Economics of Orchard Mechanization

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2017 Eastern Horticulture Fruit Schools,
February 13-15 , 2017

Agenda

- Efficiency and why it matters
- Farm efficiency: past, present and future
- Platforms
- Payback analysis
- Preparing for future technology

Efficiency – Why Does it Matter?

- Reminder: You are in business to make money!
- Fruit farming is labor intensive
- Sourcing good employees is challenging
- It's not all about labor $$ savings
  - Freeing up time
  - Not getting behind
  - Getting job done

"Seconds add up to minutes, minutes add up to hours, hours add up to days……."

Labor Costs

Expenses	2015	Percent
Labor, Direct	$ 2,367	39.7%
Labor, Indirect	$ 488	8.2%
Crop	$ 1,682	28.2%
Equipment	$ 481	8.1%
Real Estate	$ 407	6.8%
Other	$ 541	9.1%
Total	$ 5,966	

Fruit Farming Efficiency Improvements

- Tractors
- Sprayers: Hand operated pump to air-blast sprayers (50's)
- Fork lifts
- Bins (late 50's)
- Rotary mowers (50's)
- Pruning guns and baskets (50's)
- Cherry shakers
- Boom weed sprayers (70's)
- Brush pushing to choppers

thm00007 Hamlin Municpal Historian Collection

- Fertilizer spreaders
- Tree planters (80's)
- Trucks – 6 wheeler to 10 wheeler to tractor trailers

Current Fruit Farming Efficiency Improvements

- Bin trailers
- Platforms
  - Dormant & Summer Pruning
  - Hand Thinning
  - Trellising
  - Harvest
- Hedgers
- String Thinners
- Double forks
- Multi-row sprayers

Show of Hands

- Who uses a platform(s) for pruning, hand thinning or trellising?

Types of Platforms

- Self propelled vs. tractor pulled
- Self steering vs. manual
- Self leveling vs. fixed
- Fixed vs. movable work area
- Combination orchard training & harvest
- Home-made
- Commercial
  - N-Blosi - Europe
  - Huron Systems - NY
  - REVO - Italy
  - Pluk O Trak - Netherlands
  - LaGasse – NY
  - Brownie - MI

Orchard Training Platform

Home Made Orchard Training Platform

Harvest and Orchard Training Platform

Pruning Trials and Results

Study	Platform	Traditional	Platforms	Efficiency Gain
2009	N-Blosi 25, Grower Self-propelled, Grower bin trailer	1.26 min/tree	0.92 min/tree	0.34 min/tree or 27%
2013	LaGasse Tractor Mounted Platform	0.4 min/tree	0.25 min/tree	0.15 min/tree or 37%
2013	LaGasse Tractor Over the Row Platform	0.34 min/tree	0.18 min/tree	0.16 min/tree or 47%

Fruit Quarterly Summer 2015: Mario Miranda-Sazo, Terence L. Robinson
Tall spindle plantings

Hand Thinning Trials and Results

Study	Platform	Traditional	Platforms	Efficiency Gain
2013	LaGasse Tractor Over the Row Platform	0.40 min/tree	0.20 min/tree	0.20 min/tree or 50%
2013	LaGasse Tractor Mounted Platform	0.20 min/tree	0.11 min/tree	0.09 min/tree or 45%

Fruit Quarterly Summer 2015: Mario Miranda-Sazo, Terence L. Robinson
Tall spindle plantings

How to Determine Payback – Pruning and Thinning "Quick and Easy"

