



Assessing the Economic Feasibility of Growing Specialized Apple Cultivars for Sale to Commercial Hard Cider Producers

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Introduction

This publication describes a set of associated budget spreadsheets that utilize a systematic means to assess the feasibility of growing specialty apple cultivars for sale to commercial hard cider producers.

Hard cider is a growing part of the alcoholic beverage industry. It is made by fermenting apple juice with yeast and typically has an alcohol content between 5 and 10 percent by volume. To make a premium hard apple cider product, commercial cider operations, called “cideries,” want apple cultivars with high tannin, high acid, and/or high sugar content. Few apple cultivars satisfy all of these characteristics, so cider makers often blend multiple cultivars to achieve a desired flavor profile.

Some apple cultivars commonly grown in commercial orchards, such as Albemarle Pippin, Winesap, and Granny Smith, can be used to make hard cider — often as part of a blend. However, many cideries are also seeking specialized apple cultivars with high tannin content or other characteristics that make them unfit for most other market destinations.

We have created two budgetary decision aids to assist growers in determining the feasibility of growing apples for hard cider production. A partial budget for growing multipurpose apples (defined as apple cultivars that potentially have multiple market destinations, e.g., hard cider, fresh market, or processing) and an enterprise budget for planting and growing hard cider apples were developed to help growers analyze the rev-



Hard cider apple cultivars produce a highly tannic and/or acidic juice. Photo courtesy of Greg Peck.

enues, expenses, and risks associated with producing special apple cultivars for sale to cideries. Both budgetary decision aids were created using Excel spreadsheets and are readily available as a free download with a built-in user’s manual.

To estimate the costs of production for growing hard cider apples in Virginia, we surveyed growers, considered our colleagues’ and our own professional experience, and conducted a thorough literature review. The partial and enterprise budget models provide insight into the potential profitability of growing hard cider apples.

Additionally, both sets of budget worksheets are completely customizable so that specific details about your operation can be input. For example, the tree density per acre, orchard size, spray and fertilizer costs, potential yields, and estimated price per bushel can be input into the budget worksheets. This flexibility allows these budget models to provide information for specific sites, operators, and cultivars.

Explanation of Decision Aids and Key Concepts

Partial Budget for Multipurpose Apples

The first decision aid is a partial budget designed to help growers determine whether to grow multipurpose apple cultivars (those not widely grown but have the potential to be sold to cideries and fresh market venues). While a full budget analyzes all the major revenues and expenses associated with a particular enterprise, a partial budget examines only the relevant changes for a particular decision. Thus, the partial budget in the appendix includes only revenue or expense changes if the grower makes the decision to grow multipurpose apples instead of traditional fresh market apples.

This partial budget decision aid assumes that:

- The apple grower is experienced; already has the labor, land, and capital to produce apples; and is considering what to plant on an additional acre of land.
- Although returns will fluctuate throughout the life of the orchard, the comparison is based on differences between the expected revenues and expenses of traditional fresh market and multipurpose cultivars in a typical year at full production.
- The grower has the option of selling a portion or the entire crop of multipurpose apples on the fresh market at a fixed specified price.

The budget generates estimated net changes in mean annual acre profits using these assumptions or other user-defined inputs related to the changes in revenues and expenses from growing multipurpose apples as an alternative to traditional fresh market cultivars. Given the user's "best estimates," this net change in annual profits is an estimate of how much, more or less, a grower could expect in net returns on a per acre basis for

a typical year if he or she grows an acre of multipurpose apples for sale to cideries and the fresh market instead of traditional fresh market cultivars. It's calculated by subtracting the "bad side" (i.e., the reduced revenues and added expenses from not producing fresh market apples) from the "good side" (i.e., the added revenues and reduced expenses from producing multipurpose apples). Along with the initial estimate, the budget automatically updates the output sensitivity analyses and breakeven points — the point at which a decision-maker is indifferent to the two choices because cost and income are equal — allowing growers to see how changes in key variables could affect their overall budget estimates.

