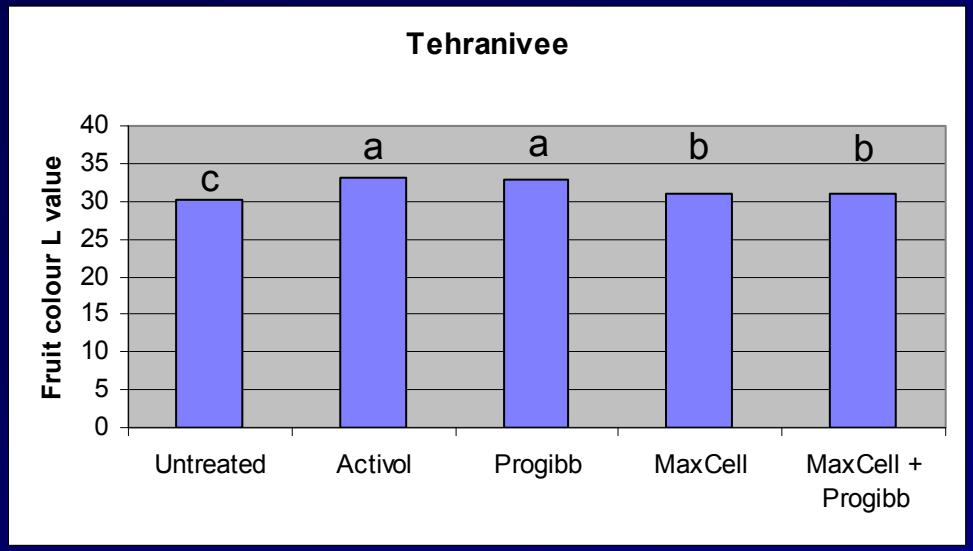
Fruit Weight Results

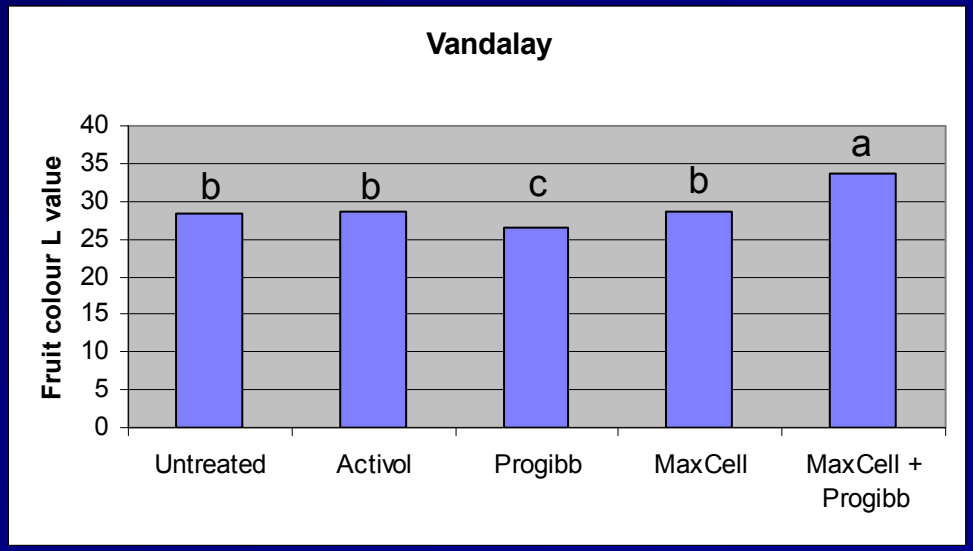




- No significant treatment effect on fruit weight
- Fruit was variable and treatment effects were inconsistent

Fruit Colour (1st harvest)





- All treatments delayed colour development of Terhanivee in comparison with untreated controls
- Activol and Progibb were less effect in delaying colour development of Vandalay.

