Mechanical Harvesting of Hazelnuts
Scott Sanford
Agricultural Extension Engineer
Biological Systems Engineering

Why Mechanized Harvest

- You can’t afford to hand pick and make a profit
  - 13# in-shell/hour @ $15/hr labor = $1.15/#
  - 30% kernel = $3.83 / # kernel .... Too high??
- 15-30 minutes per bush?
- Labor availability
- Harvest machines can be used for other crops – Blueberries, raspberries, others

Harvest Research

- Main Objectives
  - Evaluate performance of different shaking mechanisms and configurations with Hazelnut bushes
  - Investigate green cluster husking
    Not designing a harvester - only evaluating current technology

- Key Personnel
  - Scott Sanford – Biological Systems Engineering Dept
  - Dave Bohnhoff – Biological Systems Engineering Dept
  - Jason Fischbach – College of Ag and Life Science Extension
  - University of Wisconsin-Madison

Harvest Mechanism Study

- Cluster removal efficiency
- Harvesting losses
- Crop damage
- Harvest speed
- Plant type/size limitations
- Plant genotype effects
- Limited by lack of clonal plantings
Fall 2018 work

- BEI over-the-row, self-propelled, Slapper type harvester owned by John Runde, Potosi, WI
- Large bushes,
- Left clusters on tops and some sides of bushes
- Joanna 4 - half-row, pull-behind, rotary type harvester owned by Bellbrook Berry Farm, Brooklyn, WI
- 7 yr bushes – Stoughton plot
- ~99% removal rate
- Aggressive – removed Catkins

Cluster Moisture Distribution

Stem Diameter vs Detachment Force

Nuts per Cluster vs Detachment Force
Stem Diameter vs Nuts per Cluster

Type of Harvesters
- Over the Row
  - More expensive – used units available
  - Operator has good visibility
  - Narrower row spacing

Pull type
- Only one set of sway rods
- 3-point hitch or tow
- Smaller opening
- Wider rows for tractor
- Narrow orchard tractor
- Used or New

Pull Type in action
Others at: https://www.youtube.com/watch?v=2hpF4a96cAI
https://www.youtube.com/watch?v=8SLs2hmsEv4
3:15
Half row harvester

- Used for currants, aronia, gooseberry, Saskatoon
- Splits row in half
- Bends bush over
- Some stem damage
- Aggressive
- Bushes too large
- Cost ~ $50,000 new
- Source: Poland

Type of Harvest units - Shakers

- Slapper
- Sway
- Bow Rod
- Rotary
  - Vertical shaking
  - Horizontal shaking

Slapper unit

- Group of rods that swing back and forth horizontally
- Push bushes against side of tunnel - Anvil
- Less aggressive action than other types
- Older units have 6 foot high tunnel
- Not recommended

BEI Slapper in action
Sway unit

- Bars on both sides swing together to force bush back and forth
- Two sets of parallel bars – front and back
- Can be set out of phase with each other for more aggressive action
- More aggressive action than Slapper
- 7 foot height opening

Sway Bars in action

- 9 sec & 50 sec

Sway bars in action

- Start 1:40 & 2:17

Bow Rod

- Round bow that sway back and forth together
- Bush forced through small opening
- Similar action to sway bar
- More gripping action of bush/tree
- Branches need to be flexible
Bow Rod in Action

- High tunnel opening – min 8 ft 6 in x 52”
- Oxbo 6430

2:04

Rotary units

- Two types
  - Moves up and down
    - Raspberries,
      blueberry
    - Oxbo Orbirotor
  - Moves side to side
    - Blueberry, grape, ...
    - More aggressive
    - Oxbo Dynarotor
- Selection of rods
  - Stiffer → more energy
    transmitted to bush
- Rotates as the rods
  rotate into the crop
  and the machine
  moves forward

Adjustments

- Amplitude of
  movement
  - Adjust length of stroke
  - Counter weight location
- Sway Bars
  - Phase angle between
    front and back bars
- Speed
  - Compression of crop
  - Opening between bars
- Ground speed

 Berry pickers
  - Multiple trip thru field
  - Only release ripe
    fruit
  - More Aggressive
    - More leaves/debris
    - Loss of Catkins
    - One trip harvest

Orbirotor - 1:02, 1:32
Dynarotor – 2:15
Sway – 2:23
Capturing harvested crop

- Fish plates
  - Open as machine moves forward to catch crop and move it to conveyor
  - Wide stem cluster increase field loss
- Separation
  - Fans blow / suck leaves out of harvested product
  - Single / double blower

1:38 to 2:28

Harvested Crop Collection

- Rear
  - Requires 2 attendants & driver
  - Driver can’t seen fruit collection – horn to communicate
  - Fewer conveyors
  - Trailer for lugs
  - Not setup for Pallet boxes

Harvested Crop Collection

- Side
  - 3 wheel machine
  - 1 driver, 1 attendant
  - Lugs or bins
  - Driver visibility of collection

Korvan 9000

Harvested Crop Collection

- Top
  - Good Driver/attendant communications
  - 1 or 2 loading stations
  - More conveyors to maintain
  - High cost to transport
  - Conveyor to bulk bin
    - High capacity
    - Tractor / wagon fit between rows
Trailering Machines
• Width: 10 to 12 feet wide
• Height: 11 ft 2 inches plus

• DOT restrictions
  • Over 8 feet 6 inches – permit required
  • Over 13 feet 6 inches – permit required
  • 12,000 to 27,000 lbs
  • Need lowboy trailer
  • Commercial Driver Lic likely needed

Field consideration
• Room at end of rows to turn around
  • 30 to 50 ft – room to turn a tractor / harvester without backing up

• Slope of fields
• Wet soils - rutting
• Row spacing
• Height of bushes
• Pruning?

U.S. Manufacturers
• AG Harvesters - Au Gres, MI
  • Sway or rotary

• Haven Harvesters, South Haven, MI
  • Sway bar units only

• A&B Packing – Lawrence, MI
  • Fulcrum – unique design – Split canopy - Rotary

• McKibben Mfg – Grand Junction, MI

• Blueline – Yakima, WA
• Oxbo (Korvan) – Lynden, WA
  • Sway, bow rod, rotary
• Littau Harvest – Stayton, OR

Out of Business Mfg
• BEI – Used machines - Most parts available (slapper, sway bar, rotary)
• JVD – Holland, MI

Used Equipment Sources
• www.usedblueberryequipment.com
• Wyatt Oats – 334-790-1605
  wsoates@gmail.com

• New Haven Harvesters
  • Bernie Newton - 269-491-0860
    bernie.agribiz@gmail.com

• Farmers Equipment, Lyndon, WA
  • Fred Polinder – 360-815-1402 Cell
    fpolinder@farmersequip.com
Top collection Rotary harvesting Hazelnut trees

Questions??
Scott Sanford
sasanford@wisc.edu
608-262-5062