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International Journal of Current Research
Vol. 8, Issue, 06, pp.33078-33086, June, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

WINE CHARACTERIZATION FROM MERLOT, TANNAT AND CABERNET SAUVIGNON GRAPES OF THE CAMPANHA REGION OF RS, HARVESTED IN TWO MATURATION STAGES

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ARTICLE INFO

Article History:
Received 17th March, 2016
Received in revised form
23rd April, 2016
Accepted 24th May, 2016
Published online 30th June, 2016

Key words:

Late harvest, Line red wine, Leaf analysis,Potassium.

ABSTRACT

The region of Bagé, RS presents befitting edaphoclimatic conditions for the production of said guard wines. Wines with *Vitisvinifera* grapes of the region are being produced 5 years ago, although research aimed at improving the quality of wines from the region are scarce, and production and winemaking protocols are used in other regions with different edaphoclimatic conditions found in Bagé. The aim of this study was to investigate the influence of two harvest times (industrial maturation and advanced maturation) cultivars Merlot, Tannat and Cabernet Sauvignon, the composition of wines produced with grapes of the region. The Cabernet Sauvignon and Merlot cultivars showed high pH (up to 4.2 in Cabernet Sauvignon), low total acid (56 $meq.L^{-1}$to Merlot), color indices and low total polyphenol already in the first crop (IM), and the results were lower in the second crop (AM). Tannatcultivar in the harvest in industrial maturation stage proved to be well adapted to Bagé region, with good oenological potential, and, during the late harvest, the anthocyanin levels increase as well as polyphenols. Then, being advanced maturation a good choice regarding the structure and phenolic maturation of these wines. The sensory analysis verified the data of physical chemical analysis and pointed Cabernet Sauvignon and Merlot wines as poorly structured, with low marks for color and acidity. Instead, the Tannat wine obtained high marks in both crops, with the second harvest highlighting quality. The negative data of high pH, low total acidity and instability of anthocyanins found in Cabernet Sauvignon and Merlot, may be attributed to adverse weather conditions for the maturation of Merlot and high amounts of potassium found in the leaves of grapevines before harvest and wines (above 2500 mg L^{-1}) generated with Cabernet Sauvignon grapes.

Citation: Renata GimenezSampaio Zocche, Suziane Antes Jacobs, Norton Victor Sampaio *et al.* 2016. "Wine characterization from merlot, Tannat and cabernet sauvignon grapes of the Campanha region of RS, harvested in two maturation stages", *International Journal of Current Research*, 8, (06), 33078-33086.

INTRODUCTION

Different the main Brazilian wine-growing region (Serra Gaúcha), the Campanharegion of RS is characterized by providing, in the period of maturation and harvest of the grapes, low rainfall intensity (15 to 35 mm per month), strong sunlight and good thermal amplitude (10 to 12ºC), positive factors for obtaining grapes with a high potential oenological (Mota, 2003). The combination of these characteristics, with some cultural practices as on grapevines in simple espalier system, defoliation, good value canopy area / amount of grape, productivity control for plant and maturation stage can positively affect the quality of wine (González-Neves *et al.*,

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2002; Pérez-Lamela *et al*, 2007). These conditions have been generated in this new wine-growing region whose activity gained momentum in the last decade and it is estimated a total area of 500 ha. As majority were planted red cultivars Merlot, Tannat and Cabernet Sauvignon, and more recently, Shiraz, Tempranillo, National Tourriga, Pinot Noir, among others. While advances in phytotechnic plan, there are few data on the behavior of the main cultivars, as is widely known (González - Neves, 2004; Kontkanen *et al*., 2005; Parr *et al*., 2009; Rizzon, *et al*, 2002; Rizzon *et al*., 2003, Rizzon, *et al*., 2004; Montealegre *et al*., 2006; Tao *et al*., 2009; Cosme *et al*., 2009; Fischer *et al*., 1999), Theby have their expression dependent on *terroir* components.

It is widely reported in the literature that obtaining quality wine is the result of the genotype, the edaphoclimatic conditions, fitotécnico management of the vineyard (irrigation, fertilization, pruning, plant yield, pest and diseases), harvest and oenological methods. Factors related to the ecosystem, the climate and soil are cited as prevalent in the quality of wine, and each cultivar must have its expression profile validated in each case (Van Leeuwen *et al*., 2004; Ubalde *et al*., 2007). Therefore, although already they produce wines from grapes of this region, there is no descriptive scientific research references on the grapes and wine. In addition, management procedures in the pre-harvest, harvest and winemaking follow commonly used in grapes from other regions. However, there have been infromal reports obtained for problems related to low stability of wines. According Guerra (2002), Ribereau-Gayon *et al*. (2003), Ryan and Revilla (2003), Rizzon and Miele (2002, 2003, 2004), Fournand *et al*. (2006), the expression of each cultivar is highly variable with the conditions in which it is produced. Should be studied case by case basis to obtain time series of each genotype, in defined edaphoclimatic conditions and established production and winemaking processes.

In exploratory studies, it was found that during maturation in some varieties produced in Campanha region of RS for excess reducing acidity, resulting in a wine with increased pH, generating an inappropriate condition for the maturation of wines (Rizzon *et al*., 1998). Although they have not been described the exact causes for this response, it is believed that might be associated with excessive absorption of potassium which contributes to greater precipitation tarataratos and K bitartrate during alcoholic fermentation and tartaric stabilization steps that occur reduction in the total acidity, pH may be increased (Rizzon *et al*., 1998). The excess K may result from the combination of factors such as excess potassium fertilization during the soil correction, the use of rootstock with abundant root system (1103 Paulsen), the high evapotranspiration, the use of foliar supplements containing K (phosphites) and / or the maturation stage. However, there is a need for studies on local conditions, in order to characterize the behavior of each cultivar in management conditions and local ecosystem. Therefore, we studied the main physico-chemical and sensory characteristics of wines from Merlot, Tannat and Cabernet Sauvignon produced in the Campanha region of RS, harvested in two maturation stages.

