

## Chemical and sensory analysis of juices and cuts of ‘Bordô’ and ‘Niágara Rosada’ grapes

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**Abstract** - the aim of this study was to evaluate the chemical characteristics and sensory acceptance of juices and cuts of ‘Bordô’ and ‘Niágara Rosada’ grapes. The experimental design was in a one-factor scheme, with five levels. Treatments were: T1 – ‘Bordô’ (100%); T2 – ‘Bordô’ (70%) + ‘Niágara Rosada’ (30%); T3 – ‘Bordô’ (50%) + ‘Niágara Rosada’ (50%); T4 – ‘Bordô’ (30%) + ‘Niágara Rosada’ (70%); T5 – ‘Niágara Rosada’ (100%). Chemical analyses were: content of soluble solids, pH and titratable acidity, and sensory analyses were: color, aroma, flavor, body and global acceptance. For the soluble solids content, the highest averages were verified in T1, T2 and T3 treatments. As for pH, the highest value was recorded in T3, T4 and T5 treatments, while the highest titratable acidity was recorded in T4 and T5 treatments. In the sensory analysis, in juice with the highest percentage of ‘Bordô’ grape (T1 and T2) or with the same proportion of ‘Bordô’ and ‘Niágara Rosada’ (T3), the highest mean acceptance values were found. Thus, it could be concluded that the use of 100% ‘Bordô’ grape and ‘Bordô’ juice cut with up to 50% ‘Niágara Rosada’ are presented as alternatives for juice production.

**Index Terms:** grapevine, *Vitis* spp., processing.

## Análise química e sensorial de sucos e cortes de uvas ‘Bordô’ e ‘Niágara Rosada’

**Resumo** - o objetivo do trabalho foi avaliar as características químicas e a aceitação sensorial de sucos e cortes de uvas ‘Bordô’ e ‘Niágara Rosada’. O delineamento experimental foi constituído em esquema unifatorial, com cinco níveis. Os tratamentos foram: T1 – ‘Bordô’ (100%); T2 – ‘Bordô’ (70%) + ‘Niágara Rosada’ (30%); T3 – ‘Bordô’ (50%) + ‘Niágara Rosada’ (50%); T4 – ‘Bordô’ (30%) + ‘Niágara Rosada’ (70%); T5 – ‘Niágara Rosada’ (100%). As análises químicas foram: teor de sólidos solúveis, pH e acidez titulável; e as sensoriais foram: cor, aroma, sabor, corpo e aceitação global. Para os sólidos solúveis as maiores médias foram verificadas nos tratamentos T1, T2 e T3. Quanto ao pH, o maior valor foi registrado nos tratamentos T3, T4 e T5, enquanto no T4 e T5 foi obtida a maior acidez titulável. Na análise sensorial, de modo geral, no suco com maior porcentagem de uva ‘Bordô’ (T1 e T2) ou com a mesma proporção de ‘Bordô’ e ‘Niágara Rosada’ (T3) foram verificadas as maiores médias de aceitação. Assim, conclui-se que o uso de 100% de uva ‘Bordô’ e o corte de suco de ‘Bordô’ com até 50% de ‘Niágara Rosada’ apresentam-se como alternativas para a elaboração de suco.

**Termos para Indexação:** videira, *Vitis* spp., processamento.

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## Introduction

Brazilian viticulture is in constant expansion. In 2016, 987,059 t of grapes were produced, of which 641,436 t were destined for fresh consumption, and the remaining 345,623 t were destined for processing, for the elaboration of wines, juices and derivatives (MELLO, 2017).

According to Guerra (2016), over the last few years, the popular media movement in favor of healthy food and beverage consumption has led to a considerable increase in the production and consumption of grape juice. This segment has great economic and social relevance, especially in the southern states of Brazil, with consistent and continuous growth for years (GUERRA; BITARELLO, 2016). In addition, juice production has been an alternative to the sustainability of viticulture, since it has absorbed much of the production of American and hybrid grapes traditionally used in the elaboration of table wines (MELLO, 2016).

For grape juice production, any cultivar can be used, provided that it has reached appropriate maturation (RIZZON et al., 1998). In addition, it should present some basic characteristics, among which good must yield, adequate sugar/acidity ratio, aroma and flavor (MARZAROTTO, 2005).

Regarding the choice of the cultivar, Dutra et al. (2014) reported that consumer preference is a very important factor, because the diversity of habits leads to the use of grapes with very different flavor characteristics. 'Concord', 'Isabel' and 'Bordô' are among cultivars used in juice production (RIZZON; MENEGUZZO, 2007) (GUERRA, 2016), as well as hybrid varieties from the *Embrapa* grape breeding program (GUERRA, 2016).

