

PHYSICOCHEMICAL COMPOSITION OF *CABERNET SAUVIGNON* WINE FROM DIFFERENT AREAS OF THE SERRA GAÚCHA, BRAZIL

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Abstract

The objective of this work was to evaluate the physicochemical composition of the *Cabernet Sauvignon* wine made from grapes grown in different areas of the Serra Gaúcha, the Brazilian most important viticultural region. It was carried out during the 1999, 2000, and 2001 vintages. From each grower, 60 kg of ripened grapes were sampled and crushed and wines were made in glass recipients of 20 L. Results showed that wine from Bento Gonçalves was characterized by higher values of proline and ethyl acetate; from Farroupilha, by density, total acidity, methanol, and 2-methyl-1-propanol; from Flores da Cunha, by alcohol, alcohol/dry extract ratio, anthocyanins, tannins, A420, A520, color intensity, 2-methyl-1-butanol, 3-methyl-1-butanol, sum of higher alcohols, and P; from Garibaldi, by pH, dry extract, reduced dry extract, ashes, K, and Rb; and from Monte Belo do Sul, by density, tartaric acid, hue, 1-propanol, and Mn. These results suggest that it is possible to characterize *Cabernet Sauvignon* wines from different areas of the Serra Gaúcha viticultural region by their physicochemical composition.

Keywords: wine, viniculture, zoning, *Cabernet Sauvignon*, Brazil.

Introduction

The production of grapes in Brazil is concentrated in Rio Grande do Sul, the southern State of the country. The average annual production is about 600 thousand tons/year, most of them come from the Serra Gaúcha viticultural region which originates about 90% of the

Brazilian wine and 95% of the grape juice. The vineyard surface is about 45 thousand hectares, cultivated by 15 thousand families. In this way, the vitiviniculture represents an important economic and social agriculture segment.

Serra Gaúcha is a mountainous region, in general characterized by fertile soils and high precipitation. These conditions propitiate vigorous grapevines and high yields, what is not desirable for good quality wines. To solve this problem, grape growers and winemakers adopted a series of modern technologies, which improved wine quality specially from the 1970s. But there are still many subjects to be considered by producers and researchers. One of them is to know how *Cabernet Sauvignon* composition and tipicity can be influenced by different growing areas of the Serra Gaúcha.

Material and Methods

The experiment was carried out during the 1999, 2000, and 2001 vintages. Sixty kilograms of ripened *Cabernet Sauvignon* grapes of two growers of each area considered in this experiment were sampled and crushed. The areas were Bento Gonçalves, Farroupilha, Flores da Cunha, Garibaldi, and Monte Belo do Sul.

Wine was made in duplicate in glass recipients of 20 L of capacity. Fifty mg/L of a 5% SO₂ solution was added to the must before fermentation. To perform the alcoholic fermentation, it was used a dry active yeast of *Saccharomyces cerevisiae* in the concentration of 20 g/hL. Grapes were macerated for five days with two pumpings over/day. There was no must sugar correction. When alcoholic and malolactic fermentation were over, wines were racked, stabilized, and bottled.

Thirty-seven variables were evaluated which were related to physicochemical, volatile substances, and mineral composition of *Cabernet Sauvignon* wine. Density was determined by a digital densimeter; alcohol, by distillation and densimetry; pH, by a digital pHmeter having a glass electrode and calibrated with standard solutions of pH 3.0 and 4.0; total acidity, by wine titration using a 0.1N NaOH solution and bromothymol as indicator; volatile acidity, by steam distillation and titration with a 0.1N NaOH solution and phenolphthalein as indicator; tartaric acid, by HPLC (Auguste, 1979); reducing sugars were analyzed according to the methodology of Meyer and Leygue-Alba (1991); dry extract and reduced dry extract, by Ribéreau-Gayon et al. (1982); ashes, by the incineration of 20 mL of wine where the temperature varied from 530°C to 550°C (Amerine and Ough, 1976); ashes alkalinity, by

Usseglio-Tomasset (1995); anthocyanins, by Ribéreau-Gayon and Stonestreet (1965); tannins, by Ribéreau-Gayon and Stonestreet (1966); color indices – measuring absorbance at 420 and 520 nm –, color intensity, and hue, by Ribéreau-Gayon et al. (1982); and proline, by Gianessi and Matta (1987).

