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”

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.
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.
Delicate Crops: Field Pack

Harvest directly into consumer pack (clamshell)
Harvest & handling: reducing impacts
= less mechanical damage
Harvest into field bins
Harvest aids: a partial solution

- These machines increase harvest efficiency by speeding up harvest operations.
- Belt conveyors, platforms, “mule trains” are most commonly used.
- Night harvest with lights in Calif.
Harvest aids: as simple as cloth...
...or a cart
Field packing station: pushed through field
Mobile Packing Unit (mule train)

Corn packed on self-propelled unit

Sweetcorn
Semi-Field Pack

Packing shed in field

Carton stapling: puncture
Orders determine type of pack

Head lettuce

Carton Pack: "naked lettuce"
vs. over-wrapped heads, packed in carton
Increasing Harvest Efficiency

- Self-propelled, over-the-row conveyor systems
  - Conveyed to side for bulk transport
Continuous harvest
• “On-board” sorting and trash removal
• Possible sanitation rinse step
Crop conveyed to gondola or bins
Strawberry Harvest Aid
Picking
Loading
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)
Advantages of mechanical harvest

- Has high harvest efficiency.
- Fewer labor management issues.
- Reduces fatigue for workers.
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
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.*
Snap bean harvest:
Price can determine harvest method
Radish harvest
Radish trailer unloading & washing
Radish Bagging
Celery Harvest
Celery harvest

“Pillow” reduces drop height
Celery Harvest
Carrot harvest

Trailer unloading
Washing, cooling, grading
Potato Harvest
Unloading into flume
Mechanical Harvest:
- juice oranges

Trunk shaker:
2 units in tandem
Two Concerns:
- Bark damage
- Bloom removal
Robotics in Agriculture

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

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

- Agrobot – from Spain
  - https://youtu.be/VJRoco8Uh4E
- Sweeper pepper harvester
  - https://youtu.be/5chk9Sory88
Summary: To be effective, consider...

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