Commercial Tannin Addition to Increase Polyphenolic Content of Ciders Made From Popular NY Apples

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ABSTRACT

The United States cider market is rapidly increasing, far exceeding the ability of orchards to provide apples from traditional cider varieties. While there are far too few "cider" apples, many other cultivars are available across the country. Relatively little work has been done on optimizing the fermentation and blending of dessert/ processing fruit for cider production. There is also little published data on what North American consumers expect and prefer when it comes to apple varieties and blends included in hard ciders. Before apple producers take on the risk of investing in new varieties, it would be prudent to evaluate the possibilities for, and consumer attitudes towards, products made from what is currently available. The major chemical difference between traditional cider apples and those most commonly grown in New York is that the dessert/ processing apples lack tannin. Ciders have been made from prominent New York cultivars, and trials are now taking place with exogenous tannin additions as well as blending small quantities of traditional cider apples. Consumer sensory collected thus far has provided a rough blueprint for the mouthfeel characteristics necessary to make successful ciders with non-traditional apples. Further work will try to gauge whether or not these ciders are seen as viable alternatives to craft products made with classic cider varieties.

INTRODUCTION

Hard apple cider is an alcoholic beverage made from fermented apples. Once a staple in North American diets it was scarce in United States since Prohibition. However, in the past 10-15 years, the market for hard apple cider has been growing. As the second largest apple producing state in the US, New York has the potential to benefit from this trend. Already, farm cideries have increased by 300% since 2010. However, NY hard cider lacks a standard of identity. Food analysis assays and sensory research were combined in this project to determine which aspects of a cider are enjoyed most by consumers. Sensory procedures are done with human participants to interpret perceptions of products. Food analysis assays are done to quantify compounds in a sample. This study was performed to optimize ciders made from desert apple cultivars, providing a scientific guidance for New York hard cider.

OBJECTIVE

Determine how to blend and supplement single dessert apple ciders to create a final cider with a complex taste profile and consumer appeal.

MATERIALS AND METHODS

Fermentation of Single Dessert Apple Ciders

- Empire, Jonagold, Ida Red and McIntosh apples were pressed.
- Apples were fermented with DV10 and R-HST yeast for 21 to 28 days in 5 gal. glass carboys and then repacked and stored in 3 gal. carboys at 3.3 °C.

Fig. 1. Carboys of single dessert apple ciders before blending

Fig. 2. Four samples of NY commercial hard apple cider and evaluation sheet

Sensory Panel Conducted for Four NYS Commercial Hard Ciders

- A consumer cider tasting was performed on May 16, 2015 at Leonard Oakes Estate Winery with 50 tasting room visitors. Participants were a wide range of ages and about half M/F.
- Participants first answered questions on their knowledge of apple cider and purchasing habits. They then tried four commercial apple ciders made in New York (NY) and asked to rate each on a scale of 1- 9.

Chemical Analysis of Ciders

- Thirteen samples from commercial NY cideries were analyzed.
- Here, assays were performed to quantify the compounds in the ciders to understand how composition influences taste.
- The CO_2 levels of bottled ciders was measured with a pressure gauge.
- The pH and titratable acidity were measured with a pH meter and automatic titrator.
- HPLC was run to determine sugar/ acid profiles and total acidity.
- Folin-Ciocalteau assay quantified total phenolics.

Yeast Triangle Test

- Performed to determine if consumers could differentiate ciders made from two commercial yeasts.
- 40 panelists participated in the study on June 22, 2015. Participants were a wide range of ages and about half and half M/F.
- Two alike ciders and one different sample fermented with the opposite yeast formed a flight of three samples.
- A participant would taste a flight for each dessert apple to choose which of the ciders they thought was the odd one out. All samples were randomly arranged and numbered.

Informal Tannin Choice Test

- Commercial tannins Enartis Tan Uva, Ferco Oenology Graptan E, Laffort Quertanin and Scott Laboratory UVA'Tan Soft were used.
- The max. amount of tannin for a white wine was added to a blend of the four dessert apple ciders and tasted by 8 panelists.
- Trained panelists chose Enartis Tan UVA for final use.

Preference Test for Final Tannin and Sugar Concentrations

- A multiple paired preference test for finished ciders was held to see what tannin and sugar concentrations were preferred.
- An equal blend of all four single dessert apple ciders was used.
- Tannin tasting
  - Bottles made with 0, 75, 150, 225 and 300 ppm added Enartis Tan
  - They were sweetened with a 50/50 glucose: fructose solution to get 3% residual sugar.
- Sugar tasting
  - Bottles made with 1%, 2%, 3%, 4% and 5% residual sugar. 50/50 glucose, sucrose solution used.
  - Each sample contained 150 ppm Enartis Tan UVA.

Fig. 3. A layout for the consumer paired preference test used to get final sugar and tannin concentrations

Data analysis

For the triangle difference test with yeast, a Critical Number of Correct Responses in a Triangle Test table was consulted in order to determine if there was a difference between ciders. When $\alpha<0.05$, results were considered statistically significant.

For the tannin and sugar concentration paired preference tests, differences in preferences were considered statistically significant at $0.55 \leq p_{max} \leq 0.65$.

RESULTS

Table 1. Composition and Consumer Rating of Commercial and Experimental Ciders

Cider	Titratable Acidity (g/L)	Ethanol (%v/v)	Total % Sugars	Total Phenolics (ppm)	Total Vol. CO_2	Consumer Relative Preference
Commercial Cider 1	5.6	7.2	4.4	318	2.6	1
Commercial Cider 2	4.6	7.5	4	27	3	2
Commerical Cider 3	4.0	4.7	3.2	37	2.5	3
Commerical Cider 4	2.6	4	4.5	121	1.2	4

Pair	Tannin (mg/L)	Preference
1	0	
1	75	**Strong Preference**
2	75	No Preference
2	150	
3	150	No Preference
3	225	
4	225	No Preference
4	300	

Table 2. Results from tannin concentration paired preference test

Pair	Sugar (g/L)	Preference
1	10	
1	20	**Strong Preference**
2	20	
2	30	**Strong Preference**
3	30	
3	40	**Slight Preference**
4	40	No Preference
4	50	

Table 3. Results from sugar concentration paired preference test

RESULTS

According to Table 1, the cider preferred in our sensory test contained 5.62 g/L titratable acid, was 7.2 % (v/v) alcohol, 2.55 volumes CO_2, 4.4% (w/w) sugar and 300 ppm tannins. This cider served as guidelines for creating a finished cider.

Before blending the ciders, DV-10 and R-HST yeast fermentations were differentiated with a triangle test ($\alpha<0.05$) for each cider. Because R-HST fermentations produced unpleasant sulfur tastes and odors, DV-10 samples were chosen for blending.

According to Table 2, some added tannin was preferred by tasters as significant differences were observed between 0 ppm and 75 ppm. In the sugar trial, results showed that subjects preferred ciders with 4% sugar. Statistically significant preferences are seen as sugar concentrations increase to 4% (Table 3). However the difference between the 4% and 5% added sugar samples is not statistically significant.

CONCLUSION AND SIGNIFICANCE

Our consumers best enjoyed a hard cider with some level of tannin as well as a moderate level of sugar. To create such a cider, a blend of New York dessert apples can be fermented with DV-10 yeast and requires the addition of phenolic compounds, sugars and carbonation for complexity and balance. To create a cider with naturally occurring tannins, a traditional cider apple or other bitter variety must be used to increase phenolic content and astringency.

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