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## Characterization of grapes and wines of Syrah growing during the autumn-winter season in different viticultural zones of the Brazilian Southeast

# Caratérisation des raisins et vins de Syrah produits en cycle d'automnehiver dans différentes zones viticoles du Sud-est brésilien

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### ABSTRACT

Double pruning management has allowed harvesting good quality wine grapes during the winter season in the Brazilian southeast. Syrah cultivar showed the best response to the modification of grapevine cycle with good maturation and acceptable productivity indices. As a new winegrowing region, little is known about the terroir effects on the composition of Syrah berries and wines. This study was carried out with Syrah vines grafted on 1103P grown in commercial vineyards established in four southeast zones of Brazil: Espirito Santo do Pinhal at 871 m height, Itobi at 811 m, Três Corações at 993 m and Caldas at 1150 m. The vines were trained on vertical shoot position and pruned in January to harvest grapes in the winter season. The highest yield was obtained in Três Corações (9,780 kg.ha<sup>-1</sup>), followed by Caldas, Pinhal and Itobi. High bud fertility and berries' weight and size contributed to highest yield at Três Corações and Caldas. Grapes grown in Pinhal at 21.5°C of average berry temperature and thermal amplitude of 16.8°C showed higher total soluble solids (23.2°Brix) than the berries harvested in the other viticultural zones (20°Brix). These vines also showed the highest photosynthetic and transpiration rates. Berries harvested at Caldas showed the greatest must acidity probably due to lowest average temperature of the berries (19.2°C) which impairs acid degradation. Berries harvested at Itobi and Três Corações showed higher phenolic compounds and anthocyanins content. The wine from Pinhal showed an alcoholic grade of 15° GL while wine from Caldas had the lowest grade (11°GL). Wines from Três Corações and Pinhal showed the highest polymerized pigments index and color intensity after 16 months aging. Wine tipicity was also evaluated by sensorial analyses in which wines from Caldas showed the lowest scores in hedonic scale. These data showed that it was possible to identify different Syrah winemaking zones in Brazilian southeast.

Keywords: Vitis vinifera L., terroir, double pruning, bud fertility, photosynthesis, composition, sensory evaluation.

## **1INTRODUCTION**

The quality of Brazilian wines has been improved through the introduction of new varieties, adaptation of cultivars, clones, rootstocks, agronomical practices and However, enological techniques. the greatest impediment to this evolution is the low quality of grapes, mainly to climatic conditions during the growing season (1). In the Southeast of Minas Gerais State, however, some authors have shown that it is possible to improve the quality of wine grapes when the harvest is moved from summer to winter vintages by double pruning management (2). At the winter harvest, Syrah grapevines showed higher yield, sugar, anthocyanin and total phenolic levels, and lower rot incidence as compared to grapes harvested during the summer (3). These results indicate that double pruning practice is an important tool for improving wine grape quality in other regions. In fact, Syrah and other wine grape varieties such as Merlot, Cabernet-Sauvignon, Cabernet Franc, Pinot Noir, Sauvignon Blanc and Chardonnay introduced in different regions of the Southeast of Brazil and managed with double pruning practice showed good vegetative and reproductive

development and an excellent maturation index of the grapes (4,5,6,7,8). Among the cultivars submitted to double pruning management, Syrah showed the best response to the modification of grapevine cycle. This study aimed to evaluate terroir effects on the composition of Syrah berries and wines in the Southeast of Brazil, a new winegrowing region.

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### **2 MATERIALS AND METHODS**

This trial was carried out in four Syrah vineyards located in the Southeast of Brazil (figure 1).

The evaluations were performed during the winter growing season, in unirrigated Syrah vines grafted onto 1103 Paulsen rootstock and trained on a vertical shoot positioned trellis, with north-south oriented rows. Production pruning consisted of spur pruned vines with two nodes in length performed in January 2010 in lignified shoots formed during the growing season from September 2009 to January 2010. Standard cultural practices were applied. Soil fertility was evaluated by foliar analysis of the vines.  $CO_2$ assimilation rate and physico-chemical characterization of the grapes were performed as described in 9. Anthocyanins and total phenolics analysis as described in 6. Microvinification and wine composition methodologies are described in 10. HPLC analysis of phenolic compounds, anthocyanins and organic acids were performed according to 11 with some modifications. Wines aged for 16 months in bottles were submitted to sensorial analysis performed by a trained panel (13 people). Sensorial attributes described in an evaluation sheet were ranked in a hedonic scale ranging from extremely unpleasant to extremely pleasant (1-5).