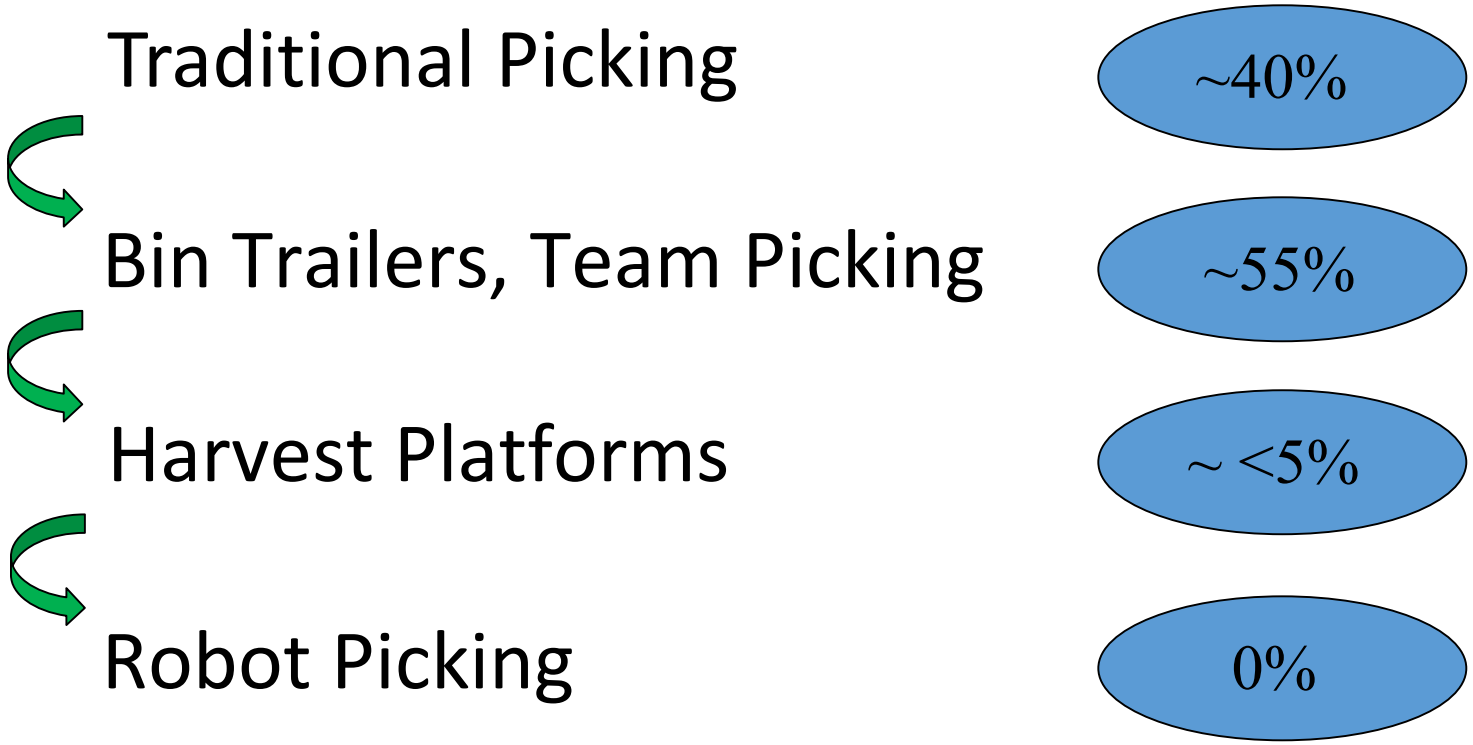
1. Identify number of acres that a platform can be used to effectively get the job done
2. Determine average costs per acre using traditional methods
3. Estimate the labor efficiency of the platform (use research data, manufacturers claim, neighbors experience, borrow and trial)
4. Determine costs for platform
5. Determine your payback goal in years

		Dormant Pruning	Hand Thinning	Summer Pruning	Trellis Work
1	Traditional ($/acre)	$ 400	$ 750	$ 200	$ 100
2	Efficiency Gain	37%	45%	37%	50%
3	Platform ($/acre)	$ 252	$ 413	$ 126	$ 50
4	Savings ($/acre)	$ 148	$ 338	$ 74	$ 50
5					
6	Acres Utilized	50	25	15	10
7	Annual Savings	$ 7,400	$ 8,438	$ 1,110	$ 500
8					
9	Total Savings	$ 17,448			
10	Cost of Platform	$ 65,000			
11	Payback (Years)	3.7			

Show of Hands

- Who harvests in traditional format – individual picker with ladder?
- Who picks in teams and uses trailers?
- Who uses a platform to harvest?

