2013 Cost Estimation of Establishing a Cider Apple Orchard in Western Washington

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS141E

Preface

Cider is fermented apple juice and is often called 'hard cider' in the United States. However, worldwide, the term 'cider' is used most often to describe this fermented beverage and will also be the term used throughout this publication. The study results presented in this WSU fact sheet can serve as a general guide for evaluating the feasibility of establishing and producing cider apples in western Washington as of 2013. Specific assumptions were adopted for use in this study, but these assumptions may not fit every situation since production costs and returns vary across orchard operations, depending on the following factors:

- Capital, labor, and natural resources
- Crop yield
- Cultural practices
- Input prices
- Orchard size
- Cider apple prices
- Management skills
- Type and size of machinery and irrigation system

Cost estimations in this enterprise budget also vary depending on the budget's intended use. To avoid drawing unwarranted conclusions for any particular orchard, readers should closely examine the assumptions used in this study, and adjust the data on costs and/or returns as appropriate for their specific orchard operation.

Cider Apple Production in Washington State

Common cider apple varieties grown in Washington State include Kingston Black (photo shown above), Yarlington Mill, Brown Snout, Dabinett, and Porter's Perfection, among others (Moulton et al. 2010). There were an estimated 204 acres of cider apples produced in Washington State in 2010 and 256 acres in 2011 (Northwest Agriculture Business Center informal survey 2013). Cider apples can be produced with fewer pesticide inputs than dessert apples require since minor surface blemishes are tolerated if yield and internal fruit quality are not affected (Peck and Merwin 2008). Cider apple production in western Washington is not limited by environmentally induced diseases (for example, scab), which often limit fresh market apple production and yields in this same region.

The volume of cider produced in the U.S. increased from 775,031 gallons in 2007 to 5.2 million gallons in 2012, a nearly seven-fold increase, or a 54% increase on average for each year during this six-year period. In Washington State, the total volume of cider produced grew by 290% between 2007 and 2012, or 37% on average for each year during this timeframe (Alcohol and Tobacco Tax and Trade Bureau 2013).

To date, the Northwest Cider Association's membership includes 43 commercial cideries (21 in Washington; 18 in Oregon; 1 in Montana; and 3 in British Columbia, Canada) and 9 cider apple orchards (7 in Washington; 1 in Oregon; and 1 in Montana). Cider is well suited for small-scale artisanal producers in western Washington who rely on local markets. Twelve of the association's member cideries and 2 member orchards are located in western Washington (Northwest Cider Association 2014).

One of the major challenges commercial cider makers face, both in western Washington and at a national level, is the limited availability of the specialized apple varieties required for making quality cider. Cider apples are sorted into four categories (Cider Advisory Committee 1956): ***bittersweet*** – high in tannin, low in acid; ***bittersharp*** – high in tannin, high in acid; ***sharp*** – low in tannin, high in acid; and ***sweet*** – low in tannin, low in acid.

The bittersweet and bittersharp varieties are used to make high quality, full-bodied ciders. Cider drinkers tend to develop a more sophisticated palate that enables them to appreciate the more complex flavors of traditional ciders (Merwin et al. 2008). When producing high quality cider, several factors should be considered, including cider apple varieties, fermentation procedures, and laboratory juice analyses, among others. For more information on cider apple production, including rootstock selection, pest management, harvest, and other cultural practices, see *Hard Cider Production and Orchard Management* (Moulton et al. 2010).

As the production of cider continues to expand, the demand for specialty cider apples will also expand (Merwin et al. 2008). As such, growers will need reliable and objective information on the costs of establishing and producing apples for cider. This publication provides information on the economic feasibility of establishing and producing cider apples in western Washington**,** including the cost of equipment, materials, supplies, and the labor required to establish a producing cider apple orchard. It also provides the price and yield levels needed to make cider apple production a profitable enterprise.

This fact sheet can be used to identify inputs, costs, and yields that are considered typical of a well-managed cider apple orchard in western Washington. This publication does not represent any particular orchard operation and is not intended to be a definitive guide to production practices. However, it does describe current industry trends and can be helpful in estimating the physical and financial requirements associated with establishing a successful cider-producing operation.