Link to Multipurpose Apple Partial Budgeting Spreadsheets

The multipurpose apple partial budgeting spreadsheets can be downloaded at <http://www.pubs.ext.vt.edu/AREC/AREC-46/AREC-46-partial-budget.xlsx>

Full Enterprise Budget for Hard Cider Apples

Unlike multipurpose apple cultivars that are fairly well-understood, very few hard cider apple cultivars have been grown on a commercial scale in Virginia. Data on the potential value, yields, and production costs of hard cider apple cultivars were gathered through a literature review and an informal survey of apple producers and cideries in Virginia and New England. Using this information, a hard cider apple enterprise budget was created to provide Virginia growers with an estimate of the major revenues and expenses to produce cultivars exclusively for hard cider. The budget gives estimated costs for a model situation and allows growers to make adjustments to fit their specific operations. After the inputs section is adjusted to the grower's situation, the budget calculates costs on a per acre basis and allows the user to display the budget for larger orchards, if desired. For example, a grower considering whether to grow hard cider apples on an additional 5-acre block can choose to display the budget at that scale. The summary page then synthesizes the budget's estimated revenues, variable expenses, annualized fixed costs, net income before taxes, net present value of net income before taxes, and cumulative net present value of net income before taxes over the life of the orchard. Along with these estimates, the budget summary page also

automatically updates output sensitivities that allow growers to see how changes in key variables could affect profitability.

Estimation of Farm Level Net Returns for Growing Hard Cider Apples

Calculating the potential farm level net returns for hard cider apple production is a complex task because there are uncertainties about the best cultural practices for growing hard cider apples, as well as large differences among operations and among apple cultivars. As hard cider apple production becomes more established in Virginia, best practice production costs and revenues will become more certain. Using the literature and expert opinion, best judgment estimates for the budget were selected, knowing they will change as apple cider production experience is gained.

With this in mind, the hard cider apple budget estimates are not intended to be representative of all operations and situations. A detailed, line-by-line explanation of the estimates is available within the worksheet (see appendix B).

The most important assumptions behind the per acre estimates are as follows:

- Apples are grown to meet the demand of a hard cider market — not a fresh market.
- The apple grower is experienced and already has the necessary skills, land, labor, and capital to produce apples.
- Apples are planted in 5-foot by 15-foot row spacing, which equates to 581 trees per acre.
- A two-wire trellis system with two end posts per row and 40 feet between line posts.
- An existing drip irrigation system can be expanded to include the new orchard.
- The workforce is made up of predominately H-2A laborers — a federally administered program that allows foreign nationals entry into the U.S. for seasonal agricultural work — working 40 hours per week for nine months at \$9.70 per hour plus a 25 percent additional allowance for other incurred costs that growers provide, such as housing and transportation for H-2A workers.

- Herbicides are sprayed twice per year, starting with the first year.
- Fungicides are applied four times during the first four years, with seven sprays from the fifth year onward.
- Four insecticide/miticide sprays are applied during the first four years, with eight sprays per acre from the fifth year onward.
- Two plant growth regulator sprays are applied for crop thinning from the fourth year onward.
- Four foliar nutrient sprays are applied from the first year onward.
- Tank mixing of sprays resulting in six spray trips per acre during the first four years, with nine sprays trips from the fifth year onward.
- Second through sixth year crop yields estimated at 25, 100, 250, 550, and 600 bushels per acre, respectively.
- An average annual yield at maturity of 775 bushels per acre projected in the seventh year onward.
- The entire yield is sold to cideries at a sale price of \$15 per bushel.
- An orchard life is 25 years.

