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Discrimination of Brazilian red wines according to the viticultural region, varietal, and winery origin

Discriminação de vinhos tintos brasileiros de acordo com a região vitícola, varietal e vinícola

Alberto MIELE^{1*}, Luiz Antenor RIZZON¹, Mauro Celso ZANUS¹

Abstract

This work evaluated the physicochemical composition of 171 red Brazilian wines from the 2006 vintage, which were represented by 21 varietals. These wines were produced by 58 Brazilian wineries in different regions of the country, with latitudes varying from 9° to 31° South. Physicochemical wine analysis was performed in the same year and discrimination in the viticultural regions, varietal wines, and wineries was performed by means of the principal component analysis (PCA). The main results show that wines from São Joaquim had higher values of A420, A520, A620, color intensity, total phenolic compounds, anthocyanins, and dry extracts, while those from Toledo had lower values of these variables; those from Vale do São Francisco had higher values of potassium, pH, density, and volatile acidity; from Serra do Nordeste A, they had higher titratable acidity; and from Planalto Superior B, higher hue. Regarding the varietal wines, PCA mainly discriminated the wines produced from the varieties Ancellotta, Teroldego, Egidola, Refosco, Marselan, Cabernet Sauvignon, Pinotage, Pinot Noir, Malbec, Arinarnoa, Barbera, and Alfrocheiro. In relation to wineries, twenty two of them were discriminated by their higher values of some variables, i.e., three were characterized by color intensity; three by hue; eight by alcohol content; six by potassium, dry extract, density, and pH; and two by titratable acidity.

Keywords: *physicochemical composition; geographical origin; grape cultivar; wine company; PCA.*

Resumo

O trabalho avaliou a composição físico-química de 171 vinhos tintos brasileiros elaborados na safra de 2006, representados por 21 variedades. Os vinhos foram elaborados por 58 vinícolas localizadas em sete regiões vitícolas do País com latitudes variando de 9° a 31° Sul. A análise físico-química foi feita em 2006 e a discriminação entre as regiões vitícolas, os vinhos varietais e as vinícolas foi realizada através da análise de componentes principais (ACP). Os principais resultados mostram que ao se considerar as regiões vitícolas, os vinhos elaborados em São Joaquim caracterizaram-se por valores mais elevados de A420, A520, A620, intensidade de cor, compostos fenólicos totais, antocianinas e extrato seco, enquanto que os de Toledo apresentaram valores mais baixos dessas variáveis; os do Vale do São Francisco tiveram valores mais elevados de potássio, pH, densidade e acidez volátil; os da Serra do Nordeste A, maior acidez titulável; e os do Planalto Superior B, matiz mais elevado. No que se relaciona aos vinhos varietais, a ACP discriminou os vinhos feitos com as variedades Ancellotta, Teroldego, Egidola, Refosco, Marselan, Cabernet Sauvignon, Pinotage, Pinot Noir, Malbec, Arinarnoa, Barbera e Alfrocheiro. Com relação às vinícolas, vinte e duas delas foram discriminadas por apresentarem parâmetros mais elevados de determinadas variáveis, i.e., três delas por terem maior intensidade de cor; três, por seu matiz; oito, pelo teor de álcool; seis, por potássio, extrato seco, densidade e pH; e duas, pela acidez titulável.

Palavras-chave: *composição físico-química; origem geográfica; cultivar; empresa vinícola; ACP.*

1 Introduction

The annual Brazilian grape production is over one million tons, half sold as table grapes and the other half as grapes for processing. Considering the latter segment, wine is an important product due to the added value it transfers to wineries and grape growers.

Nevertheless, the Brazilian wine industry has low competitiveness. Today, most of the fine wine consumed in Brazil is imported from Chile, Argentina, and European countries. To mitigate this effect, it is necessary to improve wine competitiveness, which could be reached with tipicity, quality, and price. Thus, some actions are being taken by wine producers and wine sellers.

There are few studies in Brazil regarding viticultural region, varietal wines, and wineries. In fact, the characterization of Cabernet Franc wines from five different areas of the Serra Gaúcha should be pointed out (MIELE et al., 1996; MIELE, 1999). In another study, discrimination between Brazilian, Argentinean, and Uruguayan wines was established (RIZZON; MIELE; ROSIER, 1997). However, there are many works carried out concerning physicochemical and/or sensory characterization of varietal wines (BEHRENS; SILVA, 2000; RIZZON; MIELE, 2000, 2001, 2002, 2003, 2004; MANFROI et al., 2006; MENEGUZZO et al., 2006; MIELE; RIZZON, 2006; RIZZON;

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MIELE, 2006; FALCÃO et al., 2007; TECCHIO; MIELE; RIZZON, 2007; FALCÃO et al., 2008).