Harvest Mechanization: Current States (western NY)

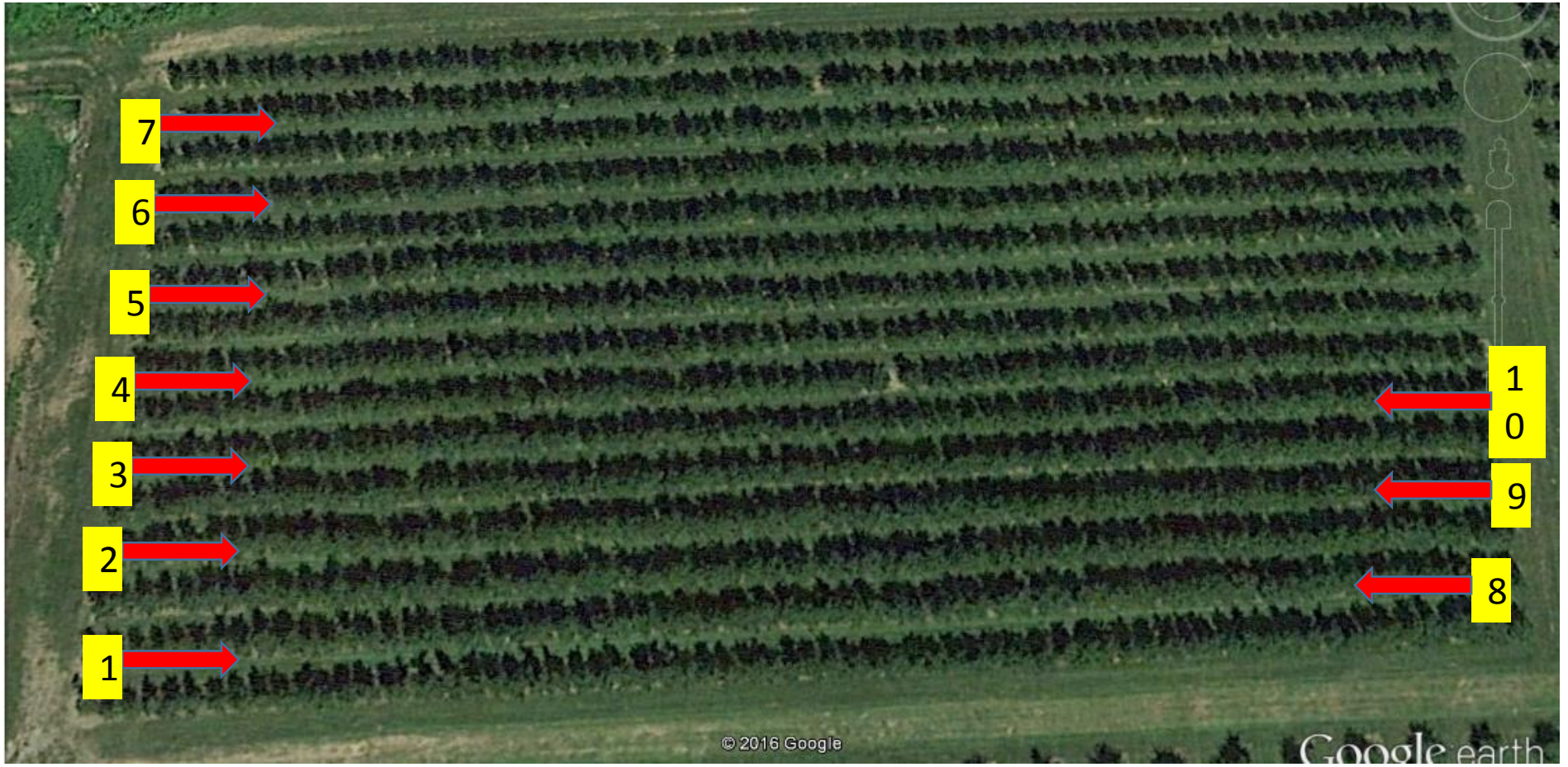


Team Picking and Trailers/Sleds

Team Picking and Trailers/Sleds

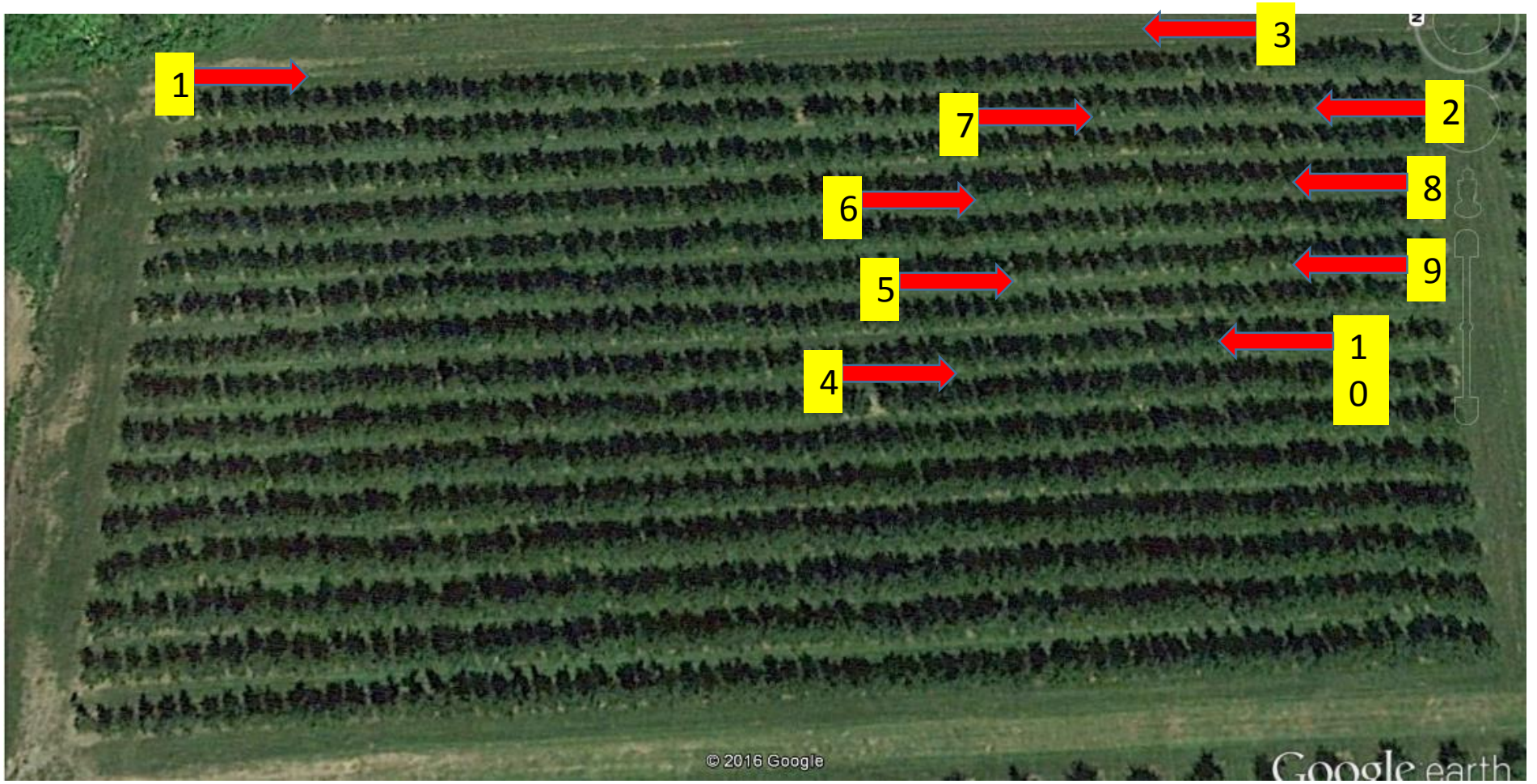
Traditional Picking Method

