Harvest Mechanization

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Harvest Goal:

"To gather a crop…

- at the proper maturity/ripeness
- with minimal injury/loss
- as rapidly as possible
- at a minimal cost"

Adapted from: Harvesting Systems. J.E. Thompson. 2002

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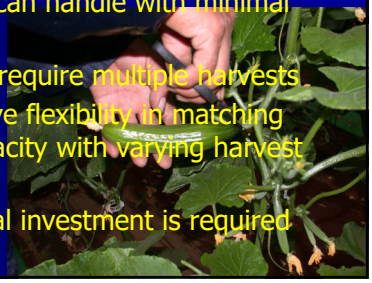
Why are most crops hand-harvested??

- People are excellent at perceiving quality and can handle with minimal injury
- Many crops require multiple harvests
- Growers have flexibility in matching harvest capacity with varying harvest needs
- Lower capital investment is required



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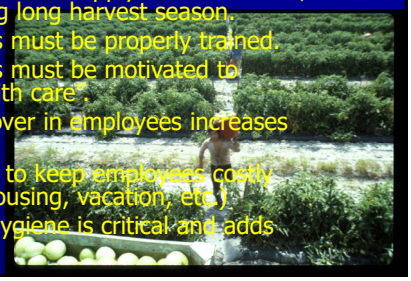
Limitations of hand harvest

- Harvest can be inefficient.
- Consistent labor supply can be difficult, esp. during long harvest season.
- Employees must be properly trained.
- Employees must be motivated to "handle with care".
- High turnover in employees increases costs.
- Incentives to keep employees costly (health, housing, vacation, etc.)
- Personal hygiene is critical and adds costs.



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Delicate Crops: Field Pack

Harvest directly into consumer pack (clamshell)

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Harvest & handling: reducing impacts = less mechanical damage

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Harvest into field bins

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Types of mechanical injury

- *Bruises*
  - *Impact: Excessive drop heights*
  - *Compression: Excessive weight*
- *Cuts, Punctures, Abrasion*

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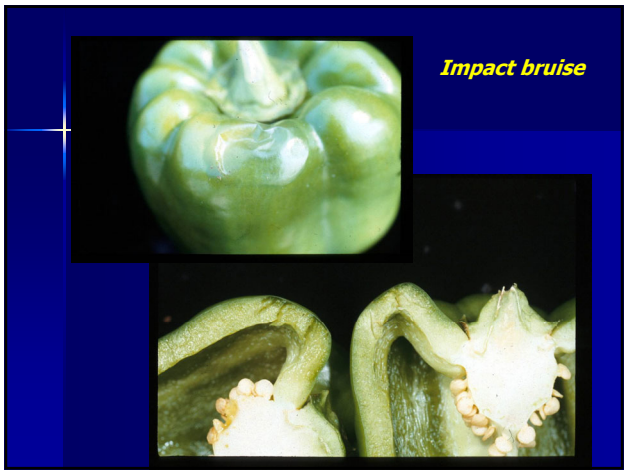

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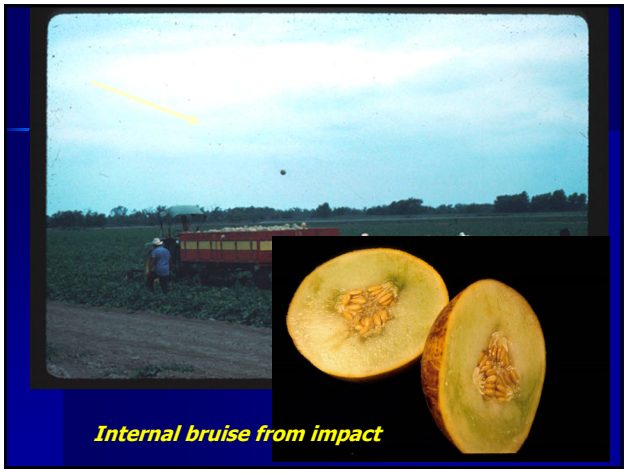