Most of minerals were analyzed using a Perkin-Elmer atomic absorption spectrophotometer. Ca, Mg, Mn, Fe, Cu, and Zn were determined by atomic absorption; K, Na, and Rb by flame emission (Perkin-Elmer, 2000). P was analyzed according to the methodology of Tedesco et al. (1995) adapted to the analysis of must and wine.

Volatile compounds were determined with the methodology of Bertrand (1975), using a gas chromatograph equipped with an ionization flame detector and the 4-methyl-2-pentanol as internal standard. For glycerol determination, a flame ionization detector was used and the internal standard was the 1,6-hexanediol (Cantagrel et al., 1978).

Results

Results show that there were no striking differences of *Cabernet Sauvignon* wines made with grapes cultivated in different areas of the Serra Gaúcha viticultural region. Nevertheless, most variables showed differences among the five viticultural regions (Tables 1, 2, and 3).

Regarding the average parameters of three years of the physicochemical composition (Table 1), wine from Bento Gonçalves had higher proline values and lower hue; from Farroupilha, higher density and total acidity and lower alcohol/reduced dry extract ratio; from Flores da Cunha, higher alcohol, alcohol/reduced dry extract ratio, anthocyanins, tannins, A420, A520, and color intensity and lower density and tartaric acid; from Garibaldi, higher pH, dry extract, reduced dry extract, and ashes and lower proline; from Monte Belo do Sul, higher density, tartaric acid, and hue and lower alcohol, pH, dry extract, reduced dry extract, ashes, ashes alkalinity, glycerol, anthocyanins, tannins, A420, A520, and color intensity.

In relation to the volatile substances (Table 2), wine from Bento Gonçalves showed higher ethyl acetate values and lower 1-propanol; from Farroupilha, higher methanol and 2-methyl-1-propanol and lower 2-methyl-1-butanol; from Flores da Cunha, higher 2-methyl-1-butanol, 3-methyl-1-butanol, and sum of higher alcohols, and lower methanol and 2-methyl-1-propanol; from Garibaldi, the wine was characterized by intermediate values; and from Monte

Belo do Sul, higher 1-propanol and lower ethyl acetate, 2-methyl-1-butanol, 3-methyl-1-butanol, and sum of higher alcohols.

Physicochemical composition of *Cabernet Sauvignon* wine from different areas of the Serra Gaúcha viticultural region, Brazil. Average of three years.

Variable	Areas					Average	Standard deviation
	BG	F	FC	G	MBS		
Density (mg/mL)	0.9960	0.9965	0.9950	0.9959	0.9965	0.9960	0.0006
Alcohol (% v/v)	10.38	9.69	10.96	10.50	9.08	10.12	0.74
pH	3.60	3.63	3.67	3.71	3.52	3.6	0.1
Total acidity (meq/L)	81.0	82.3	78.0	75.7	77.7	78.9	2.7
Volatile acidity (meq/L)	10.0	9.7	9.3	9.8	8.5	9.5	0.6
Tartaric acid (g/L)	3.10	2.95	2.90	3.10	3.20	3.05	0.12
Reducing sugars (g/L)	2.42	2.11	2.47	2.26	1.81	2.21	0.27
Dry extract (g/L)	21.23	20.31	20.97	21.34	18.11	20.39	1.34
Reduced dry extract (g/L)	19.81	18.20	19.50	20.12	17.35	19.00	1.18
Alcohol/Reduced dry extract	4.21	4.05	4.51	4.17	4.22	4.23	0.17
Ashes (g/L)	2.55	2.87	2.70	2.92	2.37	2.68	0.23
Ashes alkalinity (meq/L)	31.8	32.6	31.3	32.8	28.5	31.4	1.7
Glycerol (mg/L)	11.4	10.0	11.2	11.1	9.4	10.6	0.9
Proline (mg/L)	765	739	748	664	707	725	40
Anthocyanins (mg/L)	311	287	405	320	160	297	88
Tannins (g/L)	1.64	1.11	1.71	1.27	0.77	1.30	0.39
A420	0.254	0.258	0.322	0.308	0.190	0.266	0.052
A520	0.477	0.416	0.514	0.466	0.306	0.436	0.081
Color intensity	0.770	0.674	0.870	0.774	0.496	0.717	0.142
Hue	0.620	0.650	0.626	0.664	0.709	0.654	0.036

