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RESEARCH ARTICLE

BEHAVIOR OF PHENOLIC AND COLOR PARAMETERS DURING GRAPE VINIFICATIONOF TANNAT AND CABERNET SAUVIGNON CVS. IN BAGÉ-RS

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ABSTRACT

The Tannat grape provides wines with good structure and coloration due to high concentration of phenolic compounds (Echeverry *et al*., 2005; Gonzáles-Neves *et al*., 2006; 2004[a, b], 2002). The Cabernet Sauvignon cultivar yields a dark red wine, full-bodied, with a lasting pleasant odor (Camargo,1994; Souza, 2000).Through the monitoring of winemaking, it can be identified the behavior of phenolic compounds and color parameters in order to define the best and most suitable winemaking system, keeping the characteristics of interest. The study was conducted from a seven years old vineyard, located in the city of Bagé, Campanharegion of the RS state, Brazil, during the growing season of 2007, with Tannat and Cabernet Sauvignon cultivars. Vineyard- the vineyard was established from grafted plants in 1103 Paulsen rootstock, with spacing of 1.2 m between plants and 3 m between rows, in the simple espalier conduction system, and double Guyot pruning for Tannat cv. and simple cordon spur pruning for Cabernet Sauvignon cv. Microvinification - It was carried out the vinification of Tannat and Cabernet Sauvignon grapes harvested at technological maturity stage (March, 11th) based on the Classic method. For each experimental unit (bottle of 20 L) of each treatment, the grapes were crushed and desençada, and immediately added SO_2 (50mg.L^{-1}) and yeast (20mg.L^{-1} de *Saccharomyces cerevisiae, Maurivin*® brand), followed by 6 days of maceration at temperature of 20ºC to23ºC with daily reassembly, and cap removal on the day 7. This paper has allowed us to verify the behavior of compounds responsible for the color in winemaking of Tannat and Cabernet Sauvignon cv. wines. The decrease in acidity may have caused the fall of anthocyanin and polyphenolic compounds during the vinification for both varieties. However, Tannat cv., when compared to Cabernet Sauvignon cv., presented higher levels of these compounds. The results are very relevant because they allow the selection of the most suitable wine-making system for the studied cultivars, and also provide important information about their behavior in the studied counties.

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INTRODUCTION

The coloring is one of the main features appreciated by consumers in a wine. It is an important attribute because it may be used along other variables as a quality indicator. This trait depends on the grape composition of which the wine has been made, the winemaking process, and the conditions in which it is maintained or possibly aged (Gonzáles-Sanjosé *et al*., 2003; Hernández-Agero *et al*., 1993). Among the organic compounds that contribute to the red wine chemical composition and quality, the polyphenols have a prominent place, especially the anthocyanins, which are the main responsible components for the coloring (Gonzáles-Neves *et al*., 2003). The phenolic compounds give gustatory characteristic of softness, hardness, astringent taste, and they also participate in some way on the scent (Ribéreau-Gayon *et al*., 2003). The anthocyanins are a group of water-soluble plant pigments widely distributed in the plant kingdom. Its color spectrum ranges from red to blue, also presenting itself as a mix of both colors resulting in purple shades (Degárpari and Waszczynskyj, 2004).The color of the wines does not depend on the anthocyanins content only, but it is closely related to the physicochemical characteristics of the pigments and the environment where they occur (Ribéreau-Gayon *et al*., 2003). According to Francis (1992), the main factors that influence the anthocyanins stability are chemical structure, pH, temperature, light, presence of oxygen, enzymatic degradation, and interactions between food

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components, such as ascorbic acid, metal ions, sugars and copigments. According to Glories (1984), the study of the color in red wines is carried out by measuring absorbance at 420, 520 and 620nm wavelengths. The spectrum of young red wines has a maximum absorbance between 520 and 620nm, which decreases with aging and increases absorbance at 420nm, classifying the coloration between yellow/brown shades. The evaluation of both tonality and color intensity are quite important to allow us identifying the quality of a wine and its possible defects (Freitas, 2006). The Tannat grape provides wines with good structure and coloration due to high concentration of phenolic compounds (Echeverry *et al*., 2005; Gonzáles-Neves *et al*., 2006; 2004[a,b], 2002). The Cabernet Sauvignon cultivar yields a dark red wine, full-bodied, with a lasting pleasant odor (Camargo,1994; Souza, 2000).Through the monitoring of winemaking, it can be identified the behavior of phenolic compounds and color parameters in order to define the best and most suitable winemaking system, keeping the characteristics of interest.

