Interactive Sustainable Strawberry Budget

User Guide

Dr. Hector German Rodriguez

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University of Arkansas
Agricultural Economics and Agribusiness Department
Fayetteville, Arkansas U.S.A.
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INTRODUCTION

Currently, most growers in Arkansas produce strawberries by plasticulture production, an annual hill training system in which freshly dug tips or plugs are fall planted in double rows at approximately 15,000 to 17,400 plants per acre on raised beds covered with black plastic mulch. With new advances in plastic mulch and protected culture technologies, Arkansas growers have more opportunities to extend the strawberry season to meet the year-round demand while avoiding the need to ship long distances, thus leaving a lighter environmental footprint by minimizing fuel consumption.

For the past three years the University of Arkansas has conducted research on high tunnel to extend season production. Our recent studies have yielded up to 2.25 lb/plant (compared to 1.0 – 1.5 lb/plant field production) and provided harvest from late fall through winter and into spring using a high tunnel plasticulture production system. To help Arkansas strawberry producers capture an increased share of the market for fresh strawberries, we created an interactive tool designed to represent a real strawberry operation using information gathered at the University of Arkansas Experiment and Extension Station located in Fayetteville, Arkansas as default values.

The purpose of this tool is twofold: 1) to assist producers in the evaluation of costs, revenues and risks associated with their strawberry operation and 2) to assess the changes to cost, revenue and risk as expected costs, revenue prices and/or yields change. The production budget components of the tool estimate gross revenues, variable costs, fixed costs and total net returns using the tool’s default data or information entered by the user. But what makes this tool unique is that it includes additional economic components not found in most production budgets that: 1) estimate the operation’s breakeven price and yield, 2) conduct sensitivity analyzes (answering “What if” questions related to changes in costs and revenues), and provide a risk assessment (regarding the probability of obtaining positive net returns during the life of the strawberry crop).

This tool is useful because it allows strawberry producers to estimate operating costs, fixed costs, total costs and expected total returns by modifying production practices or production systems, cost or return values. Estimating total costs per year, breakeven analyses for yields and prices, sensitivity analyses for total costs, and risk analyses would assist strawberry producers to make better investment and management decisions when using high tunnels in their operations.
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.

SOFTWARE REQUIREMENTS

This tool employs standard Microsoft Windows graphical elements so that anyone familiar with the Microsoft Windows environment should find this organic strawberry budget easy to navigate. Familiarity with the basics of mouse operation and navigating standard Windows objects such as menus, windows, dialog boxes, scroll bars, and toolbars is very important in using this tool.

Your personal computer should have the following programs installed and operating properly:

- Windows operating system
- Microsoft Excel version 2007 or higher

QUICK START GUIDE

For easy use, please take a few moments to read the following steps:

1. Press “User Input”
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/bottom of the screen
6. Enter new values to customize the budget
7. Click “Economic Tools” button to see graphical representations of the data

GETTING STARTED

This complete user guide covers everything you need to know to start using this tool. This decision support tool is both easy to use and highly customizable. Before you can use this tool for estimating basic revenue calculations, you must tell the program a few things about your current or potential operation. Please open the tool now and follow the instructions below.
1. INITIAL INPUT

This tool needs very little information before you can start using it. Figure 1 shows the “Cover” screen. It explains what the tool does. Click “Start” to continue.

Figure 1. Cover Menu

From the “Main Menu” screen you can navigate across the tool (Figure 1.1).

Figure 1.1 Main Menu Screen
Click on any of the green icons to get more information about this tool. Detailed instructions are available by clicking on the “User Guide” icon or follow the steps in the “Quick Start” to start using this application without reading the user guide. By clicking on the icon called “User Input”, a message will appear asking if you want to enter information for “field production” or “high tunnel production” (Figure 2).

**Figure 2. Choosing a Production System**

Two different userforms will appear depending on your selection. If you click on “field production”, a userform will display seven questions (Figure 3).

**Figure 3. Field Production Userform**

If you click on “high tunnel production”, a userform will display eight questions. The user can choose between defaults or customized high tunnel values (Figure 4).
Click on each of the boxes to enter your own values. All the information in the boxes is required to calculate the budget. Use default values or overwrite them with your own information at any time. Warning messages will appear if there is missing information or if you enter invalid input. Figure 5 shows an example of missing information.

Figure 5. Example of Warning Messages
To enter your own information, follow these steps. All information is required.

1. **Fruiting Cultivar Production System** – Choose between field production and high tunnel.

2. **Cultivar** – Select among four different cultivars; Albion, Camino Real, Chandler, and St. Festival. The user can also select a “Generic Cultivar.”

