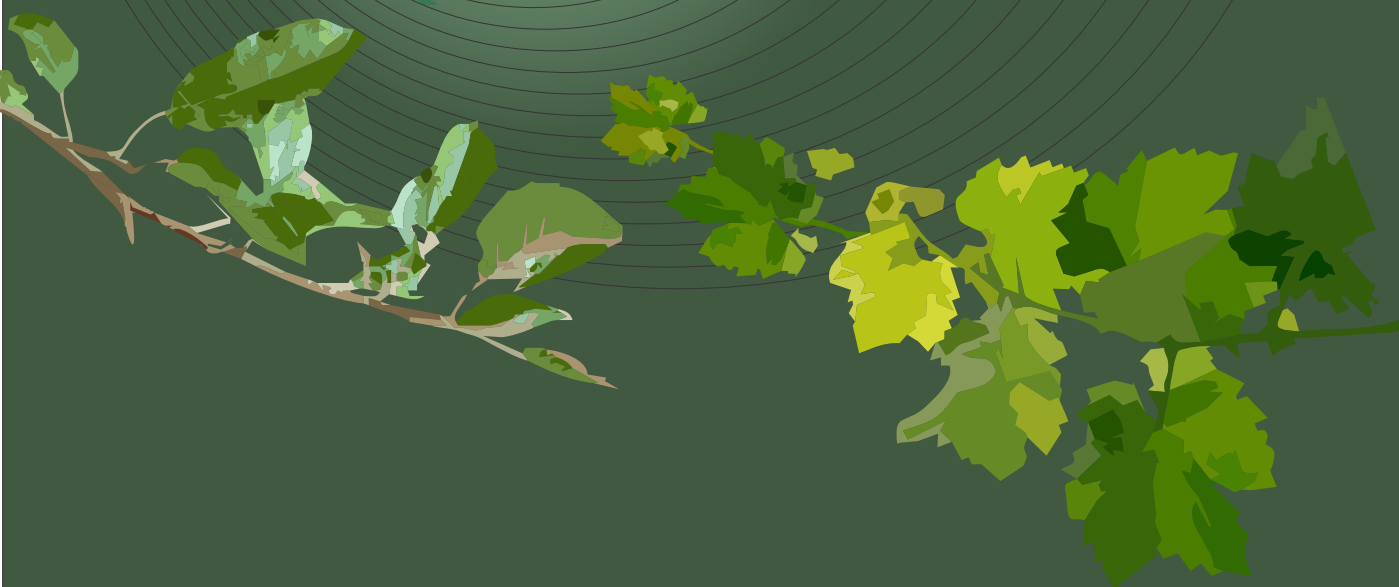


Embrapa Grape & Wine International Relations



Embrapa

Grape & Wine

Embrapa Grape & Wine **International Relations**



*Brazilian Agricultural Research Corporation
Brazilian Grape & Wine Research Center
Ministry of Agriculture, Livestock and Food Supply*

Embrapa Grape & Wine **International Relations**

Bento Gonçalves, Brazil
2011

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Mauro Celso Zanus

Assistant Director of Administration

Flávia Luzia Basso

Assistant Director of Transfer of Technology

Alexandre Hoffmann

International Issues Manager

Jorge Tonietto (2007 - 2011)

Copies of this publication may be obtained by writing to:

Embrapa Uva e Vinho
Rua Livramento, 515
Caixa Postal 130
95700-000 Bento Gonçalves, RS, Brazil
Phone: +55 54 3455-8000 Fax: +55 54 3451-2792
<http://www.cnpuv.embrapa.br>
sac@cnpuv.embrapa.br

Publications Committee

President: Mauro Celso Zanus

Executive Secretary: Sandra de Souza Sebben

Editing Team of this Publication

Technical editors: Jorge Tonietto, Alexandre Hoffmann and Flávio Bello Fialho

Graphic Designer: Luciana Elena Mendonça Prado

Bibliographic Standards: Kátia Midori Hiwatashi

Texts elaborated by the team of researchers from Embrapa Grape & Wine: Adalécio Kovaleski, Alberto Miele, Alexandre Hoffmann, Ana Beatriz Costa Czermainski, Andrea de Rossi Rufato, Carlos Alberto Ely Machado, Celito Crivellaro Guerra, César Luís Girardi, Fábio Rossi Cavalcanti, Flávio Bello Fialho, George Wellington Bastos de Melo, Gildo Almeida da Silva, Gilmar Ribeiro Nachtigall, Giuliano Elias Pereira, Henrique Pessoa dos Santos, João Caetano Fioravanco, João Dimas Garcia Maia, Joelsio Jose Lazzarotto, Jorge Tonietto, José Eduardo Boffino de Almeida Monteiro, José Fernando da Silva Protas, Loíva Maria Ribeiro de Mello, Lucas da Ressurreição Garrido, Luciano Gebler, Lucimara Rogéria Antonioli, Luís Fernando Revers, Marco Antônio Fonseca Conceição, Marcos Botton, Mauro Celso Zanus, Osmar Nickel, Patrícia Silva Ritschel, Paulo Ricardo Dias de Oliveira, Reginaldo Teodoro de Souza, Régis Sivori Silva dos Santos, Rosemary Hoff, Rosemeire de Lellis Naves, Samar Velho da Silveira, Silvio André Meirelles Alves, Thor Vinícius Martins Fajardo, Vera Quecini.

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Acknowledgment

The Challenger of Breaking a New Landscape through the Labour Force




The artist Aldo Locatelli painted in 1954, the mural “From the Italic Cradle to the Brazilian Homeland”, a commemorative work for the 75th anniversary of the Italian colonization in Rio Grande do Sul (RS), Brazil. The painting (2,75 m x 30,8 m) is located in the Centro Administrativo Municipal de Caxias do Sul, RS.

The work was chosen to illustrate this publication since it portrays elements of the Italian immigrants who, since 1875, has been exploring the natural landscape of the native vegetation in the region, currently known as Serra Gaúcha, which was inhospitable at that time. The region begins to be built by man, by virtue of work, with courage and determination. Thus the largest center of wine production in Brazil flourished in this place and it has been the location of the headquarters of Embrapa Grape & Wine, since 1975.

Tribute to the artist Aldo Locatelli by the outstanding work that emphasizes the pride and history of the Gaúcho people.

Special thanks to the Municipal Secretary of Culture of Caxias do Sul - Mr. Antonio Feldmann for releasing the photos of Aldo Locatelli's paintings which illustrate this publication (Source: Brambatti, L.E. Locatelli no Brasil. Caxias do Sul, RS: Belas Artes, 2008. 240p.; Instituto Vêneto from Caxias do Sul).

An Exceptional Man-made Landscape



The artist Anástacio Orlikowski translated the vineyards into paintings that embroider the landscape of Italian Colonization built since 1875, currently known as Serra Gaúcha, in the state of Rio Grande do Sul, Brazil. The sinuous landscape of hills and valleys of the region in an area of high biodiversity, blended with vineyards and a typical architecture in small family farms where the culture of the grapevine is predominant.

Working in thousands of small family farms, the Italian grower of Serra Gaúcha has transformed the space into territory by producing grapes and wines. This agro industry also boosted the socioeconomic aspect for the local industry consolidation, solidified changes in a little more than a century from the beginning of the Italian colonization. This is the territory of Serra Gaúcha that a significant part of the effort of RD&I Embrapa Grape & Wine seeks to ensure the sustainability of wine production.

Tribute to the artist Anastácio Orlikowski by the expressive paintings of vitiviniculture in the Serra Gaúcha that illustrate this publication.

Thanks to the Chamber of Industry and Commerce of Bento Gonçalves for authorizing the reproduction of the artist's paintings.

