Ripening of *Vitis vinifera* grapes varieties in São Joaquim, a new wine growing region, southern Brazil

Maturation des raisins de *Vitis vinifera* en São Joaquim, une nouvelle région vinicole au sud du Brésil

Eliana FORTES GRIS[1]*, Vívian Maria BURIN[1], Leila D. FALCÃO[2], Emílio BRIGHENTI[3], Marilde T. BORDIGNON LUIZ[1]*

[1]Universidade Federal de Santa Catarina/Centro de Ciências Agrárias/Departamento de Ciência e Tecnologia de Alimentos.
[2]Universidade Estadual de Ponta Grossa – PRODOC-CAPES.
[3]Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina – Estação Experimental de São Joaquim.

***Corresponding author:** elianagris@gmail.com, bordign@cca.ufsc.br

Summary

This report has investigated the ripening characteristics of *Vitis vinifera* grapes Cabernet Franc, Merlot, Sangiovese and Syrah in two consecutive vintages (2006 and 2007), in order to evaluate the adaptation from these recently varieties planted in São Joaquim town, Santa Catarina State, Brazil. The berries had been collected at 10-day intervals from véraison to harvest and in have been analyzed at levels of pH, total acidity (TA), total soluble solids (TSS), maturation index (TSS/TA), total monomeric anthocyanins (TMA) (malvidin-3-glucoside, mg/100g skin), total polyphenols index (TPI), and Color Intensity (CI). At maturity, values of pH, TA and TSS ranged from 3.3 to 3.5; from 0.60 to 0.80 (mg of tartaric acid/100 mL) and from 19 to 23.5 ºBrix, respectively. Maturation index ranged from 29 to 40, and significant differences ($p< 0.05$) have been observed among different grapes varieties, but not between vintages. The values of TMA, TPI and CI ranged from 864.6 to 352.1; from 126.1 to 45.5 and from 20.66, respectively, and significant differences have been verified among varieties and also vintages ($p< 0.05$).

Keywords: *Vitis vinifera* grapes, adaptation, ripening.

Introduction

São Joaquim town is a new wine growing region placed in the Planalto Sul Catarinense, at altitudes that vary from 1200 to 1415 m above sea level (asl) and at latitude 28º. This town which is known in Brazil as the coldest place in the country presents a budbreak and ripening later in relation to others viticulturist regions in Brazil.

In the introduction of the grapes varieties, the ripening monitoring through of classic analyses which as pH, total acidity and total soluble solids, as well as the evaluation of phenolic compounds (anthocyanins and polyphenols) and color intensity, is very important to control the berries' development and maturation.

The main of this work was to evaluate the ripening of *Vitis vinifera* grapes Cabernet Franc, Merlot, Sangiovese and Syrah in two consecutive vintages (2006 and 2007), in order to characterize their adaptation in São Joaquim town, Santa Catarina State, Brazil, a new grape growing region.

Material and methods

The experiment was conducted in a vineyard at approximately 1400 m asl in *São Joaquim* town located in *Santa Catarina* State, Southern of Brazil. The ripening of *Vitis vinifera* grapes Cabernet Franc, Merlot, Sangiovese and Syrah in two consecutive vintages (2006 and 2007) was evaluated.

The berries were collected at 10-day intervals from véraison to harvest. A total of 240 berries were collected, eight berries by vine. The berries collected were immediately counted, weighed and submitted to the physicochemical analyses.
pH, total acidity (TA), and total soluble solids (TSS) were analyzed according to Amerine and Ough (1976). Maturation index (MI) was obtained from ratio TSS/TA. Grapes skin juice was elaborated according to Lees and Francis (1972) in triplicate, and used to following analyses: total monomeric anthocyanins (TMA) (pH-differential method; Giusti and Wrolstad, 2001); polyphenols index (OD280; Ribéreau-Gayon, 1970) and color intensity (CI = 420 nm + Abs 520 nm + Abs 620 nm; Glories, 1984).
ANOVA and Tukey HSD Test were made using Statistica 6 (2001) (Statsoft, Tulsa, OK).