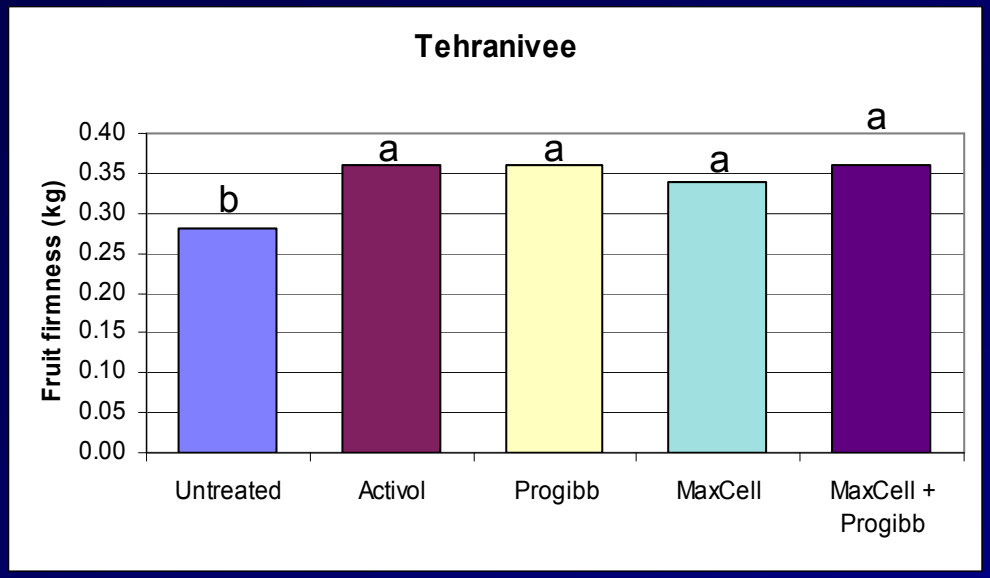
Fruit Cracking

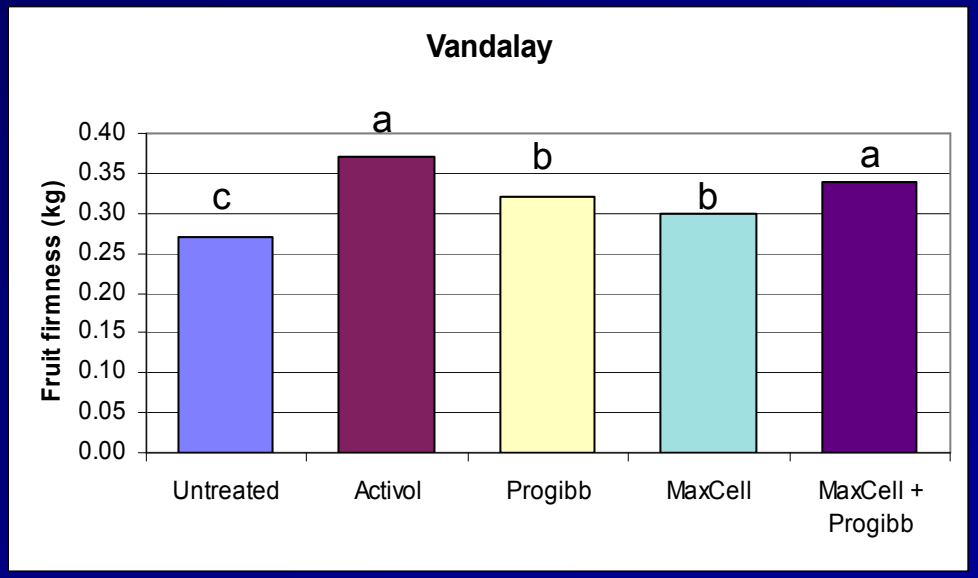
No significant treatment effect on:

- Fruit cracking
- Marketable fruit

2003 Data

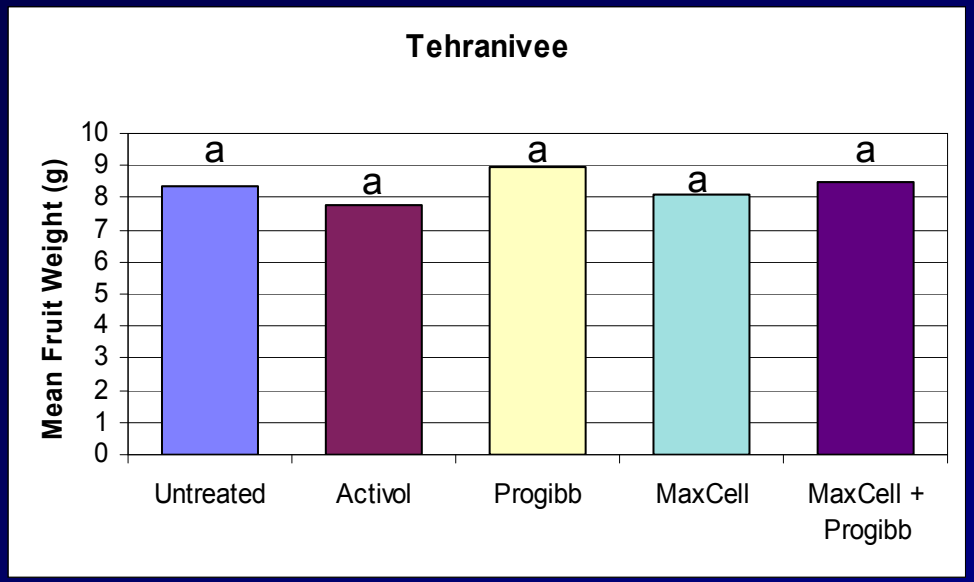
Fruit Firmness

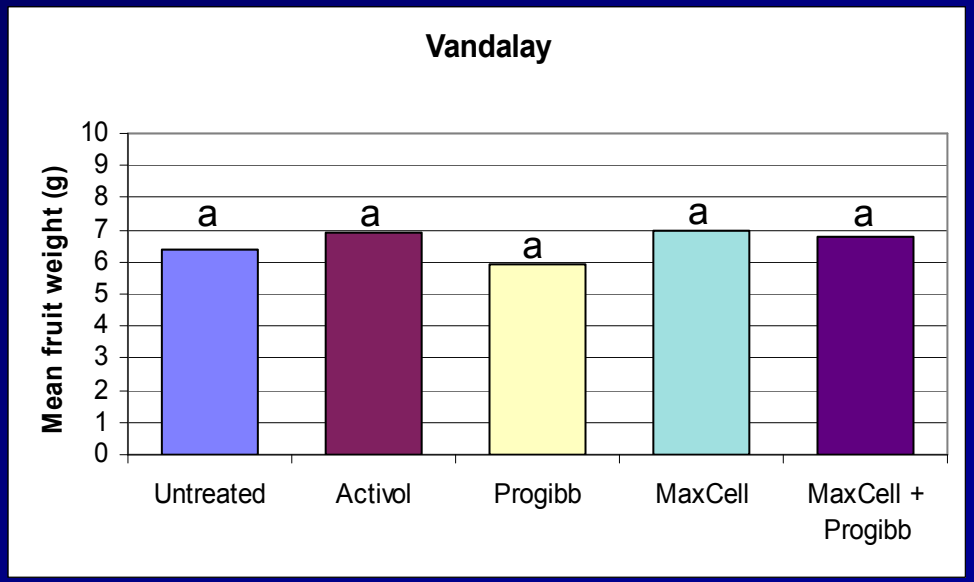




- GA resulted in significantly firmer fruit
- No effect of Maxcel
- Tehranivee (later cv.) more responsive to GA_3 than Vandalay