#### **3 RESULTS AND DISCUSSION**

Vines were nutritionally well balanced in the four regions (Figure 2). Vineyards in Caldas showed lower levels of N and higher levels of Cu in their leaves whereas plants in Três Corações showed higher levels of Ca. The highest yield was obtained in Três Corações followed by Caldas, Pinhal and Itobi. High bud fertility and berries' weight contributed to these results. Although radiation intensity (PAR) and net photosynthesis rate (A) were lower in Caldas, soluble solids accumulation did not differ from data obtained in Três Corações and Itobi. Berry temperature and thermal amplitude showed more influence on total soluble solids and must acidity. Total phenolic compounds and anthocyanins found in grapes were in an average of 3.5 and 1.3 mg g berries<sup>-1</sup>, respectively (Table 1).

Wine composition was determined after 16 months aging (Table 2). Wines from Itobi showed higher ash content which may have contributed to higher levels of pH and lower total acidity. Lowest malic and tartaric acids concentrations were observed in wines from Três Corações. These wines also presented the lowest total anthocyanins and the highest color intensity which may have resulted from anthocyanin-tannin reactions as showed by the high polimerized pigment index. Três Corações and Pinhal wines showed more phenolic compounds accumulation and color intensity after aging. (Table 2). Pinhal and Três Corações wines pointed out with high color intensity, delicate aroma and aging potential in the sensory evaluation while wines from Caldas had the lowest marks (Table 3).



✤ Três Corações (MG) 21°36'44"'S, 45°07'48"W, 993 m

Caldas (MG) 21°55'S, 46°23'W, 1150 m

Espírito Santo do Pinhal (SP) 22°10'47"S, 46°44'24"W, 871 m

Itobi (SP) 21°42'51"S, 46°55'55W, 811 m

Figure 1. Localization of the Syrah vineyards in four southeast zones of Brazil.



■caldas ∎três corações □pinhal □itobi

Figure 2. Mineral composition of the leaves of Syrah vines in four vineyards in the southeast region of Brazil.

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Parameter	Caldas	Três Corações	Pinhal	Itobi
A ( $\mu$ mol CO <sub>2</sub> m <sup>-2</sup> s <sup>-1</sup> )	8.01	10.47	11.49	8.97
PAR ( $\mu$ mol m <sup>-2</sup> s <sup>-1</sup> )	1390.33	1828.33	1811.21	1738.05
Berry lowest daily temp (°C)	1.6	5.7	12.3	16.0
Berry highest daily temp (°C)	33.0	28.0	29.1	31.6
Mean berry temperature (°C)	19.18	20.78	21.48	24.81
Mean cluster number	13.20	16.30	10.75	7.30
Mean cluster weight (g)	160.08	201.82	141.78	130.84
Mean berry weight (g)	1.51	1.62	1.21	1.21
Transversal berry diam (mm)	11.79	10.50	9.31	9.73
Total yield per vine (kg plant <sup>-1</sup> )	2.11	3.26	1.51	0.95
TSS (°Brix)	20.23	20.53	23.23	20.67
Titratable acidity (g $L^{-1}$ )	8.90	6.60	8.50	8.18
pH	3.37	3.60	3.35	3.48
Total phenolics (mg g berries <sup>-1</sup> )	3.49	3.56	3.29	3.73
Anthocyanins (mg g berries <sup><math>-1</math></sup> )	1.21	1.32	1.28	1.45

Table 1. Net  $CO_2$  assimilation rate (A), radiation (PAR), climatic conditions, yield components and berry composition of Syrah grapes from four vineyards in the southeast region of Brazil.

Table 2. Wine composition of Syrah grapes from four vineyards in the southeast region of Brazil.