Given these assumptions and others detailed in the worksheet budget, the per-acre estimate of first-year establishment cost is \$14,421, with annual variable costs at maturity of \$3,270 and total variable costs over 25 years of \$87,788 per acre. The estimated annual revenue at maturity is \$11,625 per acre, with total revenue over 25 years of \$243,750 per acre. Fixed costs are estimated at 20 percent of total variable costs, and annualized fixed costs are \$702. This results in a net loss of \$15,123 in the first year, a net income at maturity before taxes of \$7,653, and a total net income before taxes over 25 years of \$138,404.

Assuming a discount rate of 12 percent, which reflects the rate of return an operation could have earned if it had invested in its next best alternative investment, the cumulative net present value of net income before taxes becomes positive in year 10 and totals \$18,754 over the 25 year life of the orchard. In other words, the net present value analysis estimates that the operation would earn more growing cider apples than it would with its next best investment option (i.e., fresh market

apples). This assumes that costs and returns for growing hard cider apples remain constant over the 25-year span, meaning the price for cider apples remains at \$15 per bushel and there are no crop losses due to extreme weather or other unforeseen events.

What Is Net Present Value of Net Income Before Taxes?

Net present value (NPV) of net income before taxes uses the time value of money to help evaluate the viability of a long-term investment. Economists define NPV as the estimated value of a stream of costs and income received in a future time and discounted to the present.

Net present value is often described as the “time value of money.” Although the term may be unfamiliar, most growers probably already have an intuitive understanding of this concept. The time value of money can be illustrated by a simple question: Would you rather we give you \$1 today or promise to give you \$1 a year from now? The assumption is that you would rather have \$1 today to eliminate the risk that you may never receive the \$1 next year. Having the \$1 today also gives you the freedom to spend or invest your money in a manner that will improve your welfare.

Thus, the time value of money simply means that a dollar in the hand today is worth more than a dollar promised tomorrow. The NPV analysis uses this concept by reducing the value of dollars earned in the future by the discount rate. In this budget, the NPV of net income before taxes discounts each year’s net earnings (or losses) so that they are expressed in terms of what the earnings are worth to you today.

Choice of the discount rate is critical. Because NPV is supposed to reflect the time value of money, it is common practice to use a discount rate that reflects the rate of return you could have earned if you had invested in the next best alternative investment. For example, if you could earn a 25-year rate of return of 12 percent by producing Gala apples for the fresh market, and that is your next best investment option (assuming the first is growing hard cider apples), then you would want to use a discount rate of 12 percent.

Along with annual NPV, the budget estimates the cumulative NPV of net income before taxes. The cumulative estimate is simply the sum of each annual

NPV. By adding the annual NPVs together, the estimate totals how much you could net by growing cider apples after taking into account how much you could have earned in an alternative investment. A cumulative NPV of greater than \$0 means you could earn a greater amount by choosing to grow cider apples than by choosing your next best investment option.

On the other hand, a cumulative NPV estimate of less than \$0 means that you would earn less by growing cider apples than by choosing your next best investment option. In the latter case, you would probably be better off choosing the alternative investment (i.e., growing Gala apples for the fresh market).

NPV analyses must also be tempered with common sense. That is, growing cider apples with limited knowledge about their susceptibility to pest and disease versus growing a known cultivar may not be equally preferred substitutes. Therefore, growers must pay close attention to the sensitivity analysis.

Link to Hard Cider Full Enterprise Budget Worksheets

The worksheets for Full Enterprise Budget for Hard Cider Apples can be downloaded at <http://www.pubs.ext.vt.edu/AREC/AREC-46/AREC-46-enterprise-budget.xlsx>

Additional Risks to Consider With Cider Apples

A budget cannot account for all the risks associated with agricultural production, and there are a number of risks and unknowns surrounding production. For example, many hard cider cultivars bloom later in the spring than commercial cultivars, which may increase the potential for fire blight (*Erwinia amylovora*) infections as well as cause growers to extend beehive rentals, thus limiting the time period during which orchard spray applications can be conducted.

