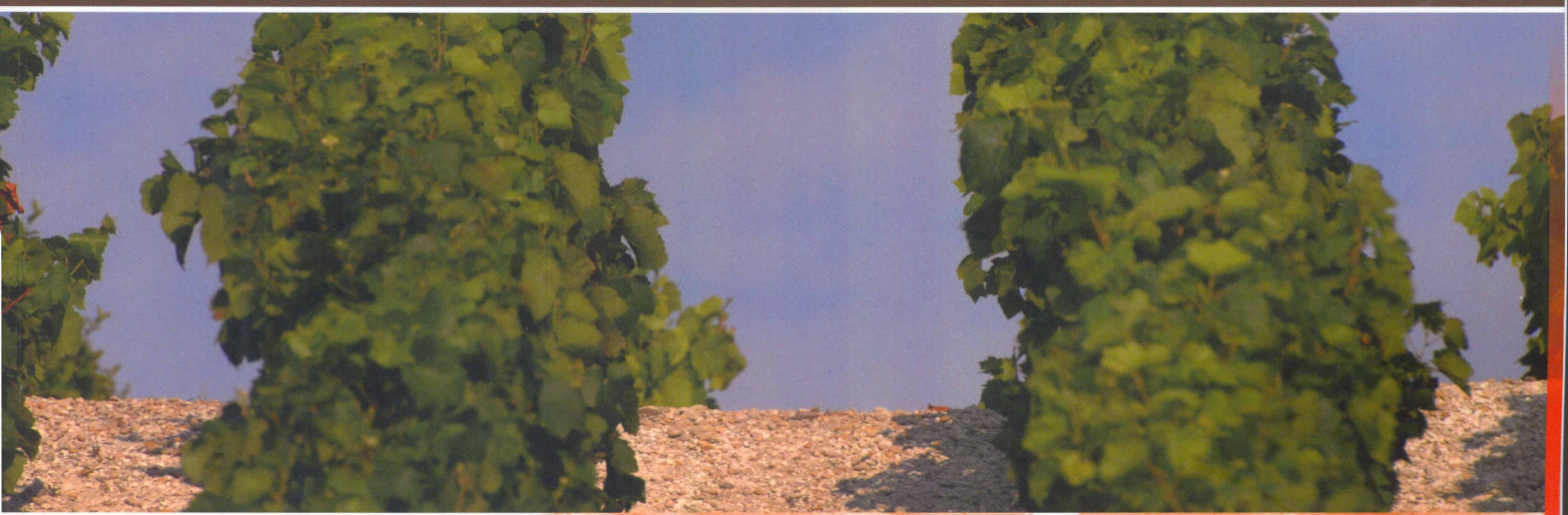
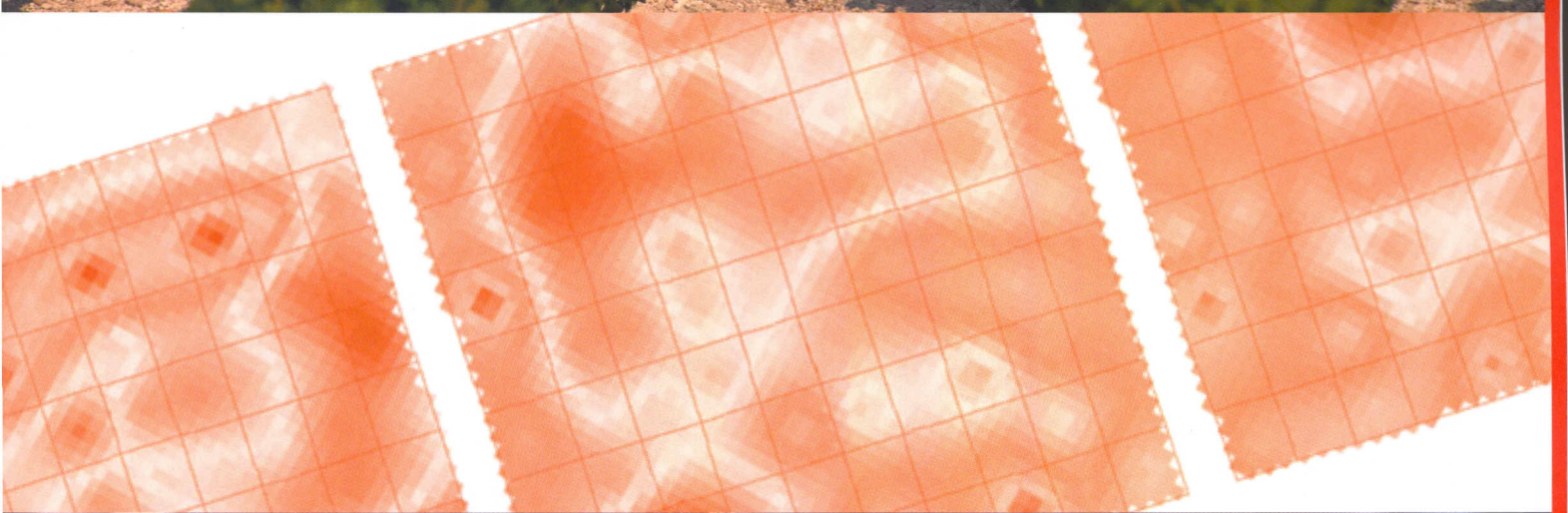