Jorge Tonietto
International Issues Manager

Artists that illustrate this publication



Aldo Locatelli was a painter who left extraordinary marks in churches and other public areas of the state of Rio Grande do Sul, Brazil. Italian from Bérgamo, he came to the State in 1948, invited by the bishop of Pelotas, Dom Záttera, to paint the São Francisco de Paula Cathedral. His appointment was made by the Apostolic Nuncio in Paris, who later would become Pope John XXIII. From this work, which caused great impact, he received invitations to perform numerous other paintings on walls and panels in the cities of Porto Alegre, Santa Maria, Caxias do Sul and others (including São Paulo). He soon became fond of the State of Rio Grande do Sul, adopting and reproducing it in expressive and impressive work. He brought his wife, had kids and became a professor of the Instituto de Artes da Universidade Federal do Rio Grande do Sul. He died in 1962, at 47 years of age.

Known as "Mestre das aquarelas" – Master of aquarelle - ,

Anastácio Orlikowski was born in Porto Alegre, State of Rio Grande do Sul, Brazil, in 1924. He got a degree in fine arts from the Universidade Federal do Rio Grande do Sul in 1946, specialized in modeling, drawing the human figure, the natural, pictures, drawings, carving and sculpture. His work is part of the official and private collections in Brazil and other countries. He was a drawing and aquarelle instructor in Casa



das Artes in Bento Gonçalves, RS, and today many artists use the techniques they learned from him. His contribution to the art of Bento Gonçalves is marked, besides the paintings, by his love for the city and for its people. He currently lives in Pinto Bandeira, where he maintains a permanent atelier and gathers small groups to study drawing and aquarelle.

"The one who travels, loves the world. The artist, even more, because he paints on the trip and then travels through of its paintings."

Anastácio Orlikowski

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Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- *immigrants arrival.*
(Source: Brambatti, 2008)



Foreword

Embrapa Grape & Wine is one of the 45 Decentralized Units of the Brazilian Agricultural Research Corporation – Embrapa. Over its 35 years of existence, it has been generating results for the viability of the productive chains of vitiviniculture and fruit production of temperate climate. It operates throughout the country by establishing partnerships with public and private companies and institutions, in the fields of education, research and extension, which allowed the advance of validation and transfer of technologies to benefit Brazilian farmers and the society.

With a multidisciplinary team of highly qualified scientists, analysts and staff assistants, distributed over three physical bases (Bento Gonçalves and Vacaria in Rio Grande do Sul and Jales in São Paulo), and a solid physical infrastructure, Embrapa Grape & Wine has great advantages in carrying out its activities, due to its proximity to the major producing regions under different soil and climatic conditions. Moreover, research is also conducted in Observation Units installed in commercial areas of growers throughout Brazil.

The challenges pursued by Embrapa Grape & Wine are based on the search for quality, added value and differentiation of products obtained by the development of new technologies or production systems with less environmental impact. They are also based on the development and establishment of geographical indications, on the creation of new cultivars obtained through classical genetic breeding or assisted by molecular mapping, and on the mitigation and production of technologies to face global climatic change. Work developed at the knowledge frontier is enabling the unit to meet future demands, thus ensuring the competitiveness of the productive chains.

The technologies developed and validated by Embrapa Grape & Wine in different biomes found in Brazil, facilitated by its large territory, makes possible its adaptation to other production regions of grapes, wine, juice, and temperate climate fruits of the world, with similar conditions. The internal progress of knowledge is being shared for the development of activities in other countries, as well as the training of local agents.

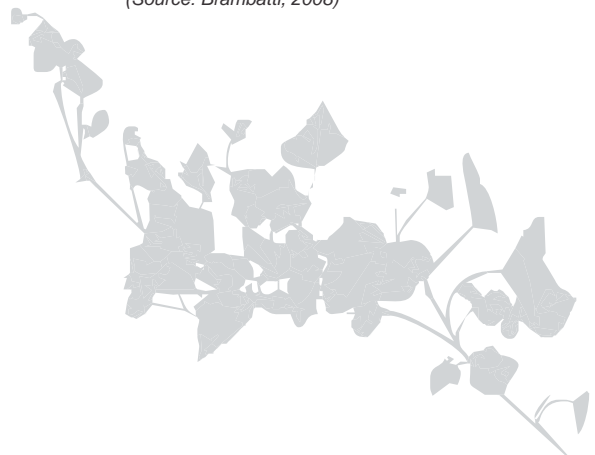
Embrapa Grape & Wine, following world trends, has been undergoing internationalization processes, following the paths outlined by the Directors of the Research Corporation. The first is characterized by the formation of part of its researchers team in the best universities abroad, which allowed the growth of knowledge in vitiviniculture and fruit growing of temperate climate. The second one involves the setting of actions of international cooperation between Embrapa Grape & Wine and research institutions abroad, either to solve problems of common interest, or for the transfer of technology and knowledge aiming at the development of other countries.

This publication presents a set of information focused on the potential of international cooperation of Embrapa Grape & Wine.

Lucas da Ressurreição Garrido
Director-General
Embrapa Grape & Wine



Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- detail of the Caaguás indians who witnessed the immigrants arrival.
(Source: Brambatti, 2008)



1. Embrapa Grape & Wine

1.1. History and Evolution

Embrapa Grape & Wine, located in Bento Gonçalves, Rio Grande do Sul, was established on August 26, 1975, about two years after the establishment of the Brazilian Agricultural Research Corporation - EMBRAPA.

It occupies the area of the former Bento Gonçalves Experimental Station, established in 1941 as a result of federal policy at the time, which included the creation of Viticulture and Enology Stations in Brazil, including the states of Rio Grande do Sul, Paraná, São Paulo and Minas Gerais.

Created initially as a State Research Unit of Embrapa (*UEPAE of Bento Gonçalves - Unidade de Execução de Pesquisa de Âmbito Estadual*) because of the socioeconomic importance of the wine industry of Serra Gaúcha, this institution has gradually expanded its scope of operation. In 1985 the Unit was classified as a National Grape & Wine Research Center, since it had already been consolidating its operation as a reference centre of viticulture and enology research across the country, and also coordinating

the National Vitiviniculture Research Program (*PNP de Vitivinicultura*).



Since 1992, due to the increasing demand for technological solutions for temperate climate fruit production in Serra Gaúcha and Campos de Cima da Serra (RS), the Unit has expanded its mission, also starting to operate with research and development in temperate climate fruit production.

To fulfill its institutional mission, the Unit consists of three physical bases: the headquarter (Bento Gonçalves, Rio Grande do Sul), where most of the research and administration teams are located, mainly concentrated on viticulture and enology; the Experimental Station of Tropical Viticulture (Jales, São Paulo) established in 1993, which supports the grape breeding program and the research in tropical viticulture; and the Experimental Station of Temperate Climate Fruits (Vacaria, Rio Grande do Sul), incorporated into Embrapa Grape & Wine in 1994, focused on research, development and innovation (RD&I) in temperate fruit growing, emphasizing the cultures of apple and pear.

Embrapa Grape & Wine is one of the 45 Decentralized Units of Embrapa, a company under the Ministry of Agriculture, Livestock and Food Supply (MAPA). Embrapa is responsible for implementing the institutional policy of MAPA and other ministries that are related to agriculture, livestock and forests regarding RD&I to the supply chains of food, fiber and biofuels for the different Brazilian biomes, as well as coordinating the National System of Agricultural Research (SNPA). Acting highly focused on seeking solutions for RD&I that contribute to the economic, social and environmental competitiveness and sustainability of growers in different dimensions and scales, Embrapa completed 37 years of existence in 2010, with almost 9 thousand employees around the country, including about 2 thousand researchers.

The practice of cooperation and partnership in generating and transferring of knowledge is embedded in the institutional culture of Embrapa, narrowing relations with universities, technical schools, state or private institutions of research and technical assistance, government institutions, growers and private sector representative bodies. Besides the intense performance in Brazil, Embrapa has expanded international cooperation activities either through virtual labs abroad, known as Labex; or through the interchange established by researchers with institutions around the world.

1.2. Mission and Vision

The mission of Embrapa Grape & Wine is to provide solutions for research, development and innovation for sustainability of vitiviniculture and temperate climate fruit growing for the benefit of the Brazilian society.