MATERIALS AND METHODS

Vineyard

The study was conducted from a seven years old vineyard, located in the city of Bagé, Campanharegion of the RS state, Brazil, during the growing season of 2007, with Tannat and Cabernet Sauvignon cultivars. The vineyard was established from grafted plants in 1103 Paulsen rootstock, with spacing of 1.2 m between plants and 3 m between rows, in the simple espalier conduction system, and double Guyot pruning forTannat cv. and simple cordon spur pruning for Cabernet Sauvignon cv. The soil in the area is part of the Santa Tecla Mapping Unit (Eutrophic red argisol), and its main features are pH 5, clay content of 24%, 1.2% of organic matter, 3.5 mg/dm^3 of P, and 80 mg/dm^3 of K. The average of plants height was 1.2m. Green pruning and clusters thinning were applied on the *véraison* occasion in order to obtain an average plant yield of 3.5 kg. The average weather conditions in the vineyard micro-region during the month of March were: relative humidity ranging between 52-84%, radiation of 686,32 kJ/m^2, precipitation of 91,9mm, and thermal range of 6,78ºC (INMET, 2008).

Microvinification

It was carried out the vinification of Tannat and Cabernet Sauvignon grapes harvested at technological maturity stage (March, 11th) based on the Classic method. For each experimental unit (bottle of 20 L) of each treatment, the must was obtained and immediately added SO_2 (50mg.L^{-1}) and yeast (20mg.L^{-1} de *Saccharomyces cerevisiae, Maurivin*® brand), followed by 6 days of maceration at temperature of 20ºC to23ºC with daily reassembly, and grape skinremoval on the day 7. Once the alcoholic fermentation was concluded, it was performed the racking and monitored the malolactic fermentation, which took four months to complete, followed by the tartaric stabilization in cold chamber at 4 ° C during 10 days. After tartaric stabilization, the wines were bottled. In the wines, it was evaluated the optimal density (DO_{420}, DO_{520} e DO_{620}), total anthocyanins, total polyphenols and total acidity, following methodology described by Amerine e Ough (1976). The K values were obtained by flame emission spectrometry (Perkin-Elmer, 1976). From the optical density values, it was calculated the color tone (TC = DO_{420}/DO_{520}) and the color Intensity (IC = $DO_{420}+DO_{520}+DO_{620}$). For all variables, except for potassium, the evaluations were conducted at the moment of must extraction, after cap removal, after alcoholic fermentation, after malolactic fermentation, and after tartaric stabilization (final wine). For potassium, evaluations occurred at the end of the alcoholic fermentation and in the final wine.

RESULTS AND DISCUSSION

It may be observed in the graphs below (Figures 1, 2, 3, 4 e 5), for all analyzed variables, a peak of compounds concentration at the cap removal stage, with subsequent decrease in these values. It was already expected, once the reduction of compounds responsible for the color is directly related to the drop in wine acidity (Figure 6), which interferes in the pigments form, and also in the different colors they might exhibit.

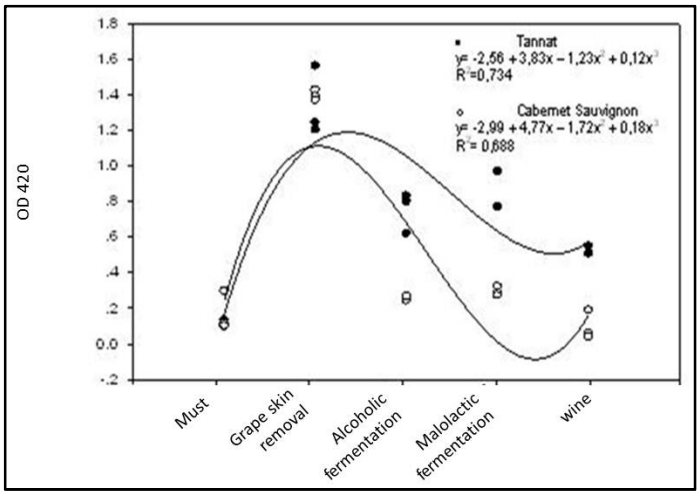

Figure 1. Evolution of 420 nm Optical Density forTannat and Cabernet Sauvignon cv. wines

