Interactive Business Tool for CEA vegetables:
Lettuce & Tomato

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Interactive Online Tools- Cost Studies for CEA Vegetables

• An interactive spreadsheet tool estimates the capital investment and operating expenses for building and operating a year-round CEA vegetable facility in NYS.

• The spreadsheet allows users to modify key parameters (e.g. price, labor costs, energy costs) to simulate impacts on return on investments.
Major costs can be divided into two categories.

- **Fixed costs:**
  - Greenhouse Structure
  - Environment control equipment
  - Growing and delivery

- **Variable costs:**
  - Production supplies
  - Labor
  - Utility
  - Packaging
Example: Lettuce Cost Studies

- Production Supplies: 5%
- Labor: 53%
- Packaging: 17%
- Utilities: 10%
- Other: 3%
- Greenhouse Structure: 5%
- Environmental Control Equipment: 4%
- Growing and Delivery: 3%
- Production Supplies: 5%

Cost (%)
Example: Tomato Cost Studies (year-round production)
Example: Tomato Cost Studies (8-months production)
Comparison of Costs and Profit

- Lettuce (Single bay with year-round prod.)
- Tomato (Multiple bay with year-round prod.)
- Tomato (Multiple bay with 8-months prod.)

<table>
<thead>
<tr>
<th></th>
<th>Profit</th>
<th>Variable cost</th>
<th>Fixed cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lettuce</td>
<td>$175,000</td>
<td>$25,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Tomato</td>
<td>$75,000</td>
<td>$25,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Tomato</td>
<td>$25,000</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
</tbody>
</table>
The assumptions tab explains how this interactive spreadsheet works and what assumptions are made.

The tables and figures change as the variables are modified.

Five tabs: Assumptions, Inputs, Cost estimates, Results and Analysis.

### Guidelines for using this tool:
1. Input your data for the variables in the Inputs tab.
2. Make different input choices for the parameters and input costs of the items in the Cost estimates tab.
3. Open the Results tab to view the total costs, revenue, and profits of a greenhouse operation based on the previous inputs.
4. Open the Analysis tab to compare profits under different scenarios. The function of each tab is described below.

### Spreadsheet Explanation

<table>
<thead>
<tr>
<th>Spreadsheet</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs</td>
<td>This spreadsheet requires information on production area, spacing, lighting, heating, and labor. The numbers in the blue box are prepopulated but user can make changes to the blue box to reflect their own operation. They can observe the resulting production and energy specifications in the yellow box.</td>
</tr>
<tr>
<td>Cost estimates</td>
<td>This spreadsheet includes items needed to calculate the variable costs and the fixed costs of a greenhouse operation. User can make different choices for fuel use, lighting, and growing system. They can change parameters and costs of the items in the blue box to calculate the variable costs and the fixed costs for their operation.</td>
</tr>
<tr>
<td>Results</td>
<td>This spreadsheet presents the total revenue, expenses, and annual operating profit. Total annual costs and profitability are calculated on a per head, per square foot, per house, and per acre basis. These results are based on the inputs user provide in the blue box mentioned above and those results can change as the parameters change.</td>
</tr>
<tr>
<td>Analysis</td>
<td>The analysis tab reflects profits under an alternative price and yield. User can conduct sensitivity analysis under different assumptions to compare different scenarios.</td>
</tr>
</tbody>
</table>

1. Analysis with 20% Increase and 20% Decrease in Labor cost
2. Analysis with 20% Increase and 20% Decrease in Utility cost
3. Analysis with 20% Increase and 20% Decrease in Packaging cost

### Notes:
1. Four options are available for user to choose the type of Greenhouse. User can choose the type they wish to build.
2. Square feet week calculator is used for space efficiency and continuous production. Supplemental...
Lettuce Interactive Spreadsheet: Inputs tab

The Inputs tab requires data on Production (greenhouse dimension, space use efficiency, etc.) and Spacing (no. of plants, days at spacing, etc.)

Users require to provide information in the blue box and can see the resulting production characteristics in the yellow box.
The inputs tab also requires data on Lighting, Heating, Labor, etc.

Users can change parameters to reflect their light use, heating cost, and labor needed for operating a Greenhouse.