Its vision is to be a center of excellence, with international recognition generating knowledge, technology and innovation for viticulture, enology and temperate climate fruits. To achieve this mission and vision, the Unit is defined under the following values: excellence in management and research, socio-environmental responsibility, ethic, respect for diversity and pluralism, commitment and cooperation.

The definition of the mission, vision and values of the Unit as well as the definition of its strategic goals is made through the Unit's Director Plan (*Plano Diretor da Unidade - PDU*), now in its fourth edition, for the 2008-2011 quadrennial. It presents to the Brazilian society its institutional commitment focusing on a robust scientific program.



1.3. Staff

Currently Embrapa Grape & Wine has a staff of 163 employees, of whom 40 are researchers. Of these, 35 have Ph.D. and 5 have M.Sc. The support team works in different areas of assistance research such as in laboratories, experimental fields and greenhouses, administration, communication, business and technology transfer.

The Unit has a partnerships policy that enables integration with universities, state research institutions, private companies and associations representing growers and wine industry. These partnerships allow a wider fund raising and aggregation of competencies. Likewise, technicians and graduate and undergraduate students develop their activities at the Unit, allowing their technical improvement.

Although the focus of the Unit is research and development, the institution has the interest that the knowledge generated turns into innovation, gains of competitiveness and sustainability for the grower. In order to do that, it maintains an Area of Transfer of Technology designed to organize and implement the actions of business communications, strengthening of technology partnerships, providing information and conducting training courses focusing on multiplier agents.

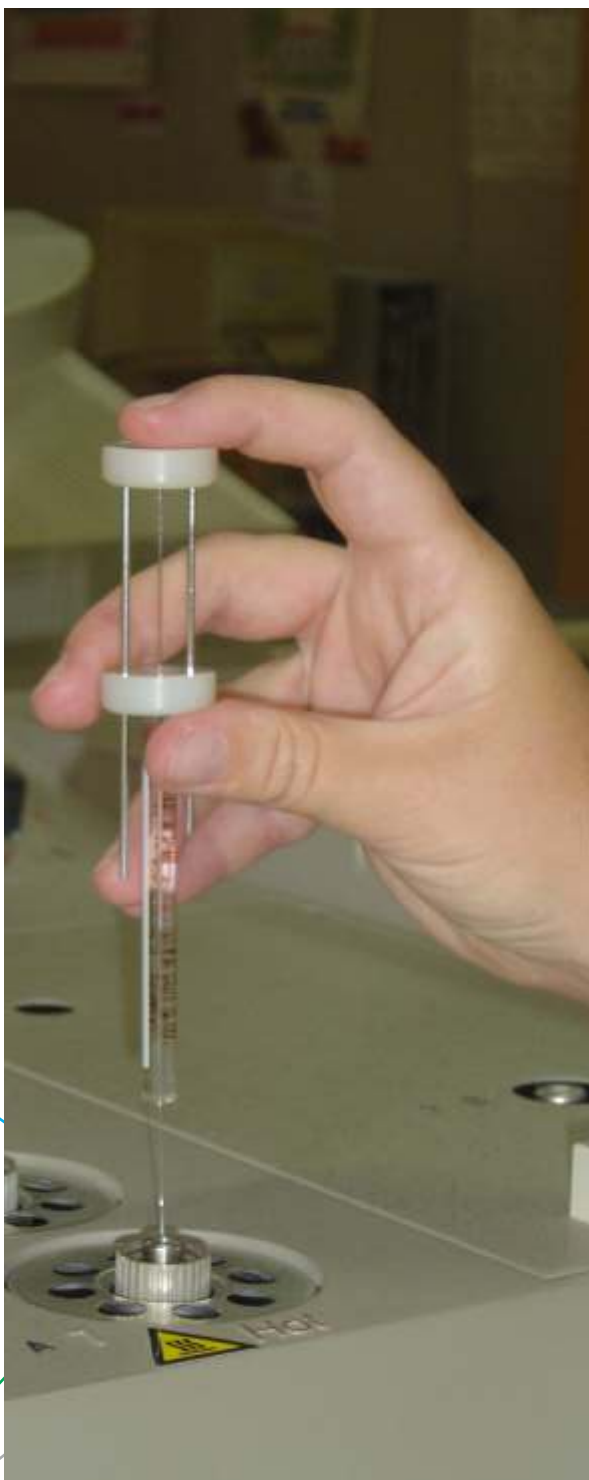


List of the researchers and their field of work
may be accessed at the address:
<http://www.cnpuv.embrapa.br/equipe/pesquisa/>

1.4. Structure and Management

Embrapa Grape & Wine has established its organizational structure in tune with Embrapa, and its management team composed of a director-general, an assistant director for Research and Development, an assistant director for Administration and an assistant director for Transfer of Technology, besides supervisors for the Experimental Stations.

In 2010, the Unit's budget was of US\$5,2 million, except salaries, being US\$1,8 million used for payment of expenses and US\$3,4 million applied to investments. The research program was performed with a budget of US\$0,6 million from Embrapa and an additional of US\$0,3 million raised from other sources.





Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- to prepare the soil, to sow and build the house and breast feed the little kid.
That's how the colony started what later would become the industrial cities.
(Source: Brambatti, 2008)



2. Experimental Fields

The Unit has three physical bases, two located in the state of Rio Grande do Sul and one in the state of São Paulo.

2.1. Embrapa Grape & Wine Headquarter

Embrapa Grape & Wine Headquarter is located in the city of Bento Gonçalves, in the main wine producing area of Brazil, 29°10' South latitude and 51°32' West longitude at an altitude of 640m. It concentrates most of the team of researchers and research support, management, communication and business structures. Embrapa has several laboratories, greenhouses and experimental fields. It occupies an area of 100 hectares with 42 hectares for agricultural use, the remainder being occupied by buildings, woods, roads and areas of steep topography.



2.2. Experimental Station of Tropical Viticulture

Created in 1993, the Experimental Station of Tropical Viticulture is based in Jales, northwest of the State of São Paulo, 20°10' South latitude and 50°36' West longitude at an altitude of 433m.

The Station has management structure, laboratory support, experimental fields and greenhouses. It hosts most of the field work of the genetic breeding program of the Unit, since the weather conditions of the region make it possible to accelerate the development of new cultivars. The Station also gives technological support to the grapevine cultivation on tropical and subtropical climates of Brazil.



2.3. Experimental Station of Temperate Climate Fruits

It was established by Embrapa Temperate Climate in 1981 in an old area of the Ministry of Agriculture, Livestock and Food Supply and transferred to Embrapa Grape & Wine in 1994. The Station is located in the city of Vacaria, 28°31' South latitude and 50°53' West longitude at an altitude of 970m in the region of Campos de Cima da Serra, one of the poles of Brazilian production of apples and others temperate climate fruits.



The Experimental Station of Temperate Climate Fruits hosts the greatest part of the research program with temperate climate fruits of the Unit, focusing on the production of apples, pears, stone fruits and small fruits. The Station has management structure, laboratory support, experimental fields and greenhouses.



Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- *harvesting time, when women predominate.*
(Source: Brambatti, 2008)



3. Laboratories

The Unit has several laboratories to fulfill its institutional mission. The main elements of each one are presented below.

3.1. Climatology Laboratory

Meteorological and climatic conditions are essential for viticulture and temperate climate fruit production. The laboratory manages a chain of automatic weather stations used to form a historical data base and to support research and experiments. The studies are conducted in different climatic scales: macroclimate, mesoclimate and plant level microclimate. This laboratory gives support to harvest monitoring, phytosanitary warning systems, zoning of agricultural crops and evaluation of potential impacts of climate changes. It also provides data for the productive sector (viticulture and apple production) and cooperates with the official system of national weather stations.



