The Economics of Growing Cider Apples

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Introduction

The U.S. Alcohol and Tobacco Tax and Trade Bureau (ATTTB) reported that in 2014 over 54 million gallons of hard cider were sold in the U.S. This volume of cider required approximately 18 million bushels (757 million pounds) of apples, which is equivalent to 7% of the U.S. apple crop. However, a substantial, but unknown amount of this cider was produced using apples and apple juice concentrate imported from outside the U.S. Statistics on specialty cider apple orchard acreage in the U.S. is lacking, so growers and academics can only speculate on the current and future supply of cider apples in the U.S.

One industry information clearinghouse has found that there are 560 cider producers in the U.S. (http://www.cydermarket.com). Increased cider production could create new opportunities for growers, allowing for orchard expansion and diversification, as well as increased profitability. However, many of the specialized European cider cultivars that are desired by cider producers have been selected for their fruit and juice quality more so than for their horticultural performance. Thus, these varieties may present production challenges to commercial apple growers. For example, some of the known issues with European cider varieties include susceptibility to fireblight and powdery mildew, biennial bearing, pre-mature fruit drop, overly vigorous growth, and production of extensive blind wood (shoots with few or no flower buds).

Growers will need to determine what kind of planting system they wish to use for growing cider apples. In many apple production regions of the U.S., there has been a dramatic shift towards growing fresh market varieties in high-density orchards using dwarfing rootstock with trellis systems. The benefits of these intensive apple production systems are clear: greater precocity (4-5 years to full production), better fruit quality, less biennial bearing, better spray coverage, and greater labor efficiency. These factors all lead to greater profitability for growing culinary apples in high-density orchards, and in Europe many cider apple growers use high-density systems for growing cider apples. In the U.S. there has not yet been sufficient research to demonstrate the benefits of using high-density systems to grow cider apples. A major consideration for the high-density system is the installation cost of more than $15,000 per acre. Additionally, more research is needed to understand the impacts of orchard design on horticultural management, disease and pest incidence, and fruit and cider quality. Cost of production budgets can aid orchard owners and managers to make fiscally sound decisions based upon known input costs and potential returns.

Economic Feasibility of Cider Apple Production

Farm owners and managers make choices on how to efficiently allocate limited farm resources among competing, individual crop enterprises. Since many decisions can have important financial impacts, a decision framework can be used to evaluate the tradeoffs and the profitability of an enterprise. An enterprise budget is a planning and informational tool for estimating the production costs, returns and profit of an enterprise. Information gained from an enterprise budget include:

- What are the start-up costs – e.g., fixed capital investments – machinery, equipment?
- What are the annual costs of production?
- After how many years will the operation be profitable?
- After how many years will the cost of investment be recovered?

Factors such as variations in orchard production systems and practices, apple cultivars appropriate for different production regions, and prices of inputs and outputs, among others, make answers to the above questions very specific to each operation. However, through surveys of cider apple growers we provide examples that can serve as benchmarks for cider apple production in Washington (WA) and Virginia (VA). The surveys involved meeting with some growers to develop a baseline production scenario, identifying production inputs, and estimating income and production costs. Enterprise budgets were published as extension bulletins, accompanied by interactive Excel workbooks (accessible at http://pubs.ext.vt.edu/AREC/AREC-46/AREC-46.html for Virginia and http://ses.wsu.edu/extension/enterprise_budgets/ for Washington).

Overview of an Enterprise Budget

Enterprise budgets are based on established assumptions about production, and these assumptions may not fit every individual farm. Growers should complete the above cited interactive Excel documents to get a more precise portrayal of their own operation. Additionally, enterprise budgets account for financial costs and opportunity costs, but not other economic forces that affect profitability. Opportunity costs are defined as revenue foregone by not investing in the next best alternative that carries a similar financial risk; for example, investing in the stock market or paying off an outstanding loan, or in terms of owned land, the opportunity cost is what an owner-producer could earn from renting out the land instead of using the land him/herself.

Enterprise budgets consist of both variable and fixed costs. Variable costs are those expenses that vary with output within a production period and result from the use of purchased inputs and owned assets. Fixed costs are those that do not vary with the level of output. For the benchmark enterprise budgets described in this paper, these costs were tabulated and then reviewed by commercial cider apple growers and industry experts.

