

How new varieties of cider apple trees grow under the pedoclimatic conditions of Quebec, Canada.



CRAM

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OBJECTIVES and CONTEXT

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

- In eastern Canada, the cider industry's development 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.

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 (TCA), 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

- All varieties resisted cold winter temperatures and had little frost damage (Tab.1)
- Some varieties show alternation in fruit production: Bulmer's Norman, Dabinette, Kingston Black, Marechal 1, Douce de Charlevoix, Marechal 2
- For several varieties, yields vary from year to year, but we usually see an increase in yield for the first 3 harvests.
- The varieties that obtain the highest yields over 4-5 years are Burgundy, Diva, Golden Russet, Chisel Jersey; and the lowest are: Yarlington Mill, Frequin Rouge, Kingston Black, Michelin, Tremblett's Bitter, Banane amère, Bilodeau, Douce de Charlevoix, Kermerrien, Marechal 2 and Reinette Russet (Tab.1).
- Some varieties produce larger fruits than standard McIntosh like Bramley Seeding, Burgundy, Roxbury Russet, Eastman Sweet, and Orléans 23/M9 (Tab.1).
- The polyphenol content was highly variable from year to year and some varieties have very high amounts of polyphenols like Marechal 1, Banane amère, Marechal 2, Cidor, Kermerrien, and Frequin Rouge Tab. 1).
- 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

Table 1: Agronomic and chemical parameters for 52 varieties evaluated between 2015-2021.

Variety	Frost index	Yield (kg)	Fruit weight (g)	TSS (Brix)	TA (g/L)	Polyphenols (mg ac. gallic)
Planting year 2015						
Bramley Seeding	1,37	7,31	229,05	12,02	13,08	1201,40
Brown Snout	1,37	7,74	147,74	12,64	14,29	2035,00
Bulmer's Norman	1,03	5,56	118,68	12,68	3,58	3746,80
Burgundy	1,20	10,76	209,02	10,96	11,09	691,75
Chisel Jersey	1,30	8,07	118,66	11,98	11,89	1693,00
Cortland Royal Court	1,37	4,91	196,18	13,48	8,34	1496,75
Dabinette	1,47	5,62	142,74	14,30	8,10	1298,60
Esopus Spitzenberg	1,53	5,38	158,79	15,10	10,92	1337,80
Frequin Rouge	1,52	2,95	75,27	14,10	5,05	4795,20
Kingston Black	1,53	3,06	78,28	14,04	7,73	1704,40
Marechal 1	1,83	5,46	117,83	13,72	5,98	6140,40
McIntosh Summerland	1,04	4,96	152,13	11,38	9,72	1628,25
Michelin	1,43	3,50	77,50	13,20	4,75	3445,40
Porter's Perfection	1,33	4,02	72,40	14,62	11,20	4526,20
Roxbury Russet	1,47	5,61	236,54	14,44	8,43	1485,80
Tremblett's Bitter	1,80	3,63	138,74	12,32	9,52	1415,80
Winesap	1,47	5,33	147,54	13,10	9,97	3659,00
Yarlington Mill	1,90	1,97	62,97	13,28	2,92	4119,40
Planting year 2016						
Banane Amère	1,04	3,86	94,60	13,83	4,14	5054,00
Bilodeau	1,08	2,74	42,33	15,13	7,38	3299,50
Cortland	1,08	7,83	193,75	12,60	8,34	3066,00
Diva	1,08	11,80	167,48	12,08	7,68	748,75
Douce de Charlevoix	1,20	2,74	114,15	14,30	5,43	3604,25
Golden Russet	1,24	9,85	136,50	17,13	8,95	2635,25
Harrison	1,40	4,59	95,37	15,28	12,24	1507,25
Kermerrien	1,40	1,78	73,38	14,15	4,07	4848,25
Marechal 2	1,68	3,71	106,43	13,00	4,37	5686,50
McIntosh	1,04	9,60	168,69	12,53	10,81	1746,33
Muscadet de Dieppe	1,32	2,73	82,56	13,00	3,49	3409,67
Reinette Russet	1,24	3,31	135,82	15,73	10,94	1646,25
Planting year 2017						
Mikki Life	1,45	4,51	145,18	13,47	4,94	263,00
Sweet Coppin	1,60	3,70	76,23	12,55	4,11	1535,50
Stoke Red	1,75	3,55	83,15	13,30	8,15	3952,67
Cortland	1,10	3,67	180,50	12,93	7,69	777,00
Planting year 2018						
Binet rouge	1,60	1,46	80,56	14,80	3,30	1775,00
Cidor	1,27	3,26	72,79	16,60	2,57	6149,50
Coat Jersey	1,20	2,52	124,83	13,90	3,13	3117,00
Douce Coët Lignée	1,17	4,27	177,60	14,70	3,72	1584,00
Eastman Sweet	1,27	4,02	195,80	13,40	2,66	885,00
Maillard	1,27	0,91	79,32			
Mettais	1,53	3,30	126,21	15,35	3,47	4259,50
Noël des champs	1,53	2,14		14,20	3,76	2256,00
Reine des pommes	1,27	2,32	69,40	14,30	3,18	4387,00
Somerset Red Streak	1,40	1,20	84,57	9,50	3,47	1075,00
Stokes's Red	1,35	1,70	57,63	14,30	12,19	394,00
Wickson	1,33	4,08	188,80	11,60	5,84	2803,00
Cortland Royal Court	1,00	8,60	199,20			
Major	1,33	0,95	88,93	14,65	2,55	3253,00
Orléans 23/M9	1,20	1,03	192,50	15,40	5,33	713,00
Cortland Royal Court/M9	1,00	3,03	33,20			
Omerta/M9	1,07	2,40	88,75	11,90	6,77	1054,00
X3426/M9	1,13	3,27	155,60	13,30	9,46	471,00