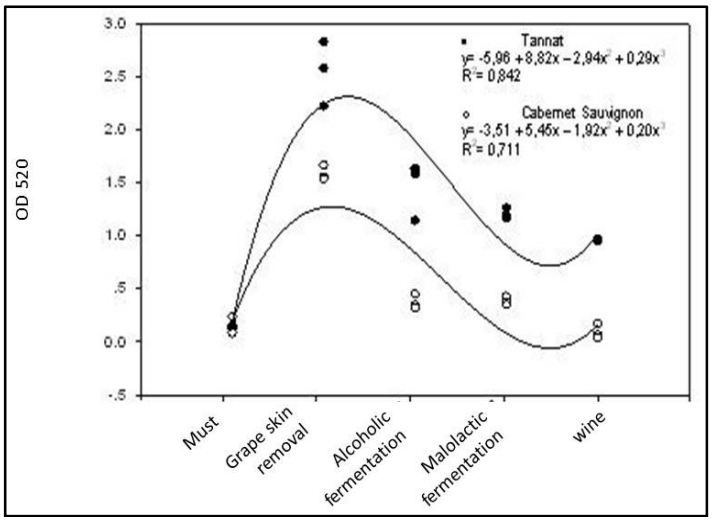

Figure 2. Evolution of 520 nm Optical Density forTannat and Cabernet Sauvignon cv. Wines

The pH (Figure 7) has a deep influence on the anthocyanin colors, as well as their stability, which are more stable in acid solutions than in neutral and alkaline (Francis, 1992; Freitas, 2006; Ribéreau-Gayon *et al*., 2003).

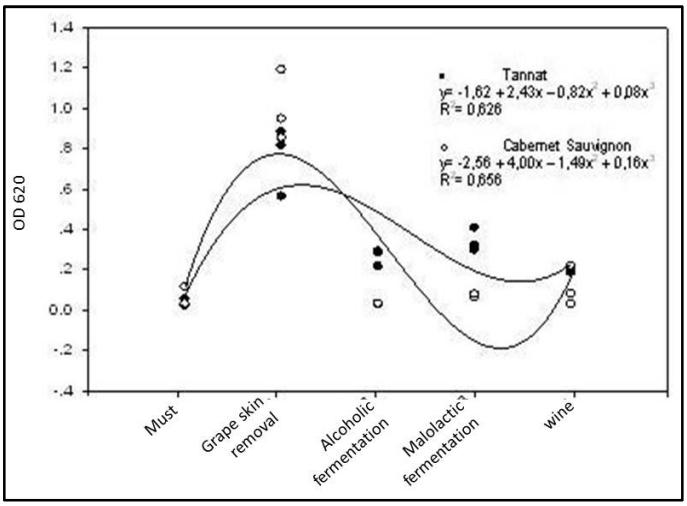

Figure 3. Evolution of 620 nm Optical Density for Tannat and Cabernet Sauvignon cv. Wines

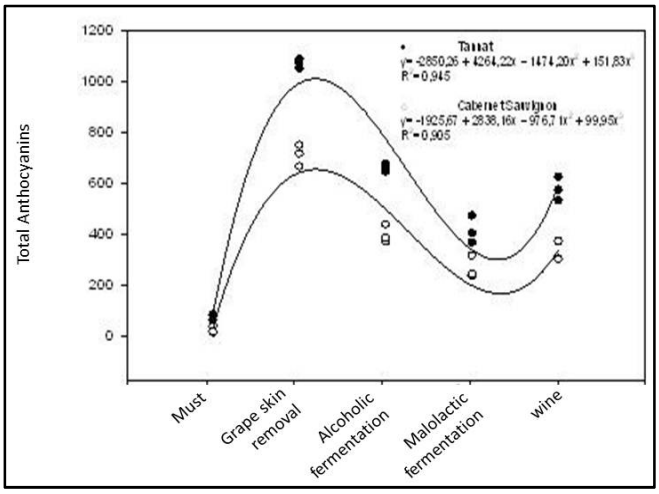

Figure 4. Total Anthocyanins Evolution for Tannat and Cabernet Sauvignon cv. Wines

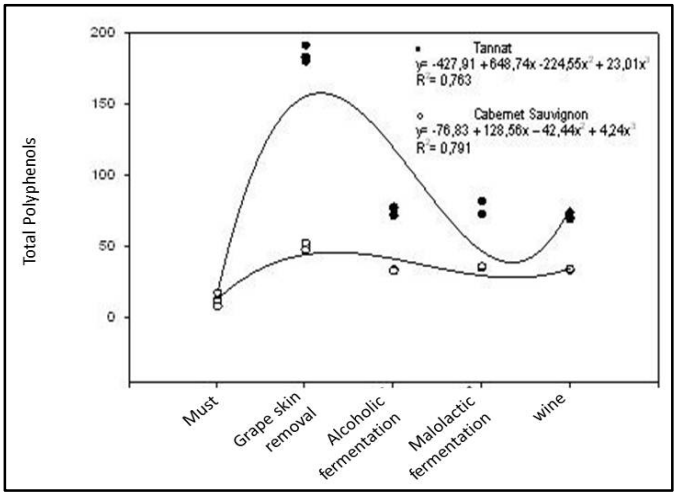

Figure 5. Evolution of Total Polyphenols Index (I280)forTannat and Cabernet Sauvignon cv. wines