In addition, many cultivars exhibit strong biennial bearing tendencies, and there is little knowledge of the effectiveness of plant growth regulators in controlling each cultivar’s biennial bearing habits. With little modern history of commercial production in Virginia or in the United States, potential yields are uncertain and will be dependent on cultivar, management practices,

weather, site conditions, and other site-specific conditions. Reported average annual yields at maturity from commercial hard cider apple growers that we surveyed ranged from 500 to 1,167 bushels per acre.

The good news for potential growers is that apples with blemishes are acceptable for hard cider production. Given that hard cider apples will be pressed and fermented before reaching the consumer, apple appearance makes little difference to cider makers. Rather, the internal characteristics of the apples (i.e., their chemical composition) determine their value to cider makers. Thus, if a spray is conducted mostly for “cosmetic” reasons and forgoing the spray will not damage the fruit or the tree, the spray may be unnecessary when managing hard cider apple trees. In this sense, hard cider apple cultivars can be grown with fewer inputs, similar to growing apples for the processing market (i.e., apples destined to be made into juice, sauce, or vinegar).

The hard cider apple growers that we surveyed estimated that this change in management requires about half the number of sprays compared to managing traditional cultivars for the fresh market. The actual number of sprays will depend on site conditions and the specific cultivar’s disease resistances and bearing tendencies. However, for growers hoping to produce multipurpose cultivars for sale to both cideries and the fresh market, the spray thresholds will likely have to be the same as other commercial apple cultivars in order to ensure sale of an unblemished, high-quality product on the fresh market.

In order to attract growers to hard cider apple production, cideries must offer premium prices so growers will allocate land, labor, and capital to the new enterprise. Based on our surveys, cideries were willing to pay between \$12 and \$18 per bushel for difficult-to-find hard cider apple cultivars. For multipurpose cultivars, prices tended to range from \$8 and \$13 per bushel.

Whether or not such a premium price makes these apple cultivars a better choice for Virginia apple growers remains to be seen. If apple growers deem the potential gains worth the inherent increases in risk, there is an opportunity for a mutually beneficial relationship with cider makers. Contracts could help share the risk between growers and cideries, but mutual understanding and communication between the two parties is essential to this relationship. In the meantime, the surveyed growers appeared much more open to produc-

ing multipurpose cultivars, which would reduce their dependence on a small number of buyers by allowing them to market to both the fresh market and cideries. In the end, cider makers appear willing to pay a premium for multipurpose and hard cider apple cultivars, but late blooming, biennial bearing, and other unknowns make growing these apples a higher risk alternative.

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Appendix. Instructions for Using the Partial Budget for Multipurpose Apples

A Partial Budget for Apple Growers

The purpose of this budget is to help current apple growers make a decision about whether to produce dual-purpose apples (such as Winesaps, Staymans, Granny Smiths, etc.) for sale to hard cideries and the fresh market. In contrast to a full budget, which outlines all the major revenues and expenses associated with a particular enterprise, a partial budget examines only what would change if a particular decision is made. By adding up the "good" side and the "bad" side of choosing to produce dual-purpose apples instead of traditional fresh market varieties on an additional acre of land, this partial budget gives an estimate of the net change in profits from the switch.

The partial budget's introduction page gives an overview of the budget, which includes a description of the cells that can be modified, how to access the built-in explanations, and the basic steps for using the spreadsheet.

Short comments like this one will show up as long as your mouse pointer remains over the cell.