3. **Plant Density (plants/ac.)** – Enter the planting distance in both “Bed Spacing (ft.)” and “Plant Spacing (in)” boxes. Once both values have been entered, the tool will automatically calculate the number of plants per acre.

4. **Yield (lb. /plant) and Production Usage (%)** – Yields per plants range from 0.50 lbs. per plant to 3.00 lbs. per plant with an interval of 0.05 lbs. Enter expected fresh market and processed market percentages. These two percentages must be equal to 100% or less. If the total of both percentages is greater than 100%, a message will appear asking to correct your input. If the total of both percentages is less than 100%, it is assumed that the difference is culled fruit.

5. **Market Price ($/lb.) and Wages ($/hr.)** – Enter the expected prices for “Fresh Market” and “Processed Market” fruit and “Management” and “Labor” costs per hour.

6. **Interest (%) and Amortization (years)** – Select interest and the number of years you want to amortize your high tunnel system (if any).

7. **Area** – Enter the number of acres of your operation.

8. **High Tunnel** – you can decide to use default values or enter your high tunnel information. This information is required if you decide to use a high tunnel in your operation. This information does not apply for field production.

   By clicking on the “Run” icon, the tool will check if there is missing information. If the initial input was not entered correctly or there is missing information, a warning message asking you to correct the data will appear. If there is no missing information, the tool will show a screen with a summary of the budget.

   The “Summary” screen (Figure 6) is a snapshot of all production activity costs, gross revenues and net returns. From this screen you can navigate across seven different categories (e.g., soil preparation and cleanup, irrigation, high tunnels, planting, pest management, production activities, and harvest) to modify or to enter new information. In
addition, you can return to the main menu, access the economic tools, access the user guide, obtain help, or edit your initial input.

Figure 6. Summary Screen

2. NAVIGATING AND EDITING DEFAULT VALUES

You can navigate across this tool from virtually any screen. There are “Navigation Tools” in each screen that enables movement across screens to edit, update or view information (Figure 7). Click any icon on the “Navigation Tool”, to quickly move among the various screens. In these screens, you can modify, update or enter new information.

Figure 7. Navigation Tools
In the top menu, the user can access the input values used to create the budget divided in seven different categories: soil preparation and cleanup, irrigation, high tunnels, planting, pest management, production activities and harvest. In the bottom menu, the user can access the main menu, the budget, the economic tools, user guide, user input, help menu and to copy the default values again.

Navigating to any category screen will reveal detailed descriptions of the costs of production for each activity and the price and quantity values used to make the calculations. You may enter your own values by placing new values in the "Your Quantity" or "Your Price" columns. Once any new values are entered, calculations are automatically updated. If you modified the default values, the total costs will be highlighted in red. This helps to identify the activities that were modified (Figure 8).

This tool calculates costs and revenues based on a representative set of activities that occur in any given year on a strawberry crop. Additional activities specific to a grower’s operation can be added to the budget; just enter a name or description, unit, quantity, and price per unit. The total cost per each additional activity will be calculated automatically. You can also delete all default activities, units, quantities and prices and enter your own. You can reload the default values by clicking on the “Default Values” icon.
2.1. Depreciation (Amortization Schedule)

An amortization schedule (Depreciation) is a table with the details of the amount of each payment allocated to principal and interest. Every payment made on a loan is split between principal and interest. An amortization schedule provides the exact amount remaining on a loan after each payment is made.

The only category with an amortization schedule is the high tunnels. The user must click on the “High Tunnels” icon, which is located to the right of the top menu. The total value of the high tunnel system has been broken down to the number of years the system is expected to operate. This tool calculates depreciation on the high tunnel system automatically. The user can enter new quantities or prices to modify the total loan amount. This can be done in the high tunnel screen.

![Figure 9. Accessing the Amortization Schedule]

You can access the amortization schedule at the bottom menu. When in the amortization schedule screen, you can choose the number of payments per year, the start date of the loan and enter equal extra payments. The scheduled payment is the value used in the budget for the high tunnel category (Figure 10). High tunnel dimensions and values can be updated by editing the initial input.
3. ECONOMICS

By clicking on the “Economics Tools” icon (from any screen), a graphical representation of the total cost of production, gross revenues, and net returns per acre associated with the information entered in the “User Input” form and all the other screens will be displayed (Figure 6). This tool will calculate breakeven points for price and yield (see Breakeven Analysis for more information). Risk and sensitivity analyses can also be conducted (see Risk and Sensitivity Analyses for more information).

3.1. Breakeven Analysis

Although obtaining positive net present values is the main goal, it is very important to know if/when the production of the organic strawberry will cover the total costs of production or, in other words, breakeven. This tool calculates how much revenue is needed (given expected fresh and processed market yields and prices) to cover the total costs of production.

