



2015 COST ESTIMATES OF ESTABLISHING AND PRODUCING SPECIALTY CIDER APPLES IN CENTRAL WASHINGTON

By
Suzette P. Galinato, Research Associate, IMPACT Center, School of
Economic Sciences, Washington State University, Pullman, WA. **Carol**
A. Miles, Professor and Vegetable Extension Specialist, Department of
Horticulture, WSU Mount Vernon Northwestern Research and
Extension Center, Mount Vernon, WA

WSU PEER
REVIEWED

TB35

2015 Cost Estimates of Establishing and Producing Specialty Cider Apples in Central Washington

Preface

Cider is fermented apple juice and is often called “hard cider” in the US. 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 results presented in this publication serve as a general guide for evaluating the economic feasibility of producing cider apples in central Washington as of 2015. This publication is not intended to be a definitive guide to production practices, but it is helpful in estimating the physical and financial requirements of comparable plantings.

Specific budget assumptions were adopted for 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 the enterprise budget also vary depending on the budget’s intended use. To avoid unwarranted conclusions for any particular orchard, readers must closely examine the assumptions made in this publication, and then adjust the costs, returns, or both as appropriate for their operation.

Cider Apple Production in Washington State

Cider apples can be produced with fewer pesticide inputs than dessert apples since minor surface blemishes are tolerated if yield and internal fruit quality are not compromised (Peck and Merwin 2008). Cider apples are grown throughout Washington. There were an estimated 204 acres of cider apples produced in Washington State in 2010 and 256 acres in 2011 (Northwest Agriculture Business Center 2013). The top cider apple varieties grown in the state are Ashmead’s Kernel, Brown Snout, Dabinett, Frequin Rouge, Harrison, Hewes Virginia Crab, Kingston Black, and Yarrow Mill (Miles et al. 2015). Examples of cider apple varieties that are grown in

central Washington include some of the aforementioned varieties as well as Foxwhelp and Porter’s Perfection (Table 1).

Study Objectives

According to the Alcohol and Tobacco Tax and Trade Bureau (various years), the production of cider in Washington State on which taxes were paid was approximately 56,600 gallons in 2008 and had risen to over 853,900 gallons by 2015—a 15-fold increase in 7 years and a 48% growth rate per year on average. As the production of cider continues to rapidly expand, the demand for specialty cider apples is expected to increase (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 enables growers to estimate (1) the costs of equipment, materials, supplies, and labor required to establish and produce cider apples in central Washington, and (2) the ranges of price and yield at which cider apple production would be a profitable enterprise.

The primary use of this publication is in identifying inputs, costs, and yields considered to be typical of well-managed cider apple orchards in central Washington. This publication does not necessarily 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 profitable cider apple-producing operation.

Sources of Information

The data used in this study were gathered from two commercial apple growers, each with about 8 years of experience growing cider apples, and 10–35 acres of diverse cider apple cultivars in central Washington (Figure 1). Both growers are still experimenting and fine tuning their planting of cider apples; hence, there is no particular cultivar or mix of cultivars that can be definitely recommended for the region at the time of this study. The production practices and input requirements of the participating producers form the baseline assumptions that are used to develop this enterprise budget. In Table 1, examples of cider apple cultivars that can be produced in central Washington are listed. The production costs and returns presented in the enterprise budget is an average for the different cider apple cultivars planted.



Figure 1. A new cider orchard (left) and an established cider orchard (right) in central Washington.

The data provided represent the crop yield and application rates of inputs that these producers anticipate over a cider 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

1. The area of the total farm operation is 100 acres of mixed fruit trees. Bearing acres include: 75 acres of apples (75% of total area), 16 acres of sweet cherries (16%), and 9 acres of pears (9%).
2. The budget is based on an 11-acre cider apple block within the 100-acre farm operation. It is assumed that 1 acre of this block is dedicated to roads, a pond, loading area, buildings, etc., rather than to fruit production. Therefore, the total productive area for this block is 10 acres. Table 1 shows the assumed cider apple block specifications.
3. The total value of bare agricultural land (including water rights) is \$12,000 per acre with annual property taxes of \$120 per acre.
4. The irrigation infrastructure is a dual system: drip system and sprinkler system (mainly for the ground cover). Water is provided through a public irrigation district.
5. Cultural practices and harvest activities are done by hand and using ladders (no mechanical aids).
6. Management is valued at \$300 per acre by a foreman or head supervisor (applied to the entire 100-acre farm). This value represents a fair return to producer's management skills based on the interviewed producers.

