Mechanical Blossom Thinning of Peaches and Apples

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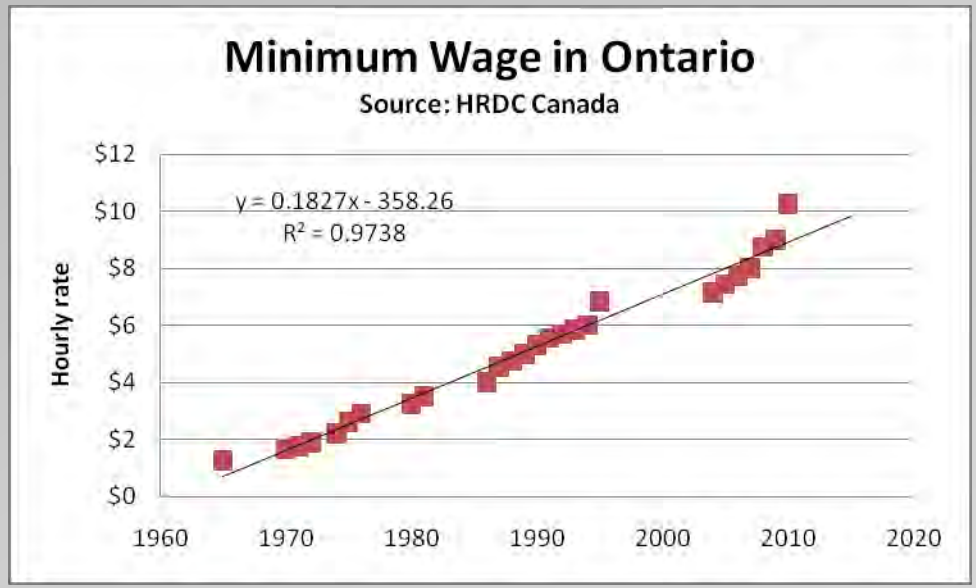
Presentation Outline

- Horticultural basis for thinning peaches & apples
- Economics of thinning
- Various strategies – past and present

Costs Associated with Thinning

- Cost: ~ $ 500/acre (based on $10/hr)
- Labour costs and availability
- Harvest efficiency is directly related to the amount of thinning

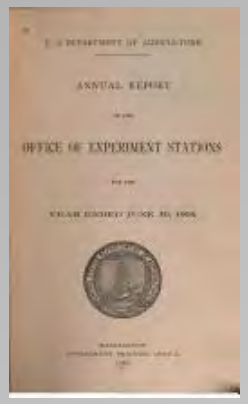


Horticultural Basis for thinning Peaches and Apples

- Fruit trees usually produce an excessive number of flowers
- Set of 5-10% of the flowers are needed to produce a normal crop
- to maximize crop value
- to promote return bloom (apple)
- to maintain tree growth and structure

Approaches to Thinning

- Mechanical
- Chemical Thinning (Apple)
- Flower Inhibition (GA)



Mechanical Thinning

Dormant pruning, physical removal of flowers by hand or specialized brushes, rope drags

Advantages

- Some approaches are selective (pruning)
- Small or damaged fruit can be removed by hand
- Indication of the remaining number of viable flowers

Disadvantages

- Ropes tend to thin larger buds
- Not uniform - flower buds in narrow crotches angles are not adequately thinned
- Hand thinning is expensive

Blossom Chemical Thinning

Surfactants, fertilizers, desiccants, oils, long chain fatty acids

Advantages

- Early in the season
- Allocating photosynthates to fruit that will persist until harvest
- Low labour requirement
- Quick
- Relatively Inexpensive

Disadvantages:

- Potential for spring frosts
- Uncertainty of environmental conditions for pollination
- Unpredictable response
- Not many registered products

Rope Thinner

Basis for Mechanical Thinning

- Method to thin earlier
- Non chemical approach for apple including organic
- For peaches and cherries, there are few effective methods (apart from pruning)
- Potential future loss of carbaryl (Sevin®)

2009 Research Objectives

To assess the effectiveness of mechanical blossom thinning on:

- Reduction in hand thinning and cost savings
- Improvement in fruit size
- Effect on yield

Mechanical String Thinner

- Designed by Fruit-Tec, Germany
- Cost: $C 15,000 for Model 300
- Has front mount 3PH, fixed, or fork-lift mounts
- Model evaluated Darwin 300

Source: Pen State University

Mechanical String Arrangements

9 Strings

Variety	Timing	Rotations Per Minute	Miles Per Hour
Autumn Glow (Snowy)	Pink	150 & 180	1
Red Haven	Pink	150	1
PF17	Pink	180	2
Sunset	Pink	150	1
Fantasia	Mixed On	150	2