The breakeven point is defined in this organic strawberry application as the point at which total costs and revenues are equal. There is no net loss or gain (i.e., the producer has "broken even"). Expected market production (EMP_{i}) is equal to market yield (EMY_{i}) per plant times the number of plants (NP) per acre times expected market price (EMPr_{i}), t is time in years, and i is fresh or processed market (See market production equation). Total revenues are the sum of expected fresh and processed market production during the life of the crop.
\[ Market\ Production\ (EMP)_t = \sum (EMY_i \times NP \times EMP_i) \]

So, the breakeven yield (See breakeven yield equation) is calculated by dividing the cumulative total costs of operating the crop (CTC) by the expected average market price (EMP, \( i \)) times the ratio between expected market production (EMP, \( i \)) and total revenues (TR).

\[ Breakeven\ Yield_i = \frac{CTC}{EMP_i} \times \left( \frac{EMP_i}{TR} \right) \]

The tool will calculate the breakeven fresh and processed yields. For example, using the tool’s default values for field production, cumulative total costs (CTC) are equal to $24,455 per acre; total revenues are equal to $57,499 per acre; fresh market fruit is $3.00 per pound assuming 100% of the fruit is sold in the fresh market. The crop will breakeven (e.g., net returns equal to zero), if total production is equal to 8,152 pounds.

Likewise, the breakeven price (See breakeven price equation) is calculated by dividing the cumulative total costs of operating the crop (CTC) by the expected average market yield (EMY, \( i \)) times the ratio between expected market production (EMP, \( i \)) and total revenues (TR). The resulting numbers will be the average annual price per pound (for each quality) that must be attained for strawberries sold for exactly zero profit to be obtained at the end of the year.

\[ Breakeven\ Price_i = \frac{CTC}{EMY_i} \times \left( \frac{EMP_i}{TR} \right) \]

For example, using the tool’s default values, cumulative total costs (CTC) are equal to $24,455; total revenues are equal to $57,499 per acre; cumulative fresh market fruit is 19,166 pounds per acre. The crop will breakeven at the end of the year (e.g., net returns equal to zero), if the fresh market price is $1.28 per pound.

By clicking on the “Breakeven Analysis” icon (See Figure 11), a userform will ask to choose between yield and price breakeven points (e.g., net returns equal to zero).
A breakeven analysis summary for both yields and prices are shown in Figure 11.1. All these values are interactive and will be updated automatically if any input is changed.

### 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 (lbs/acre)</th>
<th>Processed Market Yield (lbs/acre)</th>
<th>Total Revenues ($/acre)</th>
<th>Cumulative Total Costs ($/acre)</th>
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<td>3.00</td>
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</table>

### Breakeven Yield Analysis

This tool also allows producers to examine “What If” scenarios to make better planning and investing decisions. A “What If” analysis is also called a sensitivity analysis. This technique is used to determine how different values of an input will impact the final product. In other words, a sensitivity analysis is a way to predict the outcome of a decision if a situation turns out to be different from the current situation. Here, a user might like to
know how the total costs, gross revenues, and net returns will be affected if a change occurs (for example, unexpected lower yields, lower prices, etc.).

The “Sensitivity Analysis” icon is located on the left corner of the “Economic Tools” screen (Figure 12). Values for one or more inputs (related to yields or prices) can be changed to conduct a “What If” analysis. Once the desired values have been changed, new values for gross revenues and net returns will be recalculated. This “What If” analysis presents instantly the impact of a change in one or more of the inputs on the economic feasibility of the whole strawberry crop.

![Interactive Sustainable Strawberry Budget](image)

**Figure 12. Sensitivity Analysis Userform**

### 3.3. Risk Analysis

This tool includes a risk analysis component. In this tool, risk analysis is defined as a technique that calculates the probability of obtaining a net return greater than a specific dollar target (e.g., $10,000). This target is set by the user. To access the risk analysis component, click the "Risk Analysis" icon located in the “Economic Tools” screen. The form will open with default values but they can be changed at any time (Figure 13).
Enter new “minimum”, “most likely” and “maximum” values for yield (lb/plant) and prices ($/lb). Enter the percentage by which the total cost should increase or decrease each year, a net return target dollar amount ($/ac) that you expect to receive at the end of the year and the percentage by which you want decrease or increase your total costs. After all the input information is recorded, click “Run”.

The model will calculate the probability of the net return value being equal or greater than a specific dollar target; in this example $10,000. To do this the model will simulate net returns a large number of times (in this case 1,000 iterations) to gain a better understanding of the range of possible net returns. It also calculates the range where the average net return will lie (Figure 14). Results of this field production risk analysis example show that this operation has a 42% (out of 100%) chance that it will earn at least $10,000 in total over the life of the operation. Furthermore it is most likely (a 95% chance) that the actual amount earned will fall somewhere between $6,290 and $7,586.
New scenarios can be compared to a baseline as shown in Figure 15.