7. Post-production costs, such as extended storage, juicing, and transportation to a cidery are not included in this budget.
8. Interest on investment is 5%. Five percent is the median of the range of the average annual effective interest rates on non-real estate bank loans made to farmers from 2010 to 2015 (Federal Reserve Bank of Kansas City 2016).

Summary of Results

Table 2 shows the estimated annual cost and returns for growing cider apples in central Washington. The components of the major costs shown in these tables are provided in more detail in the Excel Workbook discussed in the next section. Production costs are classified into variable costs and fixed costs. Variable costs comprise orchard operations, harvest activities, material and application costs, and maintenance and repairs. Fixed costs are incurred whether or not apples are produced. These costs will generally be calculated for the whole farm enterprise and allocated across each unit of production. The fixed costs include depreciation on capital, interest, taxes, insurance, management, and amortized establishment costs. Management is treated as a fixed rather than a variable cost because, like land, management has been committed to the production cycle of the crop.

This study assumes that cider apple trees achieve full production in their sixth year. Based on the given assumptions, the total production costs for cider apples during full production are estimated at \$11,941 per acre. The estimated net returns (shown in Table 2) represent what a producer may earn from investment in land and management after all costs are subtracted, including labor the producer contributed

to crop production. The breakeven price for cider apples during full production is about \$239 per 900 lb bin (or \$0.27/lb) given a yield of 50 bins (45,000 lb) per acre.

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 50 bins per acre during the full production years (that is, years 6 to 30). This level of production is what experienced cider apple growers estimate to be an average over the remaining years that the orchard is in full production given the study's assumed production specifications and given annual crop yield variability (i.e., due to biennial bearing, extreme temperatures, and pest infestation, among others). To further help users evaluate potential production scenarios, Table 3 illustrates likely per-acre net returns for a fully established orchard given different price and yield levels.

Most of the budget values given in Table 2 are based on more comprehensive underlying cost data, which are shown in Tables 4 through 7. Table 4 presents the annual capital requirements for a 10-acre cider apple block. Table 5 specifies the machinery and building requirements for the 100-acre diverse cultivar orchard. Interest costs and depreciation are listed in Tables 6 and 7, respectively.

Interest costs represent required return on investments. They can be actual interest payments on funds borrowed to finance farm operations and physical capital investments, an opportunity cost (a return that would have been received if the investment had been in an alternative activity), or a combination of the two. All interest and amortization costs assume a 5% interest rate. The amortized establishment costs assume a total productive life of 30 years, which includes 5 years of establishment and 25 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 are annual, non-cash expenses that are calculated over the asset's useful life. These expenses represent the loss in an asset's value due to use, age, and obsolescence.

The economic feasibility of investing in a cider apple orchard is further assessed by using the net present value (NPV) and discounted payback period. NPV is the sum of the discounted cash flows from the first year to the last year of the planting's productive life (i.e., 30 years). NPV provides an indicator of an investment's feasibility by estimating and converting its future profits into present-day dollars given the cost and length of the investment, time value of money, and how long it takes for an investment to return a profit. The discounted payback period

gives the number of years it would take to recoup an investment from discounted cash flows.

Discounting is a method to estimate the present value of future payments. A discount rate of 5% is used in the calculation of NPV and payback periods, and represents the opportunity cost of capital.

Assuming a price of \$315 per 900 lb bin (\$0.35/lb) and a discount rate of 5%, the NPV of the investment or expected profits (in present-day dollars) over the lifetime of the cider apple orchard is \$0.49 million (Table 8). The estimated discounted payback period for the orchard investment can vary depending on the costs included in the calculation, and ranges from 6.7 to 11.9 years. If one includes total cash costs (which is the sum of total variable costs, miscellaneous supplies, land and property taxes, and farm insurance), the discounted payback period is 6.7 years. Whereas, if one includes all production costs (which is the sum of total cash costs, management costs, and fixed capital investment), the discounted payback period is 11.9 years. Table 8 also shows the sensitivity of the NPV calculations to different discount rates—3% through 9%. The range of the average annual effective interest rates on non-real estate bank loans made to farmers in the past 6 years (2010 to 2015) is between 4% and 6% according to the Federal Reserve Bank of Kansas City (2016). Alternative discount rates are included to demonstrate the value of better (or worse) investments or possible impacts of inflation. The NPV and payback period calculations can be found in Appendix 6 of the Excel Workbook.

