

How grapevine grafting for hybrids can affected wine under cold climatic conditions of Quebec, Canada?



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Introduction

Grapevine production is relatively recent in Quebec, Canada, and several challenges restrict quality grape production. Quebec's rigorous climate and short growing season are just a couple of limiting factors in grape production and varietal selection. Rootstocks adapted to growing conditions allow producers to plant varieties that are better adapted and more efficient in specific soil and climatic conditions. Selected scion/rootstock combinations could be better suited to growing conditions found in Quebec vineyards, thereby homogenizing vegetative growth for all vines, reducing costs associated with management and help to reach maturity and optimum berry quality.

The main objective was to evaluate the use of grafting as a technique to adapt hybrid vines to cold climate growing conditions found in Quebec, Canada.

Methods

Several combinations were produced using Frontenac, Frontenac blanc and Marquette cultivars (hybrids) along with 4 rootstocks (101-14 MGT, 3309 R, Riparia Gloire de Montpellier, SO4), as well as own-rooted vines. The experimental plot was implanted in 2013 in gravelly-loam soil. Several parameters were observed, such as yield, berry chemistry and wine sensory analysis.

References

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Results and discussion

Results related to yield components showed that there are significant differences between rootstocks and own-rooted vines. Frontenac was the less affected grape variety compared to Frontenac blanc and Marquette, only cluster weight and berry weight were impacted.

Overall, we observe for the two Frontenac grape varieties, a low soluble solids content, low pH and a high titratable acidity for fruits on own-rooted vines compare to grafted vines on rootstocks 101-14 and 3309C. Grafting affected differently fruit composition for Marquette where the lowest grape maturity was observed for fruits on vines grafted on SO4.

Table 1: Effect of rootstock on yield and fruit composition of grapevine for the three cold-hardy hybrids.

Frontenac	Rootstock	Average number of cluster (pcs)	Cluster weight (g)	Berry weight (g)	Yield (kg-vine-1)	Extract (°Brix)	pH	Total acidity (g-L-1 tar. ac.)
2016	101-14	31,25	96.41 ab	1.13 a	2,96	24.45 a	3.22 a	12.39 a
	3309C	30,47	103.33 a	1.18 ab	3,11	24.15 a	3.19 ab	12.54 a
	ownroot	29,54	99.42 ab	1.30 c	2,95	21.89 c	3.13 c	13.64 b
Rootstock	Riparia gloire	29,79	100.01 ab	1.21 b	3,04	23.70 ab	3.18 ab	13.06 ab
	SO4	29,44	90.22 b	1.21 b	2,68	22.43 bc	3.14 bc	13.78 b
	Year	2016	35.97 a	106.41 a	1.27 a	3.77 a	24.73 a	3.20 a
Year	2017	29.75 b	80.92 b	1.13 b	2.42 b	21.53 b	3.12 b	12.14 b
	2018	24.64 c	106.36 a	1.23 a	2.66 b	23.73 a	3.20 a	13.91 c
	Rootstock	0.8315	0.0160	<0.0001	0.2887	<0.0001	<0.0001	<0.0001
p-value	Year	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Rootstock x Year	0.7802	0.6487	0.5646	0.7077	0.8736	0.7802	0.3466

Frontenac blanc	Rootstock	Average number of cluster (pcs)	Cluster weight (g)	Berry weight (g)	Yield (kg-vine-1)	Extract (°Brix)	pH	Total acidity (g-L-1 tar. ac.)
2016	101-14	29.57	98.11 a	1.11 a	2.84 ab	23.51 a	3.12 a	12.94 a
	3309C	33.59	102.39 a	1.12 a	3.4 bc	24.13 a	3.12 a	12.74 a
	ownroot	32.85	106.69 a	1.25 b	3.56 c	20.89 b	3.05 b	14.59 b
Rootstock	Riparia gloire	31.54	97.73 a	1.23 b	3.09 abc	22.84 a	3.10 ab	13.55 a
	SO4	33.58	83.55 b	1.13 a	2.76 a	23.32 a	3.11 a	13.35 a
	Year	2016	36.58 a	103.62 a	1.27 a	3.75 a	23.48 a	3.06 a
Year	2017	34.53 a	84.53 b	1.09 b	2.93 b	21.97 b	3.10 a	11.45 b
	2018	25.55 b	106.78 a	1.16 c	2.73 b	23.48 a	3.14 b	14.09 c
	Rootstock	0.1756	<0.0001	<0.0001	0.0007	0.0005	0.0104	<0.0001
p-value	Year	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001
	Rootstock x Year	0.0307	0.8599	0.2175	0.1376	0.3627	0.9169	0.9620

Marquette	Rootstock	Average number of cluster (pcs)	Cluster weight (g)	Berry weight (g)	Yield (kg-vine-1)	Extract (°Brix)	pH	Total acidity (g-L-1 tar. ac.)
2016	101-14	29.48 ab	57.42 a	1.21 a	1.69 a	24.41 a	3.23 ab	10.98 a
	3309C	32.64 a	66.06 b	1.31 b	2.19 b	25.09 a	3.24 a	10.59 a
	ownroot	32.06 a	64.98 ab	1.40 c	2.10 b	24.81 a	3.23 a	11.24 a
Rootstock	Riparia gloire	32.14 a	71.25 b	1.37 bc	2.29 b	25.05 a	3.18 b	11.09 a
	SO4	25.61 b	58.97 a	1.34 bc	1.68 a	23.15 b	3.20 ab	12.07 b
	Year	2016	36.63 a	68.95 a	1.44 a	2.53 a	25.42 a	3.16 a
Year	2017	33.97 a	65.02 a	1.27 b	2.22 b	24.39 b	3.43 b	9.01 b
	2018	20.05 b	58.25 b	1.28 b	1.26 c	23.72 c	3.07 c	12.58 c
	Rootstock	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
p-value	Year	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Rootstock x Year	<0.0001	<0.0001	0.9850	<0.0001	0.0930	0.0874	0.0429