![Figure 15. Risk Analysis Comparison Scenario](image)

### 4. HELP AND OTHER TOPICS

This tool provides several ways to display help. There is a “Help” icon located in all screens. Click this icon to access a form with 11 different topics (i.e., Quick Start, Initial Input, Editing Input, User Guide, the Navigation Tool, Summary, Economics, Amortization, Breakeven, Sensitivity and Risk Analyses). Select a topic from the list or view the topics sequentially by clicking the “Previous” and “Next” buttons (Figure 16).

![Figure 16. Help Topics](image)

If invalid input (i.e., letters or negative numbers) is entered or there is missing input, warning messages will appear to help the user to change the entry to an appropriate value (Figure 17).
5. GLOSSARY

**Breakeven** is the point at which total cost and revenue (i.e., gross revenues) are equal: there is no net loss or gain (i.e., the producer has "broken even").

**Breakeven price** is the amount of money for which a product (i.e., strawberry) must be sold to cover the costs of producing it. In this tool, the breakeven price is calculated assuming that the total costs of production must be covered.

**Breakeven yield** is the yield required to cover the total cost of producing strawberries. In other words, it is the point at which the money brought in from the sale of strawberries is equal to the total cost of producing strawberries.

**Cash flow** is an amount of money that is either paid out (total cash has decreased; negative) or received (total cash has increased; positive) at the end of a period of time.

**Cumulative net returns** is the aggregate amount that an investment or production process has gained or lost over a period of time. In this case, it is the addition of all gross revenues minus the addition of all total costs during seven years of production.

**Depreciation** (amortization schedule) is the amount of each payment allocated to principal and interest. Every payment made on a loan is split between principal and interest. An amortization schedule provides the exact amount remaining on a loan after each payment is made.

**Fixed costs** are independent of the quantity of a good produced and include inputs (capital) that cannot be varied in the short term, such as buildings and machinery.
**Fresh market fruit** is high quality strawberries that are free of injury, decay, calyces (caps) and sunscald, are fully black in color, appear and feel turgid, and are of regular shape. To meet U.S. Grade 1, ≤ 1% of the lot must be free from mold and 5% free of other defects.

**Interest** is the additional amount of money gained/paid between the beginning and the end of a time period.

**Interest rate** is the change, expressed as a percentage, in the amount of money during the length of time that must occur before *interest* is added to the total.

**Net return** is the money a producer makes after accounting for all the strawberry production expenses. It is calculated as: Gross Revenues minus Total Costs.

**Processed market fruit consists** of dewberries or strawberries of one variety which fail to meet the requirements of the U.S. No. 1 grade but which do not contain more than 10 percent, by volume, of berries in any lot which are seriously damaged by any cause, including therein not more than 2 percent for berries which are affected by mold or decay.

**Revenue** (Gross revenues) is income that a farm receives from the sale of strawberries to customers. In other words, it is the total amount of money received by a producer from the sale of any given quantity of strawberries. It is calculated as: Quantity times Price.

**Risk analysis** calculates the probability of obtaining a *net present return* value greater than a specific dollar target.

**Sensitivity analysis** determines how different values of an input will impact the final product or good. It helps to predict the outcome of a decision if a situation turns out to be different from the current situation. Same as a “What if” analysis.

**Total costs** describe the total economic cost of production and is made up of *variable costs* plus *fixed costs*.

**Variable costs** are costs that change in proportion to the good that a farm produces and include inputs such as labor and raw materials.

**What If** (See *Sensitivity analysis*)
6. ADDITIONAL RESOURCES

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<tr>
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<tr>
<td>Edwards, W., A, Johanns, and A. Chamra</td>
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<td>High Tunnel Prices</td>
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CONTACT US

For more information or technical issues about this tool contact:

Dr. Héctor Germán Rodríguez (hrodrig@uark.edu)

Department of Agricultural Economics and Agribusiness
University of Arkansas, 217 Agriculture Building
Fayetteville, AR 72701 - USA
DISCLAIMER

Activities and prices were based on research conducted at the Fruit Production Research Unit at the Division of Agriculture, Agricultural Research and Extension Center, Fayetteville, AR. The practices described are based on production procedures considered typical for this crop in Northwest Arkansas, and may not apply to every strawberry crop. The costs, practices, and materials will not be applicable to all situations or every production year. Users are encouraged to replace default information with that specific to their operations.

This material is provided as an educational tool and is not a substitute for individualized technical advice. This budget should be used as a guide only. Please direct all production questions to your university Horticulture Department or your local Cooperative Extension Service office.