18 Strings

Variety	Timing	Rotations Per Minute	Miles Per Hour
Autumn Glow	Pink	150	1

2 On, 2 Off

Variety	Timing	Rotations Per Minute	Miles Per Hour
Red Haven	Pink	150	1

2 On, 2 Off

Opposing

Variety	Timing	Rotations Per Minute	Miles Per Hour
White Lady	Pink	150 & 180	1
PF17	Pink	180	2

Two On, Every Third Off

Variety	Timing	Rotations Per Minute	Miles Per Hour
PF 17	Pink	180	2

2 On, 4 Off

Variety	Timing	Rotations Per Minute	Miles Per Hour
PF17	Pink	180 & 220	1
White Lady	Pink	180	1

Four On, Four Off

Variety	Rotations Per Minute	Miles Per Hour
Red Haven	200	1

Materials and Methods

Grower Experiments: Blossom Thinning Peaches

- 8-yr old “Catherina” peach 1.8 x 2.4 m (841 t/ha) – central leader
- 5-yr old “Allstar” peach 1.8 x 4.8 m (1121 t/ha) – tall spindle
- Goal was to evaluate: RPM, string configuration and to compare with hand thinning

Peach: Catherina and Redhaven

Apple: Ambrosia, Gala (2), Gingergold, Honeycrisp

Treatments

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

Ground speed: 2.1 miles per hr

Timing: Full Bloom

In other experiments evaluated

- RPMs
- String configurations
- Comparison with chemical thinners (Apple)