3.2. Soil and Tissue Analysis Laboratory



The laboratory supports research activities and executes routine analysis of soil and tissues. Its main research lines are: nutrition and fertilization of temperate climate fruit trees; development of substrates for protected growth of strawberries; studies of soil contamination by copper; management of cover crops in perennial fruit production; nutrient cycles in temperate climate fruit trees; reuse of agricultural industry residues; influences of soil management on nutrient uptake by perennial fruit species.

3.3. Plant Science Laboratory

The research projects on plant science developed at the Experimental Station of Temperate Climate Fruits aim to assess the performance of somatic mutations of Gala and Fuji – varieties that account for more than 90% of the Brazilian production and other apple cultivars. Studies include



phenology, production and fruit quality. Further research projects also include the management and conduction of plants to increase production, improve quality and reduce production costs.

3.4. Remote Sensing and GIS Laboratory

The laboratory gives support to projects of geographical indications and precision agriculture, and contributes for vineyard register and zoning of agricultural products. It analyses the present and past cultivated area by remote images and performs data integration in GIS (Geographic Information System) to support decision making. It applies advanced technologies using satellite and aerial images, analyzing the spectral behavior of vegetation, soils and rocks and their integration with orbital images. To support several studies in the area of agriculture and soil science, the laboratory created and published an orbital georeferenced database of Rio Grande do Sul, including satellite images, georeferenced mosaic and altimetical data obtained through specialized Web sites and research project resources.



3.5. Phytopathology Laboratory

This laboratory develops projects in the areas of diagnosis, monitoring, epidemiology and control of diseases of grapevine and temperate climate fruits, emphasizing apple and pear trees. All actions are aimed at developing technologies that increase the competitiveness of the productive sector through greater production efficiency and economic, social and environmental sustainability.



3.6. Entomology Laboratory

Entomology research at Embrapa Grape & Wine is conducted in two physical bases: Bento Gonçalves (headquarter) and Vacaria, both research stations located in Rio Grande do Sul State. The development of ecologically-based pest management of insect and mite pests in orchards (apple, stone fruits), vineyards and strawberries are the focus of the research team. The studies are focused on biology and ecology of pests and natural enemies helping fruit growers achieve economic success while farming using environmentally and socially sustainable practices. The team also works to utilize less-disruptive approaches (e.g., Bt, pheromones, plant extracts, biorrational insecticides)



that help conserve natural enemies in the farm ecosystem, promoting naturally based biological control. The efforts also include the implementation and regulation of Integrated Fruit Production and Organic farming in viticulture and temperate climate fruits.

3.7. Virology Laboratory



The laboratory carries out research and develops diagnostic tools for the molecular and biological characterization of virus diseases of grapevines and temperate climate fruit crops. It is also responsible for the production of basic virus-free and virus-tested propagation material of rootstocks and scions of grapevines and rosaceous fruit and the biological, molecular and serological testing of materials issued from virus removal procedures.

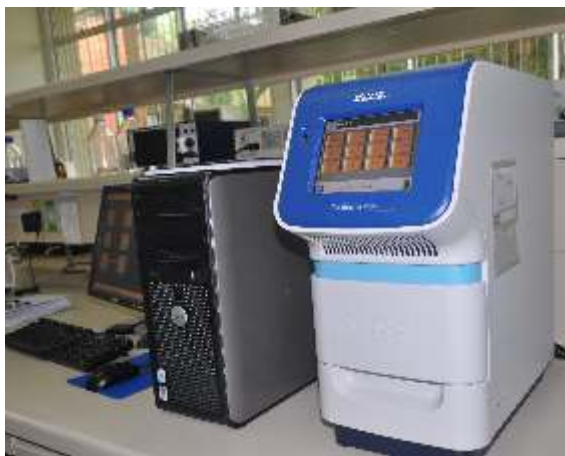
3.8. Tissue Culture and Biotechnology Laboratory

The laboratory is responsible for *in vitro* plant development and functional genomics studies. It also provides support for the grapevine, apple and pear breeding programs by *in vitro* germplasm maintenance, plant propagation, large-scale grapevine embryo rescue and genetic engineering of model- and woody-plant species. Virus removal by *in vitro* thermo- and chemotherapy and meristem isolation are performed as well.



3.9. Plant Molecular Biology Laboratory

The main goal of the research activities is to understand the genetic and molecular basis of important agronomical traits of grapevine, apple and pear. Adaptation to different environmental conditions, fruit quality and disease resistance are the subjects under investigation using genetics and molecular approaches like the construction of genetic linkage maps, determination of gene expression profiles and evaluation of genetic markers for assisted selection and germplasm management.



3.10. Plant Physiology Laboratory

Research in this laboratory aims to guarantee yield and increase quality of fruit for industry or to be fresh marketed, mainly for grapevine and apple



trees. In grapevines, the main actions are: plasticulture; trellis system and water relationship vs enological quality; physiology of grapevine vs marmarodes (*Eurhizococcus brasiliensis*) interaction; and thermal exigences of cultivars vs global climatic changes. In apple trees, the focus of research are in models and metabolic characterization of bud dormancy to help the breeding of new cultivars fitted to global climatic changes or to new regions with low chilling availability.

3.11. Physiology and Postharvest Technology Laboratory



The lines of research include methods for preserving the quality of fruits (cold storage and use of modified and controlled atmosphere), molecular mechanisms of aging, mechanical damage and physiological response of fruits, prevision of quality and aspects of postharvest in the Integrated Production of Fruits. The main products studied are table grapes, pomaceous (apples and pears), peach and berries (strawberry, blackberry, raspberry and blueberry).

3.12. Microbiology Laboratory

This laboratory deals with both the qualitative and quantitative estimations of microorganisms of industrial interest and with products of their metabolism. It is involved in performing and planning the optimization of physiological parameters and culture media to allow quick and optimal growth. These activities have given positive impact on microorganism production for biological control. The autochthonous yeasts, the ones naturally found in grape's skin, are specially selected to give the wine specific organoleptic qualities and contribute to the definition of the terroir. These yeasts were collected from vineyard of Bento Gonçalves and Monte Belo do Sul (State of Rio Grande do Sul), and São Francisco River Valley (State of Pernambuco). The influence of several fungicide treatments on yeast metabolic activity has also been investigated. The laboratory has a collection of autochthonous yeast cultures of academic interest and of real and potential agro-industrial applications.



3.13. Enology Laboratory

The laboratory performs general analysis of grapes, musts, wines and other derivatives. The main analysis are: alcohol, titratable acidity, volatile acidity, ashes, dry extract, total anthocyanins, total tannins, color intensity and hue, sulfites, index of total phenolic compounds, pH, density, total reducing sugars, hybrid test. The techniques practiced in this lab meet, above all, the demands of viticulture and enology research by performing analysis of quality control of products in development. It is also an important tool for technology transfer, analyzing and, thus delineating the quality of products elaborated by producers who had been previously trained to elaborate wines, juices and other derivatives via specific educational programs.



3.14. Chromatography and Mass Spectrometry Laboratory

It is essentially a laboratory for research (experimental studies), though some other external demands for the industry can also met. It performs analysis by techniques of atomic absorption spectrometry, gas and liquid chromatography and mass spectrometry. It works on almost all the research projects of the Unit, with emphasis on the enological ones. Mineral compounds in soils, grapes and wines, several volatile compounds in wine, grape juice and musts (primary aromas), polyphenols (stilbenes, anthocyanins, tannins, and their polymerization products), organic acids, proteins and peptides are analyzed in the projects.



3.15. Microvinification Laboratory

It is often difficult to assess the effects of different genetic materials and different techniques of grape cultivation without the technological procedures to make wine and its derivatives. The natural substances responsible for wine aromas, for example, arise only after the complex chemical reactions resulting from fermentation and winemaking. This laboratory is structured for elaboration, on a small scale, of wines and juices from experiments carried out on the field in the areas of plant breeding, studies of new practices of growing and tests of plant ecophysiology and zoning of grape growing. Enology experiments are also made, including technologies of winemaking, fermentation, storage and conservation. The laboratory has cold chambers, equipments for crushing, pressing, fermentation, filtration and storage which simulate the winemaking in semi-industrial scale, enabling the production of wines, juices and sparkling wines of high quality.