Traditional Picking Method – Individual Picking

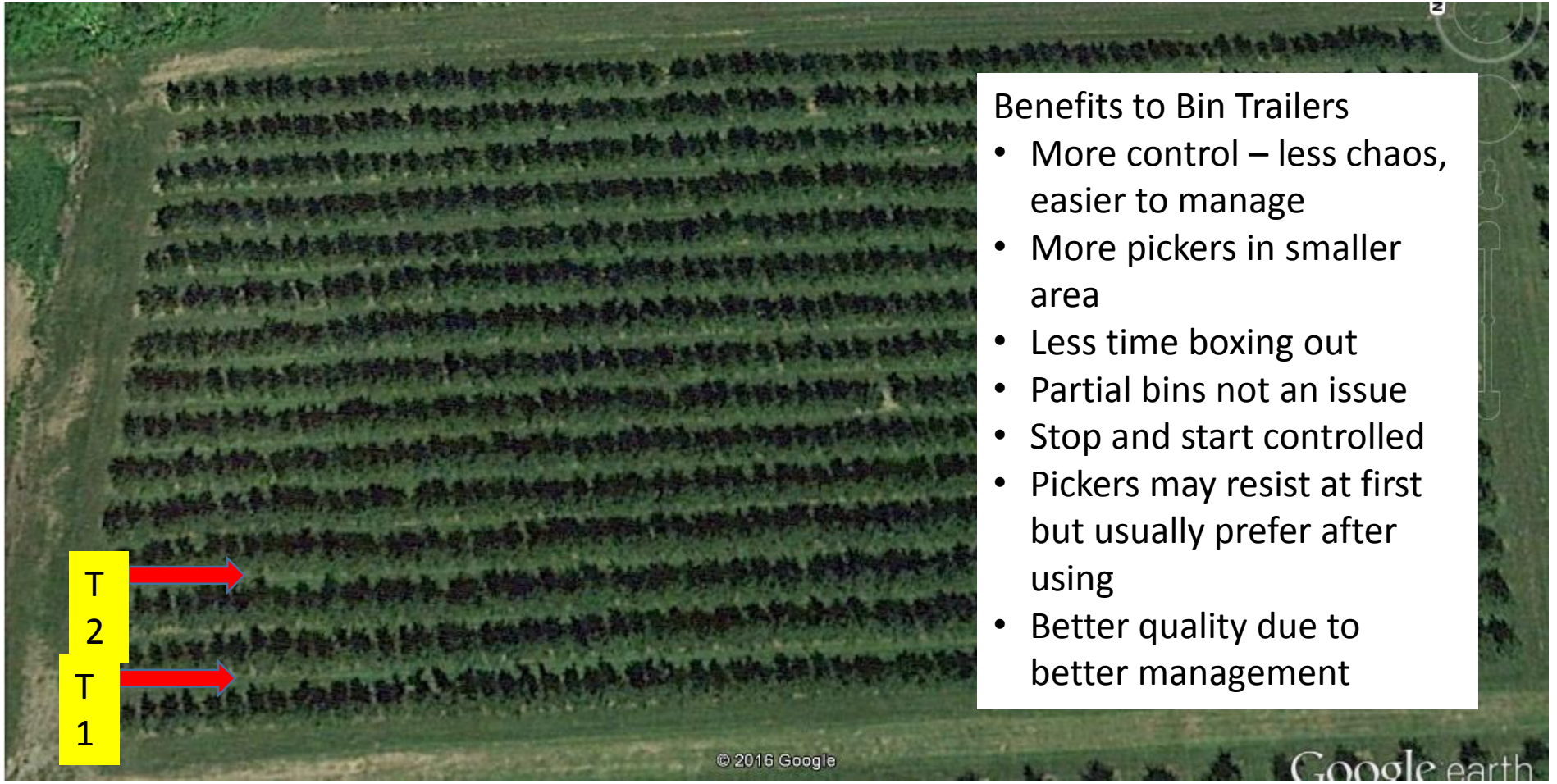


Traditional Picking Method – Chaos Begins

Traditional Picking Method – Chaos



Bin Trailer Method – Team Picking, Simple and Controlled



Benefits to Bin Trailers

- More control – less chaos, easier to manage
- More pickers in smaller area
- Less time boxing out
- Partial bins not an issue
- Stop and start controlled
- Pickers may resist at first but usually prefer after using
- Better quality due to better management

