Ag Tech in Washington

Rob Blakey, PhD
R&D Manager
Stemilt Growers
The Overview

• High level view of Washington
• What we are thinking about
• Look at some ag tech offerings (mostly harvesting & imagery)

Disclaimer: Stemilt does not endorse any products, services, or suppliers
Background to Stemilt

- Majority owned by the Mathison family
- 10,500 acres in central Washington
- 2/3 apples, 1/3 cherries, minimal pears
- Apple harvest starts end July, ends in late October
- Warehouse has 3 apple & 1 pear lines packing 10 million boxes a year
- Marketing for 4 packing sheds incl. Stemilt
Background to Washington

• Major cost price squeeze
• Direct labor cost: $3,547/acre → $5,170/acre *(or more)*
• Add overhead for guest worker
• Gala is #1 variety but tough to make money
• Need to get bigger & more efficient & into more profitable varieties

<table>
<thead>
<tr>
<th>Full Production Gala</th>
<th>2015</th>
<th>2019*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Costs to Pack</td>
<td>$20,470</td>
<td>$32,372</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>$4,184</td>
<td>$9,771</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$24,654</td>
<td>$42,144</td>
</tr>
<tr>
<td>Net Return</td>
<td>$9,265</td>
<td>-$11,360</td>
</tr>
</tbody>
</table>

- 64bins/acre @ $530/bin and $481/bin
- 2019 is draft from WSU but in line with actual
- Includes $1,800/acre for netting in 2019
- Enterprise budgets available online from WSU
Ag Tech is busy!

- Hardware & Infield
- Software & Apps
- Sensor-driven Decision Support
- Postharvest Decision Support
The fundamentals don’t change

Production

Labor & Personnel

Sales & Marketing

Finance

Stemilt
World Famous Fruit

To cultivate people & delight consumers
What is the Goal?

• High “packs per bin” of fruit that can make money
  [High yield of market-appropriate fruit year after year to make sustainable net return]

• The right management (labor & mechanization) plan to achieve goals
  [Do a task correctly first time at the right time]

• Has to fit into your time horizon & finances
What is the Goal?

- Efficient & motivated workers that add value to your business
- Use capital (machines & system) to replace & optimize labor
- Have the labor (with machines) to hit your technical targets
- Be adaptable to changing labor situations

Harvest has the highest labor cost, but don’t forget other tasks
What is the Goal?

• Have to match sales plan to storage to fruit quality
• Need data to support those decisions
• Hit your technical targets to achieve the most value from your fruit & orchard
What is the Goal?

- Make a sustainable net returns & capital gains
- Maintain cashflow
- Access capital to mechanize & update orchards
Ag Tech Timeline

- Now & Available
- Medium term Probable
- Long term Long shot

STEMILT EXISTS
To cultivate people & delight consumers
Progression of Harvesting Technology

- **Manual**
  - Ladders
  - Ground

- **Ground Assist**
  - Remove ladders
  - Work at night

- **Platform**
  - Remove ladders
  - Work at night

- **Harvest Assist**
  - Remove ladders & bags
  - Work at night

- **Ground Robot**
  - Remove (high) worker
  - Work 24/7

- **Flying Robot**
  - Remove machine
  - Work 24/7

*It’s very hard to beat a motivated ground picker*
Now & Available

Machinery
• **Harvest Assist**
• Pruning/Hedging
• Leaf Removal
• Mechanical thinning
• Mechanical weeding

Software & Monitoring
• **Irrigation Management**
• **Aerial Imagery**
• Labor & Task Management
• Business management
• Data management

Precision management always improving

Big Tech very interested in this space

STEMILT EXISTS
To cultivate people & delight consumers
Ground Assist – Bandit Scout

• Can’t beat pickers on the ground
• Bin Assist reduces walking for pickers
• More time picking increases their efficiency
• We haven’t seen the benefit but only have 2
  Larger scale test with better fruit may change our minds
Platform – Bandit Xpress

Courtesy JJ Dagorret – Automated Ag
Platform – Cub for High Density
Race the Cold

Do you have the machinery, labor, variety mix & skill to account for a change in weather?

