

A close-up photograph of two bright red apples hanging from a tree branch. The apples are round and have a smooth, slightly glossy skin. They are surrounded by numerous green leaves of various shades, some showing signs of aging or damage. The background is a plain, light color, possibly white or light blue, which makes the red of the apples stand out.

Fruit Thinning

UNIVERSITY
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Topics of Discussion

- Economics of Thinning
- Horticultural basis for thinning apples & peaches
- New mechanical technology
- Strategies

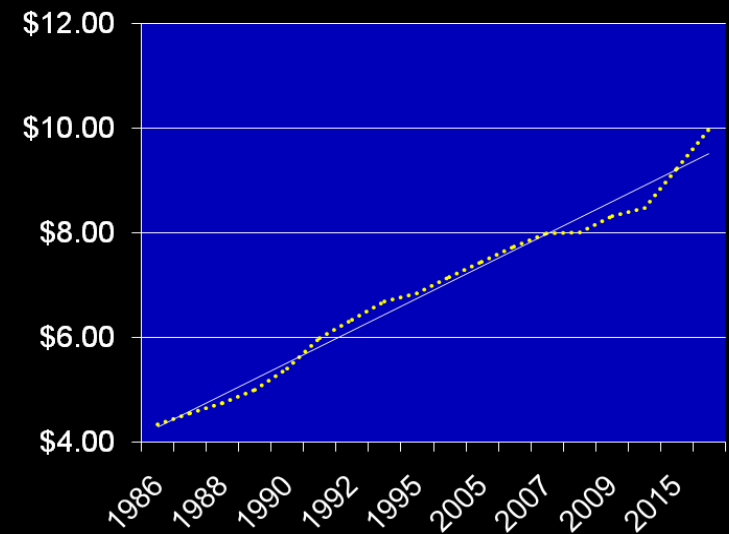


Economics of Thinning

- 🍊 Approximately \$ 500/acre (based on \$10/hr w/o benefits)
- 🍊 Labour intensive practices will be more challenging in the future
- 🍊 Harvest efficiency is directly related to crop load
- 🍊 Thinning nearly always reduce yield per tree



Ontario Minimum Wage



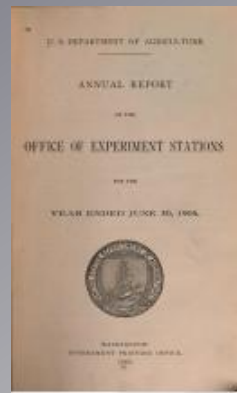
Horticultural Basis for thinning Apples & Peaches

- 🍊 Tree fruit trees produce an excessive number of flowers
- 🍊 5-10% fruit set is needed to produce a desirable crop
- 🍊 to promote return bloom
- 🍊 to maintain tree growth and structure



Several Approaches to Thinning (Crop Load)

- Mechanical (Pruning)
- Mechanical (Blossom)
- Chemical: Blossom & Fruitlet Thinning
- Chemical: Flower Inhibition
- Hand



Adjusting Crop Load by Dormant Pruning

Before



After





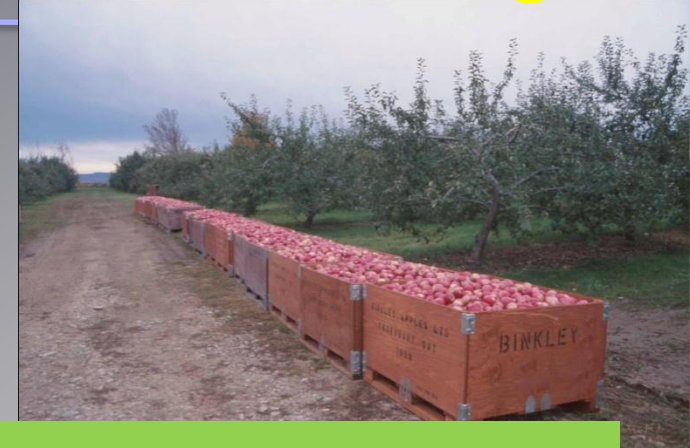
Okanagan Packinghouse Fieldmen's Group 2010 Conference Feb 18, 2010