MATERIALS AND METHODS

The grapes used were Merlot, Tannat and Cabernet Sauvignon of vineyards with 7 years of implantation, located in Campanha region of RS, city of Bage, in the agricultural year 2008. The vineyards were formed with 1103 Paulsen seedlings grafted on rootstock, spaced 1.2m between plants and 3 m between rows, in the conduction in simple espalier system, and pruning in double Gouyot for variety Tannat and cord sloped catch for the Cabernet Sauvignon and Merlot. The soil of vineyards area called Santa Tecla, and it is characterized by pH 5, clay content of 24%, organic matter 1.2%, 3.5 mg/dm^3 of P to 80 mg/dm^3 of K. The height the canopy was about 1.2m. In the month before the harvest was carried out collecting leaves for foliar potassium on 3 different dates with intervals of ± 10 days between collections. The leaves were collect in 30-leaves samples in triplicate opposed to clusters of grapes in grapevines distributed throughout the vineyard area constituting representative samples of the three cultivars. Thus, for each cultivar, the three dates were collected 3 samples constituting the repetitions of foliar analysis. The collection procedure was similar to that adopted by Fogaça *et al*. (2007). The average yield per plant was 3.5 kg for Tannat, Merlot and 4.2kg to 2.5kg for the Cabernet Sauvignon. The grape maturation was monitored by determining the total soluble solids content, total acidity and empirical tasting berries and seeds. The harvest was carried out in two stages, one when the grapes reached the usual parameters to cultivars that this year, for weather events, allowed were all taken on the same date and with characteristics consistent maturation used by wineries (13/03/2008), called hereafter as industrial maturation (IM), and 20th day after the other, hereinafter advanced maturation (AM) (date 02/04/2008). It should be noted that the cultivar Merlot behaved atypically way this year due to a physiological disturbance, caused by adverse weather conditions, in the grain color change stage thereby allowing the delay of the normal date of harvest. The harvest was performed manually, and the grape transported in plastic boxes with capacity of 17 kg, conveyed (5h) and vinified after 19 hours. In the period between harvest and winemaking, the grape was kept cool in the chamber ± 4c, and relative humidity of 85%. At harvest characterized the must of grapes with regard to density, total soluble solids, total acidity and pH.

The microvinifications were held on the premises of Embrapa Grapes and Wine, in Bento Gonçalves, RS. For each experimental unit (20L bottles) 17 kg grapes were destemmed and crushed, and immediately added SO_2 (50mg/L) and yeast (20mg/L *Saccharomycescereviseae*, Maurivin® mark), followed by maceration for 6 days at a temperature of 20˚C - 25˚C, with daily repression and descuba on the 7th day. For each treatment were performed 3microvinifications which were repetitions of the same. After the alcoholic fermentation was held racking and monitored to malolactic fermentation, which took four months to complete, after which there was the tartaric stabilization in cold 4C for 10 days. After tartaric stabilization, the wines were bottled. The physico-chemical evaluations were conducted immediately after bottling. The determination of density, alcohol content, total titratable acidity (TTA), volatile acidity, pH, reducing sugars of the wines were made using the methods described by Amerine and

Ough (1976). The content of total polyphenols and anthocyanins, and color intensity were determined according Ribéreau-Gayon and Stonestreet (1965). The trans-resveratrol content was quantified by high-performance liquid chromatography (HPLC), following the standard method by Souto *et al.* (2001) and adapted by Sautter *et al.* (2005) modified the column temperature to 50°C.

The contents of Ca, Mg, Mn, Fe, Cu and Zn were obtained from analysis by atomic absorption, while K, Na, Li and Rb were obtained by flame emission (Perkin-Elmer, 1976). The P content was determined colorimetrically using ammonium molybdate. The volatile compounds ethyl acetate, methanol, 1-propanol, 2-methyl-1-propanol, 2-methyl + 3-methyl-1-butanol and the sum of the higher alcohols were determined by gas chromatography. For this, we used an machine equipped with a flame ionization detector and a Carbowax column 600 stainless steel of 3.2m length and "1/8" internal diameter. The vector gas used was nitrogen, at a flow rate of 30 ml/min. The vaporizer temperature was 140ºC, the furnace 98ºC and 160ºC of the detector. The sample of wine (3µL) was injected directly after having received 10% of the volume of a solution of 4-methyl-2-pentanol, 1 g/L internal standard (Bertrand, 1975).
Sensory analysis was conducted after six months of bottling by a panel of 11trained tasters, with the ability to quantify aromatic, gustatory and visual descriptors in red wines. The evaluation was made on three consecutive days, each evaluating a repetition of each treatment, assigning scores from zero to nine according to the perceived loudness. The descriptors were selected to test the hypothesis of this work: color intensity, purplish red intensity, aromatic intensity, red fruit, dry fruit, tobacco/chocolate/tea, vegetable/herbaceous, mouth volume, sweet tannin, acidity, astringency, persistence, global assessment.

maturation is expected in biochemical event (Rizzon *et al.*, 2002, 2003, 2004), as occurs in most fruits. However, in the case of grapes intended for winemaking, the preservation of titratable acidity and pH constitutes an imperative for good stability of the wine, unless you make corrections (Carvalho *et al.*, 1999). In the case of the Tannat grape, although there has been reduction in total acidity and pH increase, the values obtained at the late harvest can still be considered good, respectively, 89 meq.$L^{-1}$and pH 3.29. As for the cultivar Cabernet Sauvignon and Merlot, pH values were high, above 3.67. As for the winemaking process there is reduction in total acidity and pH increase (Rizzon *et al.*, 1998), the expected problems with the stability of the wines produced with these two cultivars.