'Bordô' grape is very rustic, productive and has high dyeing content, which makes its use suitable for the correction of the coloring of juices made with other cultivars (PROTAS, 2003). On the other hand, 'Niágara Rosada' cultivar is the main table grape planted in Brazil and has excellent acceptance in the market, with lower production cost and the possibility of production in other seasons (MARTINS et al., 2014). Despite the wide use of 'Niágara Rosada' as table grape, information about the acceptance of juice elaborated with 'Niágara Rosada' cultivar and 'Bordô' with 'Niágara Rosada' cuts is scarce. However, the production of juice made with these cultivars can be a promising alternative for diversification in the growing areas, as well as the possibility of adding value to the product.

One of the ways to measure consumer acceptance and preference is the use of the nine-point structured hedonic scale, which is probably the most affective method, due to the reliability and validity of results, as well as its simplicity of use by panelists (VILLANUEVA et al., 2005).

In this context, the aim of this study was to evaluate the chemical characteristics and acceptance of juices and cuts of 'Bordô' and 'Niágara Rosada' grapes.

## Material and methods

The experiment was carried out in the 2016/2017 harvest in a commercial vineyard located in Pelotas-RS, whose coordinates are 31°29'14.6" S and 52°32'59.7" W. The climate of the region is "cfa" type - temperate climate, with rains well distributed throughout the year and hot summers (MOTA et al., 1986).

For juice production, five-year-old 'Bordô' and 'Niágara Rosada' cultivars were grafted on 'Paulsen 1103' rootstock and conducted in the trellis system, with spacing of 2.5 between rows and 1.85 m between plants. Mixed type fruiting pruning was performed on August 25, 2016.

Sprinkler irrigation was performed under the canopy of plants in sufficient amount for adequate development. Cultural treatments were carried out according to technical recommendations for the culture (PROTAS, 2003).

The time of harvest of grapes was determined by the producer, according to the stabilization of the maturation evolution. At the time of harvest, 'Bordô' grapes presented 17.0° Brix, 3.36 and 0.50% tartaric acid, respectively, for soluble solids, pH and titratable acidity. 'Niágara Rosada' grape showed the same evaluations, values of 16.7° Brix, 3.58 and 0.65% of tartaric acid, respectively.

Treatments were: T1 – 'Bordô' (100%); T2 – 'Bordô' (70%) + 'Niágara Rosada' (30%); T3 – 'Bordô' (50%) + 'Niágara Rosada' (50%); T4 – 'Bordô' (30%) + 'Niágara Rosada' (70%); T5 – 'Niágara Rosada' (100%).

Juices of cultivars were individually elaborated by the process of steam extraction, using steam extracting pan, with 18 kg capacity. After extraction, juices were bottled still hot in 1.5 L glass bottles previously autoclaved at 120°C and 1.5 atm for 20 minutes. Subsequently, they were sealed with plastic cap with seal and stored in refrigerator at temperature of  $\pm 10^\circ$  C.

Four liters of 'Bordô' juice and four liters of 'Niágara Rosada' were prepared. For chemical and sensory analyses, each treatment consisted of a 1.3 liter sample. Thus, after elaboration of juices, mixtures were made: T1 composed of 1.3 liters of 'Bordô' juice; the T2 of 910 ml of 'Bordô' and 390 ml of 'Niágara Rosada'; T3 of 650 ml of 'Bordô' and 650 ml of 'Niágara Rosada'; T4 of 390 ml of 'Bordô' and 910 ml of 'Niágara Rosada' and T5 of 1.3 liters of 'Niágara Rosada'.

Chemical analyses were carried out at LabAgro/ Fruticultura of the Graduate Program in Agronomy, UFPEL. For this purpose, soluble solids (SS) were determined using ATAGO® digital refractometer, with result expressed in °Brix; pH using a QUIMIS® pH meter and titratable acidity (TA) using the titration method using

10 mL of sample diluted in 90 mL of distilled water and titrating with 0.1N NaOH solution to reach pH 8.2. Results were expressed as tartaric acid percentage (INSTITUTO ADOLFO LUTZ, 1985).

Sensory analysis of juices was carried out in individual booths at the Laboratory of Sensory Analysis of UFPEl, and according to Borges et al. (2011) and Instituto Adolfo Lutz (2008), the analysis was composed of 50 untrained judges, among them students, professors and campus employees. The experimental design was in randomized complete blocks, where each panelist was considered a block.

Samples were served at 10°C in transparent polyethylene cups in the amount of 15 mL for each sample. Each judge received, in randomized order, five samples coded with random three-digit numbers. For cleaning the mouth before and between evaluations, mineral water at room temperature was offered ( $\pm 24^\circ\text{C}$ ).