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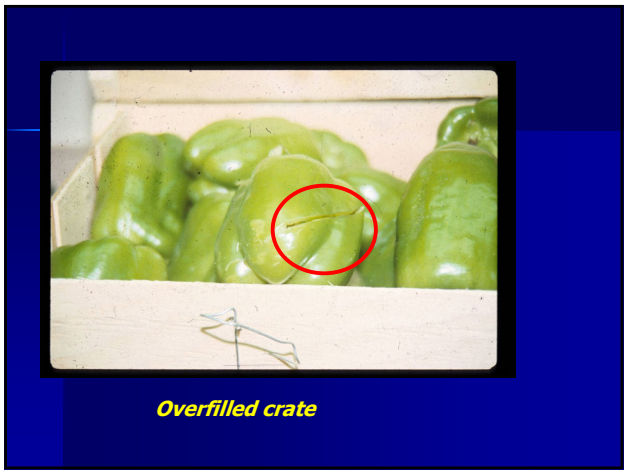

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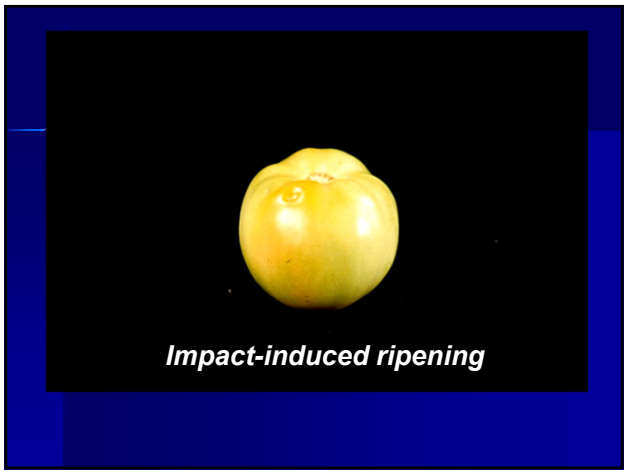

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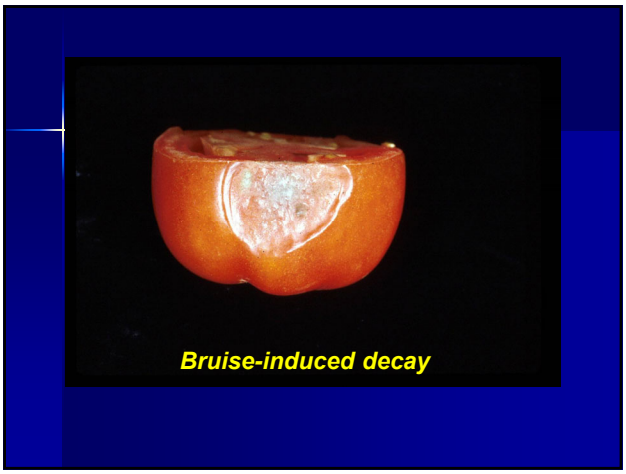

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Harvest aids: a partial solution

- These machines increase harvest efficiency by speeding up harvest operations.
- Belt conveyors, platforms, "mule trains" are most commcommonly used.
- Night harvest with lights in Calif.

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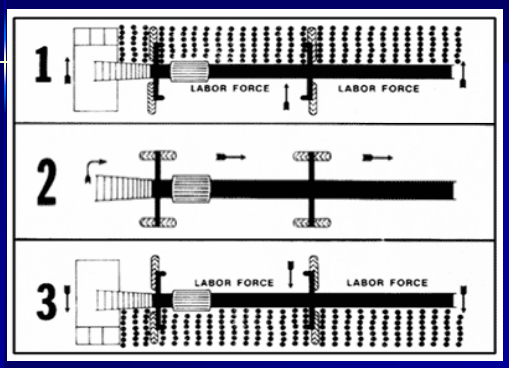
Top View