Tannat wines

Regarding the density, delayed harvest only influenced the increase of this variable in cultivar Cabernet Sauvignon, probably due to higher concentration of total soluble solids observed for this cultivar. For Tannat and Merlot cutivars, the later harvest affect these variables. The wine produced from the variety Tannat was observed (Table 2) that the harvest in AM stage provided greater DO 420 and DO 620 values, anthocyanins and total polyphenols. This difference from the wine produced from grapes harvested in stage IM can be explained by the evolution of phenolic maturation of the grapes that grow to a greater accumulation of anthocyanins and total polyphenols. This indicates that in the period between the IM and AM stage there was a higher metabolism associated with phenolic maturation, than related to the biosynthesis and accumulation of sugars. The content of anthocyanins detected for this cultivar are average values presented in two years of study of this variety in Uruguay (González-Neves *et al.*, 2004).

Table 1. Physical analysis of grapes must of Tannat, Cabernet Sauvignon and Merlot in industrial maturation stage and advanced maturation, region of Bagé- RS, the 2008 harvest

Treatments	Tannat			Cabernet Sauvignon			Merlot		
	IM	AM	CV%	IM	AM	CV%	IM	AM	CV%
DENSITY	1.0965a*	1.104 a	0.34	1.085 b	1.091 a	0.11	1.0864[a]	1.087 a	0.19
BRIX	23.2 a	24.1 a	3	20.1 b	21.6 a	0.86	20.1 a	20.7 a	1.85
TOTAL ACIDITY	107 a	89 b	10.24	93 a	76 b	0.76	62 a	66 a	4.42
pH	3.06 b	3.29 a	4.09	3.43 b	3.84 a	0.17	3.56 b	3.67 a	1.76

* Different letters among treatments indicates significant difference between the means according to the Tukey test at 5% probability.

The experiment was arranged through a completely randomized design with two treatments, the first treatment to winemaking grapes harvested in industrial maturation stage, and the second, with grapes harvested in advanced maturation stage in the agricultural year 2008. Each treatment it was formed by three repetitions. Data were statistically analyzed using the STATISTICA 5.0 software, mean comparison was made between treatments for all physico-chemical variables, using the 5% Tukey test.

RESULTS AND DISCUSSION

By analyzing the analytical variables monitoring of maturation, it was observed that for all three cultivars increasing pH with a late harvest (Table 1). Except for cultivar Merlot, this procedure also resulted in a significant decrease in the total acidity. The fact that reduction of total acidity in the grape

However, the wine made from the grape of the AM stage from the Bagé-RS region had higher polyphenol levels than those cited by González-Neves *et al.* (2004). Although some authors have observed decrease in anthocyanin content in advanced stages of maturation (Fournand *et al*, 2006;González-San José, *et al.*, 1990; Ryan and Revilla, (2003), this did not happen with the Tannat variety to harvesting the AM stage, indicating that can delay the harvest this region. This allows to increase the anthocyanin content (667.36 mg.L^{-1} to 744.96 mg.L^{-1}) and polyphenols (61.4 mg.L^{-1} to 79.53 mg.L^{-1}). Evidently, that as it is widely known in wine study (Rizzon and Miele, 2002; Rizzon and Miele, 2003; Rizzon and Miele, 2004), this type of study can only be accomplished from time series in order that several factors (genotype, age, rootstock conduction system climate, harvest point) affect the synthesis and accumulation of these components bioconversion.

Table 2. Physical-chemical characteristics of the wines produced with Tannat grapes harvested in vineyards of in the Campanha region of RS, in two stages of maturation, the 2008 harvest

Analyse	Industrial maturation	Advanced maturation	CV%
Density (20/20°C)	0.9829 a*	0.9826 a	0.049
Alcohol (%v/v)	12.96 a	13.22 a	3.192
Total acidity (meq.L^{-1})	84 a	80 a	8.307
Volatile acidity (meq.L^{-1})	8 a	7 a	12.551
Ph	3.58 a	3.64 a	2.953
Reducing Sugars (g.L^{-1})	2.34 b	3.93 a	28.402
D.O. 420	0.409 b	0.521 a	143.723
D.O. 520	0.686 a	0.836 a	16.230
D.O.620	0.130 b	0.170 a	159.079
COLOR (D.O. 420/D.O.520)	0.597 a	0.631 a	7.860
COLOR INTENSITY (D.O.420+D.O.520+D.O.620)	1.226 a	1.526 a	15.017
TOTAL ANTHOCYANINS (mg.L^{-1})	667.36 b	744.96 a	6.359
TOTAL POLYPHENOLS (mg.L^{-1})	61.40 b	79.53 a	14.215
K (mg.L^{-1})	1321.2a	1339.8^{a}	2.7
Na (mg.L^{-1})	8.9b	14^{a}	24.7
Ca (mg.L^{-1})	73.9b	85^{a}	7.8
Mg(mg.L^{-1})	112.7b	133^{a}	10.3
Mn (mg.L^{-1})	2.5a	2.6^{a}	5.2
Cu (mg.L^{-1})	0.2a	0.2a	8.4
Fe (mg.L^{-1})	1.1a	0.8b	17.1
Zn (mg.L^{-1})	0.4a	0.2b	55.5
Li (mg.L^{-1})	4.9a	5.7a	15.4
Rb (mg.L^{-1})	6.4a	6.4a	7.7
P (mg.L^{-1})	136.1a	136.6^{a}	10.24
ACETALDEHYDE (mg.L^{-1})	42.48 a	18.44 a	79.792
ETHYL ACETATE (mg.L^{-1})	69.28 a	84.76 a	16.051
METHANOL (mg.L^{-1})	194.43 b	271.27 a	20.454
PROPANOL-1 (mg.L^{-1})	45.92 a	83.72 a	44.016
2-METHIL-1-PROPANOL (mg.L^{-1})	50.25 a	48.03 a	6.741
2-METHIL-1-BUTANOL (mg.L^{-1})	82.59 a	59.83 b	19.295
3-METHIL-1-BUTANOL (mg.L^{-1})	277.10 a	200.00 b	18.827
SUPERIOR ALCOHOLS SUM (mg.L^{-1})	455.86 a	391.20 b	9.599