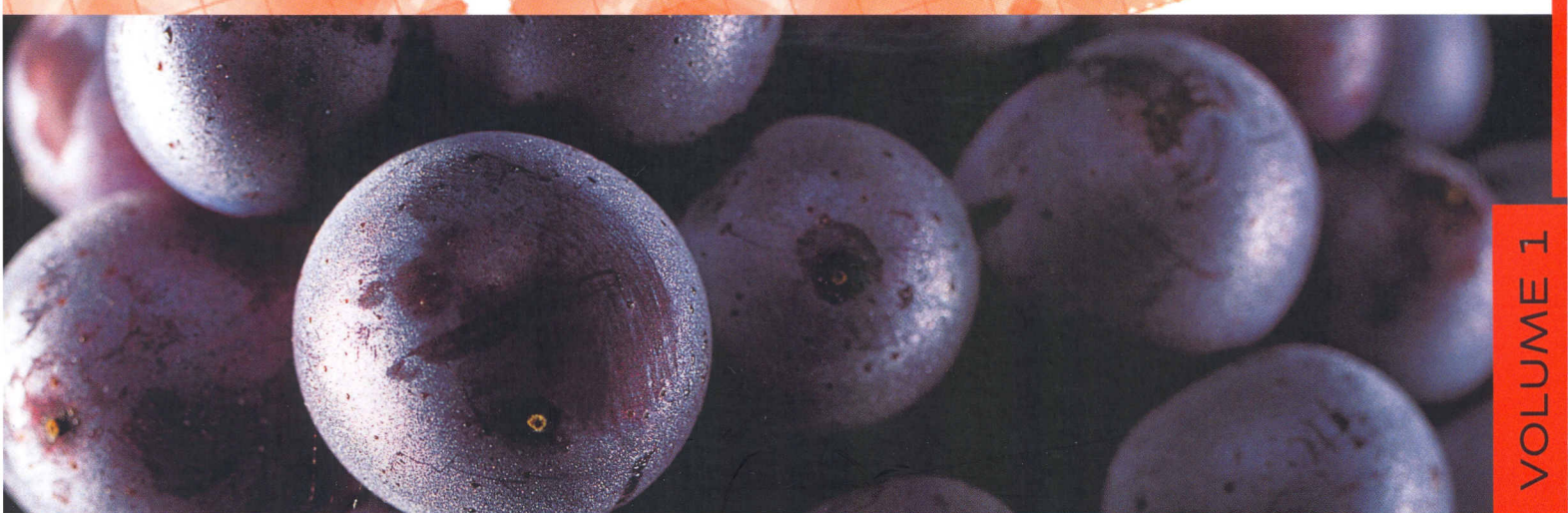
IXE CONGRES DES TERROIRS VITIVINICOLES
IXTH INTERNATIONAL TERROIR CONGRESS

