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Phenolic composition and physicochemical analysis of wines made with the syrah grape under double pruning in the Brazilian high-altitude cerrado

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Abstract. Wine growing has proven to be a development opportunity for agribusiness in several new regions of Brazil, including the federal district. There are more than ten existing wineries, established in the last five years. Through the double pruning system, which consists of trimming the growing shoots in the summer and positioning the ripening of the fruits in a cooler period of the season, the grapes are sought to ripen more completely. The syrah variety has shown excellent adaptation to this cycle management model. The objective of this study was to evaluate the physical-chemical and phenolic composition of wines made from the syrah variety in two harvests, 2022 and 2023, to understand the behaviour in the phenolic and technological ripening process of grapes on vines implemented in the federal district. Wines made from 100% of the Syrah variety were evaluated, 6 from the 2023 harvest and 3 from the 2022 harvest. We observed that wines made from different harvests showed differences in total phenolic composition, wines from the 2022 harvest presented higher values (76.68±10.42) than the 2023 harvest (67.05±5.89), p=0.0221. Regarding the physical-chemical composition, we did not observe statistical differences in alcoholic strength, total acidity, dry extract, density, and chlorides. However, we observed a statistical difference in the level of volatile acidity, wines from the 2023 harvest presented higher values, (9.19±0.345 meq/l), than those from the 2022 harvest, (6.16±0.350 meq/l), p<0.001. Although there are no statistical differences between vintages regarding the alcohol content of wines, it is observed that the average is higher than in other regions, such as in the south of the country, the average is 13.88±0.91 %v/v, with a maximum value of 15.44%v/v and a minimum of 12.38%v/v, thus demonstrating excellent technological maturity of the grape. total acidity levels also did not differ from the 2023 (91.90±5.15 meq/l) and 2022 (88.50±5.17 meq/l) harvests, however, it is possible to observe that the wines in question have excellent acidity, as a result of the thermal range present in this region, located around 1,000 m above sea level, which can reach up to 20ºc/day. More studies are needed to observe possible intra-region variations and the behaviour of different cultivars. However, the results obtained are auspicious regarding the quality of the wines in question, demonstrating a balance between the main factors involved, such as climate, soil, and relief. These characteristics will certainly be important for defining the terroir of this region, seeking its own identity, which will be constructed based on these and other analyses. The wine sector is growing exponentially in different regions of the country, which is why studies like this are necessary to recognize wines and their characteristics, seeking to present them to Brazilian consumers.

1. Introdution

The first vines cultivated in Brazil were of European origin and emerged with the arrival of Portuguese colonizers (1532). In the mid-nineteenth century, Italian immigrants introduced the "Isabel" American grape variety, culminating in the rapid replacement of vine varieties of European varieties, becoming the basis for the development of commercial winemaking in the states of Rio Grande do Sul and São Paulo. From the beginning of the twentieth century, São Paulo viticulture replaced the cultivars of the variety "Isabel" by "Niagara Branca" and

"Seibel II". In the same period, with government incentives, Rio Grande do Sul intensified the planting of vine varieties [1].

The 1990s presented a scenario of a restructuring and/or reconversion of the profile of the wine industry in the State of Rio Grande do Sul [2].

However, despite the existence of several improvements that facilitate the development of the wine production process, there is a locational movement in Brazilian winemaking: the growth of wine production outside the traditional region (Serra Gaúcha) [3]. This locational movement of viticulture allowed the discovery of new terroirs in Brazil, allowing the elaboration and commercialization of differentiated products. Therefore, it is a determining factor for the evolution of Brazilian winemaking.

Nowadays, the quality of Brazilian wine has been improved through the introduction of new varieties, adaptation of cultivars, clones, rootstocks, agronomical practices and enological techniques. However, the greatest impediment to this evolution is the low quality of grapes, mainly due to climatic conditions during the growing season [4]. In the South and Southeast of Brazil, the major grapevine growing regions in the country have only one production cycle per year, in general, from August through to January/February. Grape ripening and harvest occur during the summer months between December and February, which is a period of high precipitation. This excessive rainfall favors the occurrence of fungal diseases and increased rot incidence [5]; the ripening process is delayed or not completed due to low solar radiation and high soil water availability, which adversely affects grape composition and wine quality [4]. In contrast, the Brazilian tropical regions, the Northeast of the country, have higher temperatures and lower thermal amplitudes during the ripening process which slows the synthesis and concentration of the phenolic compounds essential for grape colour, structure and wine stabilisation [6].