Results and Discussion

pH, TA, TSS and MI values for grapes Cabernet Franc, Merlot, Sangiovese and Syrah, monitored from véraison to harvest in 2006 and 2007 vintages are evidenced in the Figures 1, 2, 3 and 4, respectively.
The most common indicators of grape must quality are pH, total soluble solids (TSS) and acidity. At maturity, values of pH, TA and TSS ranged from 3.3 to 3.5; from 0.60 to 0.80 (mg tartaric acid/100 mL) and from 19 to 23.5 ºBrix, respectively. Maturation index ranged from 29 to 40. Significant difference have been observed among different grapes varieties but not between vintages ($p < 0.05$).
The pH, total acidity, total soluble solids and maturation index values obtained in the harvest for different grape varieties are appropriated for the elaboration of wine with high quality demonstrating good adaptation of the grapes in the planted site, since analyses are the most common indicators of grape must quality.

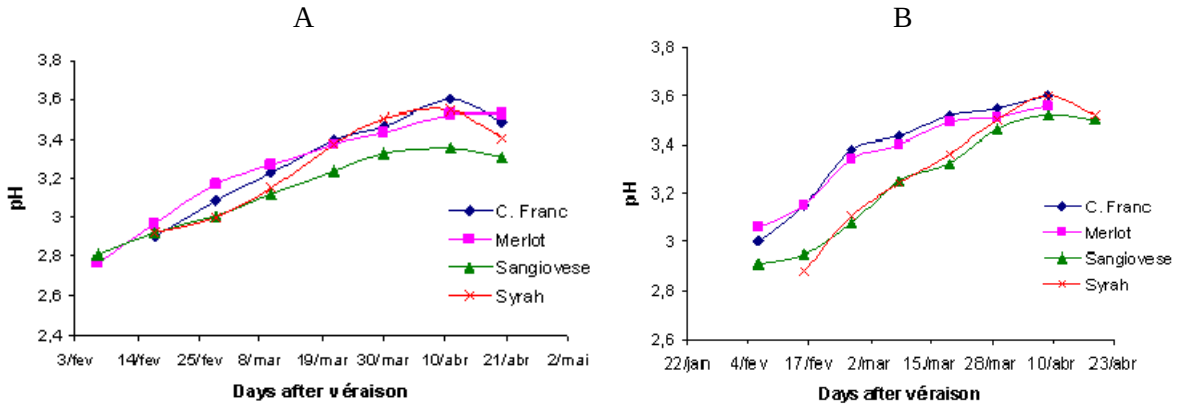

Figure 1 pH evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

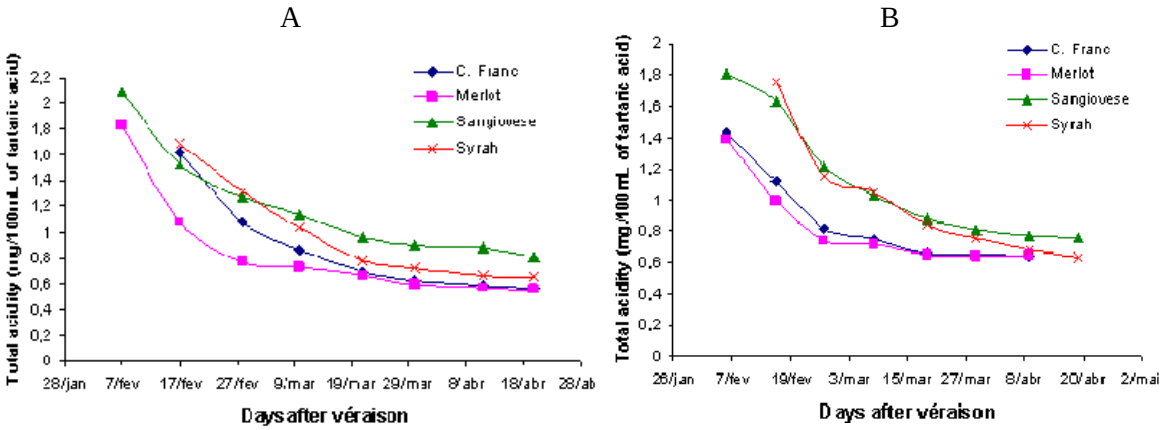

Figure 2 Titratable acidity (TA) evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

