

Hard Cider and Apple Brandy Production



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PROBLEM STATEMENT

Many small to medium sized apple orchards lack the resources to produce hard apple cider and/or applejack. However, there is a large demand on the market for these products, and a need for higher profit margins.

Overall Goal: Design a way to increase the profit of apples sold at small to medium sized apple orchards

Design Objectives:

1. Design and size proper equipment for hard cider and applejack production
2. Determine initial cost and prices of products to allow for a return on interest of 20% and a profitable business after 5 years
3. Design process to be zero discharge

The design includes :

- Fermentation process for conversion of apple cider to hard apple cider (4-7% alcohol content)
- Distillation process for conversion of hard cider to applejack (40% alcohol content)
- Piping system to connect existing equipment with new equipment
- Yeast filtration system for yeast recovery

Background:

- 50 apple trees/acre producing 20,000 lb apples/acre
- 1,000,000 lb/year apples produced
- 600,000 lb/year sold at \$1.20/lb
- 400,000 lb apples produces 28,590 gallons of cider/year
- Half fermented and half non-fermented – 14,290 gallons cider/year
- 40% hard cider distilled to applejack at a yield of 0.125
- Brandy: 714.69 gallons/year
- Hard Cider: 8,576 gallons/year

Market Analysis:

Purpose: Identify emerging trends and demographics for Doud Orchards to capitalize on underserved market demands.
Methods: Analysis of multiple reporting streams, including Mintel, news sources, and specialty websites for orchards and brewers.
Findings: Increasing demand for local, small-production products from small businesses by educated, middle and upper class persons. Particularly, very large and increasing demand for cider products, including apple brandy.

Strengths

- Local, small-production
- Potential for flavor variety
- Cider-making equipment already purchased

Opportunities

- Potential to distribute to local breweries and restaurants
- Can bring further business for other orchard products

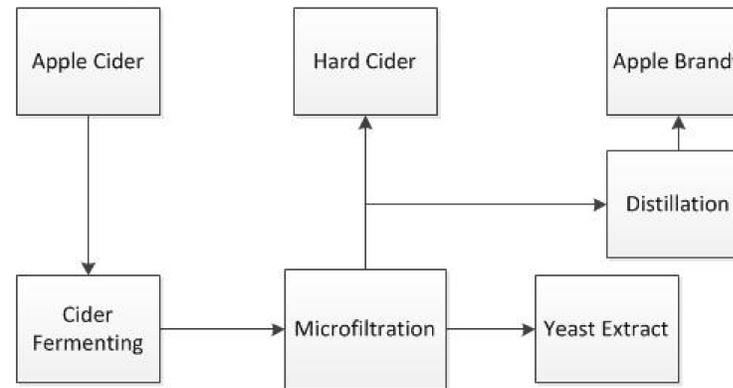
Weaknesses

- Fermentation/Distillation equipment needed
- Apple production varies yearly
- May take >1 year to age and perfect cider recipe

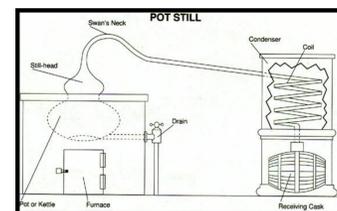
Threats

- Macro brewery production (Angry Orchards, Woodchuck, Oliver)
- Obtaining license
- EPA/OSHA requirements

Final Design:

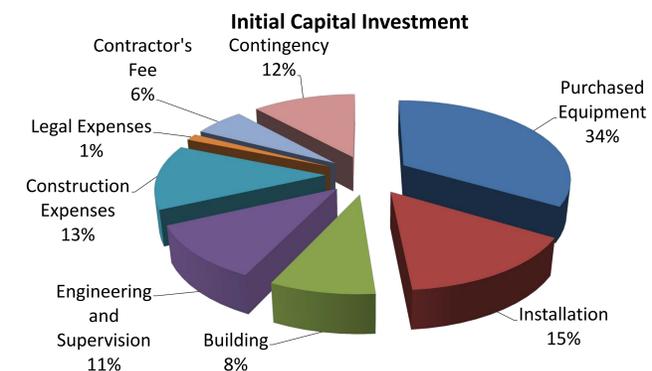


Operation		Price (\$)
Fermentation	2 – 620 gal fermenters Stainless Steel	24,500
Distillation	Pot Distiller	11,800
Yeast Filtration	Microfilter Centrifugation	10,000
Pumping/Piping System	2 Positive Displacement Pumps 10 ft stainless steel ½ inch pipes	460 600
Bottling Machine	1 machine for both hard cider and applejack	20,000



Economic Analysis:

Our economic analysis assumes that the orchard already has an operational and optimized system in place for harvesting, washing, and grading the apples as well as producing the apple cider. Our process should be able to be added onto the existing processes. We are able to sell our hard cider at \$8.00 and apple brandy at \$20. We calculated a **Fixed Capital Investment at \$200,732.80**, a **Working Capital at \$30,109.92**, for a **Total Capital Investment of \$230,842.72**.

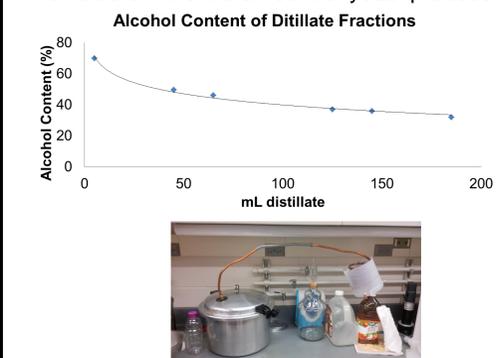


Summary	
Total Annual Revenue	219,200.00
Total Annual Cost	147,285.00
Net Annual Revenue	46,744.75
ROI	0.20
Payback Period	4.94

Annual Costs	\$ per yr
Yeast	77
Cleaner	5,231
Sanitizer	1,984
Water	55
Electricity	1,138
Labor	57,600
Packaging	24,020
Cider Opportunity Cost	57,180
Total Annual Cost	147,285

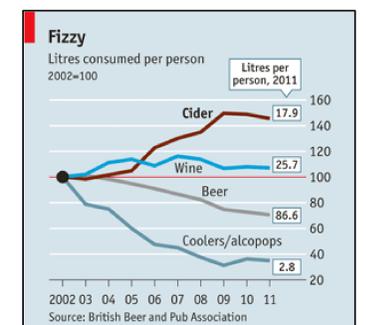
Experimental Design:

We were able to perform small scale production of hard cider and applejack. We were able to measure the amount of alcohol at both stages as well as determine the amount of yeast produced.



Global/Societal Impact:

We are hoping that this can become a potential trend setting for other orchards which will allow for a focused local culture. This will aid in the shop local movement.



Alternative Solutions:

Fermentation Tanks:

- 17,150 gallons of fermentation liquid – allows for operation at 80% operating capacity per year
- Minimum 2 fermenters for scheduling
- 5 – 217 gal vessels at \$6,700 each
- 4 – 310 gal vessels at \$7,400 each
- 3 – 465 gal vessels at \$10,250 each
- 2 – 620 gal vessels at \$12,250 each

Distillation Options:

- Natural vs. Blended Liquor
- Freeze Distillation
- Pot Distillation

Yeast Waste:

- Recycle yeast
- Make into yeast extract
- Sell to company to make yeast extract

Reference

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