* Different letters among treatments indicates significant difference between the means according to the Tukey test at 5% probability.

The density values, alcohol content, total acidity, volatile acidity and reducing sugars of the wines produced with Tannat grapes harvested in IM and AM stages remained within the standards expected of a suitable fermentation process. Regarding the pH values obtained were lower than those previously detected by Rizzon and Miele (2004) who studied wines made with Tannat grapes from the Serra Gaucha, RS.With respect to cation concentration is important to stress that were detected lower K contents of the cited for wines of this cultivar in the Serra Gaucha (Rizzon and Miele, 2004). This is a positive factor, given that the low pH is in important factor in the stability of the color and structure of the wines. This statement is supported by the higher content of anthocyanins and polyphenols obtained from wines coming from both harvest times when compared to wines in which the pH was higher (Rizzon and Miele, 2004). The smaller K values found in Bage of Tannat wines were also reflected in the pH of wines that were lower than the Serra Gaucha. In the other minerals studied, the values remained close to the values cited for this cultivar (Rizzon and Miele, 2004). The volatile compounds (Table 2), although within the patterns found by Miele and Rizzon, (2004), resulted at superior total alcohols lower than the cited by these authors, which gives the wine more aromatic refinement. Compared the harvest time, the advanced maturation showed even smaller and better values that industrial maturation, which was observed also in the sensory analysis of wine from both harvest times (Figure 1).

When comparing with grape musts (Table 1), it is found that, as expected, there was a reduction in total acidity stabilized between 80 and 84 meq.L^{-1}and increasing the pH to 3.58 to 3.64, no effect of treatment (Table 2). This indicates that the delay in maturation to cultivar Tannat can contribute to the achievement of wine with higher concentrations of polyphenols and anthocyanins, without compromising essential variables to maintain the stability of the wine, as is the case of total acidity and pH. However, there was no effect on the total soluble solids accumulation and, consequently, did not affect the alcohol content. This behavior differs from informal reports made in relation to this cultivar that by delaying the harvest, there is potential for significant increases in the levels of sugar and produce wines with high alcohol content of up to 16 to 17% (unpublished data). The exact causes of this behavior have not been elucidated, but it is believed that although it is a region with low rainfall, the regularity of rainfall in that year (2008), may have affected this variable. When analyzing sensory these wines (Figure 1), there was the perception that the wines made with the harvest in the AM showed higher staining intensity, higher volume of mouth, most sweet tannic, less astringency, greater persistence and better overall assessment of that vinified from grapes harvested in IM stadium.

These results, although they are on the evaluation of wine just a crop year are indicative that the plant variety Tannat has good potential enological and the harvest can be done in more advanced stages of maturation. It is emphasized in this respect the positive evolution of variables related to the phenolic maturation, such as the reduction of astringency, tannic increased sweetness, color intensity and mouth volume. These changes favorable to harvest in the AM stage constituted the hypothesis that work in which we sought to delay the crop to afford be better phenolic maturation of seeds and hulls, so as to obtain wine with good color, structure and tannic quality.

Cabernet Sauvignon wines

To cultivar Cabernet Sauvignon, harvest delay contributed to obtain-wines with higher alcohol content, but with lower levels of anthocyanins, probably due to the destabilization of these molecules due to the high pH above 4.0 (Table 3) . However the occurrence of high pH already occurs in wine made from grapes harvested in Cabernet Sauvignon IM stage of Campanha region of RS, and was also reported by the study Rizzon *et al*. (1998) which monitored the evolution of acidity of Cabernet Sauvignon in different regions of the state. In this study, the authors found high pH, low ATT and high K levels in musts and wines of the Santana do Livramento region, located 150km from Bagé, with similar climatic conditions and the same type of soil. With regard to most of the variables studied in relation to the color and structure of the wine, independently of maturation stage in which the grapes were