Courtesy JJ Dagorret – Automated Ag
Irrigation Management

• Irrigation scheduling with soil moisture monitors is relatively new in WA
• We use Sentek capacitance probes in each soil type & variety in rootzone
• Add Air temperature & Relative Humidity sensors
• Also have state wide AgWeatherNet stations installed on/near farms
Aerial Imagery

What & Where & How

• What are they offering?
  • Technical
  • Expertise
  • Service
• Is it scalable?
• How can it add value?
• Can it work under net?

Who

• Ceres Imaging
• HEMAV
• Aerobotics
• Slantrange
• Skycision
• Drone Deploy
• AeroVironment

Not an exhaustive list
NDVI – Vegetative Index
Split View – 6 May 2019

Thermal – Canopy Temperature

Water Stress
Some benefits we’ve seen

1. **Water stress**: Add sprinklers & fix broken lines
2. **Harvest**: During targeted cherry harvest
3. **Fruit Quality**: Manage irrigation to control vigor & fruit quality
4. **Inputs**: Reduce fertilizer in high vigor areas
5. **Big Picture**: Sometimes you need to restart an orchard
Some potential benefits

1. **Water stress**: Over-head cooling quality check
2. **Water stress**: Identify blocked sprinklers
3. **Uniformity**: Trouble shoot high/low vigor areas
   Eventually can we tie imagery into automatic variable rate?
4. **Yield & Fruit Quality**: Match fruit quality & yield to imagery
Medium-Term & Likely

Machinery

• Harvest Assist
• Precision spraying & implements
• Autonomous vehicles

Software

• In row imagery
• QC software

Will see continued merging of hardware & software
Cyclone Harvester with Automated Ag Bandit

• Early days - only 2 available currently
• No difference with SweeTango® between platform & Cyclone
• Fruit need to be put in one-by-one to avoid impact bruising – retraining
## In-Row Imagery

<table>
<thead>
<tr>
<th>What</th>
<th>Who</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fruit count &amp; size</td>
<td>• IFV</td>
<td>• Increase accuracy of estimates</td>
</tr>
<tr>
<td>• Yield mapping</td>
<td>• Farm Vision</td>
<td>• Increase uniformity of crop</td>
</tr>
<tr>
<td>• Growth curves</td>
<td>• iUNU</td>
<td>• Guide crop load management</td>
</tr>
<tr>
<td>• Water stress</td>
<td>• Dynium</td>
<td>• Guide storage plan</td>
</tr>
<tr>
<td>• Fruit color (?)</td>
<td></td>
<td>• Guide sales plan</td>
</tr>
<tr>
<td>• Pests &amp; Disease (?)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Automated Fruit Counting – Farm Vision
Automated Fruit Counting - iUNU
Long-Term & Long Shot

Machinery & Software

• Robotic harvesters
• Precision crop load management
• Precision implements
• Autonomous vehicles

Will see continued merging of hardware & software
Ground-Based Robots

Abundant Robotics

FF Robotics

 Courtesy JJ Dagorret – Automated AG

 Courtesy Good Fruit Grower
Flying Robot

• Early days but making great progress
• Detection & picking done
• Next stage is to integrate with bin management system

• Redundancy with cheap units
• Can have multiple tasks on multiple crops to reduce costs
• Picking service gives flexibility

www.tevel-tech.com
This is privileged early release footage – don’t judge the system yet
Precision Crop Load Management

• A few manufacturers are in the early stages of integrating:
  • Vision system
  • Effector to thin flowers & fruitlets
  • Autonomous driving

• Need the horticultural models to inform the system
• Could be a game changer to improve orchard uniformity

• Probably 5+ years from first commercial adoption but hard to say…
Warehouse

• Warehouses will mechanize more as labor gets more expensive & there are fewer workers
• Quality demands from retailers will necessitate capex
• This will require consolidation and big capital expenditure
**Warehouse**

**What**
- Automated QC with AI for defects, size, color in bins
- Dynamic CA technology (respiration, chlorophyll fluorescence, ethanol)
- Automatic Storage & Retrieval Systems (bins, pallets)

**Why**
- Better centralized data back to the farm & storage manager
- Better packs per bin
- Less handling, better stock management, reduced losses, better labor efficiency
Conclusion

• Think about:
  • Labor efficiency,
  • Orchard uniformity
  • Preparing your orchard for the future
• There’s a lot of ag tech available, get involved, let companies work in your orchards, don’t commit too soon
• Don’t just collect cool imagery & tools

Plan & Execute
Thank You

Rob Blakey
rob.blakey@stemilt.com