BOURGOGNE - DIJON | CHAMPAGNE - REIMS | FRANCE

25 - 29 JUIN 2012







VOLUME 1

ACTES | PROCEEDINGS

COMITÉ CHAMPAGNE
BOURGOGNES
Bureau Interprofessionnel des Vins de Bourgogne
CHAIRE UNESCO
INSTITUT NATIONAL DE L'ORIGINE ET DE LA QUALITÉ
OIV Organisation Internationale de la Vigne et du Vin
UNIVERSITÉ DE BOURGOGNE
Institut Jules Guyot
CRC
BIOGÉOSCIENCES

Based on the analytical results described above, the vineyard soils of the Columbia Basin can be readily distinguished from those of the Willamette Valley and Snake River Valley. Relative to Columbia Basin soils, Willamette Valley soils are higher in iron, manganese, titanium, and organic matter, and lower in calcium, soluble salts, and pH. The contrasts in soil chemistry are attributable to significant differences in climate and soil parent material. The Willamette Valley receives 100 cm of annual precipitation, which is four times the average for the Columbia Basin, and Willamette Valley vineyard soils are developed not in loess, but in deeply weathered colluvium derived from basalt and sedimentary rocks (5). The sampled vineyard soils of the Snake River Valley could be distinguished from those of the Columbia Basin by lower concentrations of iron, manganese, and titanium and higher concentrations of soluble salts. The differences in soil chemistry can be attributed primarily to contrasting parent materials. Snake River Valley vineyard soils, which are developed primarily in loess and fluvial and lacustrine sediments derived from granitic or silicic volcanic rocks (6), are less influenced by basalt bedrock than their Columbia Basin counterparts.

CONCLUSIONS

Based on the analyses performed by this study, three of ten Columbia Basin AVAs, the Columbia Gorge, Walla Walla Valley, and Lake Chelan, are distinguishable based on soil chemistry. The distinctive soils of these three regions arise from significant differences in climate and soil parent material. The chemical components analyzed in the study allow Columbia Basin viticultural soils to be distinguished from their counterparts in the Willamette Valley and Snake River Valley AVAs.

ACKNOWLEDGEMENTS

This study would not have been possible without the cooperation of the many vineyard owners and managers, for which we are grateful. Kirsten Nicolaysen and Nicholas Bader provided analytical assistance and Liesl Olson provided assistance in the field. A Louis B. Perry Research Award from Whitman College supported the research.

REFERENCES

1. K.R. POGUE, 2009. In J.E O'CONNOR, R.J. DORSEY, and I.P. MADIN (eds), Volcanoes to Vineyards: Geologic Field Trips through the Dynamic Landscape of the Pacific Northwest, Boulder, USA, 1-17.
2. P. GREGUTT, 2010. Washington Wines and Wineries, the Essential Guide, Berkeley, USA, 331 p.
3. E. M. PITCAVAGE, 2011. Variations in the Soil Properties of the Premier Vineyards of the Columbia Basin: Implications for Terroir, unpublished senior honors thesis, Whitman College, USA, 36 p.
4. V.E. BEIELER, 1975. Soil Survey of Chelan Area, Washington, US Natural Resources Conservation Service, Washington D.C., 75 p.
5. S. BURNS, 2012. In P.H. DOUGHERTY (ed.), The Geography of Wine, Regions, Terroir and Techniques, New York, USA, 95-108.
6. V.S. GILLERMAN, D. WILKINS, K. SHELLIE, R. BITNER, 2006. Terroir of the Western Snake River Plain, Idaho, USA, Geos. Can., 33, 37-48.