There have been many articles published concerning these aspects worldwide. Regarding the discrimination of viticultural regions, the studies carried out to establish the authenticity and regional origin of Slovenian wines should be mentioned (OGRINC et al., 2001); in Canada, red wines from three sub-appellations were sensory characterized (KONTKANEN et al., 2005); in France, red wines were discriminated according to three viticultural areas (PICQUE et al., 2005); and Riesling wines were discriminated from different countries (LIU et al., 2008). Concerning varietal wines, the work of NOBEL (1981) should be mentioned, which differentiated six white varietal wines in California using volatile compounds; in South Africa, the discrimination of five red varieties based on non-colored phenolic content (VILLIERS et al., 2005); differences among three clonal Aragonez red wines in Portugal were established (BOTELHO et al., 2007); the discrimination of four Madeira varietal wines (CAMARA; ALVES; MARQUES, 2007); the discrimination of the three main cultivars of the Bordeaux region (PEREIRA et al., 2007); and the differentiation of five red varieties cultivated in a warm climate region of Spain (VIVIANI; MORENO; PEINADO, 2007).

However, there is no information on discrimination for wineries. It is not easy to specify differences among them because they can use different winemaking technologies for different grape cultivars and also for the same cultivar, e.g., maceration time, kind of wine to be produced and enological products used during the process of vinification.

Therefore, this work addresses the discrimination of Brazilian red wines from the 2006 vintage, according to seven different viticultural regions of the country, 21 varietal wines, and 58 wineries, all in different regions of the country.

2 Materials and methods

The 171 red varietal wines were from seven different viticultural regions of the country, spanning from 9° to 31° South, representing 21 grape varieties, and produced by 58 wineries in 2006. The analyses were performed in the same year of vinification. Wine samples were directly collected in the wineries from inoxidable tanks or oak barrels. These wines took part of the National Wine Evaluation, an event annually promoted by the Brazilian Enology Association (ABE).

The viticultural regions considered in this work were: São Joaquim (SJ), in the State of Santa Catarina; Toledo (T), in the State of Paraná; Vale do São Francisco (SF), in the States of Pernambuco and Bahia; Serra do Nordeste A (SNA), Serra do Nordeste B (SNB), Planalto Superior B (PSB), and Campanha B (CB), in the State of Rio Grande do Sul. The last four regions mentioned were classified according to the studies conducted and published during the 1990s, which classify the state in agroecological regions (RIO GRANDE DO SUL, 1994; MALUF; WESTPFALLEN, 1999).

The 21 wines were produced from varieties originating from: France (11) - Arinarnoa (ARI), Cabernet Franc (CFR),

Cabernet Sauvignon (CSA), Carmenère (CAR), Egiodola (EGI), Malbec (MAL), Marselan (MAR), Merlot (MER), Pinot Noir (PNO), Syrah (SYR), Tannat (TAN); Italy (4) - Ancellotta (ANC), Barbera (BAR), Refosco (REF), Teroldego (TER); Portugal (3) - Alfrocheiro (ALF), Periquita (PER), Touriga Nacional (TNA); South Africa (1) - Pinotage (PTE); Spain (1) - Tempranillo (TEM); and in United States (1) - Ruby Cabernet (RCA).

The physicochemical variables analyzed were: density (DEN), alcohol (ALC), titratable acidity (TAC), volatile acidity (VAC), pH (pH), dry extract (DEX), anthocyanins (ANT), total phenolic compounds (TPF), absorbancies at 420 nm (A420), 520 nm (A520), and 620 nm (A620), color intensity (CIN), hue (HUE), and potassium (K). The methodology used in these analyses was based on the work of Ribéreau-Gayon et al. (1976). Wineries were enumerated from 1 to 58, avoiding specifying their commercial name.

The sensory evaluation of the 171 wines was performed according to international procedures (PEYNAUD, 1980; AMERINE; ROESSLER, 1983; SSHA, 1998; MEILGAARD; CIVILLE; CARR, 1999; MIELE; MIOLO, 2003). The sensory analysis sessions were performed in August 2006 by 75 panelists with substantial enology background. Wine samples were blindly analyzed using ISO glasses, served monadically at the temperature of 17 °C. The evaluation sheet used was the one from the Organisation Internationale de la Vigne et du Vin (OIV) and the Association Internationale des Œnologues (AIŒ). The wine quality was rated in a scale ranging from 0 to 100.

The results were submitted to the principal component analysis (PCA) (HAIR Jr. et al., 1995), in which the viticultural region, varietal wine, and winery origin effects were discriminated.

3 Results and discussion

The PCA showed that there was an important discrimination among the 171 wines as a function of the viticultural region, the varietal wines, and the wineries where they were produced.

3.1 Viticultural region

Figures 1 and 2 shows the discrimination among the viticultural regions. In fact, the three main principal components (PC) represented 80.65% of the total variation, where PC 1 was responsible for 40.65%; PC 2, 27.54%; and PC 3, 12.46%.