The key results of these enterprise budgets are based on production-related assumptions established for the study. Production costs and returns for individual growers may differ, thus the results cannot be generalized to represent the entire population of growers. An interactive Excel Workbook is provided to enable individual growers to estimate their returns based on the costs of their production.

Excel Workbook

An Excel spreadsheet version of this enterprise budget (Table 2), as well as associated data underlying the per-acre cost calculations (Tables 5 through 7 and Appendices 1 through 6 for establishment costs, full production costs, calculation of salvage value and depreciation costs, amortization calculator, production-related data, and NPV and payback period calculators) are available at the [WSU School of Economic Sciences Extension website](http://www.wsu.edu/extension/economic).

Growers can modify select values and thus use the Excel Workbook to evaluate their own production costs and returns.

Additional Cider Research Information

WSU Mount Vernon Northwestern Washington Research and Extension Center (NWREC) is actively investigating cider apple production and mechanical harvest. The new cider research orchard at WSU NWREC includes 60 specialty cider apple varieties (Figure 2). More information about cider research at WSU and in the US can be found on the [WSU Hard Cider website](#).



Figure 2. The new cider experimental orchard at WSU Mount Vernon NWREC.

Acknowledgements

The authors wish to thank the Northwest Cider Association and WSDA Specialty Crop Block Grant Program (grant number K 1270) for funding this study, and the WSU Extension publication reviewers for their helpful comments. The assistance provided by cider apple growers in developing the enterprise budget is also greatly appreciated.

References

- Alcohol and Tobacco Tax and Trade Bureau (TTB). Various years. Cider statistics CY 2008-2015. TTB, Washington, D.C.
- Federal Reserve Bank of Kansas City. 2016. [Agricultural Finance Databook: Tables](#).
- Merwin, I.A., S. Valois, and O. Padilla-Zakour. 2008. Cider Apples and Cider-Making Techniques in Europe and North America. *HortReviews* 34: 365–414.
- Miles, C.A., J. King, and G. Peck. 2015. Commonly Grown Cider Apple Cultivars in the U.S. Cider Report 202. Washington State University Mount Vernon Northwestern Washington Research and Extension Center, Mount Vernon, WA.
- Northwest Agriculture Business Center. 2013. Informal survey.
- Peck, G.M., and I.A. Merwin. 2008. Organic and Integrated Fruit Production Systems for the Northeastern US (Abstract). *HortScience* 43(4): 1111.

Table 1. Cider Apple Block Specifications

Architecture	Three dimensional central leader
In-row Spacing	3 feet
Between-row Spacing	10 feet
Rootstock	Dwarf - M9 series
Block Size	10 acres
Cider Apple Variety	Several varieties (e.g., Dabinett, Foxwhelp, Golden Russet, Harrison, Kingston Black, Porter's Perfection, Yarrowling Mill, etc.)
Life of Planting	30 years
Tree Density	1,452 trees per acre
Trellis System	Tall spindle

Table 2. Cost and Returns per Acre of Producing Cider Apples on a 10-Acre Orchard Block in Central Washington

	Establishment Years					Full
	Year 1	Year 2	Year 3	Year 4	Year 5	Production ^A
Estimated Production (bins/acre) ^B			10.00	30.00	40.00	50.00
Estimated FOB Price (\$/bin)			315.00	315.00	315.00	315.00
TOTAL RETURNS (\$/acre)			3,150.00	9,450.00	12,600.00	15,750.00
Variable Costs						
Establishment ^C	10,900.22	0.00	0.00	0.00	0.00	0.00
Orchard Activities ^D	1,721.00	2,088.00	2,529.60	2,864.60	3,412.60	3,713.60
Harvest Activities ^E			600.00	1,800.00	2,400.00	3,000.00
Maintenance and Repairs ^F	232.00	292.00	322.00	386.50	386.50	410.50
Other Variable Costs ^G	1,317.46	243.95	563.26	727.21	844.88	843.70
Total Variable Costs	14,170.68	2,623.95	4,014.86	5,778.31	7,043.98	7,967.80
Total Fixed Costs^H	2,040.67	2,851.23	3,365.85	3,577.38	3,572.67	3,973.00
TOTAL COSTS (\$/acre)	16,211.34	5,475.18	7,380.71	9,355.70	10,616.65	11,940.80
ESTIMATED NET RETURNS (\$/acre)	-16,211.34	-5,475.18	-4,230.71	94.30	1,983.35	3,809.20