Table 2: Cider appreciation related to vintage.

Year	Bramley Seeding	Brown Snout	Bulmer's Norman	Burgundy	Chisel Jersey	Cortland Royal Court	Dabinette	Esopus Spitzenberg	Frequin Rouge	Kingston Black	Marechal 1	McIntosh Summerland	Michelin	Porter's Perfection	Roxbury Russet
2018	3,0	2,9			3,2	3,7	2,7	3,6	3,6	3,3	3,5	3,4	3,3	2,9	3,7
2019		4,1				3,1				3,5					3,3
2020	3,8	3,4	3,5	3,4	3,6	3,3	1,9	4,1	4,0	4,0	2,9	3,4	3,3	1,4	3,0
2021	2,1	3,3	2,0	2,8			3,0	3,4	3,2	3,4	3,8	3,4	3,1	3,4	2,6
Year	Tremblett's Bitter	Winesap	Yarlington Mill	Banane Amère	Bilodeau	Cortland Royal Court	Diva	Douce de Charlevoix	Golden Russet	Harrison	Kermerrien	Marechal 2	Muscadet de Dieppe	Reinette Russet	
2018	3,6	2,8	3,3					3,6	3,5	3,6	3,1	3,4	3,1	3,1	
2019		2,6									1,4		3,3		
2020						2,5									
2021	3,0	2,8	3,5	2,8	2,9		3,6	2,0	3,8	3,8	2,7	2,8	2,9	3,8	
Year	Mikki Life	Sweet Coppin	Stoke Red	Cortland	Cidor	Eastman Sweet	Noël des champs	Reine des pommes	Stokes's Red	Major	Orléans 23/M9	Omerta/M9	X3426/M9		
2018															
2019															
2020															
2021	2,5	3,0	2,6	3,2	2,9	3,0	3,3	2,6	3,0	2,7	3,0	3,2	2,2		

- Frost index:
- 1. No sign of frost
 - 2. Light frost (terminal bud)
 - 3. Partial freezing (necrosis on trunk and branches)
 - 4. Total freeze (death of the tree)

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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ACKNOWLEDGMENTS

This project is funded through the Innov'Action Agroalimentaire program, under the Canadian Partnership for Agriculture, an agreement between the governments of Canada and Quebec. The CRAM thanks Monique Odette, Vicky Fillion and Laurence Théault for the participation to the project.