The variables best correlated for PC 1 were (correlation coefficients in brackets): color intensity (CIN) ($r = 0.99$), A520 (520) ($r = 0.98$), A420 (420) ($r = 0.97$), A620 (620) ($r = 0.82$), total phenolic compounds (TPF) ($r = 0.77$), dry extract (DEX) ($r = 0.67$), and anthocyanins (ANT) ($r = 0.67$); for PC 2, potassium (K) ($r = -0.85$), pH (pH) ($r = -0.84$), density (DEN) ($r = -0.81$), and volatile acidity (VAC) ($r = -0.79$); and for PC 3, titratable acidity (TAC) ($r = -0.69$) and hue (HUE) ($r = 0.68$).

Regarding the viticultural regions, PC 1 discriminated São Joaquim (SJ) and Toledo (T); PC 2, Vale do São Francisco (SF) and Serra do Nordeste B (SNB); and PC 3, Planalto Superior B

(PSB). Campanha B (CB) and Serra do Nordeste A (SNA) were placed intermediary.

Figure 1 shows that wines from São Joaquim (SJ) were characterized by higher values of A420 (420), A520 (520), color intensity (CIN), A620 (620), total phenolic compounds (TPF), anthocyanins (ANT), and dry extract (DEX), while those from Toledo (T) by lower values of these variables. Wines made in

the Vale do São Francisco (SF) had higher values of potassium (K), pH (pH), density (DEN), and volatile acidity (VAC). Figure 2 shows that wines from Serra do Nordeste A (SNA) were characterized by higher values of titratable acidity (TAC) and those from Planalto Superior B (PSB) by hue (HUE).

Wines made in São Joaquim (SJ), a somewhat colder and higher altitude viticultural region – about 1,200 m high –, had

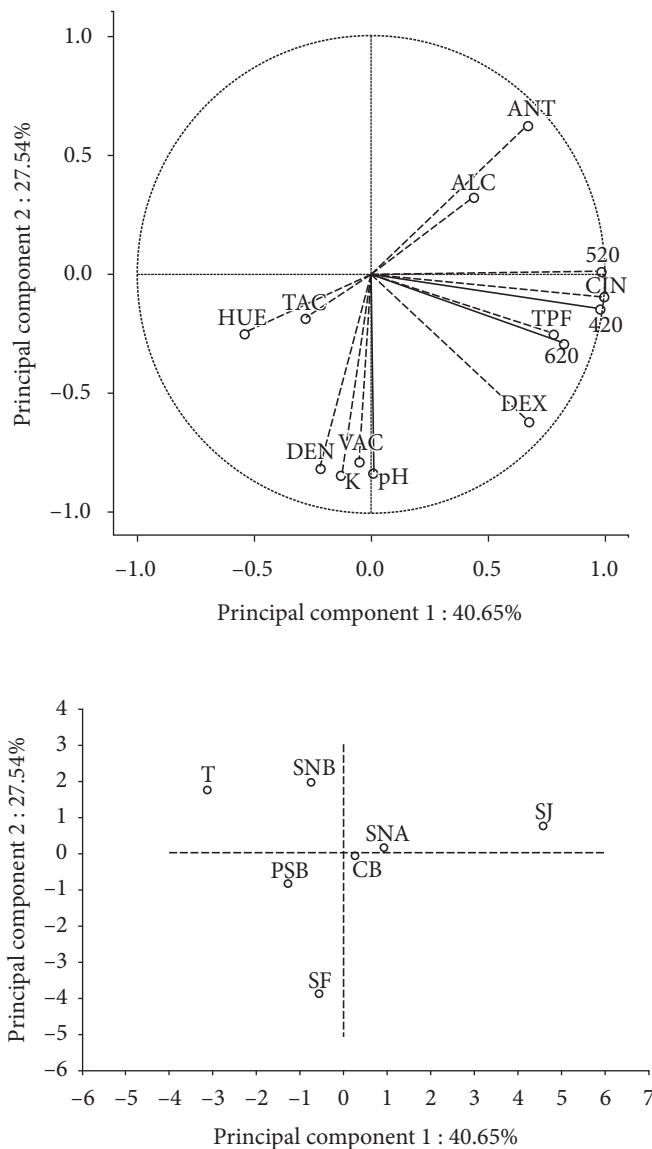


Figure 1. Projection of variables and viticultural regions on the plane formed by PCs 1 \times 2. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbancy at 420 nm; 520 = Absorbancy at 520 nm; 620 = Absorbancy at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; SJ = São Joaquim; T = Toledo; SF = Vale do São Francisco; SNA = Serra do Nordeste A; SNB = Serra do Nordeste B; PSB = Planalto Superior B; CB = Campanha B.