Harvest Platforms

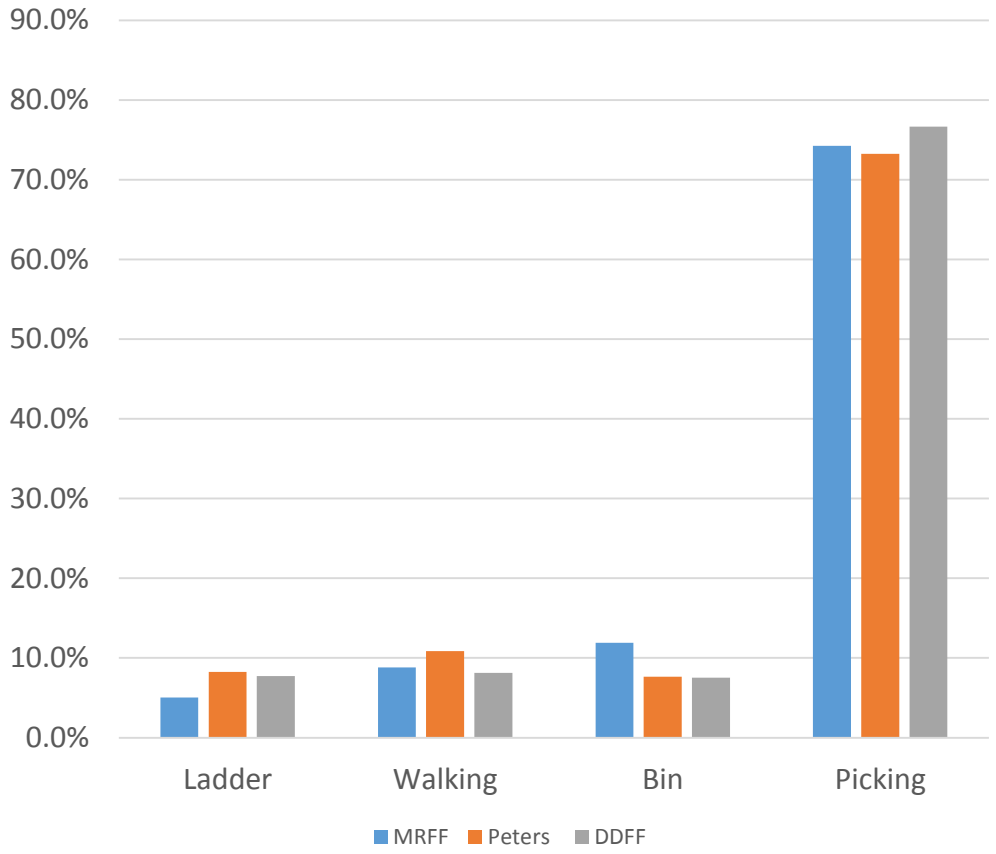
Harvest Platforms

Picking the Tops of Narrow Wall

Traditional Picking Efficiency (one pick)

Activity	MRFF	Peters	DDFF
Ladder	5.1%	8.2%	7.7%
Walking	8.8%	10.9%	8.1%
Bin	11.9%	7.7%	7.5%
Picking	74.3%	73.2%	76.7%
Opportunity	25.7%	26.8%	23.3%

Activity	MRFF	Peters	DDFF
Ladder	3.0	4.9	4.6
Walking	5.3	6.5	4.9
Bin	7.1	4.6	4.5
Picking	44.6	43.9	46.0
Opportunity	15.4	16.1	14.0



2015/16 Trial Results and Economics

- 13-17% efficiency gains in one-pick trials
- Spot picking not trialed but much better efficiencies (25+%)
- Economic analysis included pruning and hand thinning
- Platforms used for full season activities has a quick return
- Platforms for only harvest longer payback period due to lower efficiencies and use

Years Required to Payback Platform Investment by Acreage and Platforms Purchased			
	Acres		
Platforms	50	150	300
1	3.6	1.5	1.1
3	10.2	3.6	2.1
5	Not needed	5.7	3.2
7	Not needed	Not needed	4.0

