

Evaluation of the cider potential of new varieties of cider apple trees under the pedoclimatic conditions of Quebec, Canada.



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OBJECTIVES and CONTEXT

- In eastern Canada, the cider industry has been growing for about fifteen years. The varieties of apples used to make alcoholic products in Quebec have traditionally been fruit for the fresh market.
- Recently, new cider apple varieties have been introduced by producers with the challenge that they were not studied under the northeastern conditions of Canada.
- Cider production requires fruits with specific chemical and organoleptic properties, mainly in terms of tannins, acidity and polyphenol content (Bauduin 2006; Jolicoeur 2016; Moinet 2009). Therefore, the choice must be based on criteria such as the organoleptic qualities (polyphenols, tannins, etc.) sought according to the desired product and the agronomic characteristics (productivity, alternation, tree management, phytoprotection).
- Three major families of apples are used to make cider: sweet and bittersweet; bitters; and acids (Jolicoeur 2016). This categorization is generally based on the acidity of the fruits and their tannin content, but the French classification also considers the sugar content.
- Therefore, the objective of this research project was:

To determine the agronomic and chemical potential of new apple varieties for cider production under northeastern Canadian conditions.

MATERIALS and METHODS

Since 2015, 52 varieties have been cultivated and evaluated under Quebec's conditions. The experimental orchard is located at Frelighsburg, Qc, Canada.

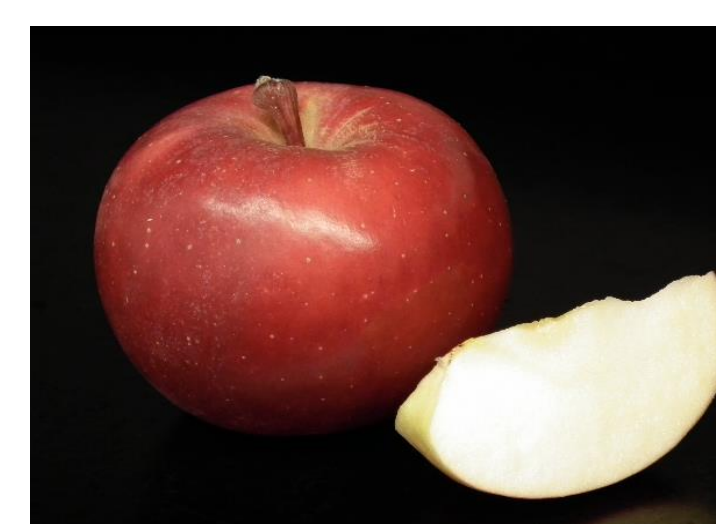
Studies were conducted for 5 consecutive years.

Agronomics parameters: frost index, lignification, flowering, yield, trunk surface (TCSA), cumulative yield (CY), productivity (CYE)

Fruits parameters: weight, color, form, pulp texture, maturity index, firmness, Total soluble solids (TSS), total acidity (TA), taste

Cidermaking: standard monovarietal ciders were made annually as soon as the fruits were harvested following standard practices. Chemical analysis were performed on cider (TSS, AT, pH, polyphenols)

Sensory evaluation: evaluation was carried out by an experts' panel using a modified "rate-all-that-apply" questionnaire followed by an hedonic evaluation on a 5-point scale



RESULTS

Results presented are those for varieties planted in 2015 and that are completed 5 years evaluation.

- All varieties resisted cold winter temperatures and had little frost damage (Fig.1)
- Some varieties show alternation in fruit production: Bulmer's Norman, Dabinette, Kingston Black, and Marechal 1 (Tab. 1).
- The varieties that obtain the highest yields over 4-5 years are Burgundy and Chisel Jersey; and the lowest are: Yarlington Mill, Frequin Rouge, Kingston Black, Michelin, and Tremblett's Bitter (Tab.1).
- Some varieties produce larger fruits than standard McIntosch like Bramley Seeding and Burgundy .
- The polyphenol content was variable from year to year and some varieties have very high amounts of polyphenols like Marechal 1 and Frequin Rouge (Fig. 2).
- Regardless of polyphenols and acidity, the majority of apple varieties evaluated are classified as sharp, and other as bittersweet (Fig. 3)
- Sugars content of the majority of the apple are higher than McIntosch, except Burgundy (Fig. 4).
- Ciders were produced when the quantity of fruit was sufficient. The overall rating shows that the ciders produced with some varieties are better than others (Tab. 2). However, some varieties would be preferable in blending and cannot be eliminated solely on the overall rating of single-variety ciders.
- Cider aromas and flavors were also noted and should be considered when choosing cider apple varieties