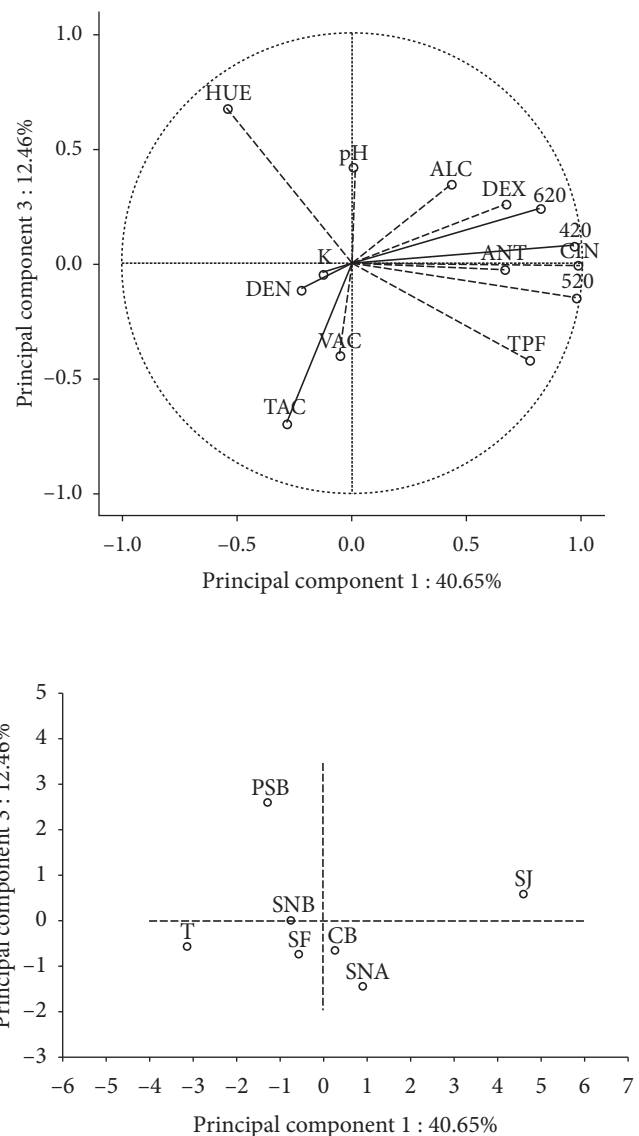


Figure 2. Projection of variables and viticultural regions on the plane formed by PCs 1 \times 3. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbancy at 420 nm; 520 = Absorbancy at 520 nm; 620 = Absorbancy at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; SJ = São Joaquim; T = Toledo; SF = Vale do São Francisco; SNA = Serra do Nordeste A; SNB = Serra do Nordeste B; PSB = Planalto Superior B; CB = Campanha B.

higher values of variables related to wine color and body. On the other hand, those from Toledo (T), State of Paraná, and from Vale do São Francisco (SF), States of Pernambuco and Bahia – this one a semi-arid region presenting high temperatures – had lower values. Phenols and anthocyanins are influenced by many factors, where night and day temperatures during ripening are especially important (JACKSON; LOMBARD, 1993). It is important to mention, however, that the concentration of anthocyanins in the red grape skin and consequently in wines is not only due to the environment. Indeed, it depends on other factors, such as the soil conditions, the cultural practices used in the vineyard – such as the canopy and soil management – as well as the procedures during winemaking.

When the quality variable was included, expressed by the general score, PCA showed that wines from São Joaquim (SJ) had the higher scores while those from Toledo (T) had lower ones. The most important correlations (in brackets) in the general score and the variables were due to alcohol (ALC) ($r = 0.81$), A620 (620) ($r = 0.77$), and dry extract (DEX) ($r = 0.77$). However, it is important to mention that the number of samples from São Joaquim (SJ) was much smaller than those from Serra do Nordeste A, which is an important point to consider. Nevertheless, the results show that this region has climatic conditions to produce wines with intense color and body. On the other hand, wines produced in high-temperature regions, such as Toledo (T), had opposite characteristics.

There are few studies on the discrimination among the Brazilian viticultural regions. In fact, the literature points out the work discriminating Cabernet Franc wines from five areas of the Serra Gaúcha (MIELE et al., 1996; MIELE, 1999). However, it is important to mention that in that study, the wines from those areas were produced with the same technology, while the 171 samples evaluated in the present work were made considering the technology of each winery. The same can be said about the studies performed in other regions of the world. Thus, Rizzon, Miele and Rosier (1997) discriminated wines from Argentina, Brazil, and Uruguay according to their mineral composition; in Slovenia, Ogrinc et al. (2001), applying a combination of isotope ratio and site-specific natural isotopic fractionation distinguished wines from the coastal and continent regions; in Canada, Kontkanen et al. (2005) established the differences of Bordeaux-style red wine from three sub-appellations of the Niagara Peninsula; Liu et al. (2006), working with VIS and NIR spectroscopy, were able to differentiate Tempranillo wines from Spain and Australia; and Liu et al. (2008) discriminated White Riesling wines from Australia, New Zealand, France, and Germany.

