

# Orange Harvester

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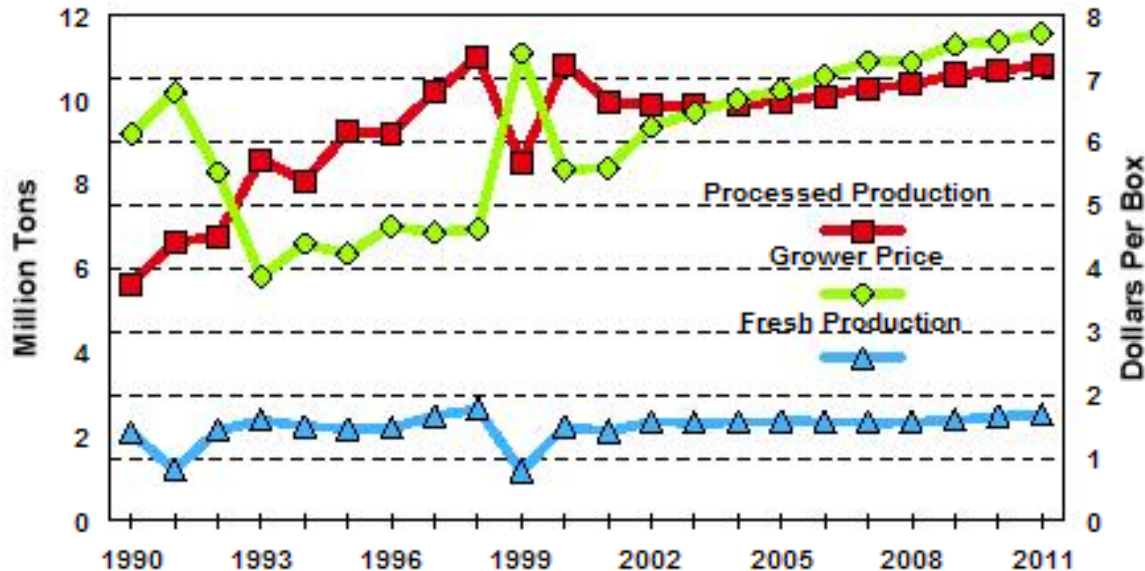
**Red B Mockup Presentation  
October 20, 2005**