Contribution of soil for tipifiyng wines in four geographical indications at Serra Gaúcha, Brazil

Eliana Casco SARMENTO[1,*], Carlos Alberto FLORES[2], Eliseu WEBER[3], Heinrich HASENACK[3], Reinaldo Oscar PÖTTER[4], Elvio GIASSON[1]

[1] *Universidade Federal do Rio Grande do Sul, Faculdade de Agronomia, PPG em Ciência do Solo, Av. Bento Gonçalves, 7712, Caixa Postal 15.100, CEP 91540-000, Porto Alegre/RS, Brasil.*
[2] *Embrapa Clima Temperado, BR. 392, km 78, CP. 403, CEP 96010-971, Pelotas/RS, Brasil.*
[3] *Universidade Federal do Rio Grande do Sul, Centro de Ecologia, Av. Bento Gonçalves, 9500, CP. 15007, CEP 91501-970, Porto Alegre/RS, Brasil.*
[4] *Embrapa Florestas, Estrada da Ribeira, km 11, CP. 319, CEP 83411-000, Colombo/PR, Brasil.*
[*] *Corresp. author: Sarmento, Telephone +55 51 3308-6001, Email : eliana.sarmento@ufrgs.br*

ABSTRACT

Brazil has a recent history on geographical indications and product regulation for high quality wines. The first geographic indication implemented was the Vale dos Vinhedos Indication of Procedence (IP), within the wine production zone named Serra Gaúcha, northeast of State Rio Grande do Sul. During the last decade, the Vale dos Vinhedos ascended to the category of Denomination of Origin (DO) and three new IPs were-delimited in the same region: Pinto Bandeira, Altos Montes and Monte Belo. It is known that production of high quality wines depends on the interaction of environmental factors and human activities. At local scale, soil plays important role since several factors affecting grape and wine quality are related to soil properties. The objective of this study was to evaluate potential contributions of soil to differentiate between wines produced in each of the four geographic indications at Serra Gaúcha. Material used included a digitized soil map in scale 1:50.000 of Serra Gaúcha and digital georeferenced boundaries of

the geographic indications. Spatial analysis was done on ArcGIS software. A total of 23 soil mapping units were found. Results showed that both the DO Vale dos Vinhedos (15 mapping units) and IP Pinto Bandeira (13 mapping units) have a relative predominance of Inceptisols, with low natural fertility and low organic matter content. The IP Monte Belo (9 mapping units) presents near 50% of Ultisols, with low natural fertility and medium to high levels of organic matter. In the IP Altos Montes (11 mapping units) most soils are Inceptisols with low natural fertility and low organic matter content, as well as Oxisols with low natural fertility and medium level of organic matter. Due to the observed spatial variability, soil information can help to tipify and differentiate wines produced in each of the four geographical indications at Serra Gaúcha.

Keywords: Soil, terroir, GIS.

1 INTRODUCTION

Brazil has a recent history on geographical indications and product regulation for high quality wines. The first geographic indication for wine was the Vale dos Vinhedos Indication of Procedence (IP), officially established in 2002 [1], within the wine production zone named Serra Gaúcha, northeast of State Rio Grande do Sul. During the last decade, several studies were done in order to help to improve quality and typicality of wine, providing information to help vine growers to choose the adequate grape variety and to adotp the right practices [2; 3; 4; 5; 6, 7; 8]. In this period the Vale dos Vinhedos ascended to the category of Denomination of Origin (DO) and three new IPs were delimited within the same region: Pinto Bandeira, Altos Montes and Monte Belo [9, 10].

It is known that production of high quality wines depends on the interaction of several factors, like climate, site or topographical location, soil and geology, grape variety and cultural practices. However, the discussion about contribution of each one is far from consensus given the complexity of interrelations [11; 12]. Climate is determinant for the production of high quality wines in a given region, but at local scale many other physical aspects assume critical importance, specially because of their high spatial variability when compared to climatic elements. The soil is one of the most import factors of the terroir, since several variables affecting grape and wine quality are related to soil properties [13].

Therefore, to know the occurrence and main characteristics of soil types is an essential step both to improve the wine quality of a given cultivated region as to search for new potential areas for grape growing. In this context, Geographic Information Systems (GIS) become an important tool for decision making.

This study aims to evaluate the occurrence and charactheristics of soil types in the four geographic indication areas above mentioned, and to identify potential contributions of soil to differentiate wines produced in each of these areas.