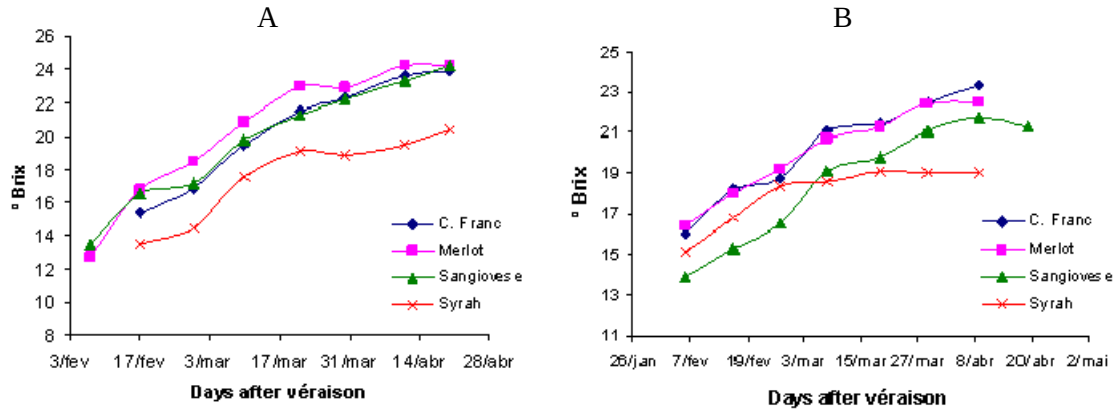

Figure 3 Total soluble solids (TSS - º Brix) evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

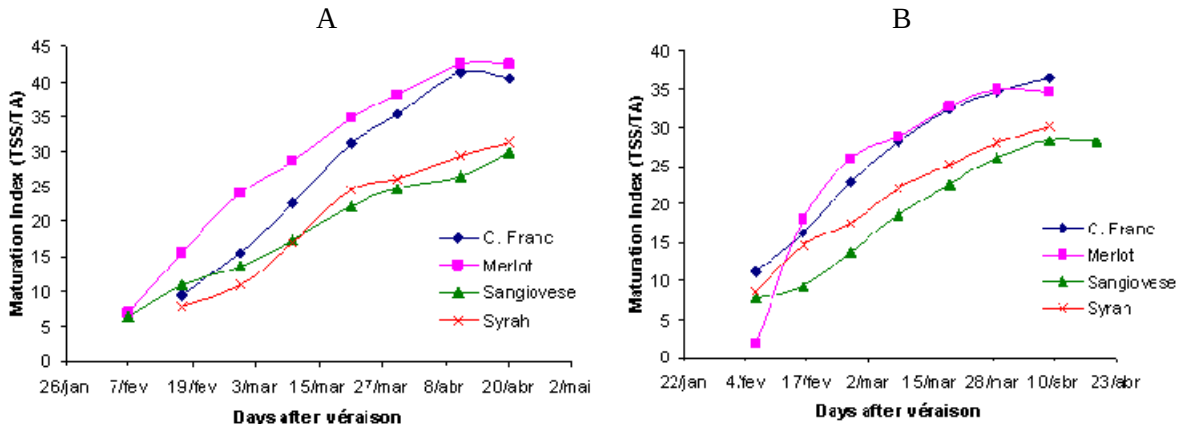

Figure 4 Maturation Index (TSS/TA) evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

Although the most common indicators of grape must quality are pH, total soluble solids (TSS) and acidity, only these factors are not either to a complete profile of the grape potential for winemaking. Figures 5, 6 and 7 show the TMA, TPI and CI evolution, respectively, from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages, respectively. The phenolic compounds, especially anthocyanins, and others flavonoids, play a major role in wine quality. They contribute to sensory characteristics of wines, particularly color and astringency (Ribéreau-Gayon, 1973; Mazza and Miniati, 1993).