Catherina

Allstar

Peach Measurements

- Percent blossoms removed
- Fruit set (on selected branches)
- Number of fruit thinned per branch
- Time required to hand thin
- Harvest: Number of fruit per tree, yield, fruit size, split pits,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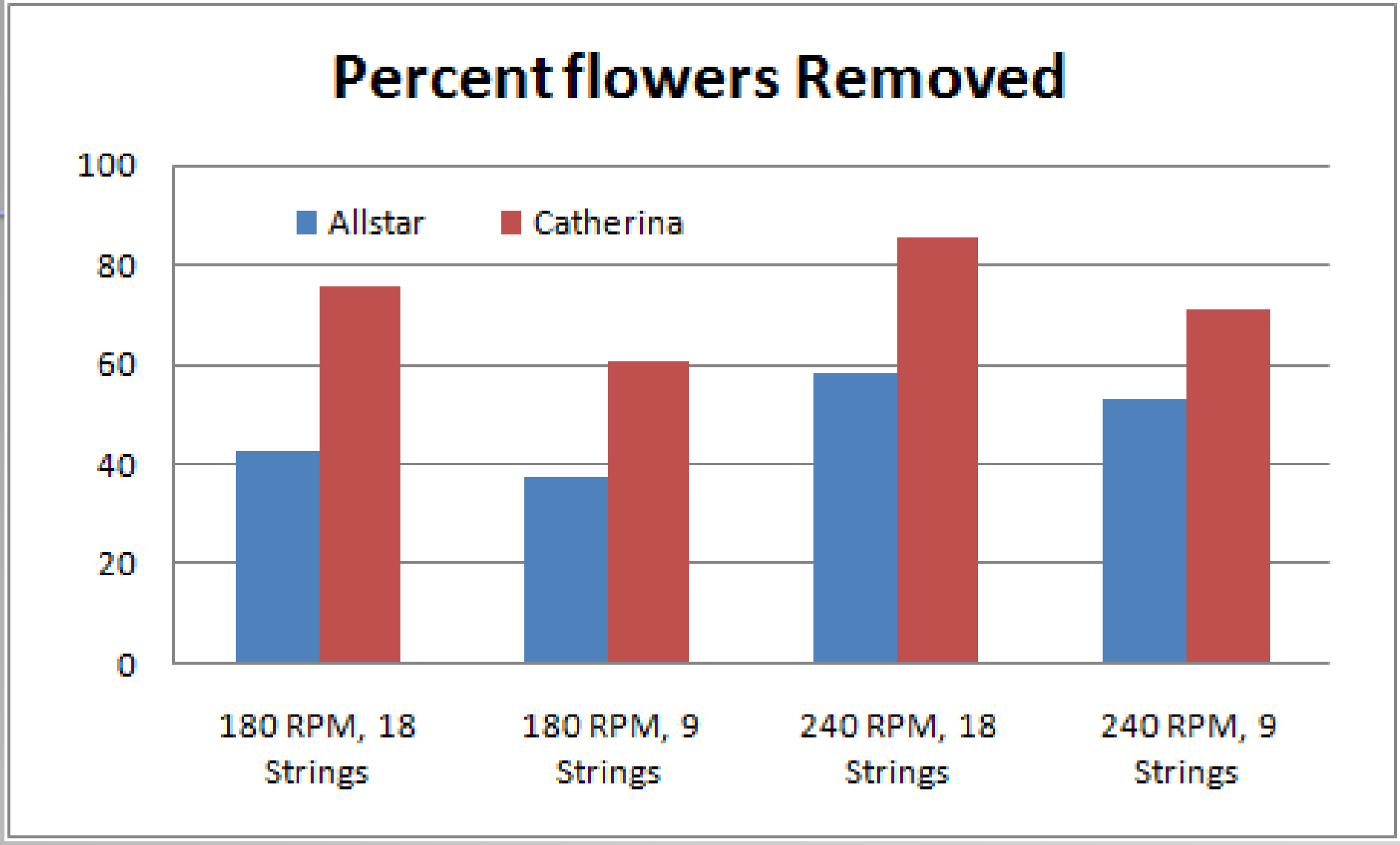
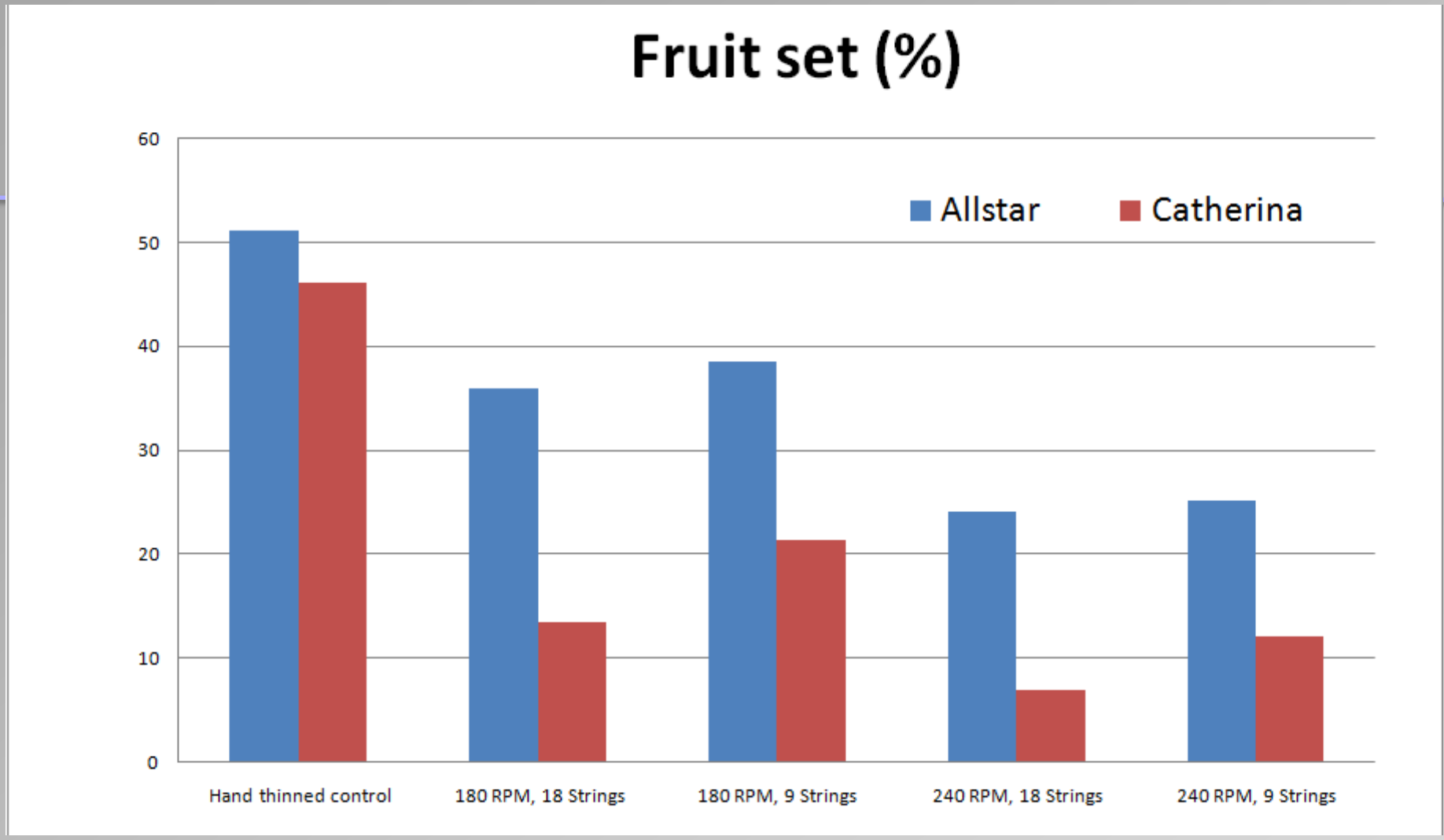