New regions in Brazil are appearing but in this case results from a new technique, called the winter viticulture or winter wine. They are called this way because the harvest is changing to winter, different from the natural summer harvest. This is possible because they do the double pruning, one after the harvest (almost in September), called the formation prune, and the other one in February, called production prune. According to studies Syrah is one of the better varieties for this kind of cultivation. This kind of the conduction is possible in places where the vineyards don't do the endodormancy, and during the harvest time in this place we have hot days and cold nights, possibly a perfect grape maturation.

Brasilia, is the capital of Brazil, a traditional politician site, but in the last 4 years viticulture has been an important choice between the agriculture practices. Actually in Brazilian there are more than 20 different vineyards .The objective of this study was to evaluate the physical-chemical and phenolic composition of wines made from the syrah variety in two harvests, 2022 and 2023, to understand the behaviour in the phenolic and technological ripening process of grapes on vines implemented in the federal district

1.1. Licence agreement

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2. Material and methods

2.1. Samples

Commercial wines from the Syrah variety were collected for the conduction of the study, being 6 samples from the harvest 2023 and 3 samples from the harvest 2022.

2.2. Analysis

The analyses were performed at the Oenological Reference Laboratory of the Secretary of Agriculture of the State of Rio Grande do Sul (LAREN/SEAPI), at Caxias do Sul - Brazil.

2.2.1. Alcoholic strength

The analysis of the alcoholic strength was performed by the distillation of the wine and the posterior measurement of the alcoholic strength of the distillate. The reference method was the OIV-MA-AS312-01A, of the Compendium of International Methods of Wine and Must Analysis of the International Organisation of Vine and Wine (OIV, 2024).

2.2.2. Total acidity

The analysis of the total acidity was performed by Potentiometric titration, using the OIV-MA-AS313-01 method [7].

2.2.3. Total Dry extract

The analysis of the total dry extract was conducted by the method Method OIV-MA-AS2-03A adapted (OIV, 2024).

2.2.4. Density

The analysis of the density was performed by using the OIV-MA–AS2–01 method (OIV, 2024).

2.2.5. Chlorides

The analysis of Chlorides was performed by potentiometry, using the OIV-MA-AS321-02.

2.2.6. Total phenolic composition

The total phenolic compounds were analysed by direct reading at 280 nm, in a Prove 600 Spectroquant (Merck Millipore), based on the Riberéau-Gayon (2003) methodology.

2.2.7. Statistical analysis

For evaluating the results we used the GraphPad Prism version 10.0. The years were compared by t student test and the different samples were compared by ANOVA, pos hoc test. We considered the statistical difference $p<0.05$.

3. Results and ciscussion

Wines made from 100% of the Syrah variety were evaluated, six (6) from the 2023 harvest and three (3) from the 2022 harvest. We observed that wines made from different harvests showed differences in total phenolic composition, wines from the 2022 harvest presented higher values (76.68±10.42) than the 2023 harvest (67.05±5.89), $p=0.0221$.

The use of double pruning enables the harvesting of grapes under climatic conditions that favour grape ripening [5]. In southeastern Brazil, this technique allowed vineyard dissemination for high quality fine wine production [5].

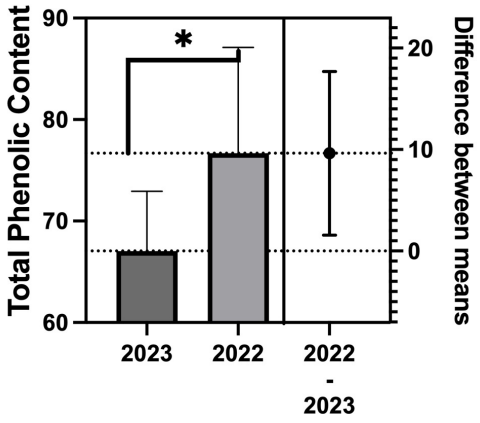

Figure 1. Total Phenolic Compounds in Syrah wines from different harvest, 2022 and 2023.

Wines elaborated from grapes harvested during the winter season under low water availability and high thermal amplitude have higher alcohol and phenols content as well as colour intensity than summer wines [8]. The authors observed that wines from less irrigated vines exhibited high levels of total phenols, anthocyanins and chroma and therefore showed higher colour intensity and sensorial perception of more fullness. Phenolic compounds are the main component of colour and mouthfeel in wine, also affecting its ageing ability. Double pruning favours phenolic maturation mainly by high thermal amplitude and low rainfall during autumn-winter season [5].