Significant differences had been verified between the two vintages evaluated ($p < 0.05$). TMA and TPI were hardly influenced by the mesoclimate conditions and because of this a great variation of these values occurred between 2006 and 2007 vintages. Similar results had been reported by others researches (Mazza et al, 1999; Gonzáles-Neves et al., 2004; González-Neves et al., 2007). It was verified that TMA, TPI and CI values presented a more linear behaviour in 2006 vintage. Conversely, a higher oscillation was observed during 2007 vintage (Figures 5, 6 and 7). It has occurred, probably, due to the higher rainfall index observed in the 2007 vintage (data not showed).

Significant differences had been also observed on the grape berries composition from different varieties ($p < 0.05$). In 2006 vintage, at maturity, higher values of TMA, TPI and CI have been found for Merlot (677.0; 84.9; 69.55, respectively) and Syrah (616.2; 91.1; 50.19, respectively) followed by Cabernet Franc (426.83; 51.6; 37.32, respectively) and Sangiovese (369.75; 45.5; 20.66, respectively) varieties (Figures 5,6, and 7). In contrast, in 2007 vintage, the higher values of TMA, TPI and CI were found for Syrah (864.6; 126.1; 85.5, respectively) and Cabernet Franc (860.9; 119.3; 81.7, respectively), followed by Merlot (567.9; 78.2; 55.9, respectively) and Sangiovese (352.1; 57.3; 33.2, respectively) varieties.

Generally, TMA, TPI and CI values verified in our study were considered in accordance with other researches on *Vitis vinifera* grapes (Mazza et al., 1999; González-Neves et al., 2007; Leeuwen and Seguin, 1994), which indicate a good adaptation of these varieties to the planted site, probably due the climatic conditions of the region. For high altitude (~ 1,000 - 1,400 m) as well as lower latitude regions (e.g. city of São Joaquim, State of Santa Catarina, southern Brazil), the vegetative cycle of grapevines is displaced up to 45 days with respect to other viticulturist regions, which provides complete conditions for maturation of berries. It can aids phenolic concentration on grape skins and seeds, which increase their potential for colour and aromatic development (Goodwin and Mercer, 1983; Brighenti and Tonieto, 2004; Rosier, 2006).

