

# Characterization of phenolic composition of altitude tropical wines in the Brazilian Northeast

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**Abstract.** The main goal of the study was to evaluate the phenolic composition of red wines from grapes cultivated in a tropical of altitude region at 1,100 m, in the Northeast of Brazil, called Chapada Diamantina, in Morro do Chapéu city. The region is located in Bahia Estate at 11° 33' 11" S and 41° 09' 27" W. Vineyard was planted in 2011 in randomized blocks, spaced 2.5 m between rows and 1 m between plants. Vines were grafted onto Paulsen 1103 rootstock and irrigated by drip. Pinot Noir, Cabernet Franc, Malbec and Cabernet Sauvignon (*Vitis vinifera* L.) cultivars were vinified separately, in the Laboratory of Enology at Embrapa in Petrolina, Pernambuco Estate, Brazil. Means evaluated for color intensity (420 nm + 520 nm + 620 nm), total anthocyanins (by different pH), total polyphenol index (at 280 nm), total phenolics (Folin-Ciocalteu) and antioxidant capacity (DPPH) were compared by Tukey test at 5% probability. Wines showed different phenolic composition, and can be used to elaborate different quality wines.

## 1. Introduction

The vitiviculture potential of a determined region is obtained by many factors, as climate conditions (temperature, pluviosity and luminosity), soil characteristics (depth, mineral, physical and chemical composition), and human choices (rootstocks, varieties, harvest date, for example), changing the grape and wine composition and typicality [1].

However, vine cultivation in regions outside traditional winegrowing zones is possible due to the development of new technologies, as vine management, irrigation, nutrition, and tests with variety adaptation for each region, as well as for particular enological winemaking. These characteristics can influence phenolic composition of the wines, in particular for organoleptic sensations, as color, astringency and bitterness [2–4].

Diversity of the factors cited above can influence grapes and its enological potential, in flavors and in colors, linked to the phenolic profile of the wines [5].

In this context, the aim of this work was to evaluate the phenolic composition of red wines elaborated from grapes cultivated in a new winegrowing region, in the Northeast of Brazil.

## 2. Material and methods

Vineyard was installed in Morro do Chapéu – Bahia Estate, at 380 km from Petrolina. Region is located in a tropical of altitude climate, at 1,100 m, in Morro do Chapéu, Chapada Diamantina, Bahia Estate, at 11° 33' 11" South of latitude and 41° 09' 27" West of longitude [6]. Vines were planted in January 2011, in an observation unity, to evaluate variety adaptation to the local edapho-climatic conditions.

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The observation unity was implanted in a randomized block, where each variety is a block, with three replicates, and each one with 30 plants spaced of 2.5 between rows and 1.0 m between vines, all varieties were grafted onto Paulsen 1103 rootstock, trellising in espalier-double cordon downward and irrigated by drip.

In this study, grapes were harvested in September 2014, being harvest date decided individually for each cultivar, according to the enological potential of each one, to elaborate fine quality red wines, taking in account total soluble sugars (°Brix), total acidity (g L<sup>-1</sup> of tartaric acid) and phenolic tasting of berries.

Pinot Noir, Cabernet Franc, Malbec and Cabernet Sauvignon (*Vitis vinifera* L.) grapes were harvested at morning and sent immediately to Petrolina and Embrapa, in a refrigerated truck at 16°C. Wines were elaborated according to traditional red winemaking with controlled temperature (25°C for alcoholic and 18°C for malolactic fermentations) and using sulphur dioxide to prevent oxidation [7]. After fermentations, wines were stabilized at 0° for 30 days, then were bottled and analysed 30 days after bottling. It was determined color intensity (420 nm + 520 nm + 620 nm) [8], total anthocyanins (by different pH) [9], total polyphenol index (at 280 nm) [10], total phenolics (Folin-Ciocalteu) [11], and antioxidant capacity (DPPH) [11], and results obtained were compared by Tukey test at 5% probability.

## 3. Results and discussion

Results of wines analysed are presented in Table 1.

According to the color intensity, values changed from 3.35 (Pinot Noir) to 12.40 (Malbec). Even showing intermediate values, Cabernet Sauvignon presented the

**Table 1.** Chemical analysis of the phenolic compounds determined in red wines elaborated from Pinot Noir (PN), Cabernet Franc (CF), Malbec (MA) and Cabernet Sauvignon (CS) grapes, cultivated in Morro do Chapéu city, Chapada Diamantina – Bahia Estate, in the Northeast of Brazil, harvested in September 2014.

Parameters	Wines evaluated			
	PN	CF	MA	CS
Color intensity	3.35d	7.87c	12.40a	8.50b
Anthocyanis (mg L <sup>-1</sup> )	100.36d	201.81c	28.47a	260.92b
TPI (I280 nm)	27.00d	41.47c	58.23b	59.33a
Total phenolics (mg galic acid L <sup>-1</sup> )	1024.21d	1516.65c	2503.69b	2958.96a
DPPH (mM TEACL <sup>-1</sup> )	6.71d	10.68c	18.91b	19.63a

Means with same letters do not differ significantly ( $p \leq 0.05$ ), according to Tukey test. TPI: total polyphenol index.

highest values in this work, as compared to the results showed by Freitas [12], with wines from the South of Brazil. As expected, Pinot Noir presented the lowest values as compared to the others [7]. Malbec wines presented the highest values, because winemaking process allowed to macerate grapes few days more than others.

Values found in total monomeric anthocyanins for all four wines presented higher than 100.00 mg L<sup>-1</sup>, and Malbec wine presented the maximum value found (328.47 mg L<sup>-1</sup>). According to total polyphenol index (TPI), values ranged from 27.00 (Pinot Noir) to 59.33 (Cabernet Sauvignon). For total phenolics, presented in mg of galic acid per liter of wine (mg galic acid L<sup>-1</sup>), Cabernet Sauvignon (CS) wine presented the highest values (2958.96 mg EAG L<sup>-1</sup>), more concentrated as compared with results showed by Li et al. (2009) [13], evaluating CS in China.

Antioxidant capacity is strongly linked to the phenolic content [5, 14, 15]. This activity is attributed mainly to resveratrol [16], vitamin C [17], and to the anthocyanins content [18]. In general it represents the bioactive capacity of wine components. Results found in this work presented lower antioxidant capacity (mM TEAC L<sup>-1</sup>) in samples with lesser values in total phenolics (PN, CF, MA – Table 1), than wines presenting the highest values (CS), in agreement to Abe et al. (2007) [5], that observed the highest antioxidant capacity in wines with high values of total phenolics, as compared to other results, in table wines (*Vitis labrusca*). Cabernet Sauvignon wine presented the highest values (19.63 mM TEAC L<sup>-1</sup>), and Pinot Noir wine the lowest values (6.71 mM TEAC L<sup>-1</sup>) in this study.

Wines presented different enological potential, and could be indicated, for example, for different wine types. Pinot Noir and Cabernet Franc wines could be used for young wines at this moment, while Malbec and Cabernet Sauvignon wines could be used for guard wines. But vines

are very young and other works need to be carried out, to evaluate variety adaptation to this new winegrowing region, in the Chapada Diamantina. Another practices that could be used is the blend between different sold as varietal or blend wines.

## 4. Conclusion

Wines in this study presented different enological potential of phenolic profile. All wines presented interesting phenolic contents, someones most indicated for young and others most indicated for red wines.

Cabernet Sauvignon and Malbec presented the highest values of anthocyanins, color intensity, total phenolic index, total phenolics and antioxidante activity, as compared to Pinot Noir and Cabernet Franc wines.

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