Adjusting Crop Load by Dormant Pruning

Calculation based on:

- Estimated yield/acre (bins)
- Target fruit size (eg, 88's)



50 Bins/acre, Target size: peak on 88's = 0.48 lbs/fruit

Yield/acre = 50 bins x 18 bu/bin x 42 lbs/bu = 37,800 lbs

Tree Density = (18" x 11') = 2641 t/a

Yield/tree = 37,800 lbs / 2641 trees = 14.3 lbs/tree

Fruit per tree = 14.3 / 0.48 = ~ 30 fruit per tree

Blossom Thinning



Chemicals: Lime sulphur, ATS, surfactants, oils

Mechanical: specialized implements, hand

Advantages

- 🍊 Conducted early in the season
- 🍊 Carbon Credits - tree photosynthates are distributed between fruit that remain on the tree
- 🍊 Mechanized - low labour
- 🍊 Quick, easy

Disadvantages:

- 🍊 Potential for spring frosts following removal
- 🍊 Uncertainty of environmental conditions for pollination
- 🍊 Unpredictable response with chemical
- 🍊 Not many registered products

Rope Thinner



Photo courtesy of Dr. Bob Belding

2009 Research Objectives

To assess the effectiveness of mechanical blossom thinning on:

- Reduction in hand thinning
- Fruit size and yield
- Labour savings



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 (heavy)	Pink	150 & 180	1
Red Haven	Pink	150	1
PF17	Pink	180	2
Saburn	Pink	150	2
Fantasia	Shucks 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

Oposing



Variety	Timing	Rotations Per Minute	Miles Per Hour
White Lady	Pink	150 & 180	2
PF 17	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	200 & 220	1
White Lady	Pink	180	2