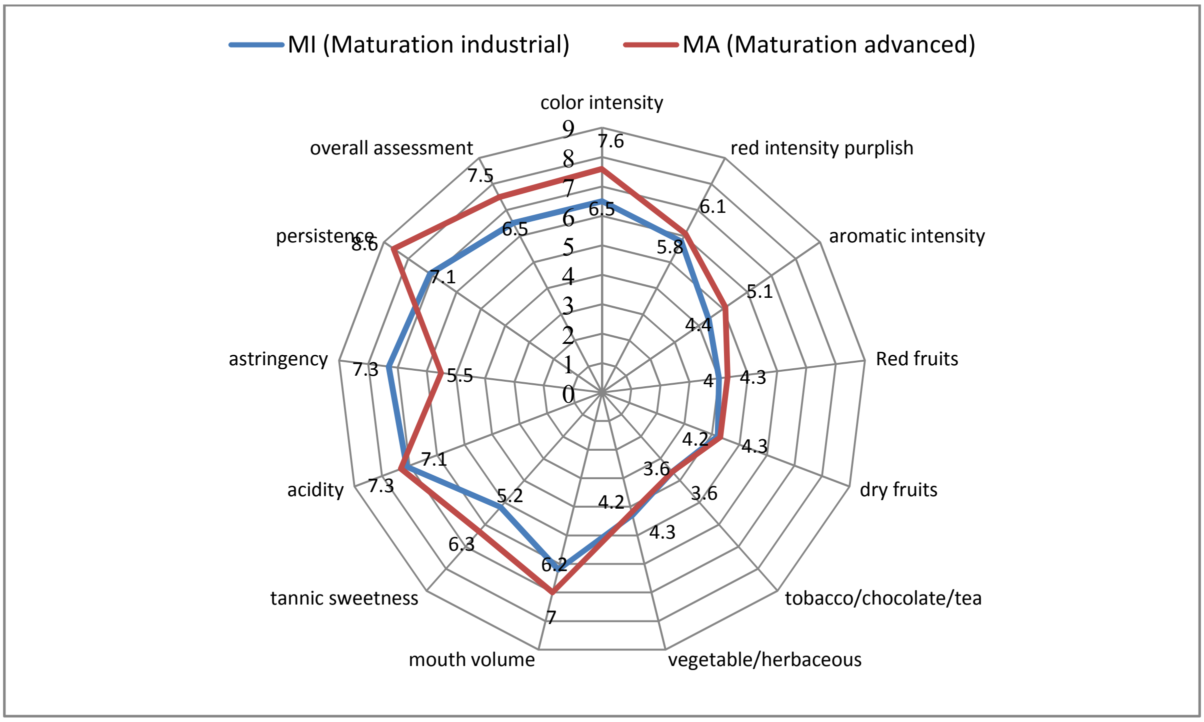

Figure 1. Sensory analysis of Tannat wines of Bage-RS region, from grapes harvested in industrial maturation stages (IM) and advanced maturation (AM), the 2008 harvest

Table 3. Physical-chemical characteristics of the wines produced with Cabernet Sauvignon grapes harvested in vineyards of in the Campanha region of RS, in two stages of maturation, the 2008 harvest

Analyses	Industrial maturation	Advanced maturation	CV%
Density (20/20°C)	0.9965 b*	0.9982 a	0.1
Alcohol (%v/v)	10.83 b	11.61 a	4.1
Total acidity (meq.L^{-1})	65 a	65 a	1.6
Volatile acidity (meq.L^{-1})	9 b	13 a	24.2
pH	4.01 b	4.28 a	3.7
Reducing sugars (g.L^{-1})	2.12 a	1.63 b	16.3
D.O. 420	0.254 a	0.276 a	12.3
D.O. 520	0.307 a	0.240 a	24.2
D.O.620	0.054 a	0.051 a	25.2
COLOR (D.O. 420/D.O.520)	0.84 b	1.16 a	20
Color intensity (D.O.420+D.O.520+D.O.620)	0.614 a	0.566 a	16.8
Total anthocyanins (mg.L^{-1})	441.80 a	292.55 b	23.4
Total polyphenols (mg.L^{-1})	34.53 a	34.33 a	1.7
K (mg.L^{-1})	1880.8b	2532.8^a	16.5
Na (mg.L^{-1})	18.7a	23^a	14.3
Ca (mg.L^{-1})	57.7a	55.2^a	3.7
Mg(mg.L^{-1})	103.3a	105.6^a	1.8
Mn (mg.L^{-1})	2.0b	2.2^a	5.5
Cu (mg.L^{-1})	0.5a	0.2b	41.5
Fe (mg.L^{-1})	0.9a	0.7b	11
Zn (mg.L^{-1})	0.4a	0.1a	63.4
Li (mg.L^{-1})	7.0b	8.2a	10.8
Rb (mg.L^{-1})	8.0b	9.2a	7.8
P (mg.L^{-1})	136.1b	212.0a	32.3
ACETALDEHYDE (mg.L^{-1})	16.43 a	8.80 a	43.237
ETHYL ACETATE (mg.L^{-1})	60.19 a	85.24 a	27.605
METHANOL (mg.L^{-1})	174.25 a	221.95 a	18.262
PROPANOL-1 (mg.L^{-1})	33.84 b	59.33 a	30.062
2-METHIL-1-PROPANOL (mg.L^{-1})	56.66 a	60.61 a	10.539
2-METHIL-1-BUTANOL (mg.L^{-1})	104.54 a	78.67 b	17.283
3-METHIL-1-BUTANOL (mg.L^{-1})	268.76 a	214.99 a	15.151
SUPERIOR ALCOHOLS SUM (mg.L^{-1})	463.80 a	413.60 a	10.566

* Different letters among treatments indicates significant difference between the means according to the Tukey test at 5% probability.