Fruit Weight





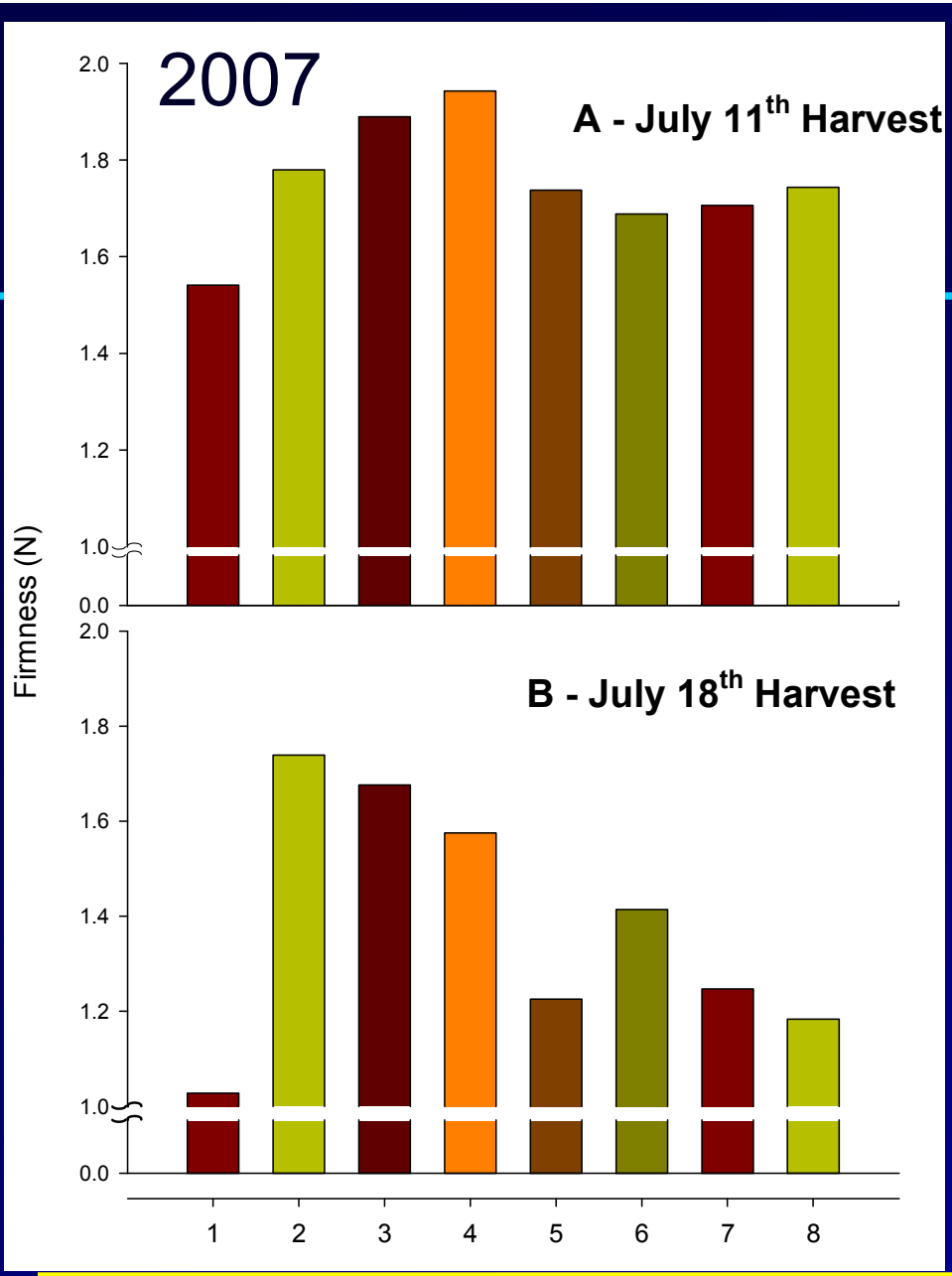
- in 2003, GA did not influence fruit weight of either cultivar