The appreciation of wines with grafted vines compared to own-root vines was higher for the two Frontenac grape varieties, but there was less difference for the Marquette. Rootstock 101-14 and 3309C produced the most appreciated wines for both Frontenac and Frontenac blanc, while wines with 101-14 and Riparia Gloire obtain the higher score for Marquette. Moreover, a significant effect on wine appreciation was noticed, where use of rootstock generally increased wine quality.

In Quebec, grafting hybrid cultivars is not a common practice, but it could be profitable to the producer to select rootstocks adapted to their soil and climate conditions in order to improve profitability.

Table 2: Effect of rootstock on wine appreciation for the three cold-hardy hybrids

Frontenac	101-14	3309	ownroot	Riparia Gloire	SO4	
2016	Aromas	black fruit, cocoa	black fruit, red fruit, cocoa	herbaceous, candied fruit	red fruit, black fruit, coffee	herbaceous, candied fruit
	Mouthfeel	complexity rich flexible	pleasant tannins, beautiful structure	less balanced astringency thinner	good length good balance tannins astringency	vegetal good length bitterness light tannins
	Note (/5)	3.4	2.8	1.9	2.8	2.4
2017	Aromas	black fruit	dark fruit, cherry, light spice	herbaceous	dark fruit, light spice herbaceous	herbaceous
	Mouthfeel	light tannins less balanced	light tannins nice acidity less balanced	hardness high acidity	light tannins nice balance lively	lively more vegetal high acidity
	Note (/5)	2.7	3	1.8	2.5	1.9
2018	Aromas	black fruit, herbaceous, blackberry	red fruits, cherry, black fruits	black fruit, cherry, blackberry	red fruits, herbaceous, blackberry	black fruit, cherry, herbaceous
	Mouthfeel	clean attack supple tannins full structure balanced	clean attack balanced supple tannins	clean attack harsh tannins thin structure unbalanced	clean attack supple tannins thin finish	frank attack narrow texture harsh tannins unbalanced
	Note (/5)	3.5	3.25	2.5	2.87	2

Frontenac blanc	101-14	3309	ownroot	Riparia Gloire	SO4	
2016	Aromas	peach, floral, almond	peach, floral	pear, floral	peach, floral	herbaceous, floral, almond
	Mouthfeel	poor balance bitterness less material	nice length good attack good balance rich, volume	little length skimmy aggressive	nice length harmonious volume interesting	little complex little volume
	Note (/5)	2.4	3.5	2.2	3	3
2017	Aromas	pear, quince	floral, lychee, pear	pear	pear, floral	floral
	Mouthfeel	lack of balance less character bitterness	nice length and nice attack warm	freshness aggressive hardness	lack of balance high bitterness unpleasant	medium intensity lack of balance
	Note (/5)	2.5	3.4	2	2.4	2
2018	Aromas	apricot, lemon, quince, exotic fruits, white flower, floral	pear, apple, quince, exotic fruits, white flower, floral	quince, lemon, pear, white flower, acacia	quince, lemon	quince, peach, almond, white flower, floral
	Mouthfeel	dry lively balanced	dry lively aggressive	dry good intensity	dry expressive medium finish	dry biting expressive
	Note (/5)	3.62	3.25	2.75	3.12	2.37

Marquette	101-14	3309	ownroot	Riparia Gloire	SO4	
2016	Aromas	red fruit, cocoa, prune	cocoa, black fruit	black fruit, pepper, herbaceous	herbaceous, red fruit	black fruit, herbaceous
	Mouthfeel	complexity, bitterness, pleasant tannins	astringency, slight bitterness, more vegetal	bitterness, slight astringency, more vegetal	nice length, beautiful material, pleasant	nice balance, astringency, tannins
	Note (/5)	3.5	1.9	2.6	2.8	2.2
2017	Aromas	red fruit, vegetal, spice	black fruit, cocoa, spice	ripe fruit	ripe fruit, black fruit	spice
	Mouthfeel	hardness tannins	fruity nice balance hardness	coarser neutral unbalanced	fruity nice balance bitterness tannins	fruity more diluted hardness
	Note (/5)	2.9	3.1	2.5	3.4	2.9
2018	Aromas	red fruits, black fruits, blackcurrant, prune, cocoa, blackberry	black fruits, prune, blackcurrant, cocoa, pepper	red fruits, cocoa, black fruits, pepper	cocoa, black fruits, blackcurrant, blackberry, pepper, cloves	red fruits, black fruits, blackcurrant, blackberry
	Mouthfeel	clean attack, balanced, supple tannins	balanced, full structure, supple tannins	clean attack, supple tannins, structure, fleshy, balanced	balanced, narrow body, full structure, supple tannins	clean attack, lack of substance, supple tannins, thin structure
	Note (/5)	3.5	3.37	2.62	3.25	2.12