Parameter	Caldas	Três Corações	Pinhal	Itobi	
Total acidity (g L <sup>-1</sup> )	6.20 A	5.30 C	5.78 B	4.92 D	
Malic acid (mg $L^{-1}$ )	248.67 B	155.60 C	310.80 A	268.00 B	
Tartaric acid (mg $L^{-1}$ )	2573.33 B	1796.27 D	2398.67 C	2702.67 A	
Volatile acidity $(g L^{-1})$	0.63 B	0.76 A	0.53 D	0.57 C	
Alcohol (% v/v)	10.98 D	12.81 B	15.18 A	12.08 C	
pH	3.88 C	3.94 B	3.93 B	4.00 A	
Reducing sugars (g $L^{-1}$ )	1.07 B	1.13 B	1.60 A	1.23 B	
Dry extract (g $L^{-1}$ )	21.80 C	22.52 C	25.12 A	23.55 B	
Ashes $(g L^{-1})$	3.21 B	3.39 B	2.91 C	3.86 A	
Total anthocyanins (mg $L^{-1}$ )	125.56 A	94.70 B	132.25 A	125.40 A	
Phenolic compounds (mg L	50.58 D	64.88 B	88.78 A	58.81 C	
1)					
Flavanols (g $L^{-1}$ )	1.75 B	1.86 B	2.23 A	2.16 A	
Polimerized pigments (%)	62.38 C	78.11 A	71.02 B	63.22 C	
Color intensity	0.74 D	1.34 A	1.20 B	0.89 C	
$(DO_{420} + DO_{520} + DO_{620})$					

 $\frac{(DO_{420}+DO_{520}+DO_{620})}{\text{Different letters within the same line indicate significant differences at 5% probability according to Tukey.}$ 

Table 3. Sensory evaluation of Syrah wines from four winegrowing regions in the southeast of Brazil.

Attribute	Caldas	Três Corações	Pinhal	Itobi
Color intensity	2.92 B	4.38 A	4.08 A	3.69 A
Aroma global	3.00 ns	3.08 ns	3.77 ns	3.46 ns
delicate	2.38 B	3.46 A	3.62 A	3.00 AB
fruity	1.90 ns	2.18 ns	2.40 ns	2.34 ns
Acidity	4.00 A	3.00 B	2.92 B	2.92 B
Alcohol	3.00 ns	3.23 ns	3.46 ns	3.31 ns
Body	2.23 B	3.00 AB	3.38 A	3.15 AB
Sweetness	1.92 ns	2.46 ns	2.77 ns	2.46 ns
Astringency	2.62 ns	2.69 ns	2.92 ns	2.46 ns
Phenolic quality	1.92 B	3.08 A	3.23 A	3.08 A
Bitterness	2.77 ns	2.23 ns	2.38 ns	2.08 ns
Harmony	1.85 B	3.08 A	3.31 A	3.15 A
Persistency	1.85 B	2.85 A	3.54 A	3.15 A
Aging potential	1.46 B	2.92 A	3.46 A	2.69 A
Overall impression	1.85 B	3.08 A	3.46 A	3.23 A

Data are average of sensorial evaluation ranked in a hedonic scale ranging from extremely unpleasant to extremely pleasant (1-5) by 13 trained panellists. Different letters within the same line indicate significant differences at 5% probability according to Tukey.

The southeast region of Brazil emerges as a new winegrowing region. The inversion of grapevine cycle through double pruning management allows grape maturation, however climatic conditions during ripening plays an important role in overall berry composition and wine quality.

#### **4 CONCLUSIONS**

Although the vineyards managed by the double pruning technique in the southeast region of Brazil presented an excellent grape maturation index, the climatic conditions play an important role in the composition of berries and wines. The results allowed identifying different Syrah winemaking zones in Brazilian southeast.

High berry thermal amplitude and low medium berry temperature observed in Caldas at 1,150 m high impaired grape ripening and reduced wine quality. In the other hand, the wines from Pinhal and Três Corações vineyards showed better chemical composition and the best score in the sensory evaluation.

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