3.2 Varietal wine

Figures 3 and 4 shows the discrimination among varietal wines. In fact, the three more important PCs represented 74.31% of the total variation, where PC 1 was responsible for 39.99%; PC 2, 19.46%; and PC 3, 14.86%.

The best correlated variables for PC 1 were (correlation coefficients in brackets): color intensity (CIN) ($r = -0.97$), A520 (520) ($r = -0.97$), A420 (420) ($r = -0.96$), A620 (620) ($r = -0.89$),

anthocyanins (ANT) ($r = -0.80$), total phenolic compounds (TPF) ($r = -0.68$), and hue (HUE) ($r = 0.68$); for PC 2, dry extract (DEX) ($r = -0.72$), pH (pH) ($r = -0.68$), and titratable acidity (TAC) ($r = -0.66$); and for PC 3, alcohol (ALC) ($r = -0.91$) and density (DEN) ($r = 0.88$).

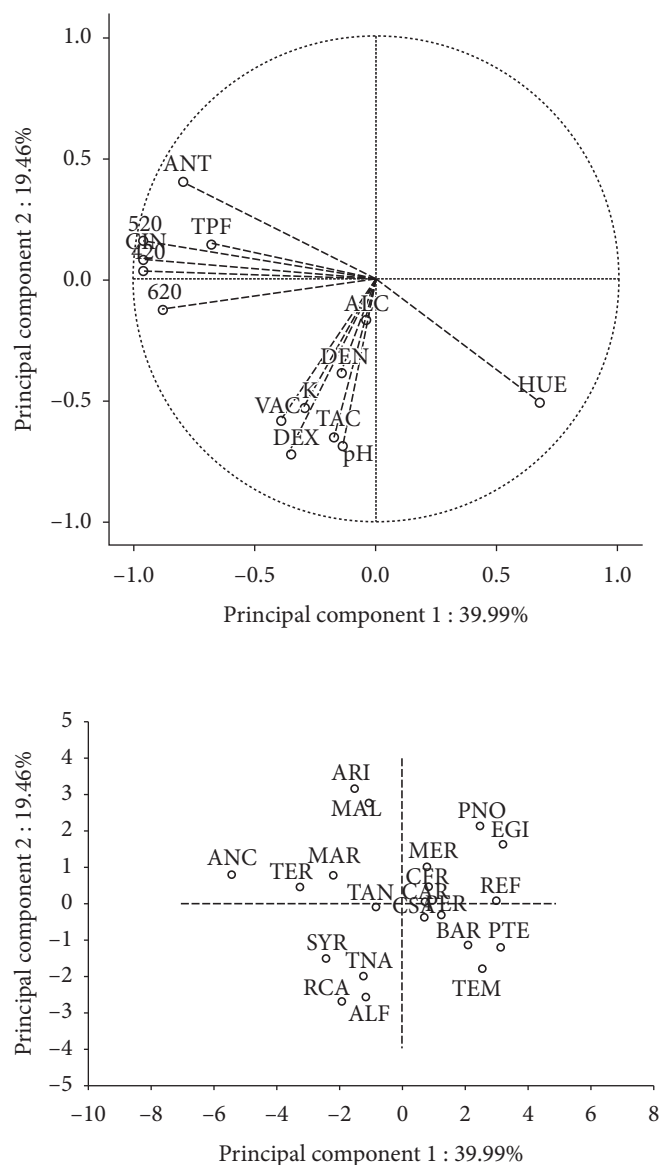


Figure 3. Projection of variables and varietals on the plane formed by PCs 1 \times 2. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbancy at 420 nm; 520 = Absorbancy at 520 nm; 620 = Absorbancy at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; ALF = Alfrocheiro; ANC = Ancellotta; ARI = Arinarnoa; BAR = Barbera; CFR = Cabernet Franc; CSA = Cabernet Sauvignon; CAR = Carmenère; EGI = Egiodola; MAL = Malbec; MAR = Marselan; MER = Merlot; PER = Periquita; PNO = Pinot Noir; PTE = Pinotage; REF = Refosco; RCA = Ruby Cabernet; SYR = Syrah; TAN = Tannat; TEM = Tempranillo; TER = Teroldego; TNA = Touriga Nacional.