2 MATERIALS AND METHODS

The study area comprises four geographic indications for wine, the DO Vale dos Vinhedos (7.244,8 ha) and the IPs Pinto Bandeira (8.114,7 ha), Altos Montes (17.384,3 ha) and Monte Belo (5.609 ha). All the four areas are situated at northeast of state Rio Grande do Sul, southern Brazil, within the Serra Gaúcha wine production zone, between latitudes 28°30'S and 29°30'S and longitudes 50°45'W and 52°W (Figure 1).

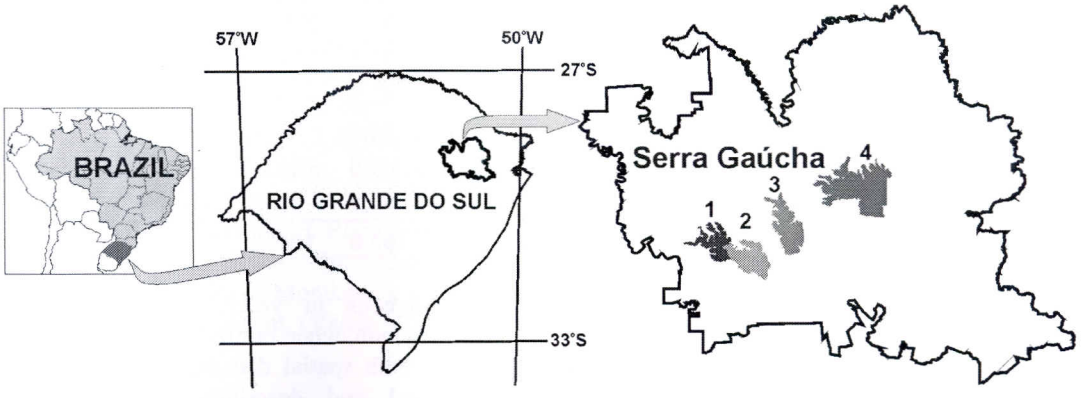


Figure 1. Location of the four geographic indications within Serra Gaúcha, state Rio Grande do Sul, Brazil (1 = Monte Belo ; 2 = Vale dos Vinhedos ; 3 = Pinto Bandeira ; 4 = Altos Montes).

According to Köppen's classification, the regional climate type is Cfb [14], and viticultural climate is classified as IH+1 IF-1 IS-2, humid, warm temperate, with temperate nights [15]. In general, natural conditions are heterogeneous, with complex relief and high variability of soil types [16].

Material used comprises a digitized soil map in scale 1:50.000 of Serra Gaúcha, descriptive and analytical data contained in the soil survey report, and digital georeferenced boundaries of the four geographic indications. ArcGIS was the software used for spatial analysis.

First the soil map was clipped with the boundaries of the four areas, aiming to identify individual soil types within each geographic indication and to calculate absolute and proportional areas. After, soil descriptive and analytical data were interpreted to identify favorable and undesirable properties of each soil type, from the wine point of view.

3 RESULTS AND DISCUSSION

Considering the four geographic indications, an overall number of 23 soil mapping units were found. Table 1 shows that the DO Vale dos Vinhedos presents the highest number of individual soil types (15), followed by IPs Pinto Bandeira (13), Altos Montes (11) and Monte Belo (9). On the other hand, the number of polygons on the soil map shows that spatial distribution of soils in Altos Montes (165) and Monte Belo (118) is notably more heterogeneous than in Vale dos Vinhedos (62) and Pinto Bandeira (43). In part this is due the more fragmented landscape of the first two areas, meaning that from the soil point of view vineyard location may affect wine quality more strongly.

Table 1. Number of soil types and number of individual polygons per soil order in four geographic indications of Serra Gaúcha (VV = Vale dos Vinhedos, PB = Pinto Bandeira, AM = Altos Montes, MB = Monte Belo).