Attributes of color, aroma, flavor, body and global acceptance of samples were evaluated using a nine-point hedonic scale with extremities termed I disliked very much (1) and I liked very much (9) and an intermediate point neither liked nor disliked (5) (INSTITUTO ADOLFO LUTZ, 2008; VILLANUEVA et al., 2005), according to Figure 1.

The experimental design consisted of single-factor experimental scheme with five levels (treatments). Data were submitted to analysis of variance through the F test ( $p \leq 0.05$ ). If statistical significance was observed, the effects were compared by the Tukey test ( $p \leq 0.05$ ).

## Results and discussion

Regarding chemical characteristics, differences were observed for soluble solids content, pH and titratable acidity (Table 1).

For soluble solids, the highest levels were recorded in T1, T2 and T3 treatments, differing from juice produced with 100% 'Niágara Rosada', which presented the lowest content; while T4 did not differ from the other treatments (Table 1), presenting intermediate values. It was verified that the value obtained for juice made with 100% of 'Bordô' was higher than that reported by Rizzon and Link (2006), whose content was 12.2° Brix, and by Bandeira et al. (2017), which verified 15° Brix. In the present study, the higher soluble solids content in 'Bordô' grape juice may have been influenced by the harvesting point.

According to Brazilian legislation for grape juice, soluble solids content must be at least 14° Brix (BRASIL, 2018). Thus, in the present work, all treatments are in accordance with the required quality standards for grape juice.

As for pH, T1 and T2 treatments had the lowest mean values, differing from T3, T4 and T5 treatments

(Table 1). The pH of juice with 100% 'Bordô', 3.28, was lower than that verified by Bandeira et al. (2017), which recorded 3.45. According to Peynaud (1997), pH is related to the taste characteristics of juices and can be influenced mainly by the genetic variability of different cultivars and by processing.

In relation to titratable acidity, the highest averages were observed in T4 and T5 treatments, and the lowest in T1; however, these samples did not differ from T2 and T3 treatments (Table 1). It was observed that in juice elaborated with higher percentage of 'Niágara Rosada' the highest acidity and pH values were obtained (Table 1). Rizzon and Sganzerla (2007) reported that their concentrations in the must are related to the physiological aspects of grape maturation, to natural climate and soil factors of the wine-growing region and the agronomic production practices. In addition, such results may have occurred as a result of the main acids responsible for the grape must acidity. Giovannini (2014) reported that tartaric acid is stronger than malic acid and cultivars with the same acidity but with higher tartaric acid content present lower pH value.

In the sensory analysis, there were differences for color, aroma, body and global acceptance (Table 2). For color, the highest scores were observed in T1, T2 and T3 treatments (8.4, 8.2 and 7.9, respectively), differing from T4, which presented score of 6.4 and T5, whose score was 4.6 (Table 2). It is worth mentioning that judges were unable to verify color differences among T1, T2 and T3 treatments, which makes it possible to infer that cuts should be up to a maximum of 50% of 'Niágara Rosada' grapes.

According to Tecchio et al. (2007), the intense color of 'Bordô' grape wine is a characteristic of the cultivar, which has high concentration of anthocyanins. Thus, it is possible to infer that in the present experiment, this characteristic may have influenced the higher scores attributed by judges for treatments with higher percentage of 'Bordo' grapes (T1 and T2) and equal cuts of cultivars (T3), indicating their preference as to the more intense juice color. Similar result was reported by Pereira et al. (2008), where 'Bordô' juice obtained better quality related to intensity and visual tonality in relation to juices of other varieties tested. According to Matsuura et al. (2002), color is of fundamental importance, since it is linked to the attractiveness for consumers. Thus, 'Bordô' cultivar is much requested by industries, since it allows the increase in the color intensity of juices elaborated with cultivars with poor coloration (RIZZON; MENEGUZO, 2007).

For aroma, there were statistical differences among treatments, with values recorded between 6.8 and 7.7, indicating good acceptance by consumers (Table 2). According to Rizzon et al. (1998), Brazilian grape juice is characterized by an intense aroma of *Vitis labrusca*, denominated in the oenological market as 'foxy' aroma

and described by consumers as grape aroma, being an aromatic characteristic considered pleasant by Brazilian, American and Japanese consumers.

Regarding flavor, there were no significant differences among treatments, which presented scores between 6.9 and 7.5 (Table 2). Barnabé et al. (2007) evaluated the flavor intensity of 'Bordô' and 'Niágara Rosada' wines and found that the flavor was more intense for 'Bordô' wine, intermediate for cuts and less intense for 'Niágara Rosada' wine. Rizzon et al. (1998) reported that grape juice should have predominant sweet taste, but not excessive in relation to acidity, as well as no taste of cooking, mold or other unpleasant taste. For body variable, T1, T2 and T3 treatments presented the highest mean values, differing from T5 (Table 2). These results are in agreement with Barnabé et al. (2007), who reported that the body attribute was considered more intense in wines with the highest percentage of 'Bordô' grapes.

