CAPSTONE/DESIGN EXPERIENCE 2017

Hard Apple Cider Production

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OBJECTIVE

To fill a void in the market by creating a craft-brewed hard cider from locally sourced apples.

BACKGROUND

- Preferences shifting from mainstream product to local manufacturers
- Rapidly expanding, open market
- Product that can potentially be made and sold on campus

IMPACT

Positive Impact

- Providing students with work experience in various fields (production, supply chain, management, etc.)
- Stimulation of local economy (by purchasing apples from local orchards)

Potential Drawbacks

- Waste creation if materials are not properly handled

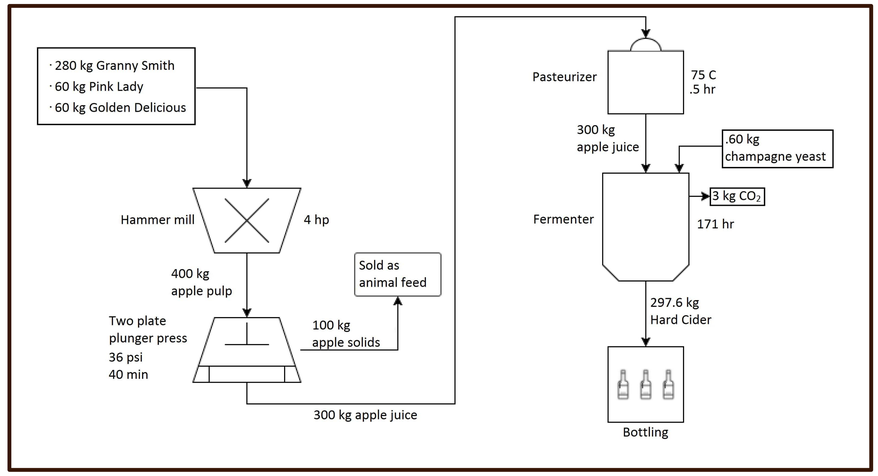
UNIT OPERATIONS

Unit Operation	Optimization Variable	Parameter Being Minimized
Milling	Final Particle Size	Operating Cost
Pressing	Pressure, Press Time	Operating Cost
Pasteurization	Temperature	Operating Cost
Fermentation	Tank Size	Fixed Cost

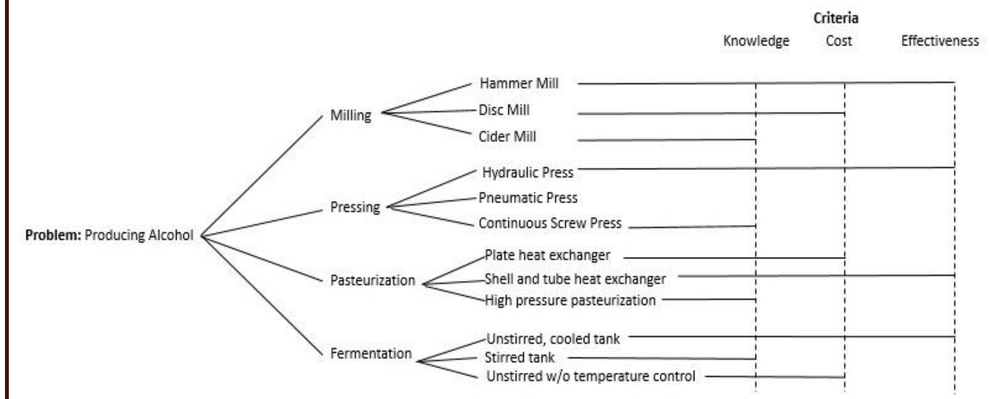
SUSTAINABILITY

Materials	Life Cycle
Large, continuous crop of desired apples	Proven demand for alcoholic beverages

PROCESS FLOW DIAGRAM



EVALUATION OF ALTERNATIVES



LAB SCALE PRODUCTION

Apples were first “milled” using a food processor and then pressed for juice. The juice was fermented using the self-developed apparatus above. Process variables were determined using a Plackett-Burman design.

FINAL PRODUCT

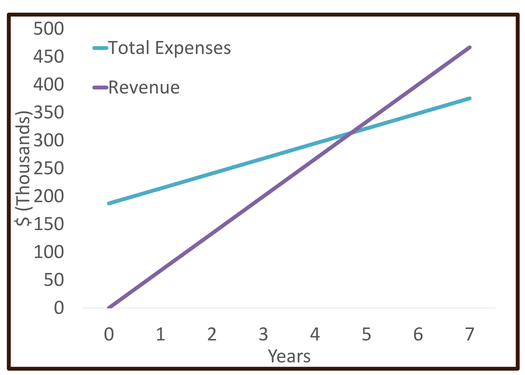
Product Composition

Serving Size 1 bottle (12 fl oz)

Apples	
Granny Smith	61.9 %
Pink Lady	19.0 %
Golden Delicious	19.1 %
Champagne Yeast	0.5 g
ABV	**3.5%**

A panel was conducted to select the batch with the most appealing taste.

ECONOMIC ANALYSIS



Year	Outflow	Inflow	Net Cash Flow	Profit
0	$187,053.00	--	-$187,053.00	-$187,053.00
1	$26,883.73	$66,666.67	$39,782.94	-$147,270.06
2	$26,883.73	$66,666.67	$39,782.94	-$107,487.11
3	$26,883.73	$66,666.67	$39,782.94	-$67,704.17
4	$26,883.73	$66,666.67	$39,782.94	-$27,921.22
5	$26,883.73	$66,666.67	$39,782.94	$11,861.72
6	$26,883.73	$66,666.67	$39,782.94	$51,644.67

RECOMMENDATIONS

- Continue experimenting with different fermentation times to ensure alcohol content stays below 8.5 % (meeting federal guidelines[1])
- Check dissolved carbon dioxide concentration (must be less than 0.392 g/100 mL to be considered a hard cider and taxed as one[1])
- Continue experimenting with different levels of added sugar to enhance taste

Technical Advisor and Instructor:
Dr. Martin Okos

[1] Alcohol and Tobacco Tax and Trade Bureau. United States Department of the Treasury. 2016.