# U.S. Orange Market

**Fresh:** 2.5 Million Tons (20%)

**Processed:** 10 Million Tons (80%)

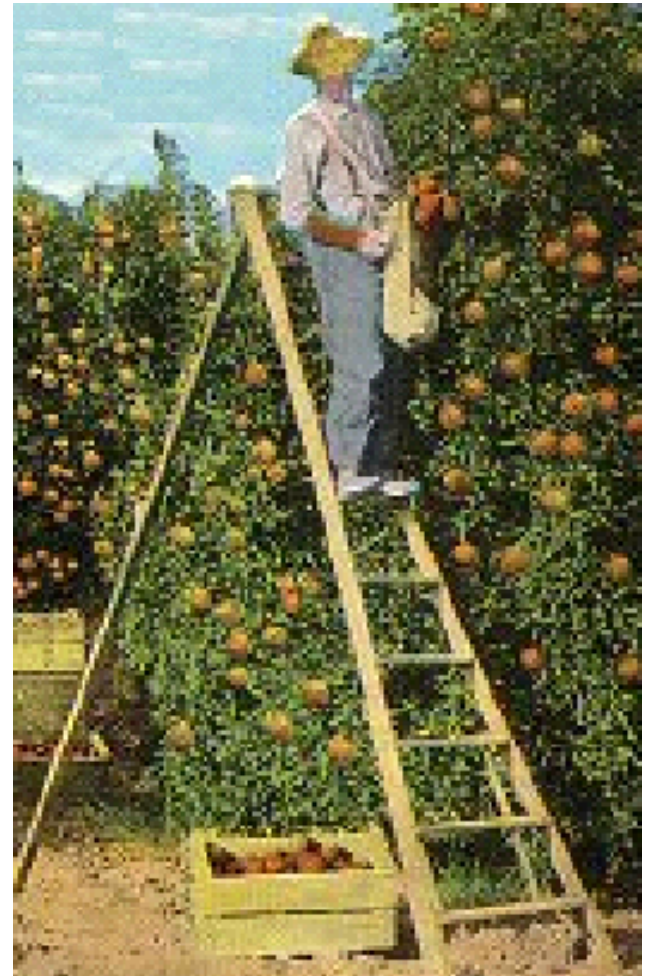
U.S. Orange Production and Price



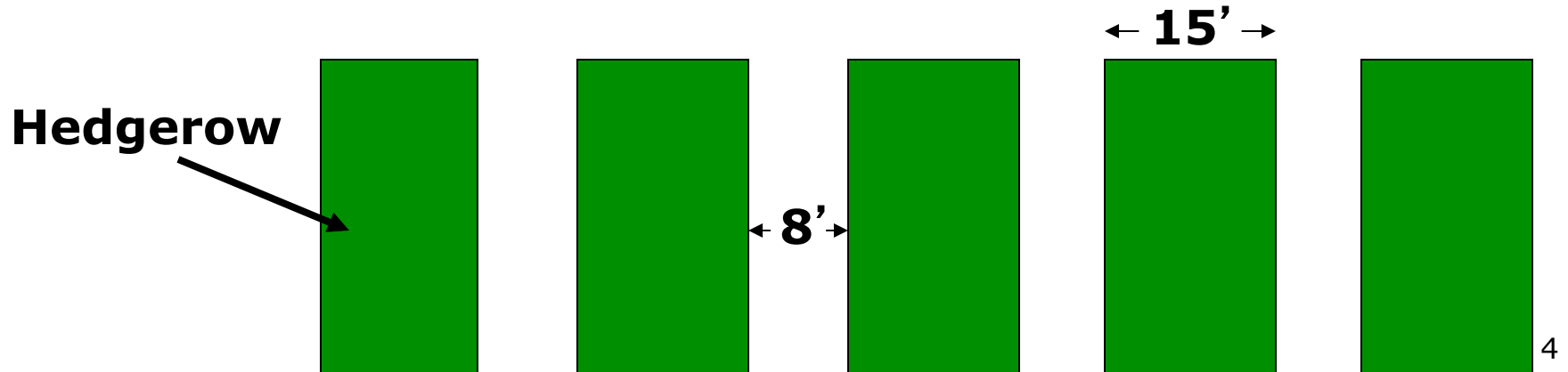
# Baseline Harvesting

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- Hand picked
- Carry bag
- Fiberglass ladders
- Dump into 1,000 pound box
- Fork lift and truck collect box



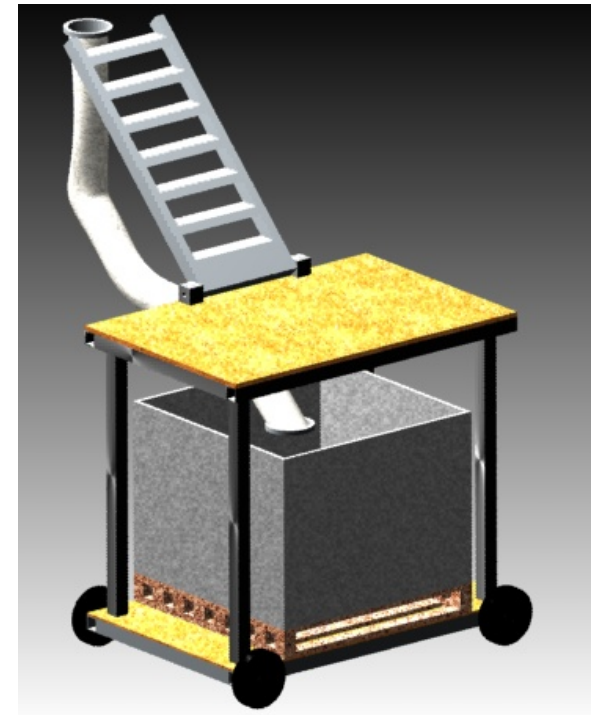
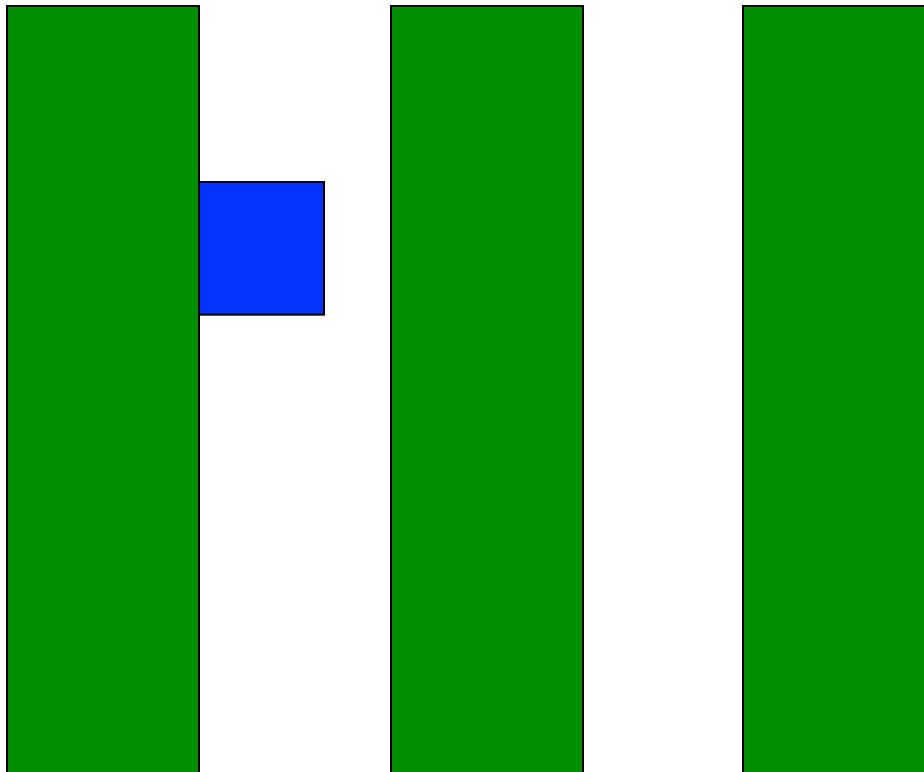
# Grove Layout