Notes:

A. The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 30).

B. Bin size is 900 lb.

C. Includes costs of soil preparation and planting (trees and labor).

D. Includes pruning and training, green fruit thinning, irrigation labor, chemicals, fertilizer, frost protection (labor), beehives, general farm labor, and irrigation and electric charge.

E. Picking labor rate is \$60 per 900 lb bin.

F. Includes maintenance and repair, and fuel and lube.

G. Includes crop insurance (starting Year 3), overhead, and interest on operating capital.

H. Includes depreciation and interest on fixed capital, interest on establishment, and other fixed costs (miscellaneous supplies, land and property taxes, farm insurance, management cost, and amortized establishment cost).

Table 3. Estimated Net Returns^A (\$) per Acre at Various Prices and Yields of Cider Apples during Full Production in Central Washington

Yield (bins/acre) ^B	FOB Price (\$/bin) ^C					
	\$195	\$225	\$255	\$285	\$315	\$345
40	-\$3,487	-\$2,287	-\$1,087	\$113	\$1,313	\$2,513
45	-\$2,839	-\$1,489	-\$139	\$1,211	\$2,561	\$3,911
50	-\$2,191	-\$691	\$809	\$2,309	\$3,809	\$5,309
55	-\$1,543	\$107	\$1,757	\$3,407	\$5,057	\$6,707
60	-\$894	\$906	\$2,706	\$4,506	\$6,306	\$8,106
65	-\$246	\$1,704	\$3,654	\$5,604	\$7,554	\$9,504
70	\$402	\$2,502	\$4,602	\$6,702	\$8,802	\$10,902

Notes:

Shaded area denotes a positive profit based on the combination of yield and price.

A. Includes amortized establishment costs. Net return is what the grower receives after all production expenses have been accounted.

B. Assumes a 900lb bin.

C. Price represents gross return before any expenses are subtracted.

Table 4. Summary of Annual Capital Requirements for a 10-Acre Cider Apple Block in Central Washington

	Establishment Years					Full Production ^A
	Year 1	Year 2	Year 3	Year 4	Year 5	
Land (11 acres)	132,000.00					
Trellis System	25,000.00					
Irrigation System	30,000.00					
Mainline & Pump	6,500.00					
Pond	3,000.00					
Wind Machine			41,289.60			
Operating Expenses ^B	148,356.75	32,889.50	46,798.64	64,433.13	77,089.83	86,327.98
Total Requirements (\$)	344,856.75	32,889.50	88,088.24	64,433.13	77,089.83	86,327.98
Receipts (\$)	0.00	0.00	31,500.00	94,500.00	126,000.00	157,500.00
Net Requirements (\$)	344,856.75	32,889.50	56,588.24	-30,066.87	-48,910.17	-71,172.02

Notes:

A. The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 30).

B. Operating expenses are the sum of the total variable costs, miscellaneous supplies, land and property taxes, insurance cost, and management costs. The yields of cider apples from Year 3, Year 4, Year 5, and Full Production are 10 bins/ac, 30 bins/ac, 40 bins/ac and 50 bins/ac, respectively.

Gross return is \$315 per 900-lb bin.

Table 5. Machinery, Equipment, and Building Requirements for a 100-Acre Diverse Cultivar Orchard

	Purchase Price (S) ^A	Number of Units	Total Cost (\$)
Housing for Manager	135,000	1	135,000
Machine Shop/Shed ^B	50,000	1	50,000
Tractor-70HP, 4WD	32,500	1	32,500
Tractor-40HP, 4WD	25,000	1	25,000
4-Wheeler	7,500	2	15,000
Speed Sprayer	20,000	1	20,000
Weed Spray Boom & Tank	7,000	1	7,000
Mower-Rotary (7 ft)	5,000	1	5,000
Flail Mower	8,000	1	8,000
Fork Lift	25,000	1	25,000
Bin Trailer	7,500	1	7,500
Pickup Truck	20,000	1	20,000
Ladder-8'	100	50	5,000
Miscellaneous Equipment ^C	20,000	1	20,000
Shop Equipment ^D	50,000	1	50,000
Total Cost			425,000

Notes:

Machinery, equipment, and building requirements are utilized in growing diverse crops in the 100-acre farm, which include cider apples. The costs of fixed capital are allocated on the entire farm operation.