Assumptions and Results

The assumptions used for the benchmark enterprise budgets in Virginia and Washington (central and western regions) included: crop yield, which began in the third year in Washington and second year in Virginia; gross return to the grower, which was $315 per 900-lb bin in WA and $321 per 900-lb bin in VA; and manual labor for horticultural practices and harvest (Table 1). These assumptions form the basis for the production cost estimates.

The operating costs of cider apple production in WA and VA are shown in Figure 1. Hired labor and management comprised the largest operating cost; followed by chemical and fertilizer costs which were 13-14% of the total operating expenses in WA, and 23% in VA.

Virginia

In Virginia, growing specialized cider apple cultivars for sale to commercial hard cider producers was found to be economically profitable. The study estimated the first year establishment cost at $35,635/ha ($14,427/acre). Annual variable costs at maturity were estimated at $8,080/ha ($3,271/acre), and the total variable costs over 25 years were $215,930/ha ($87,421)/acre). The Net Present Value of the cider apple orchard investment was positive at year 4. Furthermore, a partial budget analysis showed that growers would need to receive a median return of $0.63/kg ($12/bu) at a yield of 28,245 kg/ha (600 bu/acre) to justify producing multipurpose apples (that can be used for hard cider as well as fresh consumption) instead of mainstream cultivars (used for fresh consumption only).

Washington

The WA budgets assumed that trees start bearing fruit in Year 3, and full production was achieved in the fifth year in western WA and in the sixth year in central WA. In Figure 2, gross revenue is represented by the green marker. When the gross revenue is above the columns, it means that the grower was able to recover all production costs as well as earn a profit. During the first two years of establishment, the gross revenue was zero because there was no crop yield. In central WA, gross revenue was not greater than costs through Year 3, and in Year 4 gross revenue was a bit greater than costs, indicating that a grower was able to contribute towards the opportunity costs that year. In the case of western WA, gross revenue was only able to cover part of the variable costs by Year 4. In both WA production regions a profit is earned in Year 5 and onwards.

Enterprise budgets are also useful in performing breakeven analysis for prices. The break-even price represents a marketing price target that must be received in order to cover production costs at the expected yield. The estimated break-even prices or returns for different levels of cost recovery are shown in Table 2. If the first break-even return is below the total variable costs (i.e., below $159/bin or $177/bin), cider apples are not profitable. The second break-even return shows that the total cash costs are recovered, thus allowing the grower to stay in business in the short run. The third break-even return is what must be received to stay in business over the long run because the fixed costs are being covered. Otherwise, replacing machinery and equipment will be increasingly difficult and as a result, the enterprise will not be financially sound after a period of several years. The fourth break-even return is the total cost break-even return. Only when this break-even return is received can the grower recover all expenses including opportunity costs. This figure is lower than $315/bin that was used as the baseline, which means that in addition to recovering all costs, the grower is able to earn a profit during the full production of cider apples.

The point in time when an orchard operator is able to recover all funds expended in the orchard will vary depending on the costs included in the calculation of the payback period. For the Central WA example, if one includes total cash costs (the sum of total variable cost, miscellaneous supplies, land and property taxes and insurance cost), the payback period is 6.6 years. If all production costs are taken into account, which is the sum of total cash cost, management cost and fixed capital investment, the payback period is 11.3 years.

Discussion

Production practices and yields can vary depending on the production area; for example a high density orchard in central Washington and medium density orchard in western WA and Virginia, will have very different expected yields. However, based on the benchmark data we assembled and the economic assumptions built into the enterprise budget models, cider apple production can be economically profitable for both production systems. Economic profitability means that an enterprise is financially sustainable in the long run if a producer's revenues are able to recoup the total production costs, which is shown to be the case for cider apple production in Virginia and Washington. Labor cost, though, was a significant expense. Mechanical pruning, harvesting, and other tasks may help to reduce labor costs. Other important issues to carefully evaluate include producing multipurpose apples so that there are alternative market destinations for the fruit. In the end, growers should only consider producing specialized cider apples if they lead to increased profits and/or reduced risk. Additionally, growers need to provide a product (i.e., apples) that cideries are willing to buy.

While the consumption of hard cider has grown 9-fold from 2007 to 2014, and major marketing firms predict a strong cider market for the next decade, there is no guarantee that these consumer trends will continue. An orchard is a 20-30 year investment and growers will have to take a risk of planting varieties that have not been widely grown or objectively evaluated in the U.S. Additionally, apple growers will have to weigh the potential opportunity costs if cider consumption trends falter. It is reasonable to question the long-term prospects for the U.S. cider industry, but it is also a very exciting time for both apple growers and cider producers.