According to Rizzon & Mielle (2002), acidity is one of the most important sensory characteristics of wines. Due to insolubility of tartaric acid in the form of salts, titratable acidity and pH may be changed during the vinification, also changing the color of the anthocyanins. The analyzed samples showed final acidity of 69meq.L^{-1} for Cabernet Sauvignon cv., and 75meq.L^{-1} for Tannat cv., being these amounts considered suitable and fairly close to those found by Rizzon e Miele (2002, 2004).

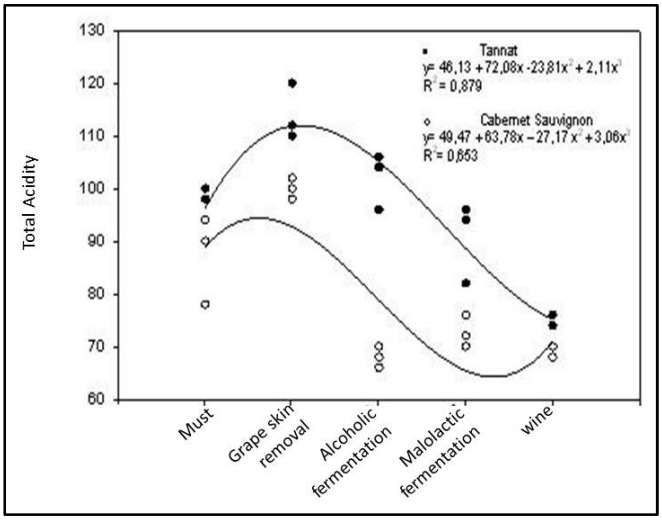

Figure 6. Total Acidity Evolution for Tannat and Cabernet Sauvignon cv. Wines

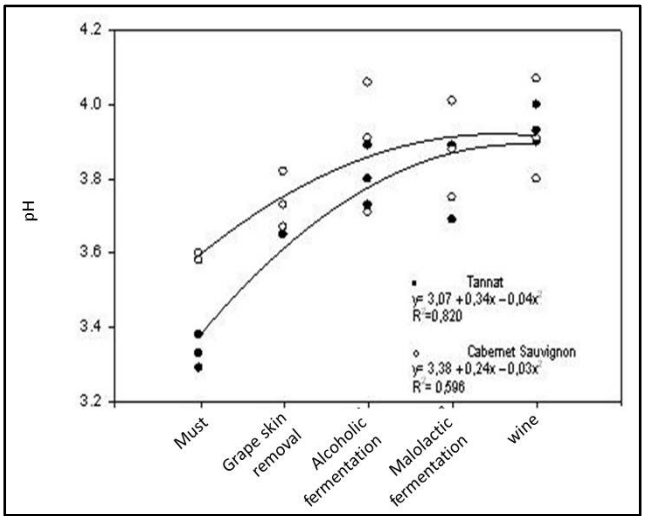

Figure 7. pH Evolution for Tannat and Cabernet Sauvignon cv. wines

The drop in color intensity (Figure 8) is due to the reduction of anthocyanins and tannins, providing an idea of development and relative amount of phenolic compounds of grapes, mainly anthocyanins (Usseglio-Tomassete, 1989). The decrease in color tone values (Figure 9) corresponds to a major increase of DO520, which measures the red color, compared to DO420, which measures the yellow color of the wines. It occurs due to the higher solubility of anthocyanins compared to tannins (Glories, 1984). In the analyzed wines, there is a lower color tone for Cabernet Sauvignon variety, indicating a more reddish hue when compared to the Tannat variety.

