Regional Cider Apple Juice Characteristics

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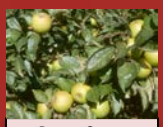
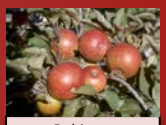
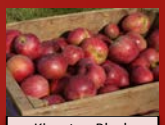
Regional Specialty Cider Cultivar Performance

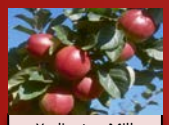
In Washington, the cider apple industry became established in the northwest where the climate is parallel to that of the regions of Europe in which cider production has thrived for centuries. With the state's dessert apple industry based in central Washington however, there has been an expansion of the cider industry into that region. With this expansion come questions regarding the regional variability in juice characteristics of specialty cider cultivars. This knowledge is important as it may provide insight into the suitability of particular cultivars to different regions, further supporting specialty cider apple production throughout Washington.

From 2012-2015, four cider orchards, Alpenfire Cider, Snowdrift Cider Co., Tieton Cider Works, and WSU Mount Vernon NWREC, provided fruit of four popular specialty cider apple cultivars, 'Brown Snout,' 'Dabinett,' 'Kingston Black,' and 'Yarlington Mill,' for evaluation of juice characteristics. Based on 3 years of data (year 4 is currently being analyzed), results show that soluble solids concentration (SSC) varied statistically across locations (higher in central WA) for 'Dabinett,' 'Kingston Black' and 'Yarlington Mill,' but differences were inconsistent across years. 'Brown Snout' juice characteristics were similar across the four locations.


Brown Snout


Dabinett


Kingston Black


Yarlington Mill

Materials & Methods

Experimental units – One crate (40 lbs. on average) per cultivar was collected from each of the four orchards (Table 1), for four years (2012-2015).

Site description- Two orchards were located in northwest Washington, Alpenfire Cider and WSU NWREC, and two were located in central Washington, Snowdrift Cider Co. and Tieton Cider Works.

Harvest method- For Alpenfire Cider and WSU NWREC, apples were harvested when seeds were black and brix had reached the desired threshold ranging from 11-14 depending on cultivar and weather. For Snowdrift Cider Co. and Tieton Cider Works, apples were harvested when fruit tasted sweet and there was significant ground fall.

Measurements – Juice characteristics were analyzed as described by Miles et al. (2015):

- **S**oluble solids concentration (SSC), with a digital refractometer (PA201, Palm Abbe, Cleveland, OH).
- **S**pecific gravity (SG), with a hydrometer (Bellweather, VeeGeeScientific, Kirkland, WA).
- **p**H, with a digital pH meter (Orion 3 Star, Thermo-Scientific, Pittsburg, PA).
- **T**itratable acidity (TA), by titration with 0.2 M sodium hydroxide to a reading of 8.1. Malic acid then calculated using: Malic acid = ml NaOH x 0.536.
- **T**otal tannin, using the Lowenthal method of permanganate titration.

Statistics – One-way analysis in JMP (version 11.0 for Windows; SAS Institute, Cary, NC).

Table 1. Climatic conditions of the four cider apple orchards

	March-September			October-February			Oct-May	Jan-Oct
Orchard	Avg. Min. Temp. (°F)	Avg. Max. Temp. (°F)	Avg. Total Precip. (in.)	Avg. Min. Temp. (°F)	Avg. Max. Temp. (°F)	Avg. Total Precip. (in.)	Chilling hrs. (base 45 °F)	Growing deg. days (base 42 °F)
Alpenfire	46.8[z]	63.9	8.4	39.2	49.3	10.3	2991[w]	3078[w]
WSU Mount Vernon	47.1[y]	64.9	13.9	37.6	50.1	18.4	2749	3593
Snowdrift	50.0[c]	73.2	3.7	29.6	43.3	3.4	3556	4761
Tieton Cider Works	47.7[x]	71.8	3.8	27.8	45.5	4.8	3635	4334

[z] Average of 1891-2010, Western Regional Climate Center; [y] Average of 1994-2015, AgWeatherNet;
[x] Average of 2009-2015, AgWeatherNet; [w] Average of 2012-2014, AgWeatherNet

Results

- Growing degree days (GDD) were 36% higher and chilling hours (CH) were 25% higher at the two Central Washington orchards (Table 1).
- Differences across locations for SSC and TA were not consistent across years ($p < 0.05$).
- For 'Dabinett,' 'Kingston Black,' and 'Yarlington Mill,' SSC and SG tended to be higher at Tieton Cider Works (Central WA) and lower at Alpenfire Cider (Northwest WA) (Table 2).

Table 2. Mean juice characteristics across locations by cultivar (2012-2014).

Brown Snout	Northwest Washington		Central Washington	
Location:	Alpenfire Cider	WSU NWREC	Snowdrift Cider	Tieton Cider
SSC (°Brix)	12.90	13.13	15.50	15.70
SG	1.052	1.054	1.062	1.067
pH	3.98	3.92	3.99	3.91
TA (gL^{-1})	2.67	3.37	3.80	3.98
Tannin (%)	0.19	0.16	0.16	0.15

Dabinett	Northwest Washington		Central Washington	
Location:	Alpenfire Cider	WSU NWREC	Snowdrift Cider	Tieton Cider
SSC (°Brix)	12.73 b[1]	14.10 ab	14.13 ab	15.73 a
SG	1.051 b	1.058 ab	1.058 ab	1.065 a
pH	4.35	4.39	4.28	4.28
TA (gL^{-1})	1.42	1.67	1.57	1.88
Tannin (%)	0.21	0.20	0.19	0.16

Kingston Black	Northwest Washington		Central Washington	
Location:	Alpenfire Cider	WSU NWREC	Snowdrift Cider	Tieton Cider
SSC (°Brix)	12.30 b	12.47 b	13.67 ab	16.05 a
SG	1.050	1.052	1.056	1.066
pH	3.58	3.60	3.58	3.53
TA (gL^{-1})	4.32 b	5.70 ab	4.93 ab	6.88 a
Tannin (%)	0.12	0.13	0.09	0.07

Yarlington Mill	Northwest Washington		Central Washington	
Location:	Alpenfire Cider	WSU NWREC	Snowdrift Cider	Tieton Cider
SSC (°Brix)	10.80 b	10.40 b	12.23 ab	14.97 a
SG	1.041	1.042	1.048	1.060
pH	4.08	4.09	4.06	3.99
TA (gL^{-1})	1.74	1.78	1.98	2.59
Tannin (%)	0.24	0.18	0.17	0.13

[z] Means not connected by the same letter within the same row are significantly different at a 0.05 level of significance as determined by Tukey's mean comparison test.

Discussion

Cider apple juice characteristics, specifically SSC, were equal to if not higher in central WA than northwest WA for some of the cultivars.

The more optimal heat, GDD, and reliable CH in central WA could lead to the higher values of juice characteristics than in northwest Washington.

The variability in harvest methods (and impact on apple maturity), and/or unusual annual climate could explain the inconsistencies across locations over the 3 years.

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WEB SITE
Hard Cider Research at WSU NWREC
http://maritimefruit.wsu.edu/hard-cider/