Following are general recommendations for potential growers of cider apples:

- Plant orchards in horticulturally desirable sites (i.e., sites with excellent sun exposure, air drainage, well-drained soils, etc.).
- Use precocious rootstocks that are disease resistant and virus free.
  - There are several Geneva rootstocks that will have a mature tree size between M.9 and M.26, but have greater resistance to soil-borne diseases, replant disease, and fireblight than Malling or Merton Malling stocks.
- Use varieties that are going to produce annually, and have some level of disease resistance.
- Source trees from a certified nursery to ensure they are virus-free.
- Use plant growth regulators for thinning, increasing return bloom, minimizing pre-harvest drop and fruit loosening.
- Identify what is most important to you (if you are producing your own cider) and/or your buyer (if you are selling fruit to a cidery); for example, organic versus conventional, high crop yield, labor efficiency, fruit with high tannin content.
- Do your homework because an orchard is a 20- to 30-year-long investment.

Other useful resources are:

- Virginia — Hard cider production - http://www.arec.vaes.vt.edu/alson-h-smith/treefruit/horticulture/hard-cider/
- Washington — Cider research – http://www.cider.wsu.edu
  Hard Cider Production and Orchard Management in the Pacific Northwest (PNW 621)
  https://pubs.wsu.edu/ItemDetail.aspx?ReturnTo=0&ProductID=15402
- Cider Apple Variety Information

- Miles, C., King, J., & Peck, G. (2015). Commonly Grown Cider Apples In the U.S. Washington State University CIDER Report #2. Retrieved from: www.wsu.edu/maritimefruit/hard-cider/.
- Merwin, I.A. (2015). Growing Apples for Craft Ciders. New York Fruit Quarterly 23(1):5-9. Retrieved from: http://www.nyshs.org/fq.php.

Table 1. Baseline production assumptions for enterprise budget om Washington and Virginia.

Specifications	Central WA	Western WA	Virginia
In-row spacing	3 feet	5 feet	5 feet
Between-row spacing	10 feet	12 feet	15 feet
Rootstock	Dwarf – M.9 Sized	Dwarf – M.9 Sized	Dwarf to Semi-Dwarf (M.9 or M.26 Sized)
Cider apple variety	Specialized cider varieties (e.g., Dabinett, Foxwhelp, Golden Russet, Harrison, Kingston Black, Porter's Perfection, Yarlington Mill, etc.)		
Life of planting	30 years (5 yr establishment, 25 yr full production)	25 years (4 yr establishment, 21 yr full production)	25 years (6 yr establishment, 19 yr full production)
Tree density	1,452 trees/acre	726 trees/acre	581 tees/acre
Trellis system	Spindle (tall)	Spindle	Vertical Axe

Table 2. Break-even return ($/bin) for different levels of enterprise costs during full production in Washington.

Levels of enterprise costs	Central WA	Western WA
Total variable cost	$159/bin	$177/bin
Total cash cost = Total variable cost + Land and property taxes + Insurance cost + Miscellaneous supplies	$167/bin	$185/bin
Total cash cost + Depreciation cost	$179/bin	$202/bin
Total cost = Total cash cost + Depreciation cost+ Interest cost+ Management cost	$239/bin	$263/bin

Note: One bin = 900 lb.