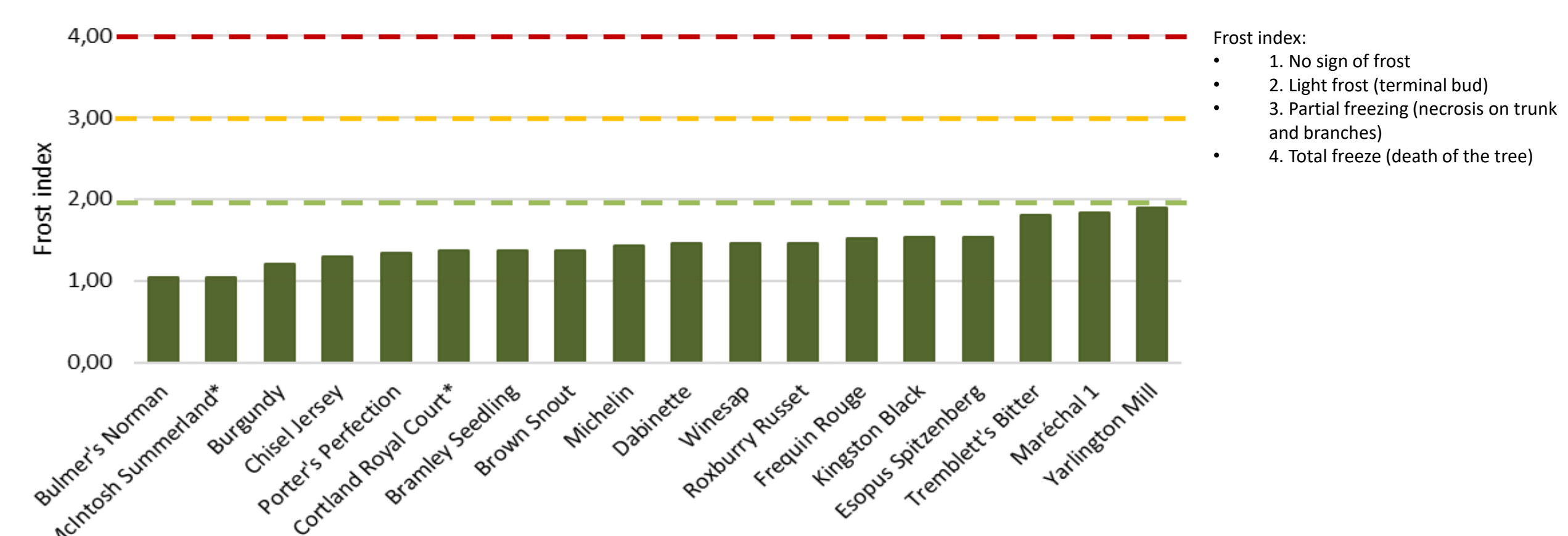


Figure 1: Frost index mean over 5 years, 2015-2021.

Table 1: Yield, cumulative yield (CY), trunk surface (TCSA), productivity (CYE), 2015-2021.