Four On, Four Off



Variety	Rotations Per Minute	Miles Per Hour
Red Haven	200	1

Materials and Methods - Peaches

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

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



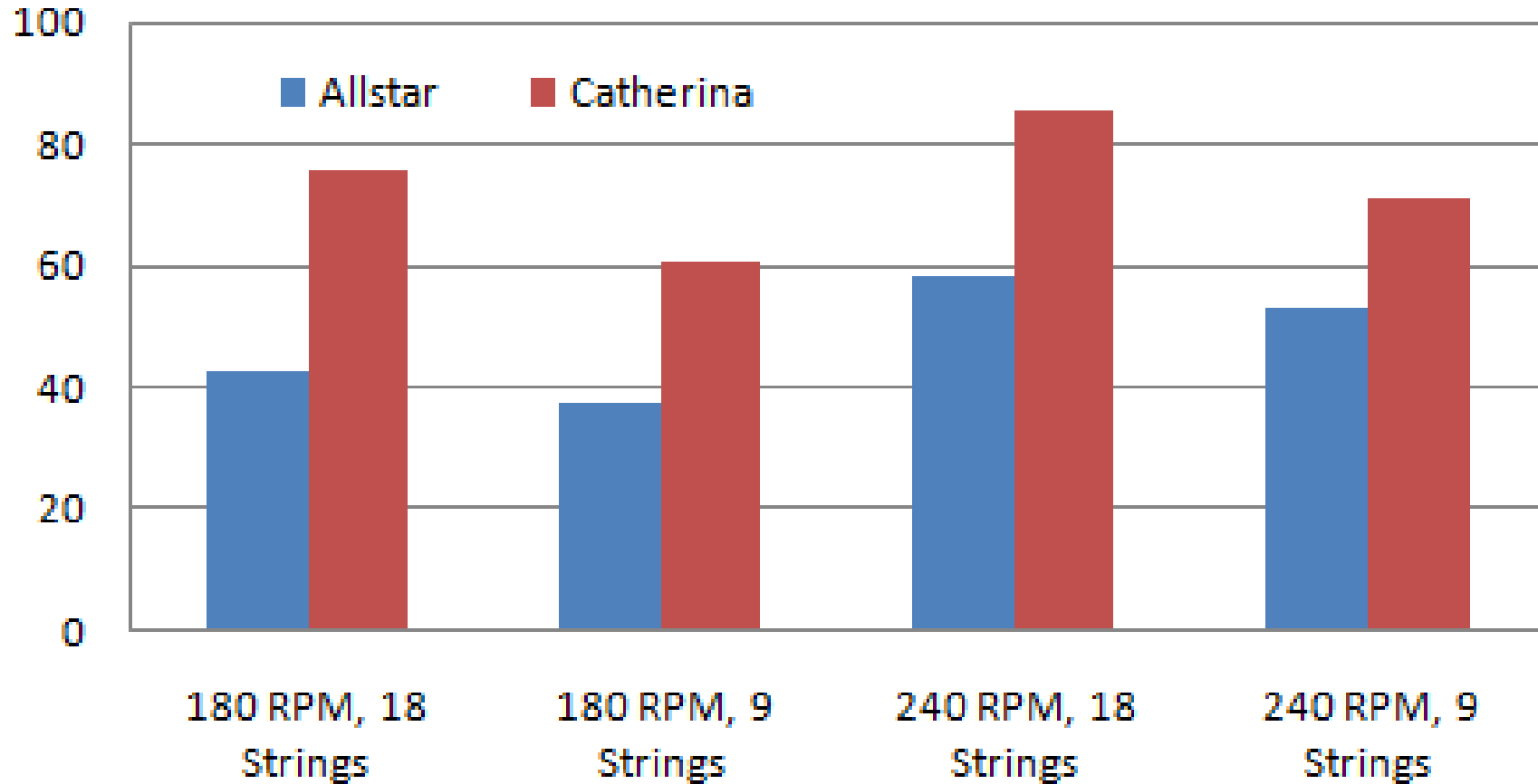
Measurements

- 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,

Video of Thinning Allstar Peaches NOTL

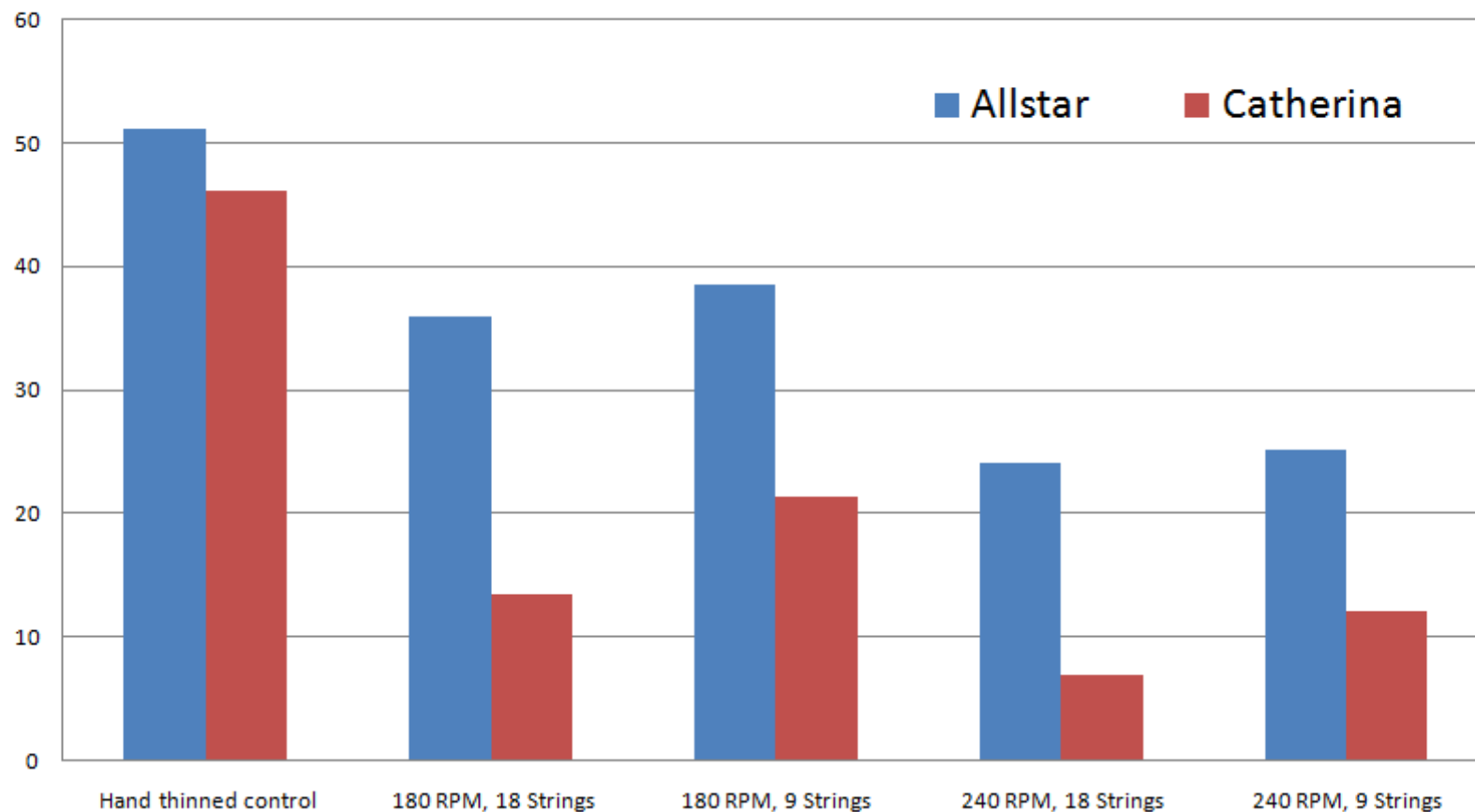


Percent flowers Removed



Allstar: 37-53 Catherina: 60-85%

Fruit set (%)



- 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		**	
<i>P</i> value	0.1624		0.0015	
Contrasts (<i>P</i> 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	**		*	
<i>P</i> value	0.0061		0.015	
Contrasts (<i>P</i> 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/ha) – vertical axe

Objectives:

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



Results – Apples

- Mechanical thinning (MT) reduced crop load comparable with hand thinning for Gala, less effective on Ambrosia
- Chemical thinning (CT) alone had comparable crop loads as hand thinned trees
- MT+CT effect was additive and resulted in over-thinning for Gala, but not Ambrosia
- Fruit weight was increased when crop load was reduced