# Product Proposition

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To assist hand pickers & be faster, more efficient and safer





# Key Issues

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1. Platform and **Chute Design**
- 2.
3. Harvesting Rate Improvements

# Technical Analysis

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<b>Customer Needs</b>	<b>Product Attributes</b>	<b>Engineering Specs</b>
Faster picker than humans alone	Eliminate time wasting steps (moving ladders, emptying bag, etc)	Develop chute: 3600+ oranges per hour per person
All oranges can be reached	Allows workers to climb up into tree and lean out from platform	5 ft pivoting ladder
Orange Quality	Oranges must get to bin without damage	Compliant chute used to deliver oranges to bin
Cleanliness	Can be sterilized	Removable chute

# Platform Design

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# Our Mockup

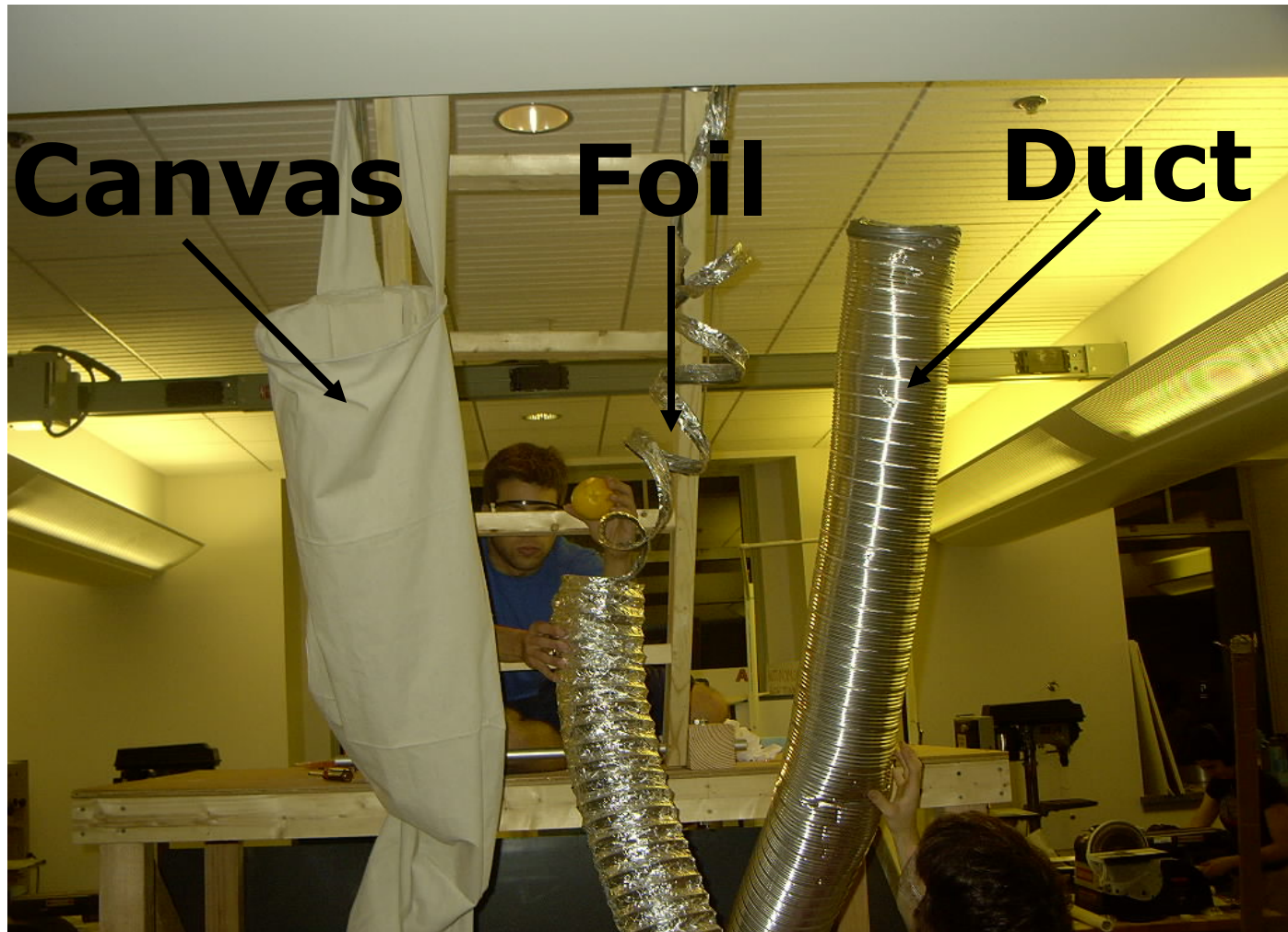
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- Why did we build it?
  - Spatial understanding of the product
  - Key issues: design and operation
- What did we learn?
  - Scale and human interaction
  - Chute tests