12	The budget is designed so that you can modify it to fit your specific situation.		
13	Cells with light green backgrounds can be changed by you.		\$ -
14	Clicking on blue or purple underlined text jumps to a detailed explanation of a particular area.		
15	Hovering your mouse pointer over cells with red triangles in the corner also shows explanations.		
16			
17			
18	Here are the basic steps to using this spreadsheet:		
19	Step 1	Read the proposed change and basic assumptions of the model to make sure they apply to your situation.	
20	Step 2	Modify the light green cells in the input and output sections of the spreadsheet based on the specifics of your operation and situation.	
21	Step 3	Examine the estimated net change in profits to see how much more (or less) money you might make with the change.	
22	Step 4	Examine the output sensitivity and breakevens to see how changes in the variables could affect the estimate.	
23	Step 5	Read over some of the other potential factors affecting the decision.	
24			
25			
26		Click Here to Begin	
27			
28	For questions contact:		
29	• Gordon Groover, Farm Management Extension Economist (groover@vt.edu)		
30	• Greg Peck, Assistant Professor of Horticulture, Also H. Smith Jr. AREC (greg.peck@vt.edu)		
31			
32	Spreadsheet developed by Jarrad Farris, Research Assistant, Agricultural and Applied Economics, Virginia Tech (farris@vt.edu)		
33	Special thanks to Alex White for his partial budget expertise.		
34	Version 1.1 Last revision: March 22, 2013		

Appendix B: Instructions for Using the Full Enterprise Budget for Hard Cider Apples

Green input cells signal areas where you can easily modify the budget based on the specifics of your operation and situation.

Proposed Change:
Switching from growing traditional fresh market varieties to growing dual-purpose apple varieties for cideries/fresh market.
Assumptions:
Existing apple grower deciding what to plant on an additional acre.
Dual-purpose varieties are compared to existing fresh market varieties.

Blue hyperlinks bring you to key definitions and in-depth explanations of concepts that might be unfamiliar.

Pa

Inputs:	
Median Return per Bushel	
Traditional fresh market	\$ 10.00
Dual-purpose cideries	\$ 12.00
Dual-purpose fresh market	\$ 9.00
Median Annual Yield (bushels/acre)	
Traditional fresh market	1,000
Dual-purpose	850
Bushels of dual-purpose sold to cideries (per acre of production)	600

Output:

Added Revenues	
Gain in revenue from selling dual-purpose varieties	\$9,450
Other added revenues	\$0
Other added revenues	\$0
Other added revenues	\$0
Other added revenues	\$0
Other added revenues	\$0
Total Added Revenues	\$9,450
Reduced Expenses	
Reduced labor	\$0
Reduced spray materials	\$0
Other reduced expenses	\$0
Other reduced expenses	\$0
Other reduced expenses	\$0
Other reduced expenses	\$0
Total Reduced Expenses	\$0
Total "Good Side"	\$9,450
Estimated Net Change in Median Annual Acre Profits	(\$550)

Reduced Revenues	
Loss in revenue from not selling traditional fresh market varieties	\$10,000
Other reduced revenues	\$0
Other reduced revenues	\$0
Other reduced revenues	\$0
Other reduced revenues	\$0
Other reduced revenues	\$0
Total Reduced Revenues	\$10,000
Added Expenses	
Increased Labor	\$0
Increased Spray Materials	\$0
Other added expenses	\$0
Other added expenses	\$0
Other added expenses	\$0
Other added expenses	\$0
Total Added Expenses	\$0
Total "Bad Side"	\$10,000

The estimated net change in median annual acre profits is automatically updated based on the information you input into the spreadsheet.

Automatically generated output sensitivities and breakeven points show how changes in input could affect the estimated net change in profits.

Output Sensitivity

Estimated Net Change in Annual Acre Profits at Various Levels of Ciderly Sales							
Median Return per Bushel of Dual-Purpose Sold to Cideries	Bushels of Dual-Purpose Sold to Cideries (bushels/acre)						
	420	480	540	600	660	720	780
\$8.40	\$ (2,602)	\$ (2,638)	\$ (2,674)	\$ (2,710)	\$ (2,746)	\$ (2,782)	\$ (2,818)
\$9.60	\$ (2,098)	\$ (2,062)	\$ (2,026)	\$ (1,990)	\$ (1,954)	\$ (1,918)	\$ (1,882)
\$10.80	\$ (1,594)	\$ (1,486)	\$ (1,378)	\$ (1,270)	\$ (1,162)	\$ (1,054)	\$ (946)
\$12.00	\$ (1,090)	\$ (910)	\$ (730)	\$ (550)	\$ (370)	\$ (190)	\$ (10)
\$13.20	\$ (586)	\$ (334)	\$ (82)	\$ 170	\$ 422	\$ 674	\$ 926
\$14.40	\$ (82)	\$ 242	\$ 566	\$ 890	\$ 1,214	\$ 1,538	\$ 1,862
\$15.60	\$ 422	\$ 818	\$ 1,214	\$ 1,610	\$ 2,006	\$ 2,402	\$ 2,798