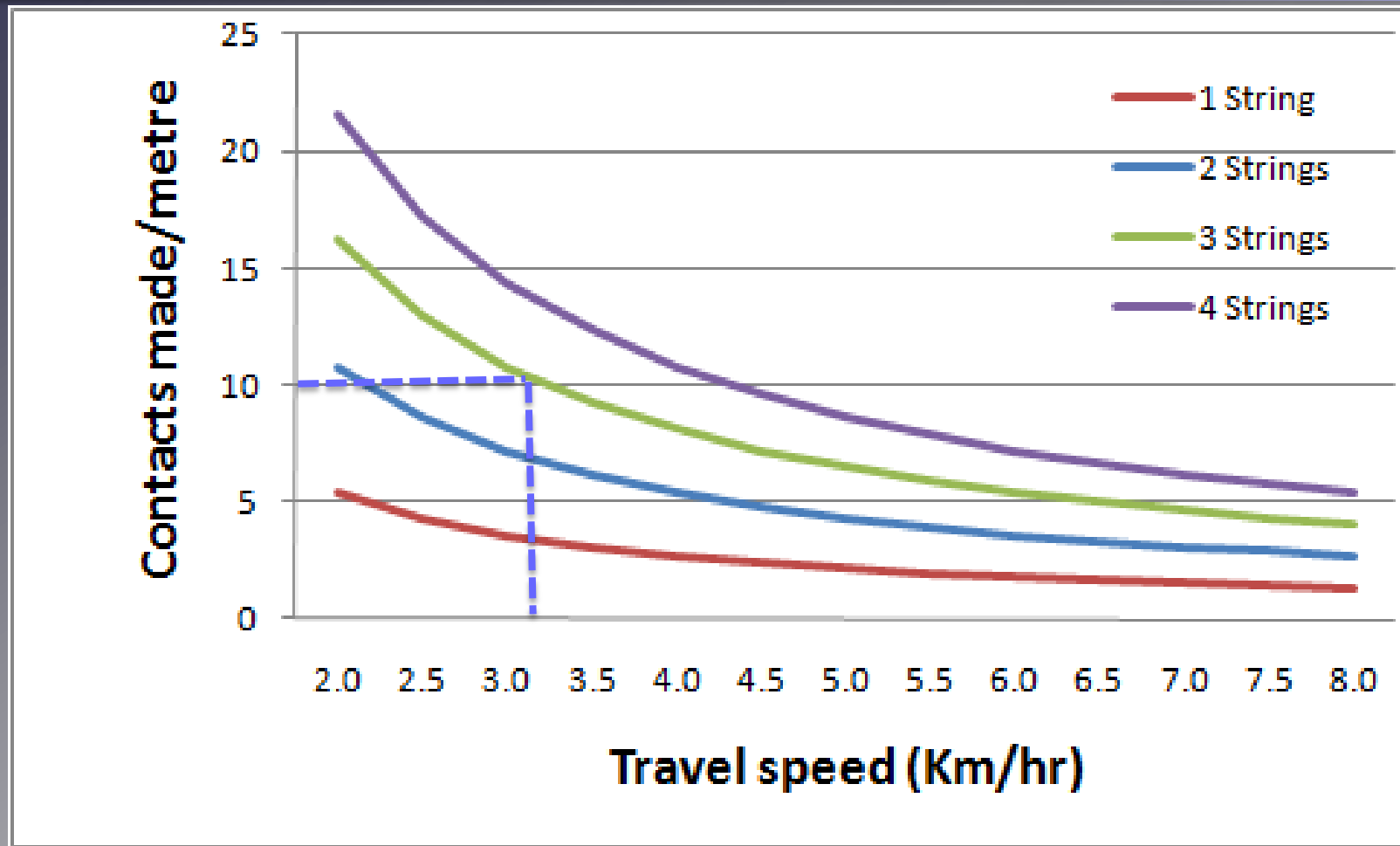
Results – Pennsylvania

- Evaluated in vertical axis (apple) and “V” peach systems
- Mechanical thinning (MT) reduced crop load by 36%
- Decreased hand thinning by 20-40%
- Increased fruit size
- Net economic impact ranged from \$175/ha to \$1966/ha
- Increased spread of FB when moving from inoculated to non inoculated trees