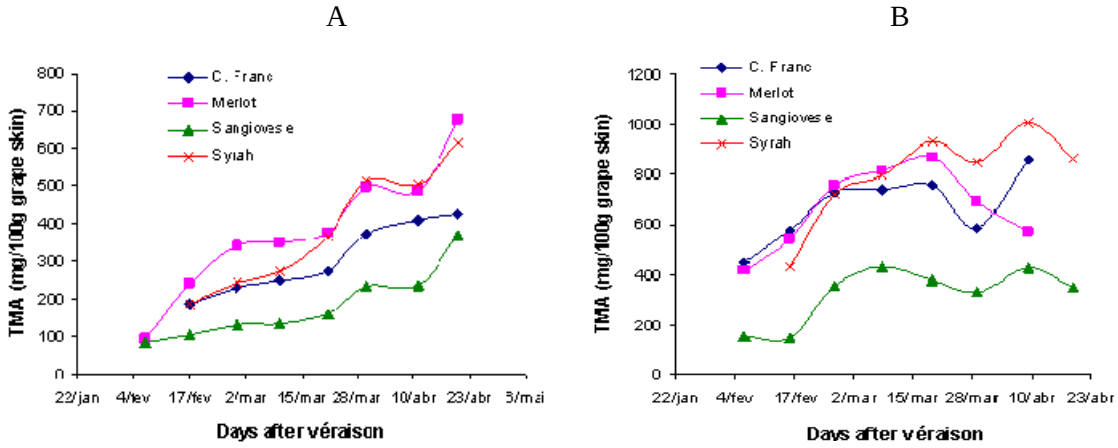

Figure 5 TMA evolution evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

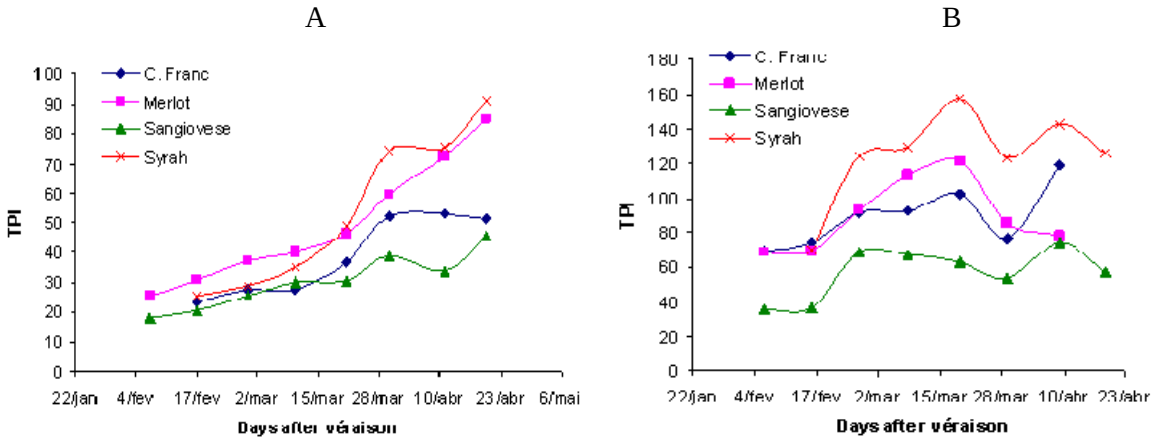

Figure 6 TPI evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

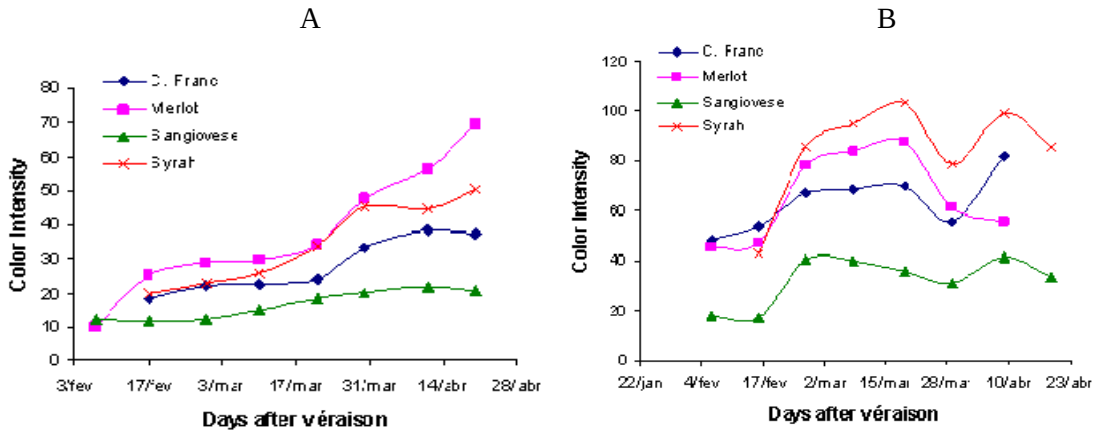

Figure 7 CI evolution from véraison to harvest for C. Franc, Merlot, Sangiovese and Syrah grapes, in 2006 (A) and 2007 (B) vintages.