Sources of Information

The data used in this study were gathered from a group of experienced cider apple producers in western Washington and supplemented with information provided by scientists at the WSU Mount Vernon Northwest Research and Extension Center (NWREC). The production practices and input requirements adopted by the participating producers form the basis for the assumptions used to develop this enterprise budget. Additionally, the data provided reflect the crop yield and application rates of inputs these area producers anticipate over an apple orchard's life, based on the established assumptions and if no unforeseen failures occur. Given that many factors affect cider apple production costs and returns, individual producers are encouraged to use the Excel Workbook provided to estimate their own costs and returns.

Budget Assumptions

This budget contains information on establishing and producing apples for cider making and incorporates the following assumptions:

1. Post-production costs, such as extended storage, juicing, transportation to cidery, and pomace disposal are not included in this budget.
2. The size of the orchard operation used in this budget is 10 acres, and it assumes one acre is dedicated to roads, buildings, storage, etc., rather than to fruit production. Therefore, the total productive area for this orchard is 9 acres. Table 1 shows the assumed specifications for the cider apple orchard.
3. The cider produced will be hard cider.
4. The total value of bare agricultural land (including water rights) is $13,500 per acre with annual property taxes of $135 per acre.
5. The orchard is drip irrigated using city water.
6. Producers sell apples within 2 weeks of harvest. Apples are stored at the farm in pole barns with no climate control.
7. The price received by cider apple producers is $315/bin. This price is based on the median price obtained by cider makers in western Washington for locally grown cider apples.
8. Bins of cider apples weigh 900 pounds each.
9. Cultural tasks and harvest are done by hand.
10. Management is valued at $300 per acre.
11. Interest on investment is 5%.

Summary of Results

Table 2 shows the estimated annual cost and return for growing cider apples in western Washington. Production costs are split into variable costs and fixed costs. Variable costs include orchard operations, harvest activities, materials, and maintenance and repairs. Fixed costs (costs incurred whether cider apples are produced or not) include depreciation on capital, interest, taxes, insurance, management, and amortized establishment costs. Management is treated as a fixed cost rather than a variable cost because management (like land) has been committed to the production cycle of the crop.

This study assumes that cider apple trees achieve full production in their fifth year. Based on the given assumptions, the total production costs for cider apples during full production are estimated at $12,920 per acre. Enterprise budget values given in Table 2 are based on the more comprehensive cost data presented in Tables 3 through 5. Table 3 and Table 4 list the annual capital requirements and the machinery and building requirements, respectively. Interest and depreciation costs are listed in Tables 5 and 6, respectively. Interest costs represent required return on investments. These costs can be actual interest payments on funds borrowed to finance farm operations and physical capital investments, or they can be an opportunity cost, or a combination of the two.

All interest and amortized costs assume a 5% interest rate. The amortized establishment costs assume a total productive orchard life of 25 years, which includes 4 years of establishment and 21 years of full production. The amortized establishment costs must be recaptured during the full production years in order for an enterprise to be profitable. Depreciation costs (costs calculated based on loss of asset value due to use, age, and/or obsolescence) are annual, non-cash expenses that are calculated over an asset's useful life. Land and other fixed capital costs are estimated based on the entire 10-acre orchard operation. Cost estimates of inputs related to direct production of cider apples are calculated on a per-acre basis for a total growing area of 9 acres (see Appendix 1 and Appendix 2 of Excel workbook).

The estimated net returns (shown in Table 2) represent the profits a producer may earn from investment in land and management after all costs are subtracted, including any labor the producer contributed to crop production. Breakeven net returns for different levels of cost recovery during full production are presented in Table 7.

The first breakeven return ($177/bin) is the amount required to cover total variable costs. If the actual return received

is less than this amount, it will be unprofitable to produce cider apples. This is true even in the short run because the increased costs of production are greater than the increased returns. The second breakeven return ($185/bin) should cover total cash costs, assuming no outstanding loans or land rent. This breakeven return is the amount needed for economical production in the short run.

The third breakeven return ($201/bin) is the amount required to cover total cash costs and depreciation costs, and must be realized to stay in business over the long run. The final breakeven return ($281/bin) is the total cost breakeven return. It is only when this breakeven return is received that the producer can recover all out-of-pocket expenses, plus all opportunity costs. Not obtaining the final breakeven return means the producer will not receive a return on capital contributions equal to what could have been earned through an alternative investment. On the other hand, receiving an actual return greater than the estimated total cost breakeven return means that in addition to covering all cash and opportunity costs, the producer will receive a return for management and the risk assumed in producing cider apples.