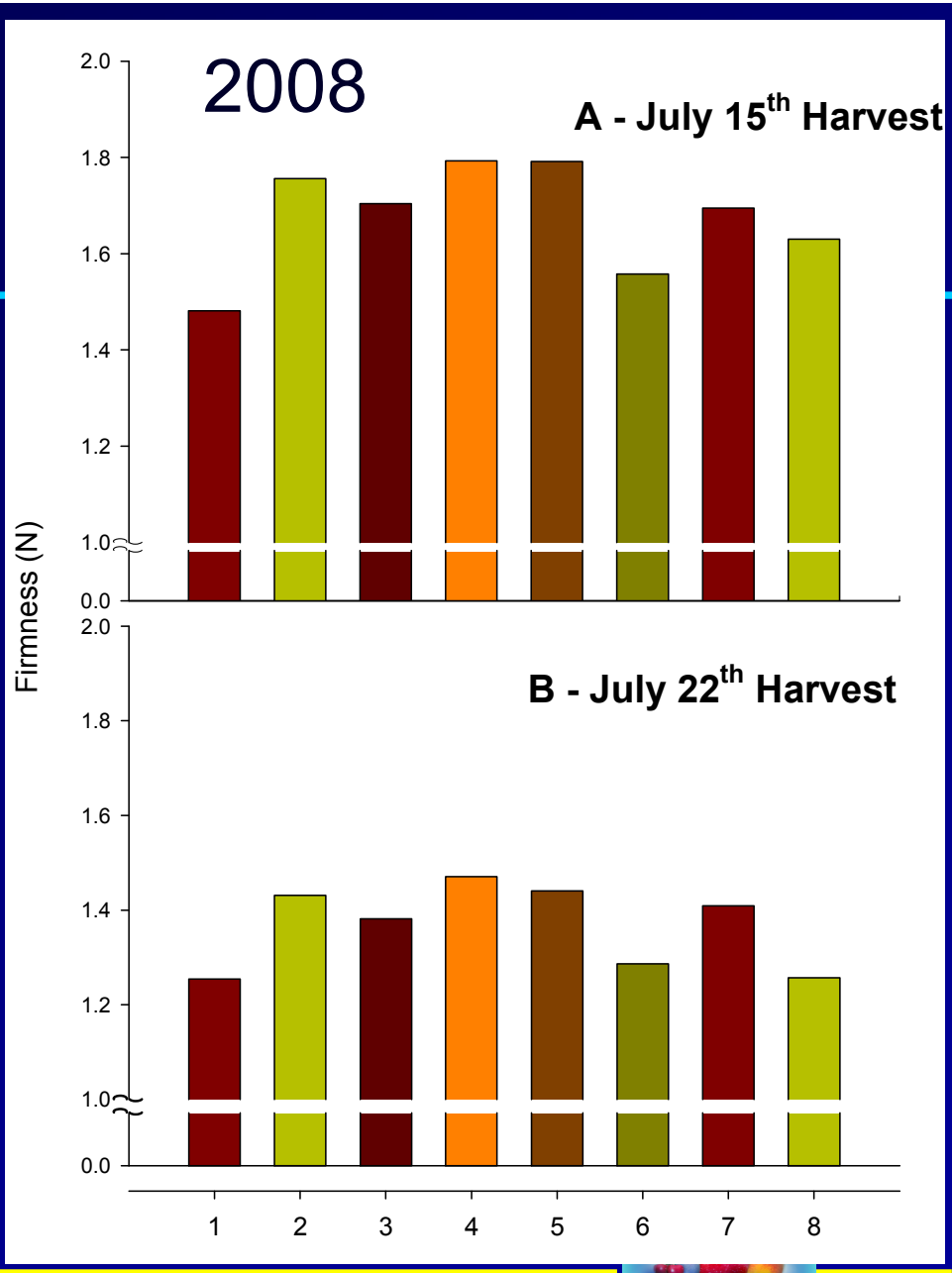
2007 Data

Table 1. Effect of giberillic acid treatment on fruit colour and firmness of 'Hedelfingen' cherries. Vineland, 2007.

GA_3 (mg/L)	Timing	Fomulation	Firmness (kg)[z]		Colour L value (lightness)		Mean fruit weight (g)		Brix (°)
			1st pick (July 11)						
Untreated	-	-	0.16	c	31.5	d	7.6		16.3
20	straw colour	Progibb 40%	0.18	b	34.7	b	7.5		17.8
40	straw colour	Progibb 40%	0.19	a	34.5	b	7.7		17.9
30	straw colour	Progibb 40%	0.20	a	35.3	a	6.3		16.2
20	10 prior to straw colour	Progibb 40%	0.18	b	33.5	c	7.3		17.0
20	straw colour + 10 days prior	Progibb 40%	0.17	b	34.8	ab	6.9		15.9
20	straw colour	Progibb 4%	0.17	b	33.0	c	7.3		17.1
40	straw colour	Progibb 4%	0.18	b	35.0	ab	6.3		16.0
Significance[z]			***		***		ns		ns
LSD (p=0.05)			0.01		0.5		2.8		2.0
P value			< 0.0001		< 0.0001		0.7524		0.7112
			2nd pick (July 18)						
Untreated	-	-	0.10	e	31.0	d	8.9	abc	17.1
20	straw colour	Progibb 40%	0.18	a	31.3	d	10.0	a	15.0
40	straw colour	Progibb 40%	0.17	a	32.1	bc	8.2	bcd	18.6
30	straw colour	Progibb 40%	0.16	b	32.3	bc	8.8	abc	16.7
20	10 prior to straw colour	Progibb 40%	0.13	d	32.4	b	9.3	ab	18.8
20	straw colour + 10 days prior	Progibb 40%	0.14	c	33.2	a	7.9	bcd	15.9
20	straw colour	Progibb 4%	0.13	d	31.8	c	7.7	cd	17.3
40	straw colour	Progibb 4%	0.12	d	33.2	a	7.0	d	14.4
Significance[z]			***		***		*		ns
LSD (p=0.05)			0.01		0.5		1.6		3.3
P value			< 0.0001		< 0.0001		0.0154		0.1115