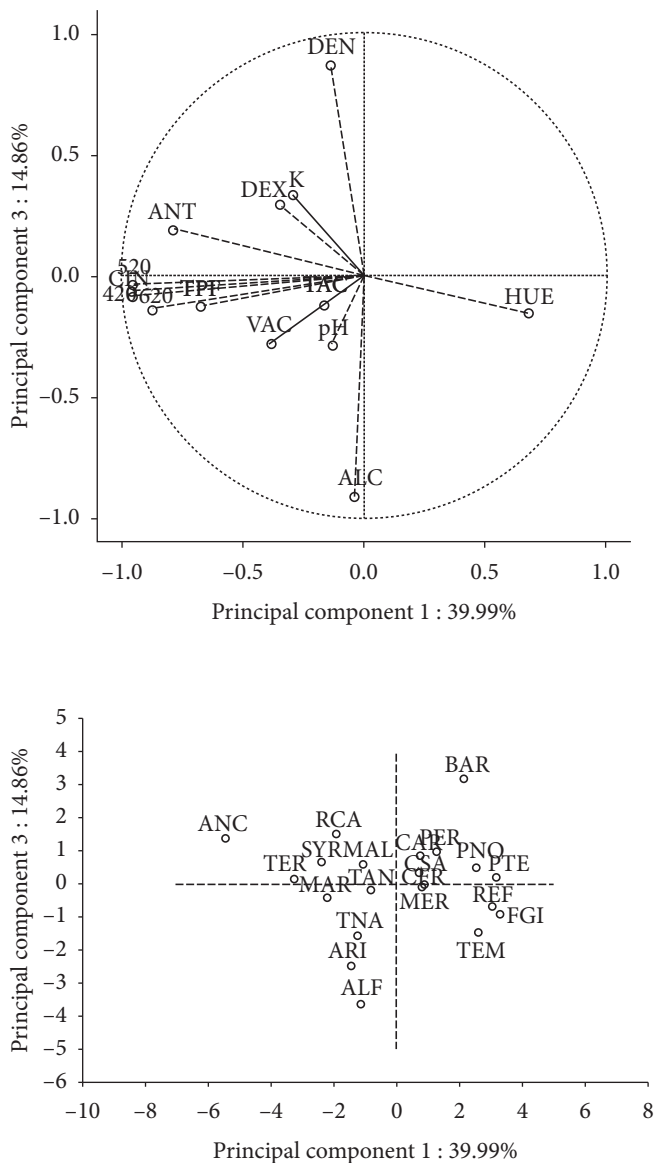


Figure 4. Projection of variables and varieties on the plane formed by PCs 1 \times 3. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbance at 420 nm; 520 = Absorbance at 520 nm; 620 = Absorbance at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; ALF = Alfrocheiro; ANC = Ancellotta; ARI = Arinarnoa; BAR = Barbera; CFR = Cabernet Franc; CSA = Cabernet Sauvignon; CAR = Carmenère; EGI = Egiodola; MAL = Malbec; MAR = Marselan; MER = Merlot; PER = Periquita; PNO = Pinot Noir; PTE = Pinotage; REF = Refosco; RCA = Ruby Cabernet; SYR = Syrah; TAN = Tannat; TEM = Tempranillo; TER = Teroldego; TNA = Touriga Nacional.

PC 1 discriminated varietal wines made from the varieties Ancellotta (ANC), Teroldego (TER), Egiodola (EGI), Refosco (REF), Marselan (MAR), Cabernet Sauvignon (CSA), Pinotage (PTE), and Pinot Noir (PNO); PC 2, from Malbec (MAL) and Arinarnoa (ARI); and PC 3, from Barbera (BAR) and Alfrocheiro (ALF).

The varietal wines Ancellotta (ANC), Teroldego (TER), and Marselan (MAR) had higher parameters of the variables responsible for the wine color and body, such as A520 (520), A420 (420), color intensity (CIN), A620 (620), anthocyanins (ANT), and total phenolic compounds (TPF), while those made from Egiodola (EGI), Refosco (REF), Pinot Noir (PNO), and Pinotage (PTE) had less color and body. Alfrocheiro (ALF) wine had a higher alcohol (ALC) content and Barbera (BAR) had a higher density (DEN), in other words, less alcohol (Figures 3 and 4). This was certainly due to the genetic characteristics of the grape cultivars, however it could also be due to the local soil and climatic conditions where they were cultivated, the cultural practices used in the vineyards, and the winemaking procedures. Regarding the alcohol content and density, it is difficult to comment the results because there is no information on chaptalization, which could have a great impact on the wine composition.

When a wine quality variable was added, PCA showed that the varietal wine Teroldego (TER) had higher scores, followed by Arinarnoa (ARI) and Tannat (TAN), while Barbera (BAR), Refosco (REF), and Pinotage (PTE) wines had lower ones. The most important correlation coefficients (in brackets) that discriminated these varieties were due to the variables A620 ($r = 0.75$), A420 ($r = 0.72$), color intensity (CIN) ($r = 0.72$), A520 ($r = 0.69$), and anthocyanins (ANT) ($r = 0.47$). These results show a very important effect of phenolic compounds on the varietal wine score, which are responsible for the wine color and body.

