




Mechanical Harvesting of Hazelnuts

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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



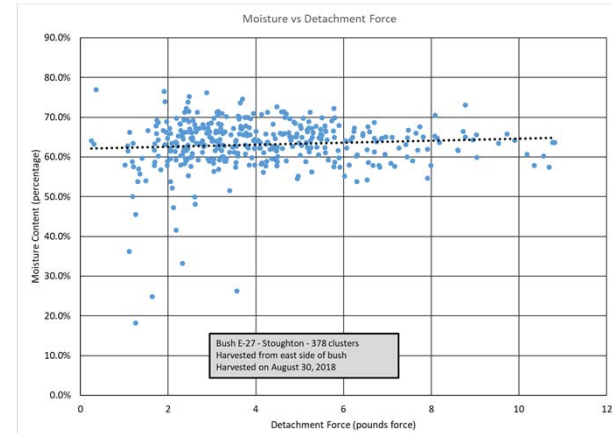
Fall 2018 work



- 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



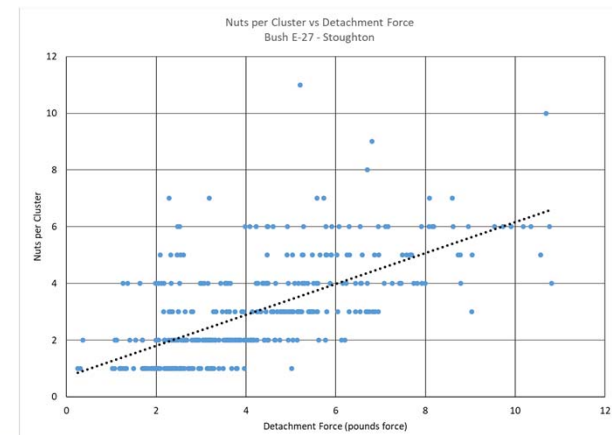
Cluster Moisture Distribution



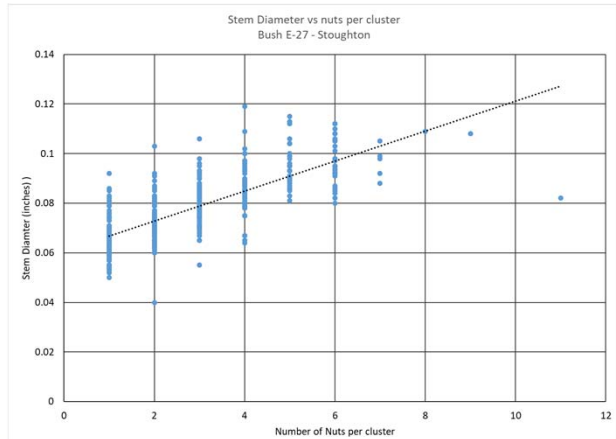
Stem Diameter vs Detachment Force



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



Oxbo 930



BEI – PAL (out of production)



McKibben Mfg. Blueberry Harvester

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



- 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

Rotary units



Rotary units



Oxbo Orbirotor Picking System
Gentle, selective, and effective picking action.

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



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



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 see 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



Trailing 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.agrbiz@gmail.com
- Farmers Equipment, Lyndon, WA
 - Fred Polinder – 360-815-1402 Cell
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Top collection Rotary harvesting Hazelnut trees



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Questions??