Ramsay Highlander, Inc., Salinas CA

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Continuous harvest

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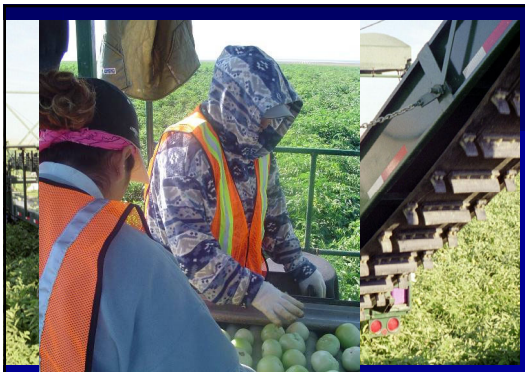

- "On-board" sorting and trash removal
- Possible sanitation rinse step

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Impact Analysis

- Based on modified version of North American Vegetable Market Model (VanSickle)
- Calculates impact of increased harvest efficiency on:
  - 4 Florida production areas
    - Miami-Dade County, Southwest, Palm Beach County and Palmetto/Ruskin
  - Fall and Spring crops

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Impact Analysis

- Also analyzes competing production areas:
  - Mexico (Sinaloa; Baja California)
  - California (northern; southern)
  - South Carolina
  - Virginia/Maryland
  - Alabama/Tennessee

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Change in average market share

Reduced Harvest Cost	Florida Districts				California	
	Dade	Palm Beach	Palmetto/ Ruskin	South-west	South	North
10%	1.6%	0.2%	3.6%	0.4%	-0.4%	0.0%
20%	3.2%	-0.2%	7.7%	1.2%	0.3%	0.0%

Reduced Harvest Cost	Other States			Mexico	
	Alab-Tenn	South Carolina	Virg-Maryl.	Sinaloa	Baja Calif.
10%	-0.3%	0.0%	-0.1%	-5.7%	0.5%
20%	1.5%	-0.4%	-0.6%	-11.4%	-1.4%

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SIMULATION

The Net Present Value (NPV) of a project or investment

=

the sum of the present values of the annual cash flows minus the initial investment.

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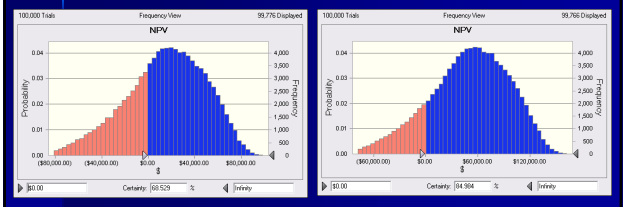
RESULTS OF SIMULATION



60 Acres

80 Acres

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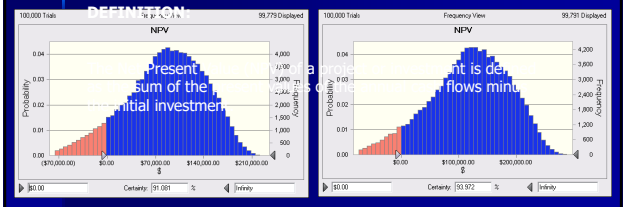
RESULTS OF SIMULATION

Net Present Value (NPV)



100 Acres

120 Acres

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Strawberry Harvest Aid

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Picking

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Loading

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MECHANICAL HARVEST

- Most effective for once-over harvests.
- Commonly used for:
  - Roots, tubers, rhizomes (cushioned by soil)
  - Leafy crops (some protection from outer leaves
  - Crops destined for processing (processed quickly)

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Advantages of mechanical harvest

- Has high harvest efficiency.
- Fewer labor management issues.
- Reduces fatigue for workers.