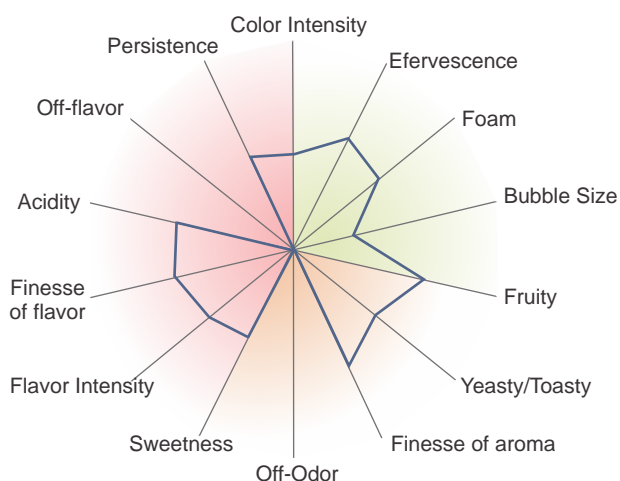


3.16. Sensory Analysis Laboratory

Through the senses of sight, smell and taste, the wine reveals the genetic effects of grapes, geographical origin, growing systems and the technologies of elaboration and fermentation. Embrapa Grape & Wine has a laboratory structure and a highly qualified team to evaluate wines of several experiments performed locally and at the wine industries. Wine characteristics are described with appropriate technical vocabulary and techniques are used for quantitative descriptive analysis (QDA), which allows building an image of sensations of aroma and taste perceived by the tasters. In collaboration with entities of the productive sector, this laboratory provides physical structure, equipment and highly qualified technicians for the assessments of quality control and sensory description of wines from scientific projects of geographical indications, such as Vale dos Vinhedos, Pinto Bandeira, Monte Belo, Farroupilha and Altos Montes. Also, in a partnership with the Brazilian Association of Enology – ABE, Embrapa Grape & Wine coordinates annually the wine assessments of the National Evaluation of Wine, an internationally renowned event, which presents the state-of-the-art in wine production from all wine regions of Brazil. Evaluations are conducted by more than 90 enologists from the wine industry of Brazil.



Aprobelo Brut Sparkling Wine 2006
Sample 012/06



3.17. Enology Innovation Laboratory

One of the peculiar experimental facilities at Embrapa Grape & Wine is the Enology Innovation Laboratory. It hosts an experimental winery with potential capacity installed for winemaking in semi-industrial scale of up to 100,000 liters annually of wines, juices, sparkling wines and distilled beverages. This structure is intended to support the research program through validation of new technologies with potencial to be appropriated by the wine production chain. Quality reference products, such as grape juices are elaborated through research projects of technological innovation. These products also serves for institutional promotion.





Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- *vintage*.

(Source: Brambatti, 2008)



4. Main Technologies Developed

Embrapa technologies aim to solve existing problems in the productive sector, seeking positive impacts on Brazilian agribusiness. These are some technologies developed by Embrapa Grape & Wine.

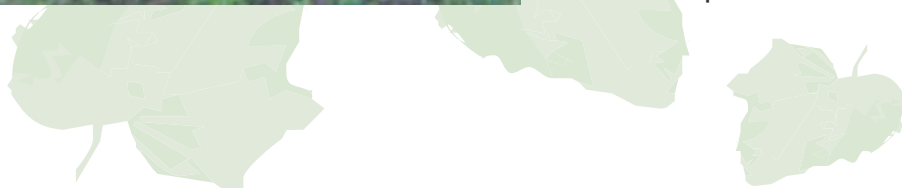
4.1. Technologies for Vitiviniculture in Tropical Regions

Production Systems of American/Hybrids Table Grapes

Research was conducted to develop a production system for *Vitis labrusca* table grapes. These include the evaluation of grape cultivars and grape rootstock, training and trellis systems, pruning systems, use of growth



regulators to promote break of dormancy (ethephon, hydrogen cyanamid and alternative products), use of growth regulators to increase the size of the berries, and the use of pesticides to control fungal diseases such as grapevine downy mildew, rust and leaf blight. The production system has been improved in the last years and has been used by the growers in the cultivation of Niagara Rosada, the only variety of this group cultivated under Brazilian tropical conditions.



Production Systems of Fine Table Seedless Grapes

Research was developed to evaluate grape cultivars, training and trellis systems, pruning systems, use of growth regulators to increase berry size and testing of pesticides to control fungal diseases. Research is also being conducted on growing the varieties BRS Morena and BRS Clara under plastic cover, which has allowed reducing the number of pesticide applications, harvesting grapes with quality in the rainy season due to lower incidence of rotten bunches, as well as avoiding fissure in berry skins.



Production Systems of American/Hybrids Grapes for Processing

These were developed and improved through research such as evaluation of grape cultivars and grape rootstock, training systems, pruning systems, evaluation of products to promote break dormancy of buds and chemical control of major diseases (downy mildew, rust and leaf blight). The recommended production system has been used by growers in new grape production regions focused on elaboration of juices and table wines. The cultivars BRS Cora, BRS Violeta, and BRS Carmem were introduced into the traditional production system in order to improve the quality of juice and table wine based on the cultivar Isabel.



Technologies for Fine Wine Production in Tropical Climate

The production of grapes for winemaking process of fine wines in tropical climate, in the Northeast of Brazil, started about 25 years ago. In 2002, Embrapa with other partner institutions, started adaptation tests of *Vitis vinifera* varieties for production of wines with better color, aroma and flavor under tropical conditions. Some varieties presented very good adaptation to the soil and climate of the region, such as Tempranillo, which is being used for red wines, representing actually about 12% of the commercial vineyards. It represents the second most planted variety in the region, after Syrah, which represents about 60% of the vineyards, resulting in wines with original qualitative characteristics, contributing to increase the value and recognition of Brazilian Tropical wines. Other varieties presenting good adaptation to the region are Petit Verdot, representing about 2% of the vineyards of the region, and Barbera, not yet employed in commercial wines.



4 2 .New Cultivars of Grapes Created in the Genetic Breeding Program































Since 1977, Embrapa Grape & Wine has been developing the Genetic Breeding Program called *Uvas do Brasil* aiming to obtain new cultivars for *in natura* consumption and for processing. The objective of the Program is to develop cultivars adapted to the Brazilian soil and climate conditions – including the regions of temperate and tropical climate -, which produce quality grapes for different purposes and that are resistant and tolerant to the main vineyard diseases (anthracnose – *Elsinoe ampelina*; downy mildew – *Plasmopara viticola*; powdery mildew – *Uncinula necator*, and rot of bunch, caused by *Botrytis cinerea* and other agents).
































Germplasm used in this work includes the species *Vitis vinifera* and *Vitis labrusca*, besides wild tropical species, as well as complex interspecific hybrid developed in Europe after the spread of phylloxera. To offer support to *Uvas do Brasil* Program, Embrapa Grape & Wine keeps a Germplasm Bank with about 1.300 accesses of genus *Vitis* and related species. Most of the collection was already evaluated for the characteristics of interest of the program. *Uvas do Brasil* Program uses classical methods, as the introduction of materials, mass selection, clonal selection and the production of hybridization followed by many steps of selection.

The last step of evaluation of a potential new cultivar is performed in the production areas. Tools such as micropropagation and embryo rescue are incorporated into the program. It is commonly used the development of genetic profiles built with molecular markers, aiming to protect the new cultivars generated. In the last years, several new cultivars of table grapes with seeds or seedless, as well as grapes for elaboration of wines and juices have been released by *Uvas do Brasil* Program.