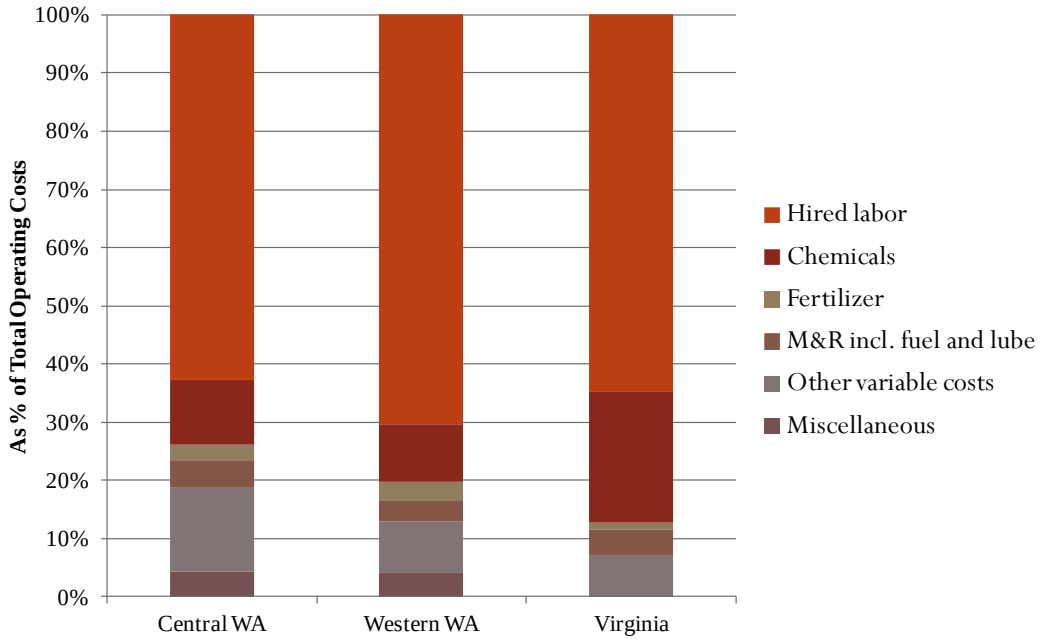

Figure 1. Operating costs during full production of cider apples in central WA, western WA and Virginia.

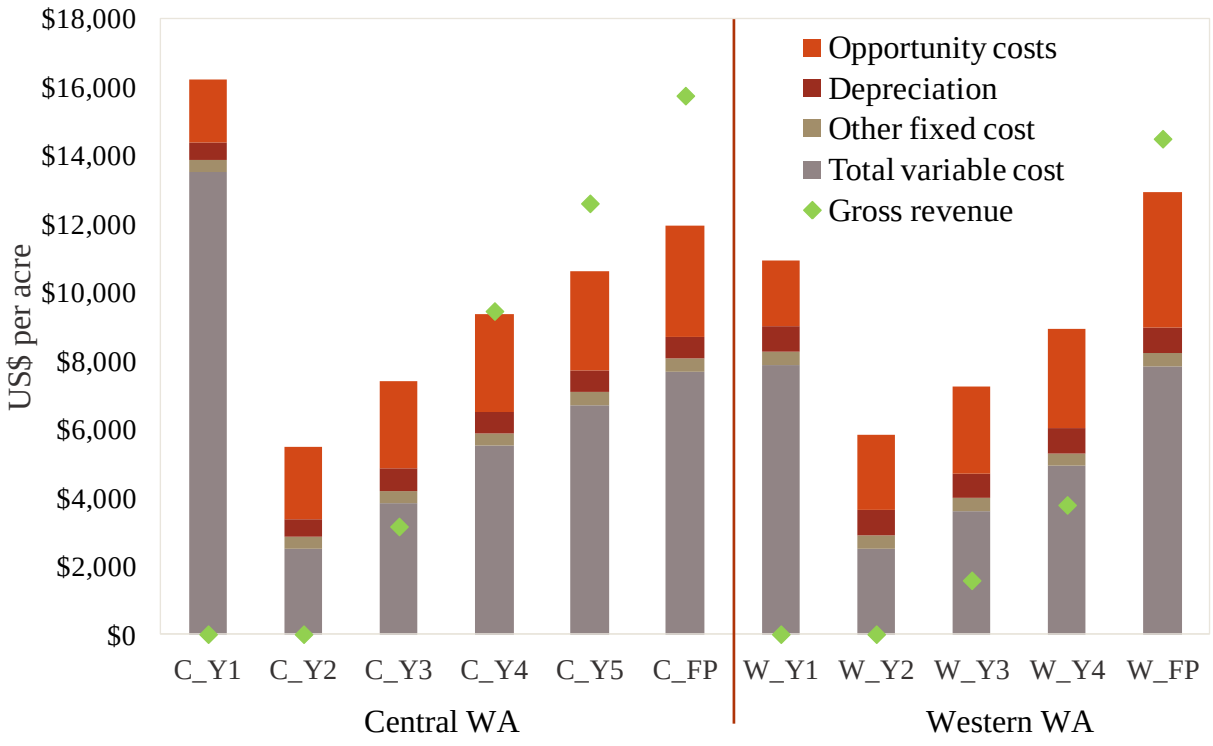

Figure 2. Production costs and revenue per acre in central WA and western WA.