Crop yield and prices can vary from year to year. Therefore, to be of use to potential investors, the assumptions underlying the estimates in this enterprise budget should be carefully examined. This study assumed a production level of 46 bins/acre during the mature production years (that is, years 5 to 25). This level of production is what experienced cider apple growers estimate to be an average based on this study's assumed production scenario and given annual crop yield variability (variability due to biennial bearing, extreme temperatures, and pest infestation, among others). To further help users evaluate potential production scenarios, Table 8 illustrates likely per-acre net returns for a fully established orchard given different price and yield levels.

It is important to note that WSU enterprise budgets are economic budgets (not cash budgets), which means they take into account not only cash costs but also opportunity costs. Opportunity costs are defined as revenue foregone by not investing in the next best alternative that carries a similar financial risk; for example, investing money in the stock market, or paying off an outstanding loan. If producers do not include the opportunity costs when they calculate their total cost breakeven return, they will be unable to correctly assess the profitability of farming relative to alternative uses of their resources.

Furthermore, the key results provided in this enterprise budget are based on production-related assumptions established for this study. Production costs and returns for individual producers may differ, thus the results cannot be generalized to represent the entire population of producers. However, an interactive Excel Workbook, described below, is provided as a supplementary reference for this enterprise budget.

Excel Workbook

An Excel spreadsheet version of this enterprise budget (Table 2) is available on the WSU SES Extension web page for crop enterprise budgets at http://extecon.wsu.edu/pages/Enterprise_Budgets. Associated data underlying the per-acre cost calculations shown in Tables 3 through 8 (which can be found in the appendix tables on establishment costs, full production costs, salvage value, and depreciation costs) are also available on this web page, along with an amortization calculator. Select "apples" in the "Commodity" drop-down menu where the publication for cider apples will be listed. Copies of both the manuscript and the Excel Workbook are available here. Growers can modify select values and thus use the Excel Workbook to evaluate their own production costs and returns.

Additional Cider Research Information

Washington State is poised to become the leader in cider research and production in the U.S., and WSU Mount Vernon NWREC has one of the most active cider research and education programs in the country. The cider block at WSU NWREC includes 58 unique cider apple varieties, making it the largest U.S. research orchard for cider apples in terms of number of different varieties. Figure 1 shows Brown Snout apples grown at WSU NWREC, one of the most popular cider apple varieties. This photo provides a view of the tree architecture and crop load described in this budget. More information about cider research at WSU and in the U.S. can be found on the following website: http://extension.wsu.edu/maritimefruit/pages/cider.aspx#research.

Figure 1. Brown Snout variety is one of the cider apple varieties grown at WSU NWREC.

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Table 1. Cider apple orchard specifications.

Total cider apple orchard application	10 acres
Production area	9 acres
Cider apple variety	Several varieties (e.g., Kingston Black, Yarlington Mill, Brown Snout, Dabinett, Porter's Perfection, Vilberie, Foxwelp)
Root stock	Dwarf—M9 series
Architecture	Central leader system
In-row spacing	5 feet
Between row spacing	12 feet
Commercial life of planting	25 years
Tree density/acre	726 trees

Table 2. Cost and returns per acre of establishing and producing cider apples in western Washington.