Grape Cultivars of Embrapa Grape & Wine

Recommendation of Use in the Different Climates of Brazil

							
	BRS Morena	BRS Linda	BRS Clara	BRS Carmem	BRS Lorena	BRS Margot	Moscato Embrapa
Tropical Climate							
Subtropical Climate							
Temperate Climate							
Table Grape							
Seedless Table Grape							
Grape for Processing Table Wine							
Grape for Processing Grape Juice							

							
	Dona Zilá	Tardia de Caxias	BRS Rúbea	Concord Clone 30	Isabel Precoce	BRS Cora	BRS Violeta
Tropical Climate							
Subtropical Climate							
Temperate Climate							
Table Grape							
Seedless Table Grape							
Grape for Processing Table Wine							
Grape for Processing Grape Juice							

4.3. Integrated Production for Safe Food and Sustainable Agriculture

Embrapa Grape & Wine pioneered in the establishment of Integrated Fruit Production (PI) in Brazil, based on the demand from the apple farmers. Combining economic viability, environmental sustainability, worker safety and food security, the PI includes all stages of production. The success with apple was the basis to set the Integrated Production (PI), currently a policy of the Brazilian Government.

The partnership of technicians from Embrapa and other institutions with producers allowed the development of a technically and economically viable production system, as well as defined the support routine for certification. After 4 years of field testing, in 2003 the system started to be officially accepted by the Ministry of Agriculture (MAPA).

As a result, PI is today an important evidence, for both importers and Brazilian consumers, of the availability of an environmentally friendly, socially just and technically feasible system capable of providing safe food at competitive prices, with the necessary traceability.



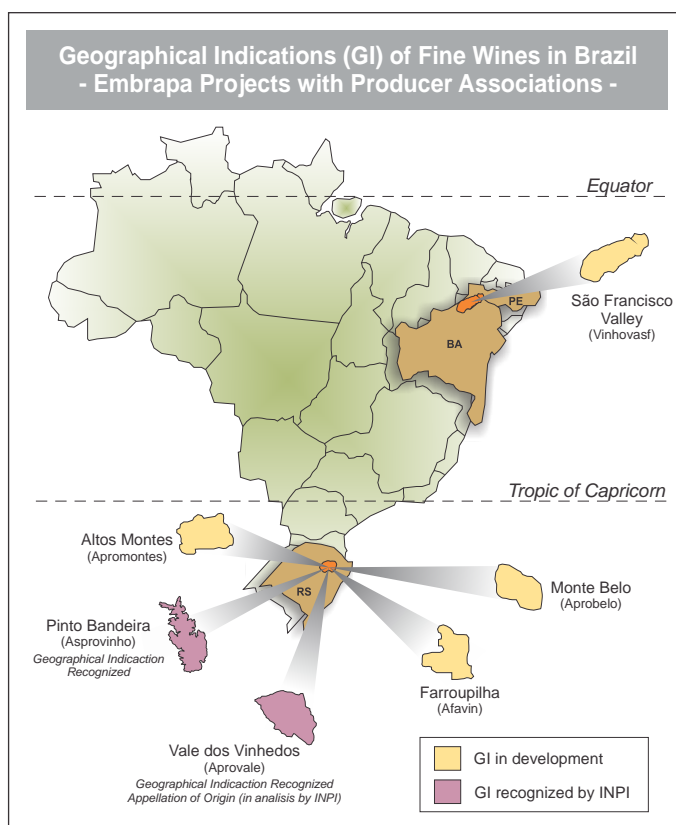
4.4. Geographical Indications



Embrapa Grape & Wine has pioneered in Brazil in the concept of Geographical Indications, developing work in the area since the beginning of the 1990s. For this, methodologies have been used for vitiviniculture zoning, which include spatial study of climate, soil, topography, soil use, and research in adaptation and cultivar-soil-climate interactions, as well as the enological potential from the different wine areas, including chemical and sensory characterization of the products and their typical qualities. To do so, Geographic Information Systems, experimental winemaking and chemical and sensory evaluation of wines were used.

As the main results, in 2002 Vale dos Vinhedos was officially recognized the first Geographical Indication of fine wines and sparkling wines from Brazil.

In 2010, Pinto Bandeira, the second Geographical Indication, was recognized. Others are under development. The results have been important elements of national and international cooperation.



4.5. Virus-free Propagation Material of Grapevines and Temperate Climate Fruits

For over two decades healthy propagation material has been delivered to growers and nurseries, which had a substantial impact on the quality of Brazilian grape and wine products. More recently a foundation stock of healthy, virus-free material of temperate climate fruit tree and small fruit species has been established of materials obtained by tissue culture, thermo- and chemotherapy. These technological inputs help Brazilian production to maintain quality and to increase its international competitiveness. It is also an effort to harmonize the quality of Brazilian propagation material with international standards, ensuring profitability to commercial orchards, reducing environmental impacts.





Detail of the Mural "From the Italic Cradle to the New Brazilian Homeland"
Aldo Locatelli
- *the construction of buildings.*
(Source: Brambatti, 2008)



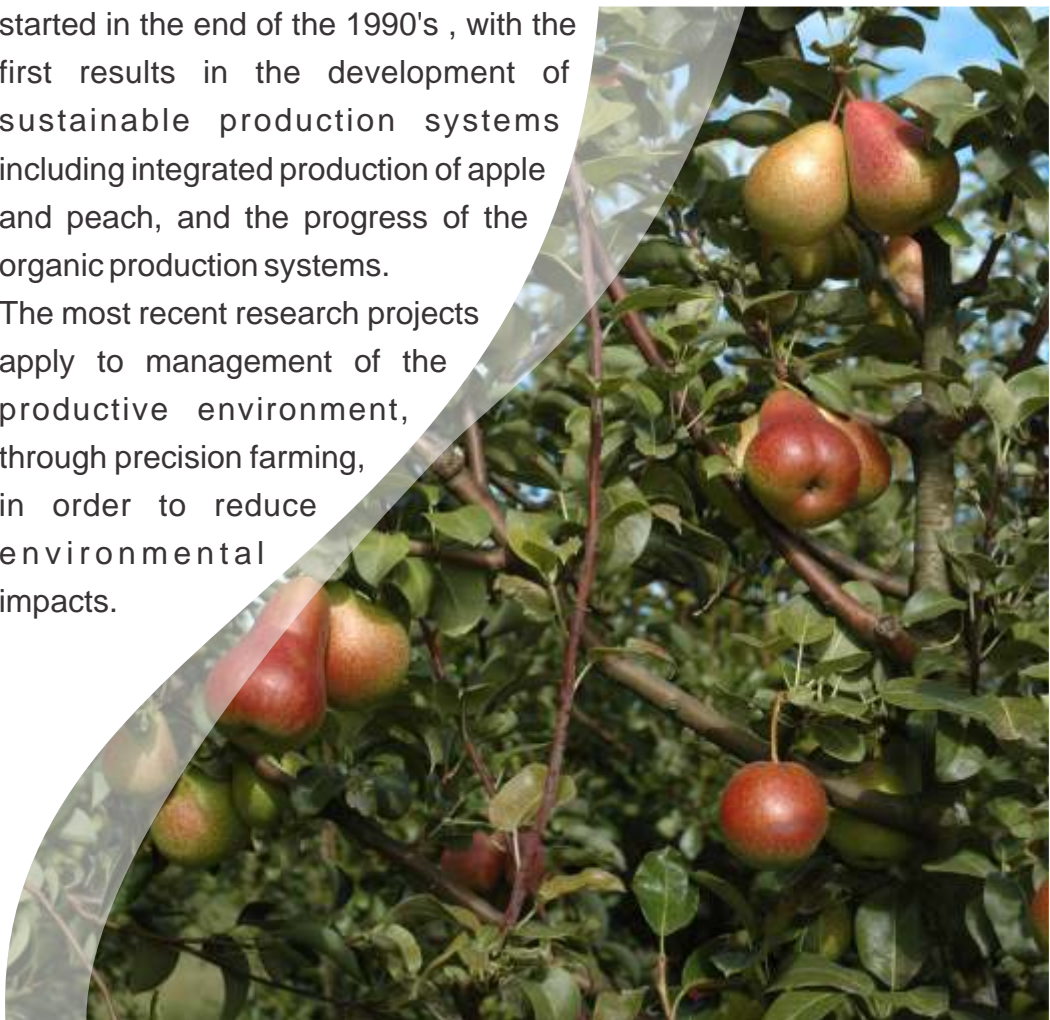
5. Common Current Demands in Brazil and Abroad

Some of the work of Embrapa Grape & Wine in solving demands of the agricultural production that also are challenges for the international scientific community, such as the topics listed below.