Cultivars à cidre	Yield (kg)					CY (kg)	TCSA (cm ²)	CYE
	R 2017 (kg)	R 2018 (kg)	R 2019 (kg)	R 2020 (kg)	R 2021 (kg)			
Bramley Seeding	3.82 abc	5.12 ab	6.25 abc	6.92 ab	14.44 abc	36.55 abcd	14.21 ab	2.72 bcdef
Brown Snout	1.92 bc	4.84 b	7.89 abc	6.06 b	18.01 ab	38.72 abc	10.36 abcd	3.78 abc
Bulmer's Norman	2.88 bc	2.51 b	8.18 abc	2.36 b	11.88 abc	27.81 bcde	12.86 abc	2.27 cdefg
Burgundy	6.10 a	9.27 a	10.19 a	13.64 a	14.60 abc	53.80 a	10.09 abcd	5.38 a
Chisel Jersey	4.45 ab	1.42 b	8.64 abc	6.96 ab	18.86 a	40.34 ab	11.46 abc	3.61 abc
Cortland Royal Court	2.12 bc	4.75 b	3.99 abc	7.01 ab	6.69 abc	24.55 bcde	7.42 cd	3.28 abcd
Dabinette	2.43 bc	1.48 b	6.64 abc	2.88 b	14.65 abc	28.09 bcde	10.73 abcd	2.64 bcdefg
Esopus Spitzenberg	1.75 bc	4.94 ab	4.98 abc	3.36 b	11.86 abc	24.53 bcde	13.91 ab	1.97 defg
Frequin Rouge	1.43 bc	1.64 b	3.19 abc	1.15 b	7.32 abc	13.03 e	6.12 cd	2.64 bcdefg
Kingston Black	1.93 bc	1.74 b	3.41 abc	1.75 b	6.46 abc	15.29 e	6.40 cd	2.65 bcdefg
Marechal 1	1.85 bc	2.88 b	6.39 abc	2.44 b	13.74 abc	27.31 bcde	10.82 abcd	2.52 bcdefg
McIntosh Summerland	2.25 bc	4.87 ab	4.80 abc	3.63 b	9.24 abc	24.79 bcde	6.36 cd	3.81 ab
Michelin	2.32 bc	4.48 b	1.32 bc	4.99 b	4.38 bc	17.50 de	8.26 bcd	2.07 defg
Porter's Perfection	2.73 bc	3.42 b	3.78 abc	3.11 b	7.05 abc	20.09 cde	16.67 ab	1.29 g
Roxbury Russet	1.41 bc	4.96 ab	5.76 abc	4.67 b	11.24 abc	28.03 bcde	20.29 a	1.43 g
Tremblett's Bitter	0.97 c	3.67 b	2.41 bc	5.84 b	5.26 abc	17.09 de	15.84 abc	1.47 fg
Winesap	1.95 bc	4.00 b	6.89 abc	1.76 b	12.07 abc	26.66 bcde	9.49 abcd	2.86 abcde
Yarlington Mill	1.36 c	1.18 b	1.10 c	2.36 b	3.84 c	9.85 e	5.70 d	1.75 efg