harvested for winemaking, the values are low compared to those obtained by Malgariñ o*et al*. (2006), González-Neves *et al*. (2004), and values around to those described by Rizzon and Miele (2002). Thus it was shown that this cultivar results in wine with high content of K (1143 mg L-1-1627 mg l^{-1}), which contributed to the reduction of acidity, from 93 meq.L^{-1}(IM) and 76 meq.L^{-1} (AM) in the must grape to 65 meq.L^{-1}in both wine and increasing the pH of 3.43 (IM) and 3.84 (AM) to 4.01 (IM) and 4.28 (AM). For other physicochemical variables, the results are similar to those observed by Rizzon and Miele (2002) in cv. Cabernet Sauvignon wines from Serra Gaúcha. Thus, it shows that the cultivar Cabernet Sauvignon, the harvest in stage commonly called IM, already has difficulties in winemaking, especially in regard to the fall of acidity, pH increase and destabilization of components responsible for color and structure. For this cultivar was demonstrated by previous studies (Rizzon *et al*, 1998; Sampaio, 2005) corroborate this, the cultivar that does not develop their enological potential satisfactorily in Campanha region of RS, producing little structured wine, with low acidity, little coloring and little body. This can be explained if we observe the amount of potassium contained in the wine. The fact that it is a cultivar of late maturation is assumed that the proportional flow mass (water and nutrients) may be higher than shorter cycle varieties, which provide greater absorption of nutrients accumulation, among which K. However, in addition to conducting study monitoring the potassium uptake by leaf petioles and analyzes, it was found that all three cultivars of this study behaved differently, being the Cabernet Sauvignon which absorbed more potassium in the same collect interval (Figure 4). Another possible cause is the use of phosphites, commonly used as a preventive treatment to the occurrence of mildew. This hypothesis, although possible in the regional context, is not the cause of the results obtained in this work, because these were not products used in the experimental area. Thus, studies should be concentrated in order to verify the factors that affect the excessive accumulation of K, which is also dependent on cultivar. It is evident that the cultivar Cabernet Sauvignon accumulates higher levels than the Merlot and Tannat in the experimental model of this study (Figure 4).

The sensory analysis it was detected that, independent of the treatments, the wines produced with the cultivar Cabernet Sauvignon showed low quality average scores below 5 for all attributes that are considered positive for the quality of a red wine, such as for example, the color intensity of the red fruit flavors, mouth volume and persistence (Figure 2). Compared treatments, delaying the harvest worsens the quality even further, especially for variables related to color, which was also evidenced by the physical-chemical analysis (Table 3).

Merlot wines

The wines made from the cultivar Merlot presented, similar to cultivar Cabernet Sauvignon, with physico-chemical characteristics much lower than you want in red quality wines. The harvest delay further damaged the quality of wine in for the harvest in stage IM (Table 4), noteworthy is however, that the later harvest did not affect the final pH of the wine in relation to IM harvest, but the values are already high (Rizzon and Miele. 2003; Cadahía *et al*, 2009), between 3.74 and 3.77.

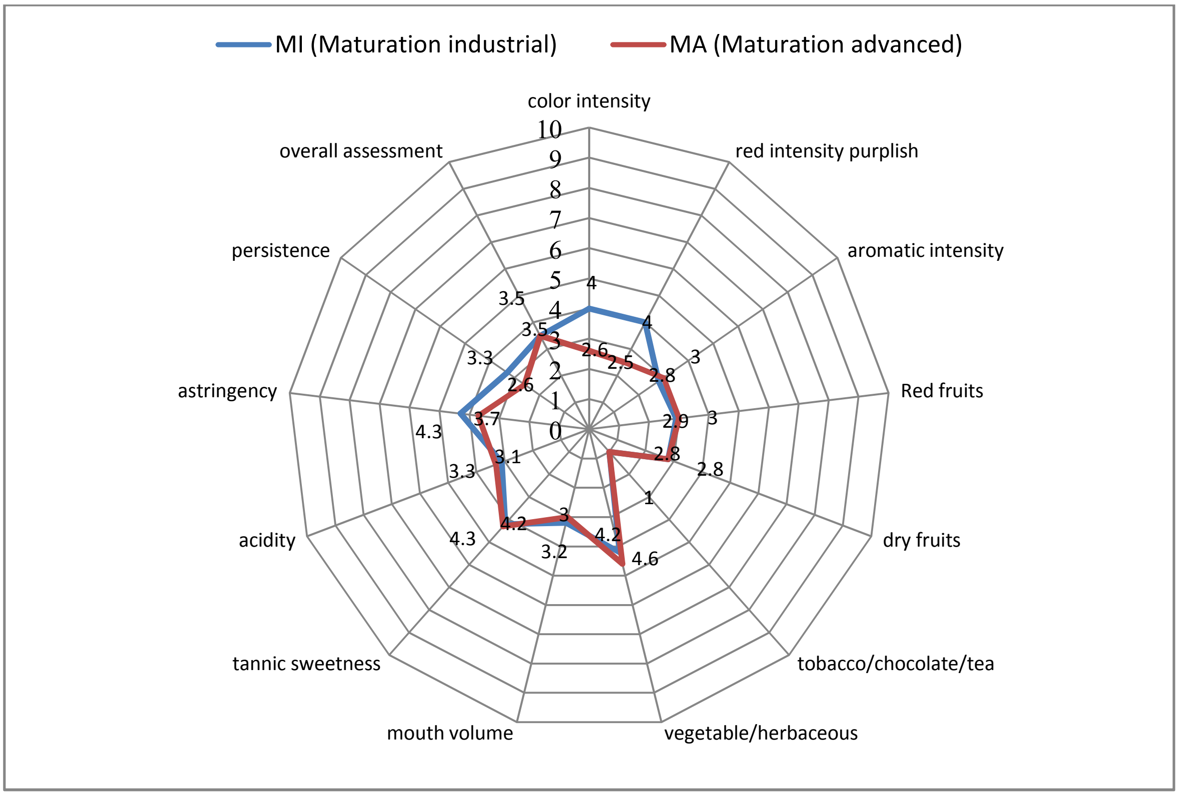

Figure 2. Sensory analysis of Cabernet Sauvignonwines of Bage-RS region, from grapes harvested in industrial maturation stages (IM) and advanced maturation (AM), the 2008 harvest