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Making mechanical harvest efficient

- Requires higher skilled workers
- Machines require regular servicing
- Production techniques may need to be changed to conform to the harvester
- Uniform crop stands and harvest maturity are essential
- Machines must be used as much as possible for best return on investment

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Disadvantages of mechanical harvest

- Higher losses due to excessive injury to crop
- Machines may become obsolete before being paid off
- Harvest rate may exceed subsequent handling capability, causing down time
- *Example: A pepper packing line with optical sizer was too fast for hand packing operation.*

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Snap bean harvest:
Price can determine harvest method

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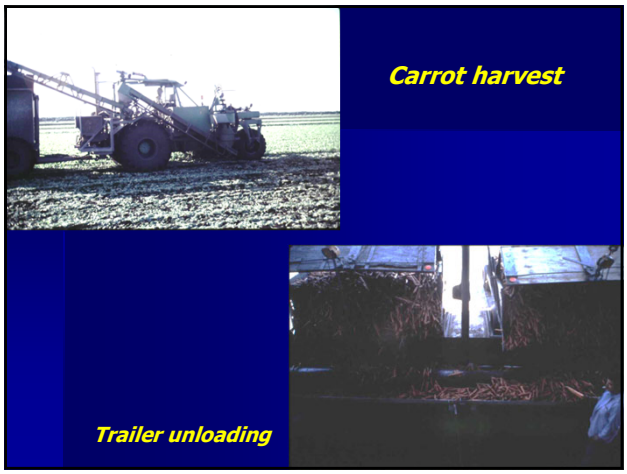

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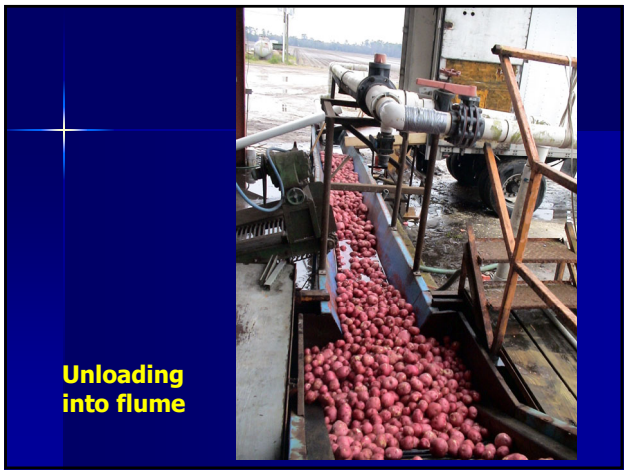

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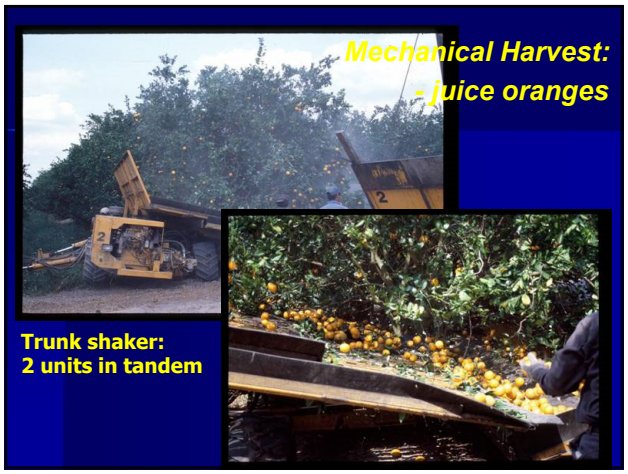

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Robotics in Agriculture

- Several units demonstrated at FIRA USA 2022:
- https://youtu.be/O3bfMgFU9bE

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Robotic Harvesting

- Harvest CROO – Florida-based
- https://youtu.be/AO1mZrB5XK8

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Robotic Harvesting

- Agrobot – from Spain
- https://youtu.be/VJRoco8Uh4E

- Sweeper pepper harvester
- https://youtu.be/5chk9Sory88

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Summary: To be effective, consider…

- Crop suitability for mechanical harvest
- Changes necessary in crop planting
- Labor availability
- Cost/benefit analysis

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