Tools to Assess Economic Returns to High Tunnel and In-Field Small Fruit Production

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Division of Agriculture
University of Arkansas

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Fruit Production Budgets

• Tools used to assess costs and revenues associated with production

• Traditionally paper based

• Require large amount of information from producers to work
New CARS Decision Support Tools

• **Interactive Budgeting:**
  – Computer based; User specifies input, tool automatically makes calculations

• **User Friendly**
  – Little computer knowledge required
  – Little data input needed

• **True Decision Support**
  – Assess costs, revenues as well as breakevens (and for most tools, risk)
Fruit Production Decision Support Tools

Available!

Visit the Specialty Crop Section of the CARS website
www.cars.uark.edu

or

Email cars@uark.edu
Fruit Production Decision Support Tools

Interactive Sustainable Raspberry Budget

Interactive Sustainable Blackberry Budget

Interactive Sustainable Blueberry Budget

Coming Soon!

Visit cars.uark.edu for release info
Presentation Objective

• Describe the benefits of CARS Decision Support Tools

• Walk through some examples using the strawberry budget
Traditional Budgets...

• Calculate net returns for one year

• Are estimated on a one acre basis
## Our Budgets...

<table>
<thead>
<tr>
<th>Budget Tool/ Capability</th>
<th>Apple</th>
<th>Blackberry</th>
<th>Blueberry</th>
<th>Raspberry</th>
<th>Strawberry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Calculations</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Multi Year Calculations</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Variable Farm Size</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>High Tunnel or Field Production systems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Breakeven Analysis</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sensitivity Analysis</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Risk Analysis</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

What does this mean?
Capabilities

• **Multi-year present value of net benefits**
  – In addition to giving annual return values, the tools calculate what the value of all net revenues generated over all years are worth today

• **Variable Farm Size**
  – Can estimate costs and returns based on portions of an acre (e.g., 0.25 acre or 2.35 acres)
Capabilities: Breakeven Analysis

• Breakeven Point
  – Point at which cumulative total costs and cumulative total revenues are equal

• Can be calculated for
  – Breakeven Price
  – Breakeven Yield
Breakeven Price

- Given yields and total costs, what price do I need (on average over time) to break even?

\[
\text{Breakeven Price} = \frac{\text{Total Cost Over Time}}{\text{Expected Average Yield Over Time}}
\]
Breakeven Yield

• Given market prices and total costs, what yield do I need (on average over time) to break even?

\[
\text{Breakeven Yield} = \frac{\text{Total Cost Over Time}}{\text{Expected Average Market Price Over Time}}
\]
Capabilities: Sensitivity Analysis

• “What if?” analyses
  – How different values of an input impact net returns

• What if:
  – My yields over time are actually higher/lower than I predict?
  – The market price for the fresh/processing market over time is higher/lower than I predict?
New Section: Risk Analysis

• A technique that calculates the probability of obtaining a net present value of returns greater than a specific dollar target

• What is the probability that I will earn a net present value greater than $90,000?
Importance of The Tool

• Allows the user to make more informed decisions by
  – Comparing costs/revenues of different production practices
  – Estimating impacts of changes in yield/prices on the solvency of the operation
  – Assess the economic risk associated with a particular production system

• Assessments can be made hypothetically; without having to actually change practices
Decision Support Tool Example

Sustainable Strawberry Production
Main Menu

Interactive Sustainable Strawberry Budget

Walmart

UofA

Center for Agricultural and Rural Sustainability

About This Tool Credits Disclaimer Contact Us User Guide Quick Start User Input

UofA

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System
User’s Guide

Interactive Sustainable Strawberry Budget

This project is funded by a grant from the Walmart Foundation and administered by the University of Arkansas System, Division of Agriculture Center for Agricultural and Rural Sustainability.

Dr. Hector German Rodriguez

University of Arkansas
Agricultural Economics and Agribusiness Department
Fayetteville, Arkansas U.S.A.
Summer 2014
Quick Start Menu

1. Press "User Input" button
2. Select between field and high tunnel production
3. Enter or select values in the boxes
4. Click "Run" to see an overview of cost/returns
5. Navigate the application by clicking on icons at the top of the screen
6. Edit or enter new values to customize the budget
7. Click "Economics Tools" button to see graphical representations of the data

Click "Help" to search for more detailed instructions
Start: User Input

- Tool can run two production systems (Field or High Tunnel):
User Input: Field Production

- Userform opens with default values

1. Cultivar Production System
   - Field Production

2. Cultivar Name
   - Generic Cultivar

3. Plant Density
   - Bed Spacing (in): 60
   - Plant Spacing (in): 12

4. Expected Yield - Production Usage
   - Yield (lb/plant): 1.10
   - Fruit Production Usage (%)
     - Fresh Market: 70
     - Processed Market: 10

5. Expected Market Prices - ($/lb)
   - Fresh Market: 2.50
   - Processed Market: 0.75

6. Interest (%) - Amortization (yrs)
   - Interest: 7
   - Amortization: 5

7. Area
   - Acres: 1.0

Run | Cancel | Help | Demo
User Input: High Tunnel Production

- Userform opens with default values

1. Cultivar Production System
   - High Tunnel (HT)

2. Cultivar Name
   - Generic Cultivar

3. Plant Density
   - Bed Spacing (in) 48
   - Plant Spacing (in) 12

4. Expected Yield - Production Usage
   - Yield (lbs/plant) 1.50
   - Fruit Production Usage (%)
     - Fresh Market 80
     - Processed Market 10
   - These two values must be equal to 100% or less.