Estimated Net Change in Annual Acre Profits at Various Yields							
Median Annual Traditional Fresh Market Yield (bu. / acre)	Median Annual Dual-Purpose Yield (bushels/acre)						
	595	680	765	850	935	1,020	1,105
700	\$ 140	\$ 920	\$ 1,685	\$ 2,450	\$ 3,215	\$ 3,980	\$ 4,745
800	\$ (860)	\$ (80)	\$ 685	\$ 1,450	\$ 2,215	\$ 2,980	\$ 3,745
900	\$ (1,860)	\$ (1,080)	\$ (315)	\$ 450	\$ 1,215	\$ 1,980	\$ 2,745
1,000	\$ (2,860)	\$ (2,080)	\$ (1,315)	\$ (550)	\$ 215	\$ 980	\$ 1,745
1,100	\$ (3,860)	\$ (3,080)	\$ (2,315)	\$ (1,550)	\$ (785)	\$ (150)	\$ 125
1,200	\$ (4,860)	\$ (4,080)	\$ (3,315)	\$ (2,550)	\$ (1,785)	\$ (1,020)	\$ (255)
1,300	\$ (5,860)	\$ (5,080)	\$ (4,315)	\$ (3,550)	\$ (2,785)	\$ (2,020)	\$ (1,255)

Detailed explanations in each table are accessible within the spreadsheet.

The blue cell shows the budget's current estimated net change in profits based on the green input cells.

Estimated Breakevens

Estimated annual breakeven dual-purpose yield (bushels/acre)	911
OR	
Estimated annual breakeven dual-purpose bushels sold to cideries	783

[Click here to return to the start](#)

A Hard Cider Apple Budget for Current Growers

The purpose of this budget is to outline the major revenues and expenses that current apple growers would face if they choose to produce hard cider apple varieties and to support the estimation of farm-level cider apple net returns. The budget gives estimated costs for an example situation and is designed so that growers can make adjustments to fit their specific operations. After the input section is adjusted, this budget gives an estimate of the annual and cumulative net income before taxes on a per acre or per block basis, as well as the net present value (NPV) of the investment. Sources for the example estimates are listed in the references tab.

This budget's estimates are examples only and are not intended to be representative of all operations and situations. The budget's utility is in allowing current apple growers to make changes based on their operations. Thus, this analysis is not designed for new startups, but rather for estimating the costs of an ongoing operation. Although new startups might benefit from viewing the budget, they would require closer analysis of the total costs of the farm operation (i.e., a more detailed look at the costs of machinery, equipment, buildings, land, etc.).

Similar to the partial budget's introductory page gives an overview that includes a description of the cells that can be modified, how to access the built-in explanations, and the basic steps for using the spreadsheet.

In this budget, the green input cells will turn orange when they have been changed from the original estimate.