The inputs here are linked to the cost estimates tab which reflect in variable costs, fixed costs, and in return on investments.
Lettuce Interactive Spreadsheet: Cost Estimates tab

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VARIABLE COSTS</strong></td>
<td><strong>Production Supplies</strong></td>
<td><strong>Production Labor</strong></td>
<td><strong>Packaging Costs</strong></td>
<td><strong>Utilities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>Seed (package)</strong></td>
<td><strong>Production Transplant/ Harvest Package</strong></td>
<td><strong>Clamshell</strong></td>
<td><strong>Fuel choice only for NYS user (choose one):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Horticubes</strong></td>
<td><strong>Delivering to market</strong></td>
<td><strong>Box</strong></td>
<td><strong>Liquid Propane</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>Beneficial Insects</strong></td>
<td><strong>Production management</strong></td>
<td><strong>Labels</strong></td>
<td><strong>Natural Gas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><strong>Fertilizer</strong></td>
<td><strong>Other (Marketing, Maintenance, etc.)</strong></td>
<td></td>
<td><strong>21.297 therms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><strong>Blended Mix</strong></td>
<td><strong>Fringe benefit</strong></td>
<td><strong>Total Packaging Costs</strong></td>
<td><strong>-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><strong>CaCO3</strong></td>
<td></td>
<td></td>
<td><strong>2.48 $/gallon</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td><strong>Additions</strong></td>
<td></td>
<td></td>
<td><strong>-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td><strong>Fungicide-Pesticide</strong></td>
<td></td>
<td></td>
<td><strong>Fuel Oil</strong></td>
<td></td>
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</tr>
<tr>
<td>16</td>
<td><strong>Sanitizer</strong></td>
<td></td>
<td></td>
<td><strong>-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td><strong>Sticky Traps</strong></td>
<td></td>
<td></td>
<td><strong>-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Please enter information in the Blue box**

Cost estimates tab includes items needed to calculate the variable costs and fixed costs of a Greenhouse.

Variable costs include categories like Production supplies, Labor, Packaging, etc.

Users can modify the cost for items in the blue box and can see the sub total under each category.
Fixed costs include categories like Greenhouse Structure, Environmental Control Equipment, etc.

Users can make different choices to different parameters to reflect their operation.

Users can modify the cost and quantity for items in the blue box and can see the sub total under each category.
The results tab includes the total revenue, expenses and annual operating profit. Total annual costs and profitability are calculated on per head, per square foot, per house, per acre basis. These results change as the parameters change.
Lettuce Interactive Spreadsheet: Sensitivity Analysis

The sensitivity analysis tab reflects profits under alternative price and yield.

Users can conduct sensitivity analysis under different assumptions.
With Natural Gas

Actual Profit decreases by 40%

Lettuce Sensitivity Analysis tab (cont.)

With Fuel Oil:
Actual Profit decreases by 40%
Baseline (with natural gas)

With 20% Increase in Labor cost:
Actual Profit decreases by 30%

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### Lettuce Sensitivity Analysis tab (cont.)

<table>
<thead>
<tr>
<th>Actual</th>
<th>High</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>$40,000</td>
<td>$20,000</td>
<td>$0</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

### Annual Output

- **Actual**: $60,000
- **High**: $100,000
- **Average**: $40,000
- **Poor**: $8,000

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**Profit**

- **Actual**: $120,000
- **High**: $160,000
- **Average**: $80,000
- **Poor**: $20,000

**Price**

- *Baseline (with natural gas)*
- *With 20% Increase in Labor cost: Actual Profit decreases by 30%*
Lettuce Sensitivity Analysis tab (cont.)

Baseline (with natural gas) vs With 20% Decrease in Utility cost: 
Actual Profit increases by 6%
Lettuce Sensitivity Analysis tab (cont.)

With 20% Decrease in Packaging cost:
Actual Profit increases by 10%

Baseline (with natural gas)

<table>
<thead>
<tr>
<th>Annual Output</th>
<th>Actual</th>
<th>High</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-40,000</td>
<td>$-20,000</td>
<td>$0</td>
<td>$20,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>$60,000</td>
<td>$80,000</td>
<td>$100,000</td>
<td>$120,000</td>
<td>$140,000</td>
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</tbody>
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<table>
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<th>Actual</th>
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<tr>
<td>$80,000</td>
<td>$100,000</td>
<td>$120,000</td>
<td>$140,000</td>
<td>$160,000</td>
</tr>
</tbody>
</table>

Graphs show profit changes at different output levels with actual, high, average, and poor conditions.
Conclusions

• For lettuce, labor (53%), packaging (17%), and utilities (10%) share the biggest costs in a greenhouse operation

• For tomato, utilities (39%), labor (11%), production supplies (7%) and packaging (7%) are the biggest variable costs in a year round greenhouse operation

• In a 8-month tomato production scenario, utilities (26%), labor (14%) and production supplies (12%) are the biggest variable costs
Conclusions (cont.)

• Growers’ particular management systems, available resources, and location can affect the performance of the operation

• Users should experiment with their own yields, inputs, and prices to develop a budget that will accurately represent their own operation

• We are willing to share the beta version of the Interactive tools to get feedback from the users
Thank you!
Questions, Comments?

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