[z] 3 mm probe


2007
A - July 11th Harvest
B - July 18th Harvest
Firmness (N)
2.0
1.8
1.6
1.4
1.2
1.0
0.0
1
2
3
4
5
6
7
8


2008
A - July 15th Harvest
B - July 22th Harvest
Firmness (N)
2.0
1.8
1.6
1.4
1.2
1.0
0.0
1
2
3
4
5
6
7
8

‘Hedelfingen’ fruits on July 11th 2007 (1st harvest)

Summary of Gibberellic Acid use on Sweet Cherries…

- Progibb has consistently increased fruit firmness and has typically delayed harvest 3-5 days
- Effects on fruit red colour at harvest have been marginal
- Inconsistent treatment effects on fruit weight, soluble solids, and rain cracking
- Progibb 40% was more effective than Progibb 4% in enhancing fruit firmness and size

Further Information

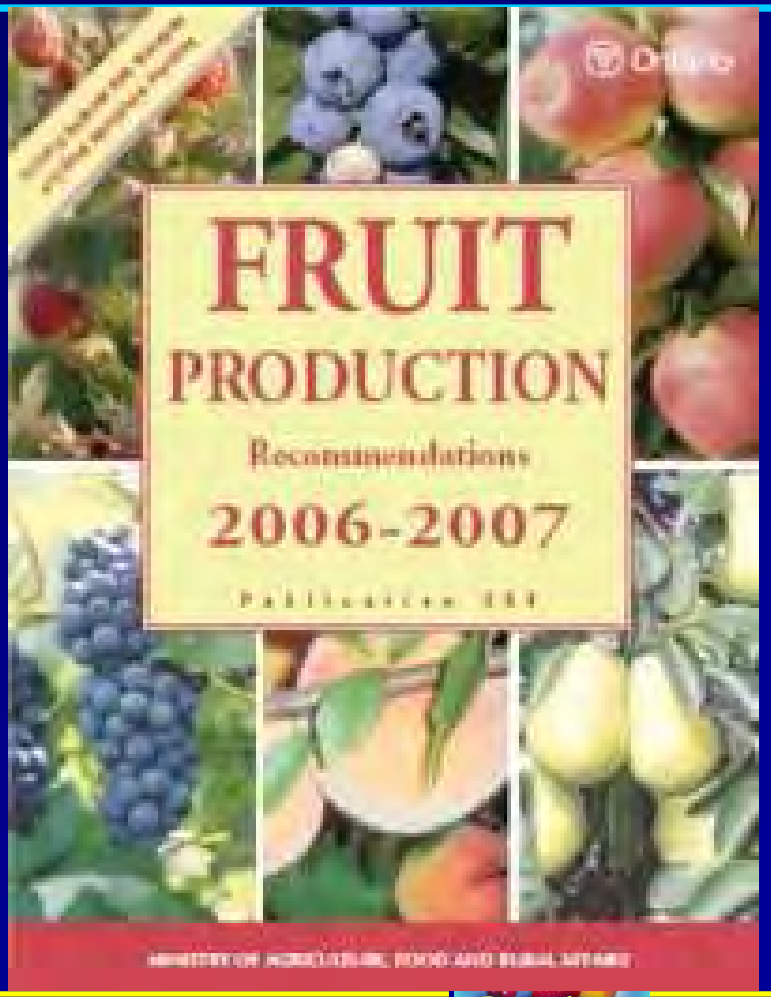
The MSU Fruit Management Guide- E-0154

Crop Protection Guide for Tree Fruits in Washington

- NY Fruit Production Guide

Growth Regulator Informaion

- PGR Use on Sweet and Tart Cherries
- Updated Thinning and PGR Information



http://www.plant.uoguelph.ca/treefruit

Orchard

Acknowledgements

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VALENT

Ontario

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