Soil order	Number of soil types				Number of polygons on soil map			
	VV	PB	AM	MB	VV	PB	AM	MB
Ultisols	3	3	2	1	11	12	10	7
Inceptisols	4	5	6	3	6	7	49	20
Mollisols	4	1	0	0	4	2	0	0
Entisols	2	2	2	2	37	18	88	69
Oxisols	2	2	1	3	4	4	18	22
Total	**15**	**13**	**11**	**9**	**62**	**43**	**165**	**118**

Table 2 shows that, in terms of occurrence in the four study areas, Ultisols and Inceptisols are dominant. In Vale dos Vinhedos, Pinto Bandeira and Altos Montes most frequent soil types are Inceptisols, whith low natural fertility and low organic matter content. Altos Montes also presents a significant area of Oxisols, with low natural fertility and medium level of organic matter. In Monte Belo, in turn, near 50% are Ultisols, with low natural fertility and medium to high levels of organic matter. Mollisols occurr only in Vale dos Vinhedos and Pinto Bandeira, presenting high natural fertility and high levels of organic matter. Entisols, that are shallow soils, are more frequent in Pinto Bandeira and Altos Montes.

Table 2. Area (ha) and proportion (%) per soil order in four geographic indications of Serra Gaúcha (VV = Vale dos Vinhedos, PB = Pinto Bandeira, AM = Altos Montes, MB = Monte Belo).

Soil order	Area (ha)				Proportion (%)			
	VV	PB	AM	MB	VV	PB	AM	MB
Ultisols	2686.5	2462.5	3204.8	2795.7	37.1	30.3	18.4	49.8
Inceptisols	3100.6	2710.3	6956.8	2059.6	42.8	33.4	40.0	36.7
Mollisols	1042.1	621.7	0.0	0.0	14.4	7.7	0.0	0.0
Entisols	362.3	1468.5	2768.6	279.6	5.0	18.1	15.9	5.0
Oxisols	53.3	851.7	4454.1	474.1	0.7	10.5	25.6	8.5
Total	**7244.8**	**8114.8**	**17384.3**	**5609.0**	**100.0**	**100.0**	**100.0**	**100.0**

Considering the climate in Serra Gaúcha (1.736mm mean annual rainfall), some properties can be regarded as unfavorable for wine quality, such as deep soils and/or with high levels of natural fertility, clay content, and organic matter. In this context, Mollisols are not recommended because of high fertility and organic matter content. Ultisols are also undesirable because of poor drainage and high levels of aluminium and organic matter. On the other hand, Inceptisols are preferred since they present good internal drainage, low fertility and low contents of organic matter. Oxisols are favorable as they are well drained and tend to produce more structured wines due higher levels of Iron oxides. Finally, Entisols have no limitations and, because of exceptional drainage, they can be specially advantageous in years affected by the El Niño phenomenon, when rainfall increases even more.

Along with spatial distribution, interpretation of soil analytical and descriptive information allows to identify similarities and differences between the four geographic indications in Serra Gaúcha. Beside areas that present soils with good suitability there are also significant areas where it is not recommended to establish vineyards. Thus, soil must be taken into account to understand the terroir, and soil information is useful both to help planning new vineyards as to give a guide when changing varieties in some already cultivated area.

4 CONCLUSIONS

Although the four geographic indications fall within the same wine production region, they present considerable differences in relation to soil types and properties. Due to the observed spatial variability, soil information can help to tipify and differentiate wines produced in each of the four geographical indications at Serra Gaúcha. However, for specific recommendations at vineyard scale, it is recommended to gather more information about soils at local level since the available soil map is not detailed enough for that purpose.

ACKNOLEDGEMENTS

To FINEP-APL Vinhos, for the financial support of this and other studies aiming to qualify the Brazilian wine sector.