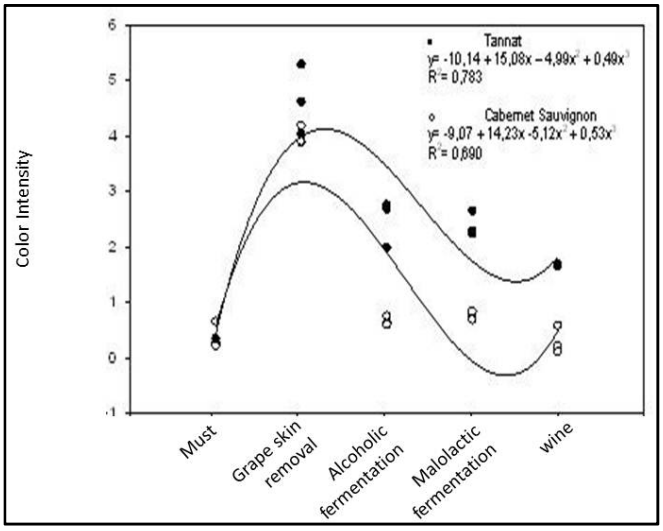

Figure 8. Color Intensity Evolution for Tannat and Cabernet Sauvignon cv. wines

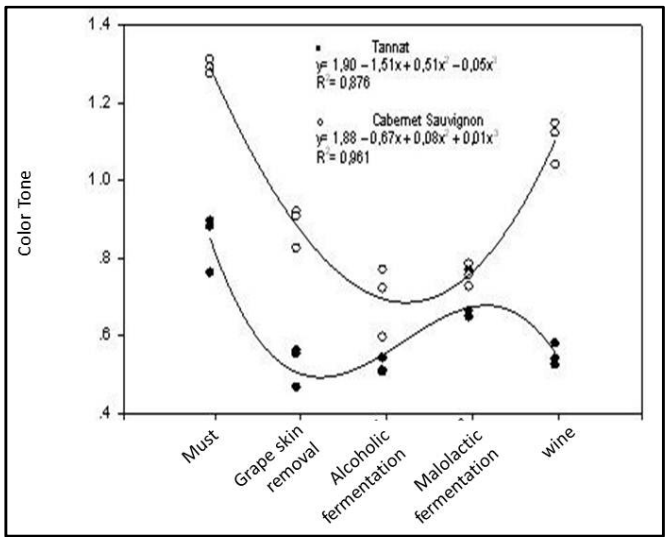

Figure 9. Color Tone Evolution for Tannat and Cabernet Sauvignon cv. Wines

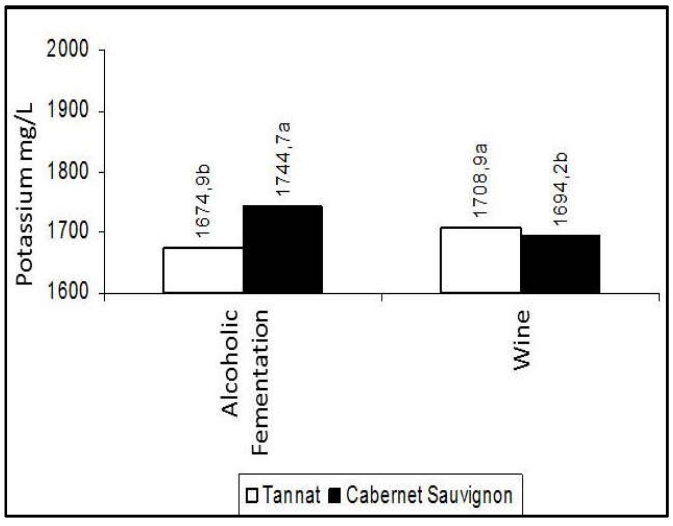

Figure 10. Potassium Evolution for Tannat and Cabernet Sauvignon Cv. Wines

The color change may be explained by the anthocyanins and tannins participation in the ruby-red color of the new wine. During storage, free anthocyanins disappear and the tannin/condensed anthocyanins complex confer to the old wines their tile characteristic color (Freitas, 2006).Potassium is the most abundant cation in wine, and it is released by the solid parts of the grape during maceration. Some authors relate high K levels to significant pH increases, due to precipitation in the form of K bitartrate, causing turbidity in the wine (Zocche, 2009; Rizzon, 2002; Amerine and Cruess, 1960; Daudt and Garcia, 1887; Amerine and Ough, 1976). In the studied growing season, potassium had no significant influence on the wines acidity.

Conclusion

This paper has allowed us to verify the behavior of compounds responsible for the color in winemaking of Tannat and Cabernet Sauvignon cv. wines. The decrease in acidity may have caused the fall of anthocyanin and polyphenolic compounds during the vinification for both varieties. However, Tannat cv., when compared to Cabernet Sauvignon cv., presented higher levels of these compounds. The results are very relevant because they allow the selection of the most suitable wine-making system for the studied cultivars, and also provide important information about their behavior in the studied counties.

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