# Mockup



# Chute Test



# Canvas/Duct Chute

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Foil: Broke apart

Canvas: Not rigid

Duct: Too fast

**Solution:**

**Canvas in Duct**

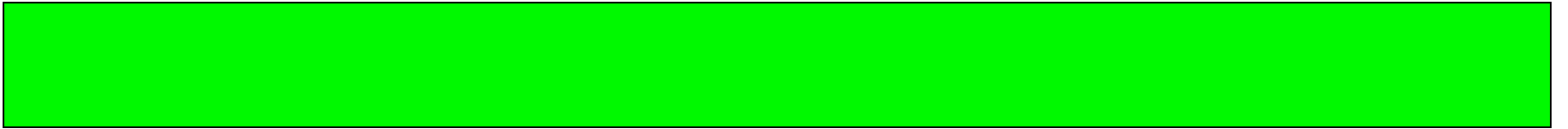


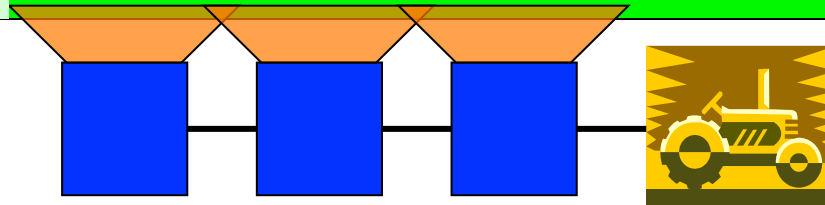


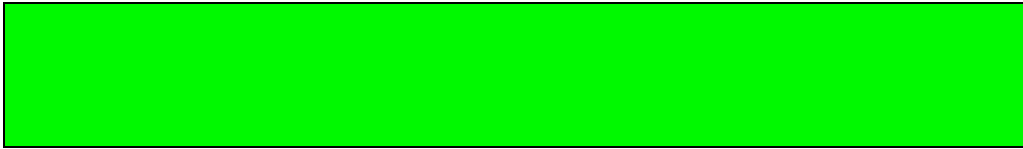
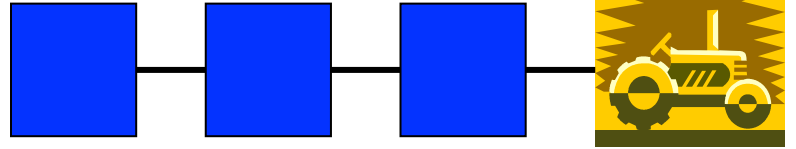
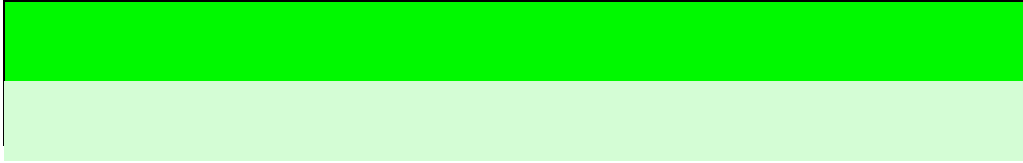
# System Process