A. Purchase price corresponds to new machinery, equipment or building.

B. Includes pesticide handling area and storage, dry storage, area for equipment cover, and shop bay for equipment work/repair.

C. Includes mobile portable toilet (2), quick connect loader, utility trailer, ladder trailer (2), etc.

D. Includes compressor, welder, pressure washer, and miscellaneous tools.

Table 6. Annual Interest Costs per Acre for a 10-Acre Cider Apple Block in Central Washington

	Total Purchase Price (\$)	Salvage Value (S) ^A	Number of Acres	Total Interest Cost (\$)	Interest Cost Per Acre (S) ^B
Irrigation System ^C	30,000	0	10	750	75.00
Land	132,000	N/A	11	6,600	600.00
Machinery, Equipment, & Building ^{D,E}	425,000	24,000	100	11,225	112.25
Mainline & Pump ^C	6,500	0	10	163	16.25
Pond ^C	3,000	0	10	75	7.50
Trellis ^C	25,000	0	10	625	62.50
Wind Machine ^C	41,290	0	10	1,032	103.22

Notes:

A. Not applied to land because land is not a depreciable asset.

B. Annual interest cost is calculated as: $(\text{Total Purchase Price} + \text{Salvage Value}) \div 2 \times \text{Interest Rate}$. For land the calculation is: $\text{Total Purchase Price} \times \text{Interest Rate}$ because there is no salvage value for land.

C. The irrigation system, mainline and pump, pond, trellis system, and wind machine are used for the direct production of the fruit. Hence, their respective interest costs are divided by the production area (10 acres) to get the interest cost per acre.

D. Total area of the farm operation is 100 acres and machinery, equipment, and building are used in the entire, diverse cultivar farm. Thus, the corresponding interest costs are divided by the total area (100 acres) to derive the interest cost per acre.

E. See Excel Workbook (Appendix 3) for a detailed calculation of the salvage value of machinery, equipment, and building.

Table 7. Annual Depreciation Costs per Acre for a 10-Acre Cider Apple Block in Central Washington

	Total Purchase Price (\$)	Number of Acres	Total Value Per Acre (\$)	Years of Use	Depreciation Cost Per Acre (\$/yr)^A
Irrigation System	30,000	10	3,000.00	30	100.00
Mainline & Pump	6,500	10	650.00	30	21.67
Pond	3,000	10	300.00	50	6.00
Trellis	25,000	10	2,500.00	30	83.33
Wind Machine	41,290	10	4,128.96	30	137.63
Machinery, Equipment & Building ^B					291.17

Notes:

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

B. See Excel Workbook (Appendix 3) for calculation of the depreciation cost of the machinery, equipment, and building.

Table 8. NPV and Payback Periods given Different Discount Rates

Discount rate	NPV	Payback Period of Total Cash Cost^A (years)	Payback Period of Total Cost^B (years)
3%	\$778,436	6.43	10.77
4%	\$618,889	6.55	11.28
5%	\$487,766	6.67	11.86
6%	\$379,392	6.80	12.55
7%	\$289,330	6.94	13.37
8%	\$214,092	7.09	14.39
9%	\$150,923	7.26	15.69

Notes:

A. Cash cost is the sum of total variable cost and land rent. Excludes interest on operating capital.

B. Total cost is the sum of: total cash cost, management cost and fixed capital investment. Excludes interest on operating capital and interest on fixed capital.



Copyright 2017 Washington State University

WSU Extension bulletins contain material written and produced for public distribution. Alternate formats of our educational materials are available upon request for persons with disabilities. Please contact Washington State University Extension for more information.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, and national or ethnic origin; physical, mental, or sensory disability; marital status or sexual orientation; and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local WSU Extension office. Trade names have been used to simplify information; no endorsement is intended. Published November 2016. Revised January 2017.