BG = Bento Gonçalves; F = Farroupilha; FC = Flores da Cunha; G = Garibaldi; MBS = Monte Belo do Sul.

Volatile substances of *Cabernet Sauvignon* wine from different areas of the Serra Gaúcha viticultural region, Brazil. Average of three years.

Variable (mg/L)	Areas					Average	Standard deviation
	BG	F	FC	G	MBS		
Ethyl acetate	59.7	46.9	45.4	55.5	39.8	49.5	8.0
Methanol	140.3	151.7	106.9	144.3	129.8	134.6	17.4
1-Propanol	20.1	30.7	21.7	30.6	33.9	21.7	6.1
2-Methyl-1-propanol	57.8	60.3	52.4	55.3	56.0	56.4	2.9
2-Methyl-1-butanol	81.7	69.3	92.6	81.7	69.4	78.9	9.8
3-Methyl-1-butanol	240.4	232.7	262.3	251.7	223.0	242.0	15.5
Sum of higher alcohols	400.0	393.0	429.0	419.3	382.3	410.3	16.7

BG = Bento Gonçalves; F = Farroupilha; FC = Flores da Cunha; G = Garibaldi; MBS = Monte Belo do Sul.

Wine mineral composition from the five areas was not so different, but some parameters can be considered. In this way, wine from Flores da Cunha, had higher P; from Garibaldi, higher K and lower Rb; and from Monte Belo do Sul, higher Mn and lower P and K (Table 3).

Mineral composition of *Cabernet Sauvignon* wine from different areas of the Serra Gaúcha viticultural region, Brazil. Average of three years.

Variable (mg/L)	Areas					Average	Standard deviation
	BG	F	FC	G	MBS		
P	94.2	95.7	113.0	103.8	82.7	97.9	11.3
K	1,249	1,340	1,287	1,377	1,097	1,270	108
Ca	73.1	82.2	69.3	84.6	72.5	76.3	6.7
Mg	90.5	84.8	79.4	87.6	83.3	85.1	4.2
Na	5.57	4.13	4.20	4.47	4.03	4.48	0.63
Mn	1.57	1.90	2.20	2.20	3.20	2.21	0.61
Fe	1.83	2.20	1.87	1.77	2.37	2.01	0.26
Cu	0.13	0.27	0.20	0.17	0.27	0.21	0.06
Zn	0.47	0.60	0.50	0.60	0.67	0.57	0.08
Rb	5.70	6.63	8.23	9.40	9.30	7.85	1.64

BG = Bento Gonçalves; F = Farroupilha; FC = Flores da Cunha; G = Garibaldi; MBS = Monte Belo do Sul.

Prior to this work, a study was conducted in this region which contributed to characterize the *Cabernet Franc* wine made in different areas of the Serra Gaúcha viticultural region (Miele, 1999; Miele et al., 1999). The present work was carried out with the *Cabernet Sauvignon* variety, which cultivated surface increased from that time while that of *Cabernet Franc* decreased. It is necessary to emphasize that the viticultural area considered in the present work is larger than that one of the prior study. Nevertheless, despite its contribution to the physicochemical characterization of the *Cabernet Sauvignon* wine made in five areas of the Serra Gaúcha, the characterization of this wine and the discrimination among regions should be regarded as a preliminary study.

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