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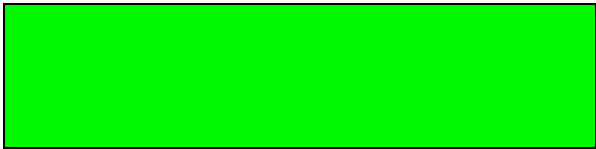
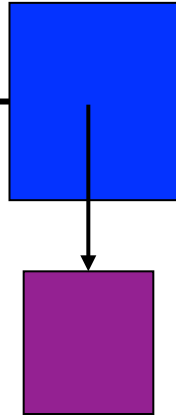
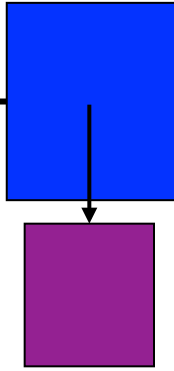
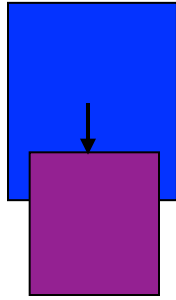
- Connect platforms into a short train
- 1 Platform ~ 5 trees
- “Quick change” operated by pickers
- Reload with empty boxes

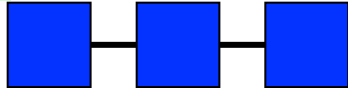
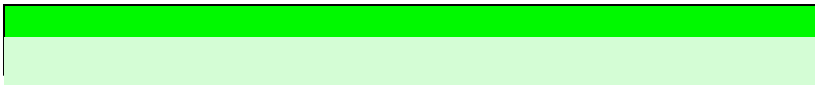