Regarding the physical-chemical composition, we did not observe statistical differences in alcoholic strength, total acidity, dry extract, density, and chlorides. However, we observed a statistical difference in the level of volatile acidity, wines from the 2023 harvest presented higher values, (9.19±0.345 meq/l), than those from the 2022 harvest, (6.16±0.350 meq/l), $p<0.001$. Although there are no statistical differences between vintages regarding the alcohol content of wines, it is observed that the average is higher than in other regions, such as in the south of the country, the average is 13.88±0.91 %v/v, with a maximum value of 15.44%v/v and a minimum of 12.38%v/v, thus demonstrating excellent technological maturity of the grape. total acidity levels also did not differ from the 2023 (91.90±5.15 meq/l) and 2022 (88.50±5.17 meq/l) harvests, however, it is possible to observe that the wines in question have excellent acidity, as a result of the thermal range present in this region, located around 1,000 m above sea level, which can reach up to 20ºc/day.

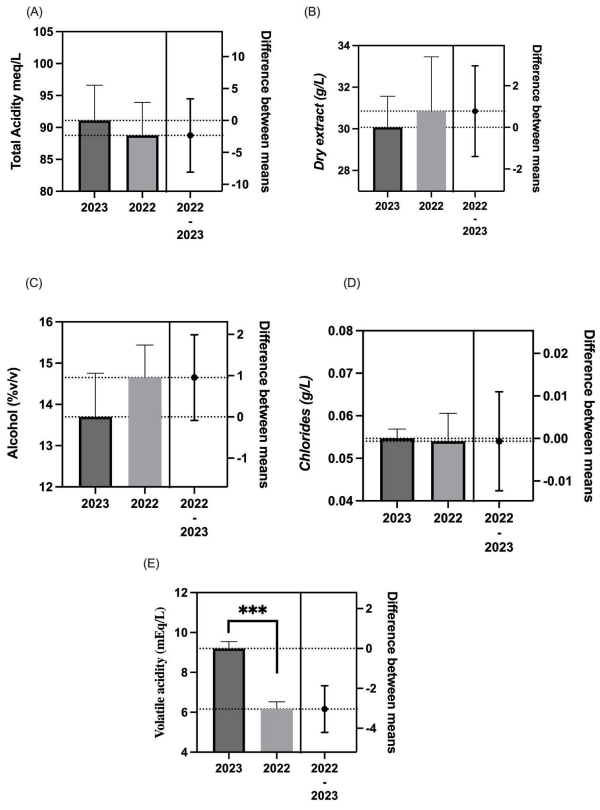

Figure 2. Total Acidity, Dry Extract, Alcohol, Chlorides and volatile Acidity in Syrah wines from different harvest, 2022 and 2023.

In A Recent study from Chile, evaluating the volatile acidity of finished wines elaborated in different vessels, they observed the wines elaborated in inox contained higher amounts of volatile acidity, although it is below their sensory threshold [9]. The authors supported the idea that the inox fermentations were carried out in the presence of lower amounts of oxygen, since strict anaerobiosis increases acetic acid production by yeasts [10.11]. Moreover, it has been described that yeasts metabolise a large proportion of the acetic acid secreted in grape juice

at the beginning of alcoholic fermentation (via acetyl CoA in the lipid-producing pathways), while they do not metabolise acetic acid during the last stages of fermentation [10,11]. In this study, since fermentation in the inox tanks was longer than that in the other vessels, it seems quite logical that the accumulation of acetic acid in this kind of tank was greater than that in the other tanks [9]. Although in our study there were no differences in elaboration methods, influences at the grape maturation, such as the sugar level at the fermentation beginning, could explain these results .

4. Conclusions

Nowadays different vineyard areas have been planted in all of the country. The non-traditional regions are presenting wines of very good quality and typicity. Different kinds of vineyard techniques and cultivars are being implanted and the results of these different factors until now is unknown. In our results we observed differences in polyphenols content and volatile acidity. These factors could be explained by the maturation levels of these two harvest conditions. The wine sector is growing exponentially in different regions of the country, which is why studies like this are necessary to recognize wines and their characteristics, seeking to present them to Brazilian consumers.

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