	Establishment Years				Full Production[1]	
	Year 1	Year 2	Year 3	Year 4		Your Costs
Estimated Gross Production (bins/acre)			5.00	12.00	46.00	
Estimated Price ($/bin)			315.00	315.00	315.00	
Total Returns ($/acre)			**1,575.00**	**3,780.00**	**14,490.00**	
Variable Costs ($/acre)						
Establishment						
Soil Preparation	500.00					
Trees (including labor)	5,263.50					
Orchard Activities						
Pruning & Training[2]	288.00	720.00	1,080.00	1,440.00	1,260.00	
Green Fruit Thinning[3]		144.00	288.00	576.00	576.00	
Irrigation Labor[4]	480.00	480.00	480.00	480.00	480.00	
Chemicals[4],[5]	350.00	350.00	350.00	350.00	350.00	
Fertilizer[5]		60.00	60.00	60.00	248.00	
Manual Pest Control[6]	120.00	120.00	120.00	120.00	120.00	
Beehive			50.00	50.00	50.00	
General Farm Labor[7]	180.00	180.00	180.00	180.00	180.00	
Irrigation/Electric Charge	144.00	144.00	144.00	144.00	144.00	
Harvest Activities[8]						
Picking Labor			405.00	972.00	3,726.00	
Maintenance and Repairs						
Machinery Repair	50.00	75.00	100.00	120.00	140.00	
Fuel & Lube	70.00	70.00	110.00	130.00	140.00	
Irrigation System Maintenance	50.00	50.00	50.00	50.00	50.00	
Other Variable Costs						
Overhead (5% of VC)	374.78	119.65	170.85	233.60	373.20	
Interest (5% of VC)[9]	393.51	125.63	179.39	245.28	293.90	
Total Variable Costs	**8,263.79**	**2,638.28**	**3,767.24**	**5,150.88**	**8,131.10**	
Fixed Costs ($/acre)						
Depreciation						
Irrigation System	100.00	100.00	100.00	100.00	100.00	
Machinery, Equipment & Building	539.76	539.76	539.76	539.76	539.76	
Trellis	90.51	90.51	90.51	90.51	90.51	
Interest						
Irrigation System	62.50	62.50	62.50	62.50	62.50	
Land	675.00	675.00	675.00	675.00	675.00	
Machinery, Equipment & Building	432.35	432.35	432.35	432.35	432.35	
Trellis	56.57	56.57	56.57	56.57	56.57	
Establishment Costs (5%)		545.27	836.54	1,120.06		
Other Fixed Costs						
Miscellaneous Supplies	200.00	200.00	200.00	200.00	200.00	
Land & Property Taxes	135.00	135.00	135.00	135.00	135.00	
Insurance Cost (all farm)	50.00	50.00	50.00	50.00	50.00	
Management Cost	300.00	300.00	300.00	300.00	300.00	
Amortized Establishment Costs[10]					2,147.53	
Total Fixed Costs	**2,641.70**	**3,186.97**	**3,478.23**	**3,761.76**	**4,789.23**	
TOTAL COSTS	**10,905**	**5,825**	**7,245**	**8,913**	**12,920**	
ESTIMATED NET RETURNS	**(10,905)**	**(5,825)**	**(5,670)**	**(5,133)**	**1,570**	
Accumulated Establishment Costs	**10,905.49**	**16,730.74**	**22,401.21**	**27,533.85**		

[1]The full production year is representative of all the remaining years the orchard is in full production (Year 5 to Year 25).
[2]Hand labor rate is $12/hour in Year 1 and $15/hour in subsequent years.
[3]For pruning and training, hand labor rate is $12/hour in Year 1 and $15/hour in subsequent years. For green fruit thinning, hand labor rate is $12/hour. Labor rate includes all applicable taxes and benefits.
[4]Irrigation labor and chemical application are $12/hour and include all applicable taxes and benefits.
[5]Includes materials and labor.
[6]Hand removal of pests, including tent caterpillars.
[7]General farm labor rate is a lump sum per acre and applied to miscellaneous/all other labor. Rate includes applicable taxes and benefits.
[8]Hand labor. Picking rate = $60/bin.
[9]Interest expense on full year during establishment years and for 3/4 of a year during full production.
[10]Represents the costs incurred during the establishment years (minus revenues during those years) that must be recaptured during the full production years.

Table 3. Summary of annual capital requirements for a cider apple orchard operation (10 acres) in western Washington.

	Establishment Years				Full Production[1],[2]
	Year 1	Year 2	Year 3[1]	Year 4[1]	
Annual Requirements ($)					
Irrigation System	22,500				
Land	135,000				
Machinery, Equipment & Building	153,940				
Trellis System	20,366				
Operating Expenses	80,539	29,910	40,070	52,523	79,345
Total Requirements ($)	389,845	29,910	40,070	52,523	79,345
Receipts ($)[3]	—	—	14,175	34,020	130,410
Net Requirements ($)	389,845	29,910	25,895	18,503	(51,065)

[1]The gross yield of cider apples from Year 3 to Full Production is 5 bins/ac, 12 bins/ac, and 46 bins/ac, respectively.
[2]The full production year is representative of all the remaining years the orchard is in full production (Year 5 to Year 25).
[3]Price received is assumed at $315/bin.

Table 4. Machinery, equipment, and building requirements for a cider apple orchard operation (10 acres) in western Washington.