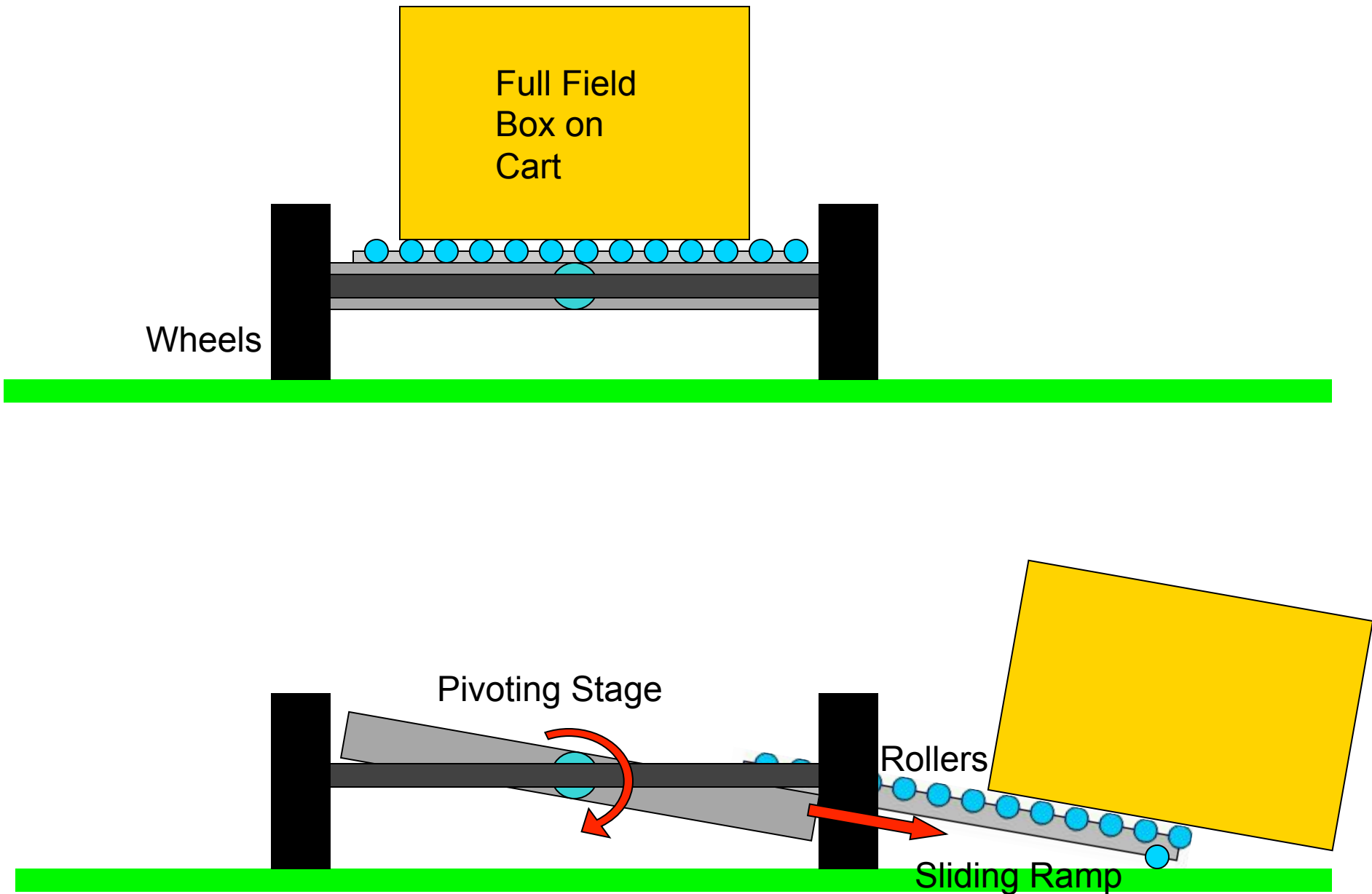
Wheels

Full Field  
Box on  
Cart

Pivoting Stage

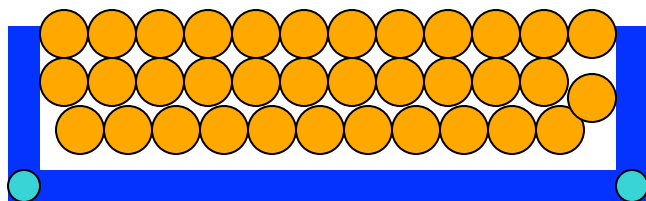
Rollers

Sliding Ramp



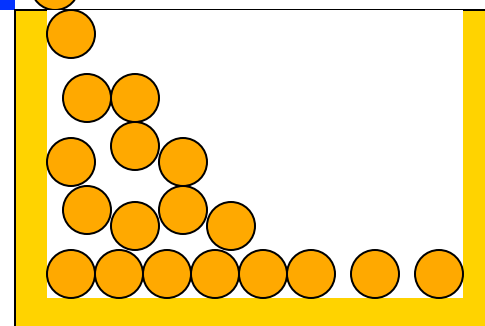
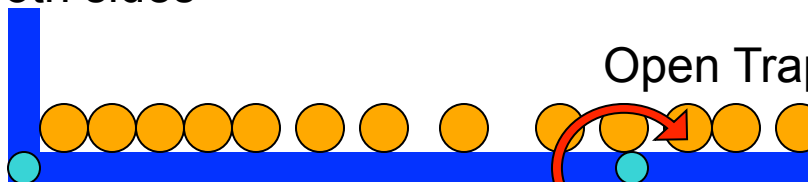
Elevated  
Container

Wheels



Trap Doors on both sides

Open Trap Door



# Rate Improvement

	<b>CURRENT method</b>	<b>PROPOSED method</b>
<b>Picking fruit from tree</b>	>2 fruit/sec	Same
<b>Getting to Fruit</b>	Climbing ladder	Stand on platform
<b>Transporting fruit</b>	Carry 45lb bag down ladder to stationary field box	Fruit sent down chute into field box
<b>Overall Productivity</b>	~810 lbs/hour	Up to 900lbs/hr <b>~10% improvement</b>



# Cost Estimation

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- Decrease tree height 6 ft = 10% speed improvement
- \$900 savings/worker/year
- Cost/platform < \$3500 (pay off in 2 years)

# Next Steps

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- Test mechanism for quick change
- Increased chute compliance
- Pick materials
- Wheel size and alignment
- Linkage details
- Testing



# Acknowledgments

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