Conclusions

The results showed that these different grape varieties had typical characteristics at maturity, in relation to classical wine growing regions of the world, , showing a good adaptation in São Joaquim town. This indicates that the C. Franc, Merlot, Sangiovese and Syrah grapes varieties present a high potential for fine wines elaboration, ranking São Joaquim town as a suitable region for *Vitis vinifera* grapes growing.

References

AMERINE, M. A., and OUGH, C. S. 1976. *Análisis de vinos y mostos*. Zaragoza: Acribia, 1976. 158p.

BRIGHENTI, E., and TONIETTO, J. 2004. O clima de São Joaquim para a viticultura de vinhos finos: classificação pelo sistema CCM geovitícola**.** In: CONGRESSO BRASILEIRO DE FRUTICULTURA, **8**, Florianópolis. *Anais eletrônicos*....Florianópolis.

CALO, A., GIORGESSI, F., PEZZA, L., GIANOTTI, S., and DI STEFANO, R. 1994. Effect of prunning and bud position on compounds accumulated by grapes (*Vitis* sp). *Rivista di Viticoltura e di Enologia*, **47**, 3-22.

GIUSTI, M. M., and WROLSTAD, R. E. 2001. Anthocyanins: characterization and measurement with uv-visible spectroscopy. In: Wrolstad, R. E. *Current protocols in food analytical chemistry*. New York: John Wiley & Sons, Unit. F1.2.1-13.

GLORIES, Y. 1984. La couleur des vins rouges. 2ème partie. Mesure, origine et interpretation. *Connaissance de la Vigne et du Vin*, **18**, 253–271.

GONZÁLEZ-NEVES, G., CHARAMELO, D., BALADO, J., BARREIRO, L., BOCHICCHIO, R., GATTO, G., GIL, G., TESSORE, A., CARBONNEAU, A., and MOUTOUNET, M. 2004. Phenolic potential of Tannat, Cabernet-Sauvignon and Merlot grapes and their correspondence with wine composition. *Analytica Chimica Acta*, **513**, 191–196.

GONZÁLEZ-NEVES, G.; FRANCO, J.; BARREIRO, L.; GIL, G.; MOUTOUNET, M.; and CARBONNEAU, A. 2007. Varietal differentiation of Tannat, Cabernet-Sauvignon and Merlot grapes and wines according to their anthocyanic composition. *Eur Food Res Technol*, **225**, 111–117.

GOODWIN, T. W., and MERCER, E. I. 1983. *Introduction to plant biochemistry*. 2 ed. Oxford: Pergamon, 677p.

LEES, D. H., and FRANCIS, F. G. 1972. Standardization of pigment analysis in cramberries. *Hortscience*, **7**, 83-84.

LEEUWEN, C. V., and SEGUIN, G. 1994. Incidences de l'alimentation en eau de la vigne, appreciée par l'etat hydrique du feuillage, sur le développement de l'appareil végétatif et la maturation du raisin (Vitis vinifera variété Cabernet Franc, Saint-Emilion 1990). *Journal International des Sciences de la Vignes et du Vin*, **28**, 81-110.

MAZZA, G.; FUKUMOTO, L., DELAQUIS, P., GIRARD, B., and EWERT, B. 1999. Anthocyanins, phenolics, and color of Cabernet Franc, Merlot, and Pinot Noir wines from British Columbia. *Journal of Agricultural and Food Chemistry*, **47**, 4009-4017.

MAZZA, G., and MINIATI, E. 1993. *Anthocyanins in fruits, vegetables and grains*. Boca Raton: CRC Press Inc., **362**.

RIBÉREAU-GAYON, P. et al. 1970. Le dosage des composés phénoliques totaux dan les vins rouges. *Chimie Analitique*, **52**, 627-631.

RIBEREAU-GAYON, P. 1973. Interprétation chimiques de la couleur des vins rouges. *Vitis*, **12**, 119-142.

ROSIER, J. P. 2006. Vinhos de altitude: característica e potencial na produção de vinhos finos brasileiros. *Informe Agropecuário*, **27**, 105-110.