Regarding global acceptance, T1, T2 and T3 treatments presented the highest scores, with values between 7.5 and 7.7, differing from T4 and T5, which presented scores 6.8 and 6.6, respectively (Table 2). Despite the statistically significant difference, T4 and T5 treatments obtained good acceptance from judges. Borges

et al. (2011), in the sensory analysis of 'Isabel' grape juice, pointed out that it is necessary to consider the acceptance of the product by the consumer due to the risk of financial losses for the sector.

Evaluating the sensory quality of a food is not an easy task, since it is a complex response to the sensory properties of the product, which is based on expectations, preferences and previous experiences of an individual in relation to the product. However, Mascarenhas et al. (2010) mentioned that consumer acceptance is a crucial part of the consolidation process of a product on the market.

In the present study, due to the mean scores obtained for most attributes, juices with the highest percentage of 'Bordô' grapes (100 and 70%) or with the same proportion of 'Bordô' and 'Niágara Rosada' were well accepted by judges, indicating the potential of these products as alternative for processing.

Considering the importance of new options for diversification in production areas, further studies on this theme should be carried out in order to evaluate other cultivars. Assis et al. (2011) reported that the selection of different cultivars for the production of juice may be favorable, as eventual imbalances can be corrected during processing through cuts.

**Table 1.** Chemical characteristics of juice from 'Bordô' and 'Niágara Rosada' grapes. Pelotas-RS, 2017.

Juices	Variable analyzed		
	SS <sup>a/</sup> (°Brix)	pH	TA <sup>b/</sup> (% tartaric acid)
T1- Bordô (100%)	16.5 a <sup>1/</sup>	3.28 b	0.93 b
T2- Bordô (70%) + Niágara Rosada (30%)	16.2 a	3.28 b	1.05 ab
T3- Bordô (50%) + Niágara Rosada (50%)	16.2 a	3.42 a	1.03 ab
T4- Bordô (30%) + Niágara Rosada (70%)	16.0 ab	3.45 a	1.08 a
T5- Niágara Rosada (100%)	15.6 b	3.48 a	1.15 a
VC (%)	1.4	0.9	4.9

<sup>1/</sup>Means followed by the same letter in the column do not differ by the Tukey test ( $p \leq 0.05$ ). VC (%): variation coefficient. <sup>a/</sup>: soluble solids. <sup>b/</sup>: titratable acidity.

**Table 2** . Average attributes of color, aroma, sweetness, acidity, flavor and global acceptance of juice from 'Bordô' and 'Niágara Rosada' grapes. Pelotas-RS, 2017.

Juices	Variable analyzed				
	Color	Aroma	Flavor	Body	Global acceptance
T1- Bordô (100%)	8.4 a <sup>1/</sup>	7.7 a	7.5 <sup>NS</sup>	7.7 a	7.7 a
T2- Bordô (70%) + Niágara Rosada (30%)	8.2 a	7.3 ab	7.4	7.4 a	7.6 a
T3- Bordô (50%) + Niágara Rosada (50%)	7.9 a	7.5 ab	7.5	7.4 a	7.5 a
T4- Bordô (30%) + Niágara Rosada (70%)	6.7 b	6.8 b	6.9	6.8 ab	6.8 b
T5- Niágara Rosada (100%)	4.6 c	7.2 ab	7.0	6.6 b	6.6 b
VC (%)	15.9	18.4	20.1	18.8	16.7

<sup>1/</sup>Averages followed by the same letter in the column do not differ from each other by the Tukey test ( $p \leq 0.05$ ). <sup>NS</sup>: not significant by the F test ( $p \leq 0.05$ ) of the analysis of variance. VC (%): variation coefficient.

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

Evaluate each coded sample **from left to right**. Use the scale below to indicate how much you liked or disliked each attribute (color, aroma, flavor, body and global acceptance).

9 - I liked it very much  
 8 -  
 7 -  
 6 -  
 5 - I neither liked nor disliked  
 4 -  
 3 -  
 2 -  
 1 - I disliked it so much

Samples	No.:	No.:	No.:	No.:	No.:
<b>Color</b>					
<b>Aroma</b>					
<b>Flavor</b>					
<b>Body</b>					
<b>Global acceptance</b>					

Comments: \_\_\_\_\_  
 \_\_\_\_\_

**Figure 1**. Grape juice sample assessment form.

## Conclusion

Juices made with 100% 'Bordô' grape and 'Bordô' juice cut with up to 50% 'Niágara Rosada' are presented as alternatives for grape juice production.

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