Table 4. Physical-chemical characteristics of the wines produced with Merlot grapes harvested in vineyards of in the Campanha region of RS, in two stages of maturation, the 2008 harvest

Analyse	Industrial maturation	Advanced maturation	Cv%
DENSITY (20/20°C)	0.9953 a*	0.9949 a	0.03
ALCOHOL (%v/v)	11.25 a	11.14 a	2.06
TOTAL ACIDITY (meq.L^{-1})	62 a	56 b	5.97
VOLATILE ACIDITY (meq.L^{-1})	7 b	11 a	28.97
pH	3.74 b	3.77 a	0.4
REDUCING SUGARS (g.L^{-1})	1.91 a	1.43 b	18.56
D.O. 420	0.171 a	0.159 a	14
D.O. 520	0.213 a	0.102 b	41.08
D.O.620	0.024 a	0.019 a	34.54
COLOR (D.O. 420/D.O.520)	0.811 b	1.572 a	35.48
COLOR INTENSITY (D.O.420+D.O.520+D.O.620)	0.408 a	0.280 b	24.59
TOTAL ANTHOCYANINS (mg.L^{-1})	242.89 a	83.55 b	53.91
TOTAL POLYPHENOLS (mg.L^{-1})	29 a	23.77 b	11.11
K (mg.L^{-1})	1289.7a	1160.7b	6.2
Na (mg.L^{-1})	9.3a	17.5a	41.7
Ca (mg.L^{-1})	63.1a	63.5a	4.4
Mg(mg.L^{-1})	102b	109.1a	3.8
Mn (mg.L^{-1})	3.1a	2.7a	11.5
Cu (mg.L^{-1})	0.3a	0.2a	9
Fe (mg.L^{-1})	0.7a	0.5b	16.6
Zn (mg.L^{-1})	0.3a	0.2a	19.2
Li (mg.L^{-1})	3.2a	3.9a	19
Rb (mg.L^{-1})	5.7b	7.2a	12.1
P (mg.L^{-1})	87.1a	65.9b	17.6
ACETALDEHYDE (mg.L^{-1})	27.04 a	6.35 b	71.88
ETHYL ACETATE (mg.L^{-1})	67.46 b	108.74 a	27.65
METHANOL (mg.L^{-1})	310.35 a	257.49 a	21.38
PROPANOL-1 (mg.L^{-1})	61.23 b	123.58 a	38.51
2-METHIL-1-PROPANOL (mg.L^{-1})	66.45 a	58.19 a	11.8
2-METHIL-1-BUTANOL (mg.L^{-1})	102.77 a	38.25 b	53.59
3-METHIL-1-BUTANOL (mg.L^{-1})	281.80 a	131.01 b	43.46
SUPERIOR ALCOHOLS SUM (mg.L^{-1})	512.25 a	351.03 b	24.41

* Different letters among treatments indicates significant difference between the means according to the Tukey test at 5% probability.

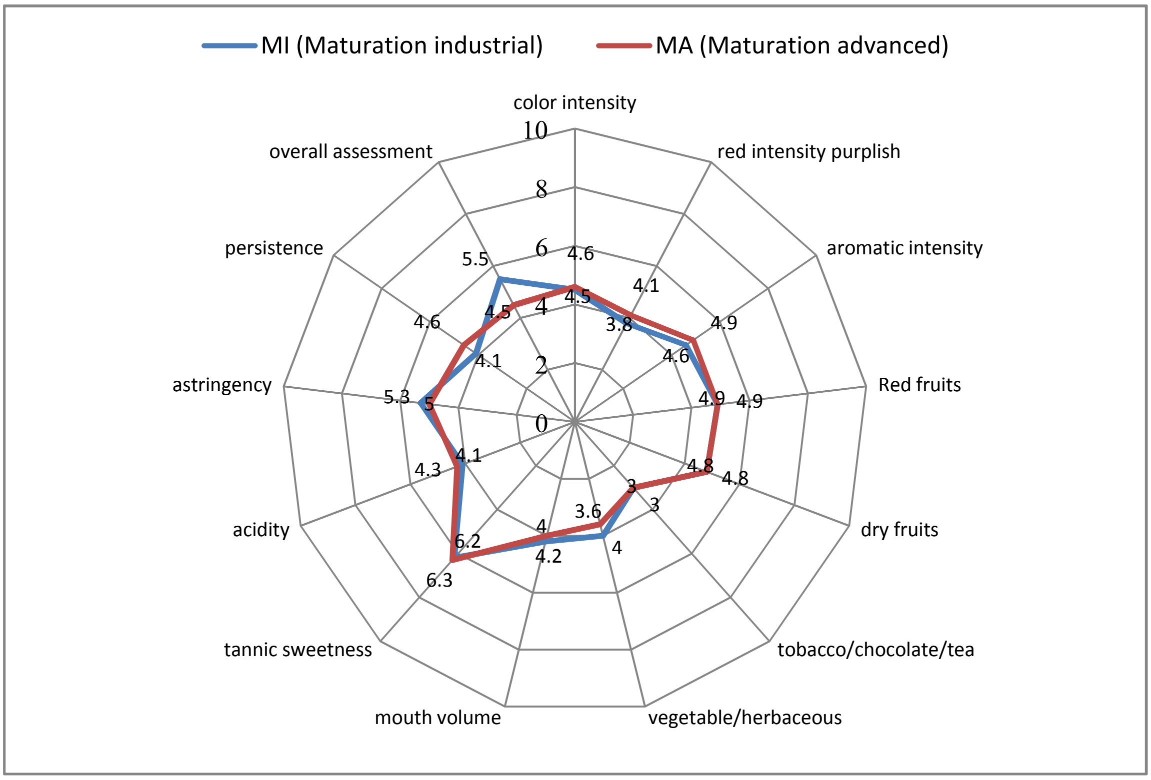

Figure 3. Sensory analysis of Merlotwines of Bage-RS region, from grapes harvested in industrial maturation stages (IM) and advanced maturation (AM), the 2008 harvest