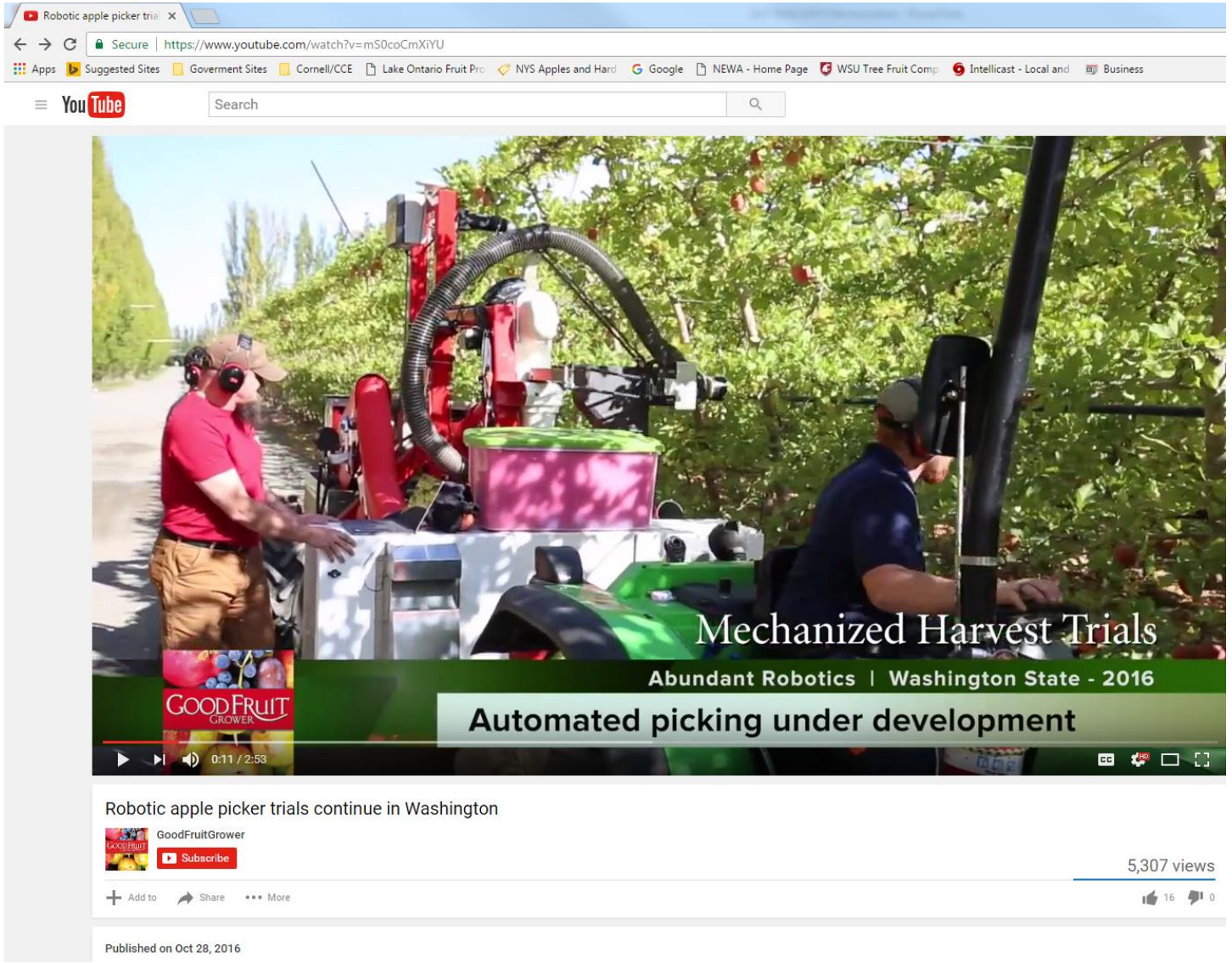
Key “Take-Aways” from Trials

- Pickers prefer platform
- There is a learning curve – mostly around working as a team
- Narrow fruiting walls more suitable due to one side picking
- <14’ Rows required, <12’ best
- Support equipment and bins needs to match platform
- More harvest platforms needed than required for pruning/thinning

Additional Considerations or Benefits

- Improvements in pack out rates?
- Night picking
- Benefit of “getting the job done”
- Lower injury rates (ladder falls)
- Lower turnover – preferred employer
- Access to a larger labor pool

The Future


Robotic apple picker trial
Secure | https://www.youtube.com/watch?v=mS0coCmXiYU
Apps Suggested Sites Goverment Sites Cornell/CCE Lake Ontario Fruit Pro NYS Apples and Hard Google NEWA - Home Page WSU Tree Fruit Comp Intellicast - Local and Business
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Mechanized Harvest Trials
Abundant Robotics | Washington State - 2016
Automated picking under development
GOOD FRUIT GROWER
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Abundant Robotics

Prepare for the Future

- Narrow fruiting surfaces are more conducive to harvest mechanization
- With no narrow canopy orchards on a farm today a 5% orchard renewal rate takes 20 years for full conversion
- Waiting a few years to “see if robotics work” and become commercial puts orchard further out in readiness

The Best Way to Predict the Future is to Create It. – Abraham Lincoln