5. Expected Market Prices - Wages
   - Fresh Market 2.50
   - Processed Market 0.75
   - Wages ($/hr)
     - Management 15.00
     - Labor 10.00

6. Your High Tunnel Values
   - Total Area in High Tunnels (sqft) 43,560
   - $ per sqft 1.50
   - Total EQIP Subsidy ($/area) 0
   - Total Installation Labor (hours) 250
   - Interest Rate (%) 7
   - Amortization (years) 5
User Input: Run

- Once data are entered or selected click run.
Summary

- The tool will generate total costs, gross revenues and net returns.

<table>
<thead>
<tr>
<th>Production System:</th>
<th>High Tunnel (HT)</th>
<th>Production Area (acre):</th>
<th>1.0</th>
<th>Plant Density (plants/acre):</th>
<th>21,780</th>
</tr>
</thead>
</table>

**Balance**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Revenues ($/area)</td>
<td>$67,790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Costs ($/area)</td>
<td>$63,567</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Returns ($/area)</td>
<td>$4,224</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Expected Values**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Market Price ($/lb)</td>
<td>$2.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed Market Price ($/lb)</td>
<td>$0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh Market Yield (lb/area)</td>
<td>$26,136</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed Market Yield (lb/area)</td>
<td>$3,267</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gross Revenues ($/area)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Market</td>
<td>$65,340</td>
</tr>
<tr>
<td>Processed Market</td>
<td>$2,450</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$67,790</td>
</tr>
</tbody>
</table>

**Net Returns ($/area)**

- $4,224

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvest</td>
<td>$20,127</td>
</tr>
<tr>
<td>High Tunnel</td>
<td>$16,241</td>
</tr>
<tr>
<td>Irrigation</td>
<td>$433</td>
</tr>
<tr>
<td>Pest Management</td>
<td>$610</td>
</tr>
<tr>
<td>Planting</td>
<td>$7,514</td>
</tr>
<tr>
<td>Production Activities</td>
<td>$12,215</td>
</tr>
<tr>
<td>Soil Preparation &amp; Cleanup</td>
<td>$6,427</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$63,567</td>
</tr>
</tbody>
</table>

**Breakeven Analysis**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Market Price ($/lb)</td>
<td>$2.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed Market Price ($/lb)</td>
<td>$0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh Market Yield (lb/area)</td>
<td>$24,508</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed Market Yield (lb/area)</td>
<td>$3,063</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How to Change Levels of Activity or Prices

- Click on a red button associated with any of the seven categories. The selected category will be highlighted on green.
# How to Change Levels of Activity or Prices

- Here you can change:
  - Activities
  - Quantities
  - Prices

- Once changed, the tool will recalculate all costs and returns

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Unit</th>
<th>Quantity</th>
<th>Your Quantity</th>
<th>Price</th>
<th>Your Price</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drip Tape (10 mil; 12” emitter; 0.22 gpm per 100 ft; 6000 ft).</td>
<td>roll</td>
<td>2.00</td>
<td></td>
<td>$195.80</td>
<td></td>
<td>$391.60</td>
</tr>
<tr>
<td></td>
<td>Drip Tape - Couplers</td>
<td>unit</td>
<td>54.00</td>
<td></td>
<td>$0.35</td>
<td></td>
<td>$18.90</td>
</tr>
<tr>
<td></td>
<td>Equipment Costs - Frost Protection</td>
<td>acre</td>
<td>1.00</td>
<td></td>
<td>$600.00</td>
<td></td>
<td>$600.00</td>
</tr>
<tr>
<td></td>
<td>Fittings: Barb with Valve to connect T-Tape and Header Line</td>
<td>unit</td>
<td>53.00</td>
<td></td>
<td>$1.71</td>
<td></td>
<td>$90.63</td>
</tr>
<tr>
<td></td>
<td>Fittings: Couplers 2&quot;</td>
<td>unit</td>
<td>1.00</td>
<td></td>
<td>$0.85</td>
<td></td>
<td>$0.85</td>
</tr>
<tr>
<td></td>
<td>Header Line - 2” Barbed Coupler</td>
<td>unit</td>
<td>2.00</td>
<td></td>
<td>$0.79</td>
<td></td>
<td>$1.58</td>
</tr>
<tr>
<td></td>
<td>Header Line - 2” Barbed Elbow</td>
<td>unit</td>
<td>1.00</td>
<td></td>
<td>$2.89</td>
<td></td>
<td>$2.89</td>
</tr>
<tr>
<td></td>
<td>Header Line 2” Oval Hose - 150’ Roll</td>
<td>roll</td>
<td>2.00</td>
<td></td>
<td>$124.30</td>
<td></td>
<td>$248.60</td>
</tr>
<tr>
<td></td>
<td>Injector</td>
<td>unit</td>
<td>1.00</td>
<td></td>
<td>$300.00</td>
<td></td>
<td>$300.00</td>
</tr>
<tr>
<td></td>
<td>Labor - Assembling Irrigation System</td>
<td>hour</td>
<td>12.00</td>
<td></td>
<td>$10.00</td>
<td></td>
<td>$120.00</td>
</tr>
</tbody>
</table>