Agronomic characteristics

Chemical properties

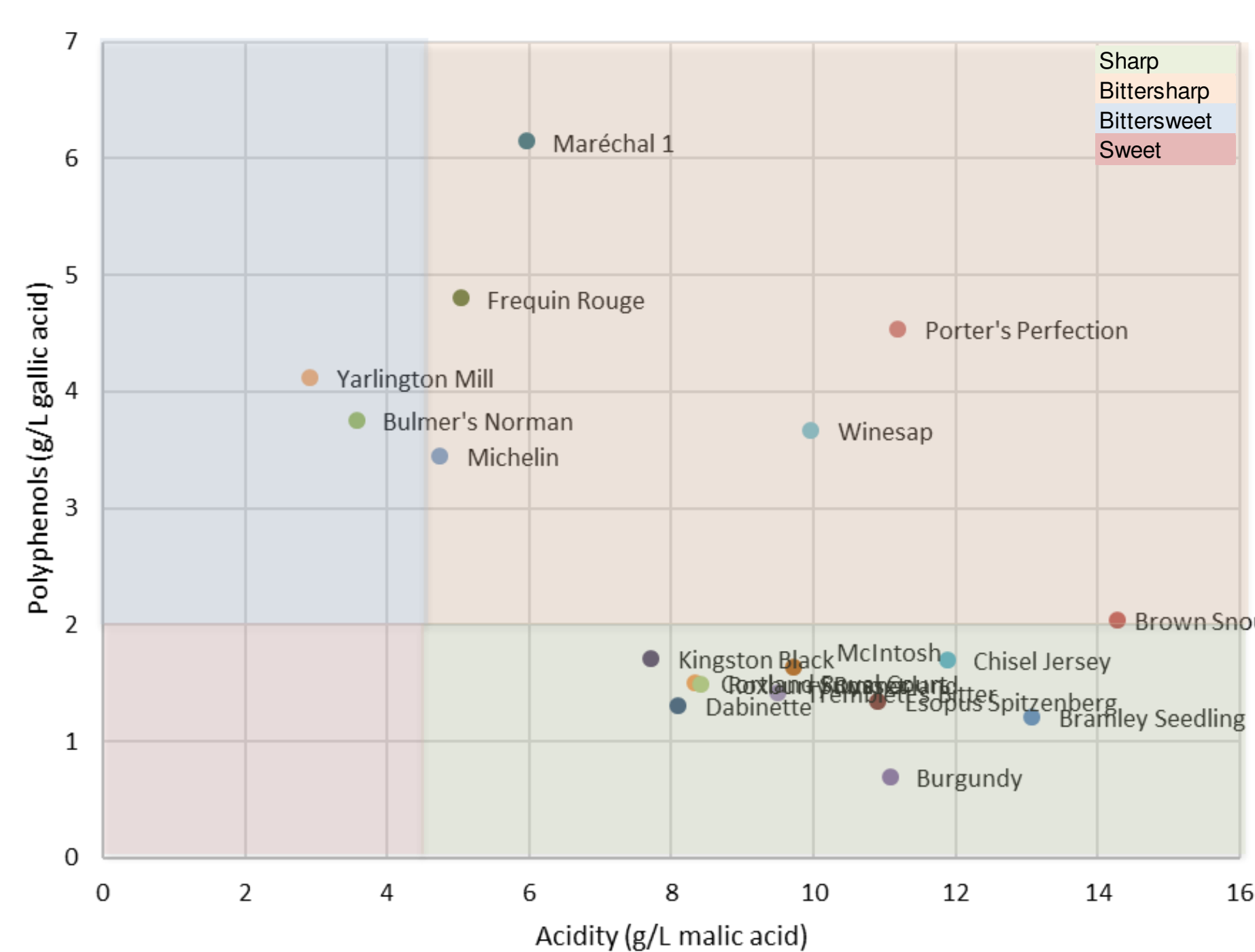


Figure 2: Relation between acidity and polyphenols.