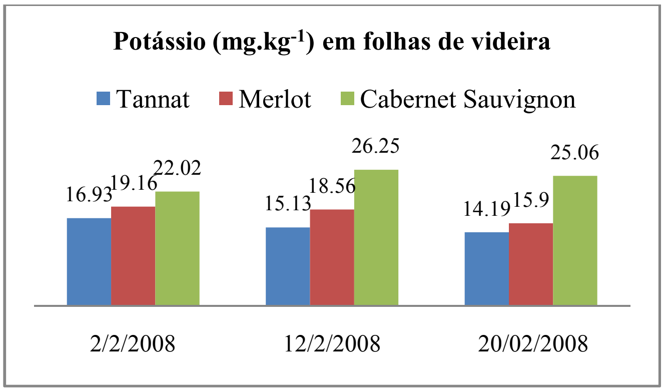

Figure 4. Levels of K in leaves with petiole of Cabernet Sauvignon grapevines, Tannat and Merlot at Bage-RS region in 2008

Alcohol values are appropriate considering the soluble solids content of the must. The TTA wine is low since the IM and the advanced maturation reached 56 meq.L^{-1}, as expected for this cultivar wines is to remain close to 70 meq.L^{-1} (Miele and Rizzon 2003, Cadahía *et al*., 2009). Following the acidity, pH showed high compared to Merlot wines from Serra Gaucha (Rizzon and Miele, 2003) and produced in the region of Navarra- Spain (Cadahía *et al*., 2009). The volatile acidity was higher in the wine made from grapes harvested in the AM stage, but fell within levels accepted as normal for the Brazilian legislation. The related variables to color were equally lower in AM as well as polyphenols and anthocyanins, and as the cultivar Cabernet Sauvignon in value low cited for the Merlot grown in other regions (Rizzon and Miele, 2003, González-Neves *et al*., 2004). The potassium levels were not the cause of high pH and low acidity should be followed studies that may explain the cause of these values, limiting the quality of the wine. They were also detected smaller amounts of calcium and magnesium higher than in wines from Serra Gaúcha. For the other cations, there were no significant variations with other Merlot wines (Rizzon and Miele, 2003).

Regarding the volatile compounds, methanol, although within the limit imposed by Brazilian law that governs the standards of wine (up to 350 mg l-1), presented levels considered high in wines produced with grapes from the AM (310 mg .L-1). The ethyl acetate at low levels indicates grapes in good phytosanitary conditions, so ruling out any possibility of negative results are a consequence of harvested grapes with some injury. The sum of the higher alcohols was superior in industrial wine maturation above 500 mg.L-1, which makes the unpleasant smell inhibiting the perception of the flavorings could be refined in wine (Ribéreau-Gayon *et al*., 2003).In a general way, the cultivar Merlot did not show good potential oenological and delay harvest, and does not assist in the major extraction of phenolic compounds and anthocyanins favored increasing pH and reducing the TTA. The observations made by physicochemical analyzes were supported by sensory analysis of Merlot wines produced with grapes from two seasons of crops that had little color, little volume in mouth, lack of flavor and low overall evaluation (Figure 3).

The rates of total polyphenols, anthocyanins, pH, total acidity and potassium followed the same standards as other works that studied the same cultivars (González-Neves *et al*., 2004; Cadahía *et al*., 2009).

Levels of foliar K

With the aim to evaluate the accumulation of K, probable cause of excessive reduction of TTA and increased pH were performed foliar analysis in their respective vineyards of cultivars before harvesting (Figure 4). From the data obtained, it is found that precisely cultivars that provided wine with higher pHs (Cabernet Sauvignon and Merlot) were those who also had greater leaf K concentrations, even potassium in Merlot wine has not accompanied the amounts found in the leaves petioles and vines.

Overall, the evaluation of K leaf content is a good indicator of the dynamics of this cation in the various organs of the plant (Tecchio *et al*, 2006; Fogaça *et al*., 2007). Thus, the highest concentration of K in the leaves of Cabernet Sauvignon indicate a greater focus on berries and other plant parts (Tecchio *et al*., 2006; Fogaça *et al*., 2007). This generic statement was confirmed for both cultivars, as Tannat wines had lower K content than from the Cabernet Sauvignon grape. As for the cultivar Merlot, the quantities of K found in the leaves and petioles not accompanied the K data in the wine and not served to the explanation of the high pH and low TTA, given these that are probably due to some physiological disturbance occurred during maturation, and / or some unfavorable climatic phenomenon.

Conclusions

Grapes of Tannat cultivar produced in Bage-RS region provide wines with higher enological potential than cultivars Cabernet Sauvignon and Merlot. The harvest delay It is a positive alternative to cultivar Tannat, contributing to better phenolic maturation. The high K levels constitute a limiting factor for the production of guard cultivar Cabernet Sauvignon wines.

Acknowledgments

This project was financed with funds from the CNPq (Scholarship and bench rate, Case no. 141935 / 2006-5), from Embrapa Grapes and Wine (microvinifications and physico-chemical analysis) and UFPel (physico-chemical analysis). The authors thank the Official Committee of Appellation d'OrigineContrôlée (AOC) LanguedocRoussillon, France, for contribution to the Sensory Evaluation of Wine.

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