12	The budget is designed so that you can modify it to fit your specific situation.		
13	Cells with light green backgrounds can be changed by you.	\$ -	
	Once a cell has been changed from the original example estimate, it turns orange.	\$ -	
14	Clicking on blue or purple underlined text jumps to a detailed explanation of a particular area.		
15	Hovering your mouse pointer over cells with red triangles in the corner also shows explanations.		
16			
17			
18	Here are the basic steps to using this spreadsheet:		
19	Step 1	Get a feel for the budget by browsing its pages, hovering your mouse pointer over cells with red triangles, and clicking on underlined text.	
20	Step 2	Modify the spreadsheet cells based on the specifics of your operation and situation.	
21	Step 3	View the estimated budget and adjust to a specific block size if desired.	
22	Step 4	Examine the summary page and adjust the fixed costs and discount rate estimates.	
23	Step 5	See how changes in the variables could affect the output.	
31			
32	Row Spacing		
33	Feet between trees:	5	
34	Feet between rows:	15	
35	Calculated No. of trees per acre:	580.8	Calculated No. of rows per acre: 13.9
36	Actual No. of trees planted per acre:	581	Actual No. of rows per acre: 14
37			
38			
39	Click Here to Begin		
41	For questions contact:		
42	• Gordon Groover, Farm Management Extension Economist (groover@vt.edu)		
43	• Greg Peck, Assistant Professor of Horticulture, Also H. Smith Jr. AREC (greg.peck@vt.edu)		
44			
45	Spreadsheet developed by Jarrad Farris, Research Assistant, Agricultural and Applied Economics, Virginia Tech (farris@vt.edu)		
	Version 1.1 Last revision: March 22, 2013		

The row spacing, actual number of trees planted per acre, and actual number of rows per acre can be edited on the introduction page.

Editing these cells based on your operation will also automatically update some of the other budget estimates on the inputs page. You can read an explanation of which estimates will be affected by hovering your mouse pointer over the cells with the red triangles.

As you make changes on the inputs page, you can reference the budget page to get an overall feel for your estimates. This page takes the inputted estimates and calculates the costs of each line item.

Variable Machinery Costs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Labor																	
Seasonal labor	\$ 946	\$ 946	\$ 946	\$ 1,135	\$ 1,419	\$ 1,324	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892	\$ 1,892
Permanent labor	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Operator labor	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230
Trellis																	
End posts	\$ 489	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Line posts	\$ 938	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Wire	\$ 139	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Anchors/tensioners	\$ 840	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Tree stakes	\$ 2,219	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Tree ties	\$ 157	\$ 8	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other trellis installation costs	\$ 146	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Irrigation																	
Drip tape	\$ 87	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Header line	\$ 564	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other irrigation installation costs	\$ 194	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Miscellaneous																	
Bee rental	\$ -	\$ -	\$ -	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75	\$ 75
Insect trap	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16	\$ 16
Tree guards	\$ 436	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Deer repellent	\$ 436	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other animal control	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Ground fertilizer	\$ -	\$ -	\$ -	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140	\$ 140

The budget is displayed for one acre by default. You can choose to display the budget for a larger block size by modifying this cell.

View the worksheets to see all the years, line items, and explanations.

Expenses	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Expenses																	
anting	\$ 1,875	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 3,777	\$ 189	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 123	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 88	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 213	\$ 11	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 37	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30	\$ 30
	\$ 172	\$ 172	\$ 172	\$ 172	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301	\$ 301

The page also provides preliminary estimates of annual and cumulative net income before taxes that exclude other fixed costs.

Once you think the budget page represents your operation and situation, the following page provides relevant summary analyses and sensitivities.

A fixed costs input cell allows you to quickly estimate your other fixed costs as a percentage of total variable costs.

You can also change the estimated discount rate and automatically see how it affects the NPV estimates.

Q. What is this sensitivity table for?

A. This table allows you to easily compare how the median annual net income before taxes varies as the median yield and the median return per bushel change; if there is uncertainty surrounding what the hard cider apple cultivar yield will be and what price you will receive per bushel, this can help you get a feel for how much better or worse off your operation would be at various levels. Each cell represents the estimated median annual net income based on the medians of the "bushel yield per acre" and "average return per bushel" from the inputs page. The estimates will be displayed for the number of acres specified on the budget page.