		Market Value of Machinery/Equipment/Building		
Machine/Equipment/Building	Size or Description	Number of Units	Purchase Price ($/Unit)[4]	Total Cost ($)
Tractor	50 hp	1	25,000	25,000
Sprayer	Air blast sprayer, 100 gal	1	4,500	4,500
Weed sprayer boom & tank		1	4,000	4,000
Mower, rotary	6 ft	1	3,500	3,500
Fork lift	5000 lb, gas-powered	1	22,000	22,000
Pickup truck	3/4 ton, 4 WD, extended cab	1	30,000	30,000
Bin trailer	8 ft x 16 ft	1	6,000	6,000
Ladders	8 ft unit	2	120	240
Fence		1	6,600	6,600
Bins[1]	Plastic, 900 lb	46	350	16,100
Shop tools, used[2]		1	6,000	6,000
Machine shop/pole barn[3]		1	30,000	30,000
Total				**153,940**

[1]Number of units correspond to the number of bins of cider apples during fall production.
[2]Includes tools for equipment maintenance, trellis building, irrigation maintenance.
[3]Includes pesticide storage.
[4]Purchase price corresponds to new machinery, equipment, or building.

Table 5. Interest costs per acre for a cider apple orchard in western Washington.

	Total Purchase Price ($)	Salvage Value ($)[1]	Number of Acres	Total Interest Cost ($)	Interest Cost Per Acre ($)
Irrigation System	22,500	0	9	563	62.50
Land[1]	135,000	N/A	10	6,750	675.00
Machinery, Equipment & Building [2]	153,940	19,000	10	4,324	432.35
Trellis	20,366	0	9	509	56.57
Interest Rate	*5.0%*				

Interest Cost is calculated as: (Total Purchase Price + Salvage Value)/2 x Interest Rate.
[1]N/A—Salvage value is not applicable to land because land is not a depreciable asset.
[2]See Appendix 3 in the Excel workbook at http://extecon.wsu.edu/pages/Enterprise_Budgets for a detailed calculation of the salvage value.
The irrigation system and trellis system are used for the direct production of the fruit. Hence, their respective interest costs are divided by the production area (9 acres) to get the interest cost per acre.
Total land area of the orchard operation is 10 acres and machinery, equipment, and building are used in the entire orchard. Thus, the corresponding interest costs are divided by the total area (10 acres) to derive the interest cost per acre.

Table 6. Depreciation costs per acre for a cider apple orchard in western Washington.

	Total Purchase Price ($)	Number of Acres	Total Value Per Acre ($)	Years of Use	Depreciation Cost Per Acre ($/yr)
Irrigation System	22,500	9	2,500.00	25	100.00
Machinery, Equipment & Building	153,940	10	15,394.00	25	539.76
Trellis	20,366	9	2,262.87	25	90.51

The depreciation cost is calculated as straight line depreciation: (Total Purchase Price – Salvage Value)/Years of Use.

Table 7. Breakeven return ($/bin) at different levels of enterprise costs during full production in western Washington.

		Cost ($/acre)	Breakeven Return ($/bin)[1]	Your Cost ($/acre)	Your Breakeven Return ($/bin)
1.	Total Variable Costs	8,131.10	176.76[2]		
2.	Total Cash Costs = Total Variable Costs + Land & Property Taxes + Insurance Cost + Miscellaneous Supplies	8,516.10	185.13[3]		
3.	Total Cash Costs + Depreciation Costs	9,246.37	201.01[4]		
4.	Total Cost = Total Cash Costs + Depreciation Costs + Interest Costs + Management Cost	12,920.32	280.88[5]		

Assumed yield (bins/acre) = 46
Assumed price per bin = $315
[1]Breakeven return is calculated as cost divided by yield.
[2]If the return is below this level, cider apples are uneconomical to produce.
[3]The second breakeven return allows the producer to stay in business in the short run.
[4]The third breakeven return allows the producer to stay in business in the long run.
[5]The fourth breakeven return is the ***total cost breakeven return***. Only when this breakeven return is received can the grower recover all out-of-pocket expenses plus opportunity costs.

Table 8. Estimated net returns[1] ($) per acre at various prices and yields of cider apples during full production in western Washington.

Gross Yield (bins/acre)[2]	Price ($/bin)					
	300	320	340	360	380	400
20	-4,626	-4,226	-3,826	-3,426	-3,026	-2,626
25	-3,567	-3,067	-2,567	-2,067	-1,567	-1,067
30	-2,508	-1,908	-1,308	-708	-108	492
35	-1,450	-750	-50	650	1,350	2,050
40	-391	409	1,209	2,009	2,809	3,609
45	668	1,568	2,468	3,368	4,268	5,168
50	1,727	2,727	3,727	4,727	5,727	6,727

Shaded area denotes a profit based on the combination of yield and price.
[1]Net returns take into account out-of-pocket expenses and opportunity costs.
[2]Assumes a 900-pound bin.

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