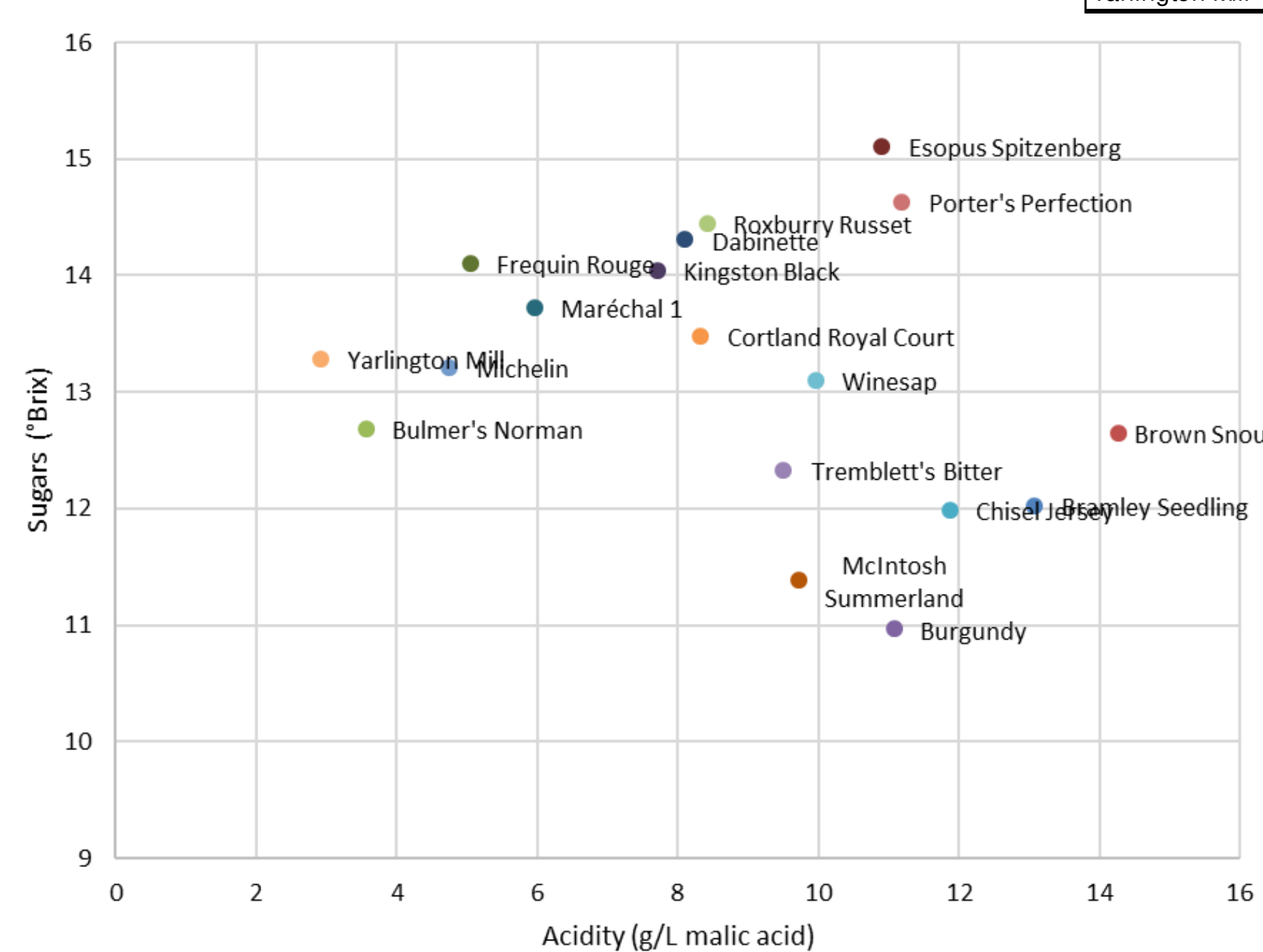


Figure 3: Relation between acidity and sugars.

Table 2: Overall cider appreciation rating on a 5-point scale, related to vintage.

Year	Bramley Seeding	Brown Snout	Bulmer's Norman	Burgundy	Chisel Jersey	Cortland Royal Court	Dabinette	Esopus Spitzenberg	Frequin Rouge
2018	3,0	2,9			3,2	3,7	2,7	3,6	3,6
2019		4,1				3,1			
2020	3,8	3,4	3,5	3,4	3,6	3,3	1,9	4,1	4,0
2021	2,1	3,3	2,0	2,8			3,0	3,4	3,2

	Kingston Black	Marechal 1	McIntosh Summerland	Michelin	Porter's Perfection	Roxbury Russet	Tremblett's Bitter	Winesap	Yarlington Mill
2018	3,3	3,5	3,4	3,3	2,9	3,7	3,6	2,8	3,3
2019	3,5					3,3		2,6	
2020	4,0	2,9	3,4	3,3	1,4	3,0			
2021	3,4	3,8	3,4	3,1	3,4	2,6	3,0	2,8	3,5



CONCLUSIONS

- The collection of agronomic and oenological data on specific varieties for cider production will make it possible to draw a reliable portrait of the varieties and their potential for cider production under Quebec conditions.
- The availability of new apple varieties specific to cider production will allow producers to develop different products to meet the growing consumer demand.

LITERATURE CITED

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