REFERENCES

1. http://www.isa.utl.pt/riav/Pdf/2005/, visited online on November 23th 2011.
2. F. MANDELLI, J. TONIETTO, H. HASENACK, E. WEBER, 2005. Zoneamento climático para a produção de uvas para vinhos de qualidade: índice heliotérmico para o Estado do Rio Grande do Sul. In: Congresso Brasileiro de Agrometeorologia, 15, Campinas. Anais... Campinas: Sociedade Brasileira de Agrometeorologia, 1 CD-ROM.
3. E.C. SARMENTO, E.J. WEBER, H. HASENACK, J. TONIETTO, F. MANDELLI, 2006. Topographic modeling with GIS at Serra Gaúcha, Brazil: elements to study viticultural terroir. In: Terroir Viticoles 2006 Congrès Internacional, 6., 2006, Bordeaux. Terroirs Viticoles 2006. Bordeaux: Vigne et vin Publications Internacionales, v. 1, 365-372.
4. J. TONIETTO, F. MANDELLI, E.J. WEBER, H. HASENACK, 2006a. Zonage climatique viticole et cartographie numérique du Rio Grande do Sul - Brésil, par les indices du Systéme CCM Géoviticole. In: Terroir Viticoles 2006 Congrès Internacional, 6., 2006, Bordeaux. Terroirs Viticoles 2006. Bordeaux: Vigne et vin Publications Internacionales, v. 1, 21-26.
5. J. TONIETTO, H. HASENACK, E.J. WEBER, E.C. SARMENTO, I. FALCADE, 2006b. Eléments de viticulture de montagne dans les indications géographiques Vale dos Vinhedos et Pinto Bandeira dans la Serra Gaúcha, Brésil. In: Congresso Internazionale Sulla Viticultura di Montagna e in Forte Pendenza, 1., 2006, Saint-Vincent (Vallée d'Aoste). Proceedings... Saint-Vincent (Vallée d`Aoste): CERVIM.
6. C.A. FLORE, H. HASENACK, E. WEBER, E. SARMENTO, 2007. Potencial edáfico da Serra Gaúcha, Brasil para viticultura. In: Congresso Latinoamericano De Viticultura e Enologia, 11., 2007, Mendoza. Anais... Mendoza: CLEIFRA, 1 CD-ROM.
7. F. MANDELLI, J. TONIETTO, H. HASENACK, E. WEBER, 2007. Caractérisation Mésoclimatique de la Vituculture de la Serra Gaúcha, Brésil. In: Congreso Sobre Clima y Viticultura, 2007, Zaragoza. Anais... Zaragoza: Ministério da Agric. Pesca e Aliment: OIV: GESCO: Gob. Aragon, 1 CD-ROM.
8. C.A. FLORES, R.O. PÖTTTER, P.J. FASOLO, H. HASENACK, E. WEBER, 2003. Levantamento semidetalhado dos solos para o zoneamento vitícola da Serra Gaúcha. Congresso Brasileiro de Viticultura e Enologia, 10. Anais. Bento Gonçalves/RS.
9. http://ainfo.cnptia.embrapa.br/digital/bitstream/CNPUV/8133/1/cir055.pdf, visited online on March 18th 2012.
10. http://ainfo.cnptia.embrapa.br/digital/bitstream/CNPUV/9754/1/cir076.pdf, visited online on March 18th 2012.
11. E. VAUDOUR, 2002. Journal of Wine Research, 13 (2), 117-141.
12. G. JONES, N. SNEAD, P. NELSON, 2004. Geoscience Canada. 31, 167-178.
13. J. COIPEL, B.R. LOVELLE, C. SIPP, C. VAN LEEUWEN, 2006. J. Int. Sci. Vigne Vin. . 40 (4), 177-185.
14. J.A. MORENO, 1961. Clima do Rio Grande do Sul. Porto Alegre, Brasil, 42 p.
15. J. TONIETTO, A. CARBONNEAU, 1999. Análise mundial do clima das regiões vitícolas e de sua influência sobre a tipicidade dos vinhos: a posição da viticultura brasileira comparada a 100 regiões em 30 países. In: 9th Congresso Brasileiro de viticultura e enologia, Bento Gonçalves. Embrapa Uva e Vinho, Bento Gonçalves, 75-90.
16. E.C. SARMENTO, E.J. WEBER, H. HASENACK, J. TONIETTO, F. MANDELLI, 2006. Topographic modeling with GIS at Serra Gaúcha, Brazil: elements to study viticultural terroir. In: Terroir Viticoles 2006 VI Congrès Internacional, 2006, Bordeaux. Terroirs Viticoles 2006. Bordeaux: Vigne et vin, Publications Internacionales, v.1, 365-372.