5.1. Sustainability of Vitiviniculture and Temperate Climate Fruit Production

Embrapa Grape & Wine is committed to the generation of socioeconomic and environmentally sustainable production systems. Research projects started in the end of the 1990's , with the first results in the development of sustainable production systems including integrated production of apple and peach, and the progress of the organic production systems.

The most recent research projects apply to management of the productive environment, through precision farming, in order to reduce environmental impacts.



5.2. Safe Food

Embrapa Grape & Wine has been working on the topic of safe food, on nourishing practices that promote health and well-being and to investigate biological mechanisms that compromise human health.



Research is being conducted on new tools to identify the presence of pesticides residues and microbiological contaminants in grape and apple and their derivatives. Filamentous fungi can form mycotoxins and compromise human health. Osmophilic and osmotolerant yeast modify the nourishing value of the juice and interfere in the organoleptic characteristics.

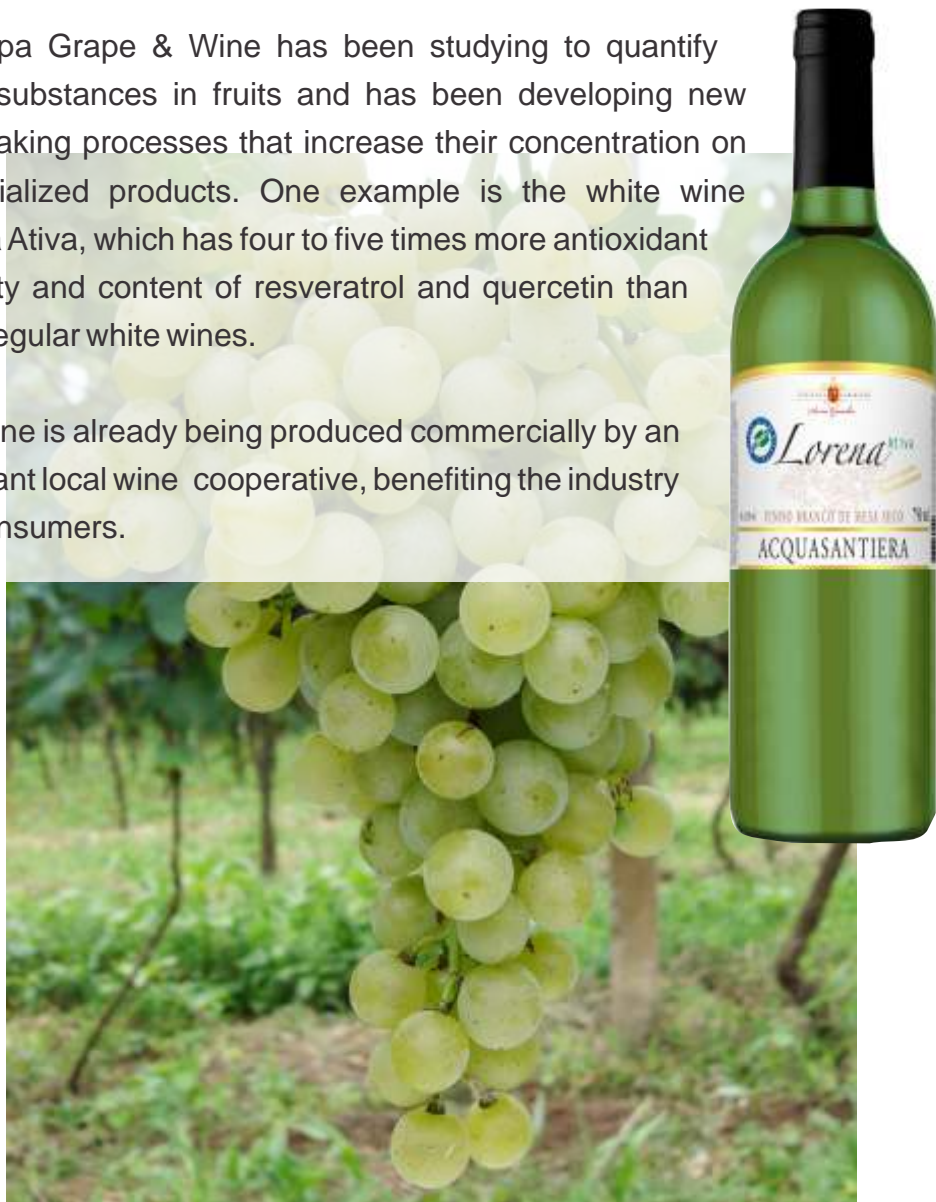
Embrapa Grape & Wine also evaluates the presence of biologically active substances important to human health in agricultural products, with emphasis on polyphenols and antioxidants.

5.3. Functional Food

Fruits are an excellent source of beneficial substances to human health. Grapes, apples and small fruits like blackberries, raspberries and blueberries contain high concentration of phenolic substances (flavonoids, hydroxycinnamates and stilbenes), which have high antioxidant potential, and acts by other cell mechanisms that have been recently unveiled by science.

Embrapa Grape & Wine has been studying to quantify these substances in fruits and has been developing new winemaking processes that increase their concentration on industrialized products. One example is the white wine Lorena Ativa, which has four to five times more antioxidant capacity and content of resveratrol and quercetin than other regular white wines.

This wine is already being produced commercially by an important local wine cooperative, benefiting the industry and consumers.



5.4. Sustainability of Small Rural Properties

Family based farming sustainability depends on the availability of suitable technologies and policies to facilitate their adoption in small properties. Once these constraints are met, the necessary conditions are created to improve development policies based on the quality of agricultural and agro-industrial products (table grapes, wines, juices and other derivatives from grape and wine, fruits and derivatives). These policies can promote a leap in competitiveness and sustainability of small rural properties with family based agriculture, which is one of the challenges of Embrapa Grape & Wine.



5.5. Zoning for the Orderly Development

Geographical technologies available today permit the study, characterization and zoning of areas and regions of high complexity in terms of natural and human factors. They contribute to reach a new level in the organization of productive sectors, directing investments toward areas with higher farming potential, resulting in gains in competitiveness. There is an increasing potential for research in this area, in order to enable an oriented expansion of viticulture over new boundaries, as well as to better qualify traditional areas. Zoning has been incorporated into the philosophy of preservation work in the biomes in which the production of grapes and fruits has been installed, ensuring not only environmental sustainability, but also sustainability of industrial agribusiness.



Typical house in the Serra Gaúcha Region
Anastácio Orlikowski



6. International Cooperation Actions

International Cooperation of Embrapa Grape & Wine has increased throughout its history. The cooperation mechanisms are varied, including among others, participation or promotion of international events, conducting training courses, consultancy, development of projects in partnership with the international community, mobility of researchers, including post doctoral and cooperation agreements.

The insertion of Embrapa Grape & Wine in network and international institutions is also part of the cooperation and interchange policy. Examples are the participation in the groups of experts of the International Organization of Vine and Wine – OIV, membership in the international network of UNESCO Chaire - *Culture & Traditions of Wine*, the development of cooperative projects in the scope of CYTED - Ibero-American Program for Science, Technology and Development, and as associate partner of Vinifera Euromaster.

Some concrete cases of international cooperation are listed below.