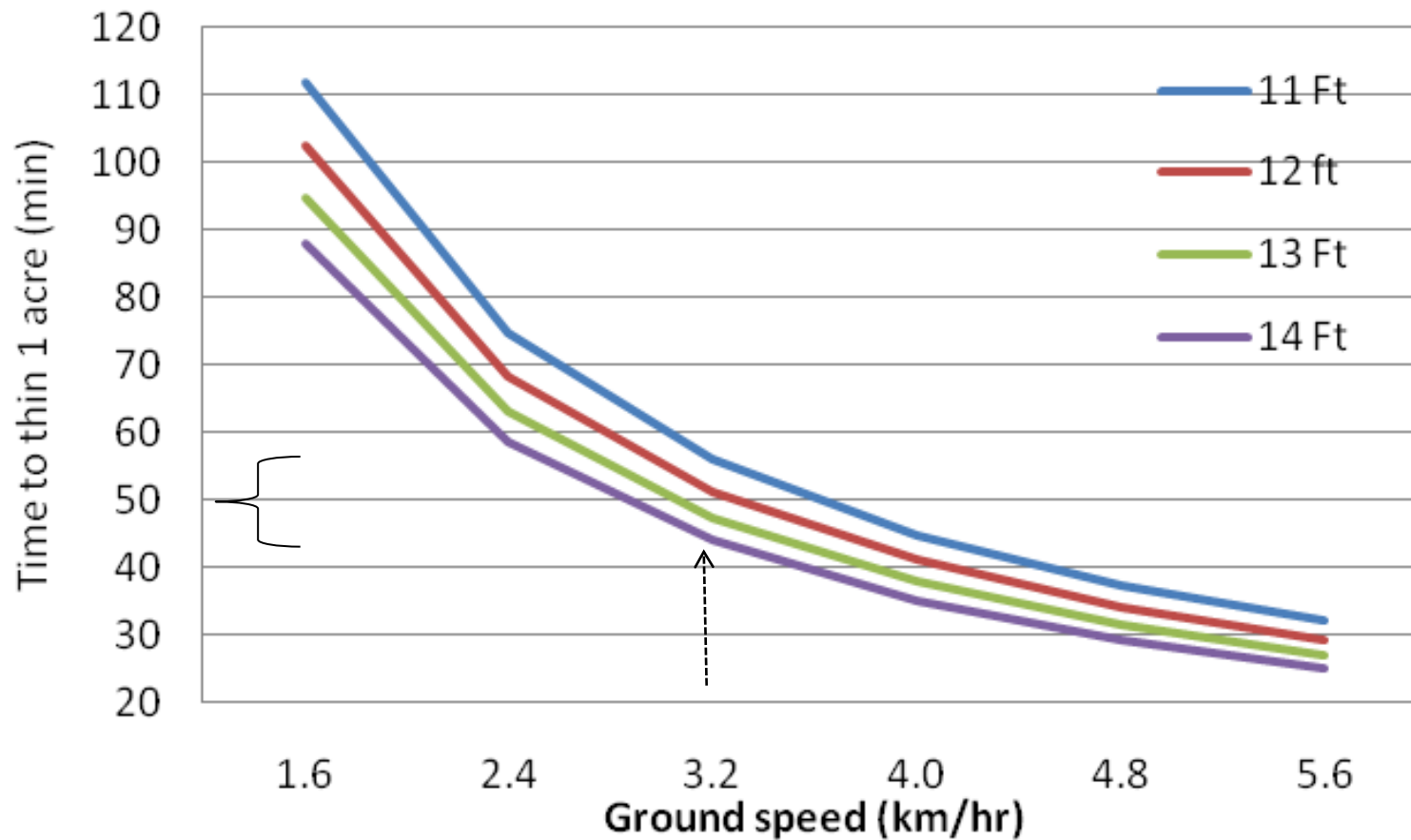
Schupp et al, 2008.
HortTechnology 18:660

Ngugi and Schupp, 2009.
Hort Science 44:862

Mechanical Contact in Relation to Ground Speed at 180 RPM



Relationship between ground speed, between row spacing, and time to thin 1 acre



Estimate of Mechanical Thinning Device Costs

Based on initial purchase price of \$15,000

10 yr life span

8% interest (interest costs around \$6,500)

Costs of Purchase = ~ \$2,100/year

Would need to factor in tractor, operator costs, maintenance etc.

Challenges & Future Research

- Untested on sweet cherries
- Tree architecture will need to be adjusted to make best use of this technology
- Effects on leaf injury are unknown
- Other `soft` chemical approaches for blossom thinning tree fruit is merited

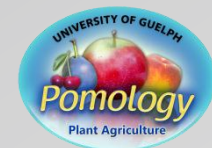




www.plant.uoguelph.ca/treefruit

<http://www.fruit-tec.com>

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



Acknowledgements

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