Total Cost: $432.92
Breakeven Analysis

Expected values using the input entered when high tunnel production was chosen.

Summary of Breakeven yields and prices.

<table>
<thead>
<tr>
<th>Expected Values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Market Price ($/lb)</td>
<td>$ 2.50</td>
</tr>
<tr>
<td>Processed Market Price ($/lb)</td>
<td>$ 0.75</td>
</tr>
<tr>
<td>Fresh Market Yield (lb/area)</td>
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</tr>
<tr>
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<table>
<thead>
<tr>
<th>Breakeven Analysis</th>
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<tr>
<td>Fresh Market Price ($/lb)</td>
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<td>3,063</td>
</tr>
</tbody>
</table>

Click the Breakeven Analysis Icon located in the summary page to see calculations in more detail. These calculations will be updated if initial inputs are edited or new input is entered.
Breakeven Analysis: Calculations

### Expected Values

<table>
<thead>
<tr>
<th></th>
<th>Average Fresh Market Price ($/lb)</th>
<th>Average Processed Market Price ($/lb)</th>
<th>Fresh Market Yield (lb/area)</th>
<th>Processed Market Yield (lb/area)</th>
<th>Total Revenues ($/area)</th>
<th>Cumulative Total Costs ($/area)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.50</td>
<td>0.75</td>
<td>26136</td>
<td>3267</td>
<td>67,790</td>
<td>63,567</td>
</tr>
</tbody>
</table>

### Breakeven Yield Analysis

\[
\text{Breakeven Fresh Yield (lb/area) = Total Costs of Production ($/area) / Expected Fresh Market Price ($/lb)} = 24508
\]

\[
\text{Breakeven Processed Yield (lb/area) = Total Costs of Production ($/area) / Expected Processed Market Price ($/lb)} = 3063
\]

\[
\text{Cumulative Total Costs ($/area)} = 63,567
\]

### Breakeven Price Analysis

\[
\text{Breakeven Fresh Market Price ($/lb) = Total Costs of Production ($/area) / Fresh Market Yield (lb/area)} = 2.34
\]

\[
\text{Breakeven Processed Price ($/lb) = Total Costs of Production ($/area) / Processed Market Yield (lb/area)} = 0.70
\]

\[
\text{Cumulative Total Costs ($/area)} = 63,567
\]
Sensitivity Analysis

- “What if?” analyses
  - How different values of an input impact net returns

- What if:
  - My yields over time are actually higher than I expected?
  - The market price for the fresh market over time is higher than I expected?
CASE 1 (Yield 1.50 lb/plant)

CASE 2 “What if” yield increased by 0.10 lb/plant everything else constant
Risk Analysis

The tool also calculates the risk associated with this operation by entering some required information.
Risk Analysis

The tool also calculates the risk associated with this operation by entering some require information.

EXAMPLE: suppose we change the production system from “Field” to “High Tunnel”
Risk Analysis

By changing production systems, the likelihood of getting returns of $10,000 or more increases but there is a 95% change of obtaining negative net returns.

Before – Field Production

The probability of obtaining a value equal or greater than $10,000 is 9%.

There is a 95% change that the true average lies between $2,191 and $2,864.

After – High Tunnel Production

The probability of obtaining a value equal or greater than $10,000 is 15%.

There is a 95% change that the true average lies between -$4,436 and -$2,893.
Lots to this Tool!

• The capabilities of this tool are great

• But at the same time it can be used to answer very simple questions alone

• Built to be flexible, based on the needs of the user
Get Your Decision Support Tools for Apple and Strawberry Production Now!

- Take CD with you today
- Send an email to CARS (cars@uark.edu) to request CD copy or go to www.cars.uark.edu for free download
Tools for Blackberries, Raspberries and Blueberries in Development

• Blackberry, Raspberry and Blueberry tools coming in spring
• Watch CARS website for announcements of releases
Visit Our Website

Center for Agricultural and Rural Sustainability
www.cars.uark.edu

Look under Food Industry Program pages for more information
Thank You

• For more information...

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