Chemical and statistical analyses are commonly used to discriminate varietal wines all over the world. The works of Camara, Alves and Marques (2007) should be cited, which distinguished Madeira wines made from Boal, Malvazia, Sercial, and Verdelho working on the free fraction of monoterpenols and norisoprenoids; and in France, Pereira et al. (2007), working with metabolic profile based on proton nuclear magnetic resonance spectra, differentiated Cabernet Franc, Cabernet Sauvignon, and Merlot wines; Setkova, Risticvic and Pawliszyn (2007), using chromatographic-time-of-flight mass spectrometric method, differentiated ice wines from Canada and the Czech Republic. In addition to varietal wines, it is possible to discriminate wines made from clones from only one grape variety. Indeed, Botelho et al. (2007), in Portugal, discriminated three clones of Aragonez red wines using the gas chromatography-olfactometry method.

3.3 Winery

Figures 5 and 6 show the discrimination conducted among the wineries. In fact, the three more important PCs represented 66.93% of the total variation, with PC 1 responsible for 32.14%; PC 2, 19.56%; and PC 3, 15.23%.

The best correlated variables for PC 1 were (correlation coefficients in brackets): A520 (520) ($r = -0.98$), color intensity (CIN) ($r = -0.98$), A420 (420) ($r = -0.95$), and A620 (620) ($r = -0.87$); for PC 2, potassium (K) ($r = -0.84$), density (DEN) ($r = -0.74$), dry extract (DEX) ($r = -0.73$), and pH (pH)

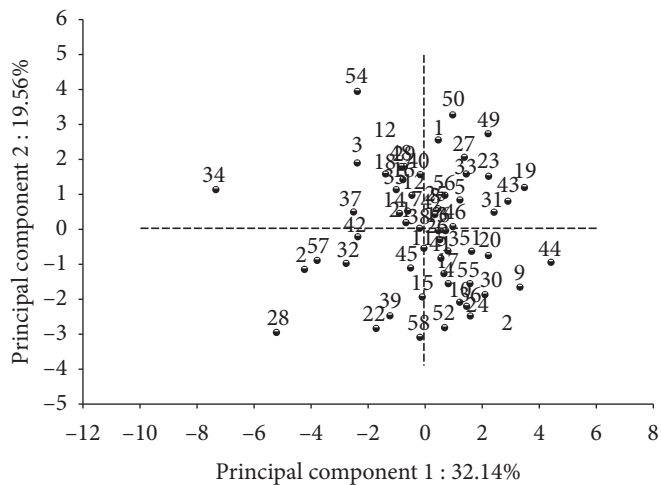
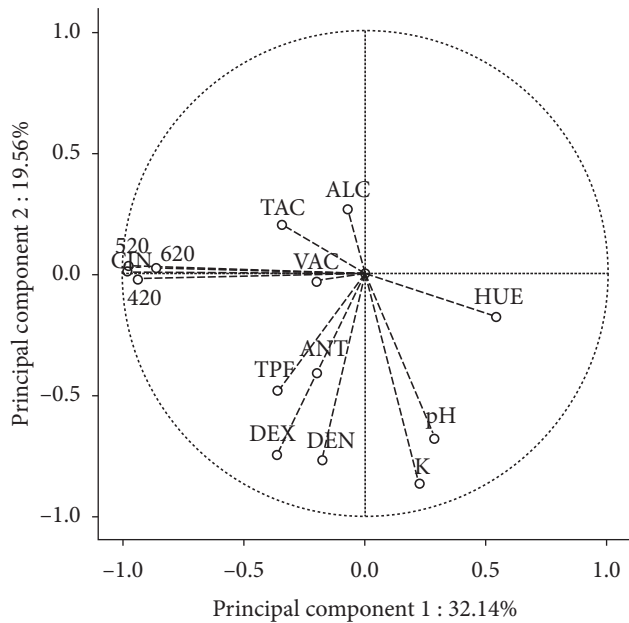


Figure 5. Projection of variables and wineries on the plane formed by PCs 1 \times 2. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbance at 420 nm; 520 = Absorbance at 520 nm; 620 = Absorbance at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; 1 to 58 = wineries (not specified).

($r = -0.66$); and for PC 3, alcohol (ALC) ($r = 0.86$) and titratable acidity (TAC) ($r = -0.61$) (Figures 5 and 6).

PC 1 discriminated wineries 34, 28, 2, and 57, which produced wines that were characterized by higher values of the variables related to total phenolic compounds, such as A420 (420), and red pigments, expressed by A520 (520) and A620 (620). On the other hand, wines from wineries 49, 19, 31, 44, and 9 presented lower values of these variables. PC 2 shows that wineries 58, 22, 39, 10, and 36 had wines with higher values of