For example:

Median Return per Bushel	Estimated Median Annual NI Before Taxes at Various Levels						
	Median Yield (bu / A)						
	643	620	698	775	853	930	1,009
\$10.00	\$ 1,762	\$ 2,076	\$ 3,208	\$ 4,204	\$ 5,977	\$ 6,831	\$ 6,645
\$12.00	\$ 2,076	\$ 2,390	\$ 3,522	\$ 4,518	\$ 6,291	\$ 7,145	\$ 6,959
\$15.00	\$ 3,208	\$ 3,522	\$ 4,654	\$ 5,670	\$ 7,423	\$ 8,277	\$ 8,091
\$18.00	\$ 4,340	\$ 4,654	\$ 5,786	\$ 6,802	\$ 8,555	\$ 9,409	\$ 9,223
\$16.00	\$ 2,076	\$ 2,390	\$ 3,522	\$ 4,518	\$ 6,291	\$ 7,145	\$ 6,959
\$18.00	\$ 3,208	\$ 3,522	\$ 4,654	\$ 5,670	\$ 7,423	\$ 8,277	\$ 8,091
\$18.00	\$ 5,831	\$ 7,226	\$ 8,621	\$ 10,016	\$ 11,411	\$ 12,806	\$ 14,201
\$18.00	\$ 6,645	\$ 8,040	\$ 9,435	\$ 10,830	\$ 12,225	\$ 13,620	\$ 15,015

On the other hand, if the median yield is 620 bushels per acre with a median return of \$18.00, the estimated median annual net income before taxes would be \$7,226 (which is \$460 less than the budget's current estimate of \$7,691).

The blue cell in the center of the table shows the budget's current estimated median annual net income before taxes based on the yield and bushel returns specified on the input page. In this case, the current budget estimates give a median yield of 775 bushels per acre and a median return of \$15 per bushel. This results in an estimated median annual net income before taxes of \$7,691.

Adjusting the yield and returns on the input page of the budget will automatically update the table. The table shows sensitivity for 30% above and below the initial medians.

[Click anywhere in this box to return to the budget](#)

Various sensitivity tables surround key variables, as well as an estimate of your potential internal rate of return. All of these tables and key concepts, such as NPV, are explained in the hyperlinked explanations.

Copies of the default estimates are included as the last tab in the file, so you always have them, even after you make changes on the inputs page.

Irrigation														
Drip tape feet per acre	2,904													
Drip tape cost per foot	\$ 0.03													
Header line feet per acre	209													
Header line cost per foot	\$ 2.70													
Other irrigation installation costs per acre	\$ 194.08													
Miscellaneous														
Bee rental cost per acre				\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00	\$ 75.00
Insect trap cost per acre	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00	\$ 16.00
Tree guards per acre	581													
Tree guard cost per unit	\$ 0.75													
Deer repellent units per acre	581													
Deer repellent cost per unit	\$ 0.75													
Other animal control costs per acre														
Ground fertilizer pounds applied per acre				350	350	350	350	350	350	350	350	350	350	350
Ground fertilizer average cost per pound	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40	\$ 0.40
Mowing cost per acre	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70	\$ 4.70
Other														
Expected Harvest														
Bushel yield per acre		25	100	250	550	600	775	775	775	775	775	775	775	775
Average return per bushel	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00

Row Spacing	
Feet between trees:	5
Feet between rows:	15
Calculated of trees per acre:	580.8
Actual No. of trees per acre:	581
Calculated No. of rows per acre:	13.9
Actual No. of rows per acre:	14

No. of acres	1
--------------	---

Fixed costs %	20%
Discount rate	12%

Supplementary Files

Hard Cider Partial Budget	Download Excel File
http://www.pubs.ext.vt.edu/AREC/AREC-46/AREC-46-partial-budget.xlsx	
Hard Cider Enterprise Budget	Download Excel File
http://www.pubs.ext.vt.edu/AREC/AREC-46/AREC-46-enterprise-budget.xlsx	