Allstar: 37-53 Catherina: 60-85%



- Mechanical thinning reduced fruit
- RPM greater effect than String configuration

Labour Savings

Hand thinning per Acre

77 hrs (Allstar)

20 hrs (Catherina)

Reduction

- 21-50% (Allstar)
- 10-50% (Catherina)

Savings (at $10 per hr)

- $160-290 (Allstar)
- $20-100 (Catherina)

Treatment	Time required to thin (hr/ acre)	# hrs	%
Allstar			
Hand thinned control	76.8		
180 RPM, 18 Strings	61.0	16	21
180 RPM, 9 Strings	60.0	17	22
240 RPM, 18 Strings	39.3	37	49
240 RPM, 9 Strings	47.9	29	38
Significance [x]	**		
P value	0.0044		
Contrasts (P value)			
Effect of Hand vs Mechanical Thinning	0.0018		
Effect of 18 vs 9 strings	0.5422		
Effect of 180 vs 240 RPM	0.0118		
Catherina			
Hand thinned control	20.3		
180 RPM, 18 Strings	13.0	7	35.9
180 RPM, 9 Strings	18.2	2	10.7
240 RPM, 18 Strings	10.2	10	49.8
240 RPM, 9 Strings	11.9	8	41.7
Significance [x]	***		
P value	<0.0001		
Contrasts (P value)			
Effect of Hand vs Mechanical Thinning	0.0029		
Effect of 18 vs 9 strings	0.0001		
Effect of 180 vs 240 RPM	<0.0001		

Yield and Fruit Size

Total Weight per Tree

No effect (Allstar)

Mechanical thinning reduced yields 9 to 45% (Catherina)

Fruit size

- Mechanical thinning increased fruit size 8 – 15%

Treatment	Total fruit weight (kg/tree)		Fruit weight (adjusted for crop load) (g)	
Allstar				
Hand thinned control	24.4		147	c
180 RPM, 18 Strings	24.1		158	b
180 RPM, 9 Strings	21.9		155	b
240 RPM, 18 Strings	20.0		173	a
240 RPM, 9 Strings	20.9		167	a
Significance [x]	ns		**	
P value	0.1624		0.0015	
Contrasts (P value)				
Effect of Hand vs Mechanical Thinning	0.1103		0.0005	
Effect of 18 vs 9 strings	0.6302		0.1926	
Effect of 180 vs 240 RPM	0.0926		0.0011	
Catherina				
Hand thinned control	29.7	ab	198	c
180 RPM, 18 Strings	27.1	ab	218	ab
180 RPM, 9 Strings	34.6	a	219	bc
240 RPM, 18 Strings	16.1	c	231	a
240 RPM, 9 Strings	23.1	bc	212	bc
Significance [x]	**		*	
P value	0.0061		0.015	
Contrasts (P value)				
Effect of Hand vs Mechanical Thinning	0.0237		0.1085	
Effect of 18 vs 9 strings	0.0017		0.4446	
Effect of 180 vs 240 RPM	0.1803		0.8209	

Materials and Methods – Apples

- 6-yr old “Gala”/M.9 2.0 x 4.5 m (888 t/ha) – vertical axe
- 6-yr old “Ambrosia”/M.26 2.0 x 4.5 m (888 t/h – vertical axe

Objectives:

- Compare mechanical thinning with hand thinning
- Compare mechanical thinning with chemical thinning
- Combine both mechanical and chemical thinning

Results – Apples

Significant Reduction in Crop Load (fruit /TCSA) / Fruit Weight						
Treatment Comparison with Control	Details	Ambrosia	Gala 1	Gala 2	Ginger-gold	Honeycrisp
Mechanical Thinning	220 RPM, 2 sets of 9 strings, 1.8 mph	-/0	0/0	0/0	0/0	0/0
Chemical Thinning	750 mg Carbary per litre, 75 ppm 6-BA	0/+	0/+	0/0	0/+	0/0

- Mechanical thinning was comparable to hand thinning in 4 of 5 expts
- Chemical thinning provided superior fruit size in 3 of 6 expts

Future Research and Challenges

- Need to demonstrate effectives on sweet cherries
- Tree architecture (tall spindles, hedge row systems) will need to be adjusted to make best use of this technology
- Negative effects of leaf injury not understood
- Incorporate methods to reduce risk of fireblight
- Likely a useful tool for peach and organic apple growers
- Useful for apple cultivars requiring early thinning

www.plant.uoguelph.ca/treefruit

http://www.fruit-tec.com

http://www.abe.psu.edu/scri/

Acknowledgements

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