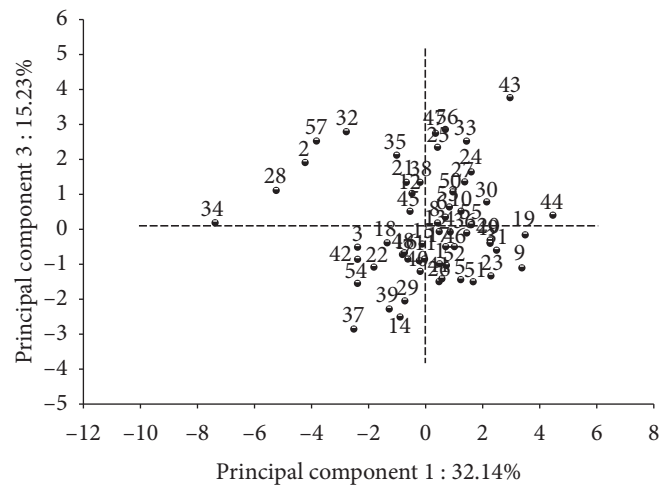
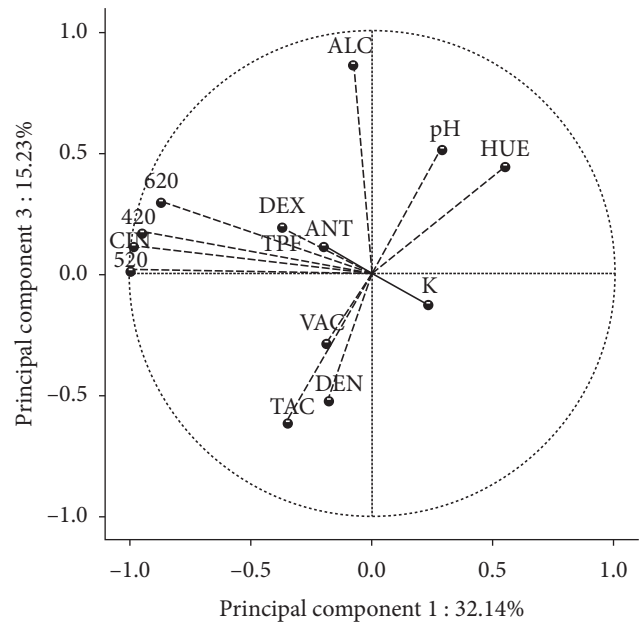


Figure 6. Projection of variables and wineries on the plane formed by PCs 1 \times 3. TAC = Titratable acidity; VAC = Volatile acidity; ALC = Alcohol; pH = pH; DEN = Density; DEX = Dry extract; ANT = Anthocyanins; TPF = Total phenolic compounds; 420 = Absorbance at 420 nm; 520 = Absorbance at 520 nm; 620 = Absorbance at 620 nm; CIN = Color intensity; HUE = Hue; K = Potassium; 1 to 58 = wineries (not specified).

potassium (K), density (DEN), dry extract (DEX), and pH (pH), while those from wineries 50 and 1 had lower values (Figure 5). PC 3 shows that wines from wineries 14 and 21 had higher values of titratable acidity (TAC) while those from wineries 35, 37, 47, and 56 had lower ones (Figure 6).

When the general score was added, wineries 2, 28, 32, 34, and 42 had higher scores. This was mainly due to the variables A420 (420) ($r = 0.39$), A520 (520) ($r = 0.35$), A620 (620) ($r = 0.43$), and color intensity (CIN) ($r = 0.39$) which characterized the

wines produced by these wineries and were responsible for the wine color and body. However, other variables accounted for this quality, such as alcohol (ALC) ($r = 0.38$) and dry extract (EXS) ($r = 0.34$). These results imply that, in general, wineries had similar technologies regarding winemaking. Some of them, however, showed important discrimination in wine composition.

It should be emphasized that this work represents the results of wines made in 2006, from grapes of different regions of the country, each one with their particular soil and climate conditions; grapes produced from vineyards cultivated under many different technologies; and from wineries using different winemaking procedures. In addition, it focused on important but limited number of variables. If others were considered – such as volatile substances, amino acids, minerals –, PCA could reveal other differences related to the discrimination among the viticultural regions, varietal wines, and wineries. Actually, these differences could be even greater. It is also important to consider that discrimination among the a) viticultural regions were established regardless the varietal wines and wineries; b) varietal wines, regardless the viticultural regions and wineries; and c) wineries, regardless the viticultural region and varietal wines.

4 Conclusions

The principal component analysis (PCA) discriminates wines from the 2006 vintage produced in five – of a total of seven – Brazilian viticultural regions, i.e., São Joaquim, Toledo, Vale do São Francisco, Serra do Nordeste B, and Planalto Superior B, however Serra do Nordeste A and Camapanha B are not discriminated. Regarding the varietal wines, PCA discriminates Ancellotta, Teroldego, Egidola, Refosco, Marselan, Cabernet Sauvignon, Pinotage, Pinot Noir, Malbec, Arinarnoa, Barbera, and Alfrocheiro. Considering the wineries, the majority does not show a discrimination among them, which could indicate the existence of similar technology used in winemaking. Despite of this, twenty two are discriminated as a function of the variables taken into consideration, mainly those related to phenolic compounds and anthocyanins.

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