6.1. MCC System and Viticulture Climate Zoning

The methodology known as “Geoviticulture Multicriteria Climatic Classification System” was developed by Embrapa Grape & Wine with SupAgro from Montpellier, France. It is structured into 3 complementary climatic indexes. It has been widely used in several vitivinicultural countries around the world, having most of the work developed with the help of Embrapa Grape & Wine.

One of the most important work involved 10 Ibero-American winegrowing countries, including Argentina, Bolivia, Brazil, Chile, Cuba, Mexico, Peru, Spain, Portugal and Uruguay in studies of characterization and climatic zoning as elements of diversity of different producing regions from different countries.



6.2. International Consortium on Advanced Biology

Embrapa (in Brazil) and Agropolis (Cirad, IRD and INRA, in France), created, in 2007, the International Consortium on Advanced Biology (CIBA), whose objective is to consolidate an efficient strategy of technical-scientific international cooperation, sharing the necessary means, capacities, knowledge and expertise necessary to study and explore the diversity of genetic resources of plants and identify important genes and essential characteristics to the programs of genetic improvement.



Under CIBA two themes were defined to be worked by Embrapa Grape & Wine and French institutions: climate adaptation and fruit quality.

The first one has been approached from 2008, with the project "AppleClim - Apple Genetic Improvement: innovative strategies in the development of cultivars adapted to climatic conditions of the South of Brazil ", with the collaboration of UMR GenHort (INRA, Angers) and of UMR DAP (CIRAD/INRA/SupAgro) and supported by Embrapa.

The second theme is in the project "Molecular Aspects related to the maturation of apple fruit", approved by CAPES/Cofecub (2009), in cooperation with PPGCTA/UFPel, UMR Génomique et Biotechnologie des Fruits (INRA/INP-ENSAT) and UMR GenHort (INRA, Angers).

6.3. Cydia Eradication Program in Brazil

The program permitted interchange of specialists from several countries, including the Cydia Eradication Program in British Columbia, using the technique of sterile insect.

The participation in the project approved by International Energy Agency - IAEA, permitted the participation of Embrapa Grape & Wine in many meetings coordinated by the agency (Canada, South Africa, Argentina and Brazil) which had the participation of about 12 countries.

In 2005, with the support of IAEA, Brazil received consulting from an expert in cost-benefit of programs. The success of Cydia eradication in Brazil also resulted in a consultancy in Chile in order to eradicate the pest in the Patagonian region.





Vineyards in the Serra Gaúcha Region
Anastácio Orlikowski



7. Competence Areas for International Cooperation

Embrapa Grape & Wine has an outstanding participation in Brazil in research lines involving viticulture, enology and temperate climate fruits.

Genetic breeding areas are highlighted in viticulture, with focus on the development of seedless varieties,

disease and pest resistant genetic materials and varieties with high productivity and industrial quality (colour, aroma and taste) for wine, grape juice or *in natura* consumption.



The research center develops production system for small family properties, with studies in rational use of soils, virology and integrated control of pest and diseases, agricultural and wine zoning and the definition of scientific and technological bases for geographic indications. In the area of enology, highlighted projects are the characterization of physical-chemical and sensorial properties of Brazilian wines, development of winemaking technologies adapted to new regions - including the tropical region of the Rio São Francisco Valley (Pernambuco, Bahia), identification of new yeasts and microbiological control of fermentation.

Key lines of research in apples and pears involve selection of new genetic materials, the development of postharvest technologies and sustainable production systems, Integrated Production certification and fertilization oriented by the Diagnosis and Recommendation Integrated System - DRIS.

7.1. Viticulture and Enology in Tropical Regions

Technologies for table grape production of *Vitis vinifera* and *Vitis labrusca* in tropical conditions are part of the expertise for international cooperation of Embrapa Grape & Wine. Tropical vitiviniculture represents an important socio-economic activity for the Brazilian Agribusiness. In 2010, about 7 million liters of fine wines were produced in the São Francisco Valley, in an area of about 700 hectares, which represents 15% of the national market of fine wines.

The activity employs around 6.000 people, direct or indirectly. Brazil is pioneer in conducting research projects on tropical wines. In 2006, an Enology Laboratory was built at Embrapa Tropical Semi-Arid, in Petrolina, in the state of Pernambuco, to develop technological innovations which allow characterizing, describing and understanding the effects of edaphic and climatic semi-arid tropical conditions on grape quality and wine composition.



Tropical wines from the Northeast of Brazil present a different chemical evolution as compared and observed in wines from temperate climate regions. Ongoing research works are studies about the effects of regional climate and microclimate of the grapevines, in different production periods during the year, soil characterization, vineyard training and trellis systems, evaluation of different clones, rootstocks, irrigation systems, mineral nutrition and harvest date on the physical-chemical characteristics of the grapes.



Different enological protocols and their effects on the chemical, metabolic and sensory characteristics of tropical wines are being evaluated. Wines are being analyzed to determine the phenolic and aromatic composition, which will allow to describe and explain the quality and typicity of tropical wines. The results being obtained are opening new frontiers of knowledge in wine production for tropical regions.

The Unit also promotes in partnership with Embrapa Tropical Semi-Arid the International Symposium on Tropical Wines, aiming to intensify the scientific and technological interchange among the producing countries, in order to boost its development and to give international recognition to this new vitiviniculture.

7.2. Grape Breeding and Embrapa Cultivars



Since the 1970's a theme of excellence of Embrapa Grape & Wine has been the Breeding Program *Uvas do Brasil*. It resulted in obtaining new cultivars that are being commercially grown in Brazil; the grapes are either for fresh consumption or for the elaboration of juices and wines.

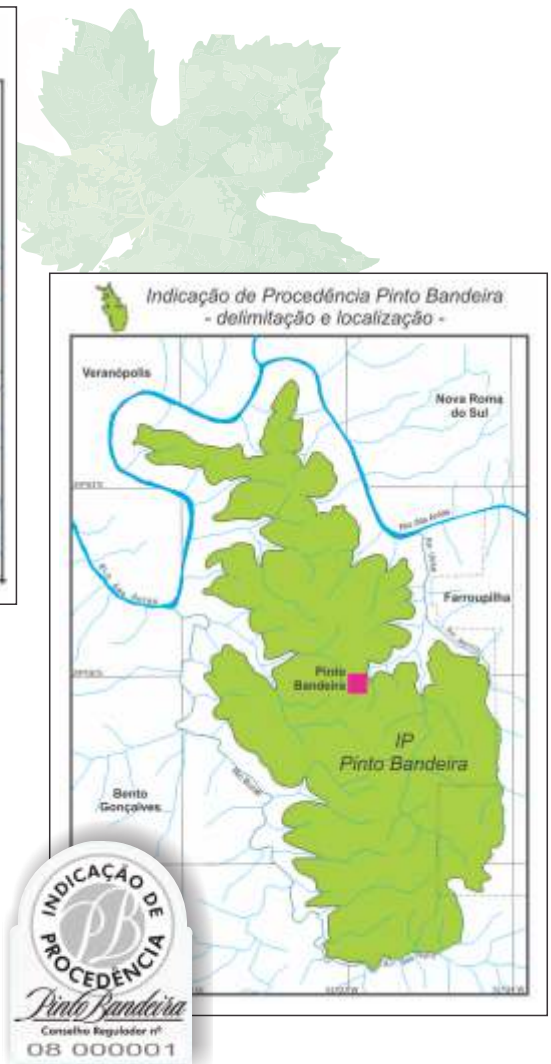


The interchange of genetic material, the maintenance of a germplasm bank, the techniques and processes of genetic improvement and the evaluation of materials in every step up to industrial validation are made by the Units research staff.



7.3. Vitiviniculture Zoning and Geographical Indications Development

In the issue of Geographical Indications - GI, the competence includes studies of the characterization of natural factors of climate, soil, topography and delimitation of the geographical area, especially for GI of fine wine and sparkling. Characterization of quality and typicity of the products and development of Regulations of Use and Systems of Control and Traceability is also done, in partnership with winery and farmer associations.



In geo technologies, the Unit is qualified in remote sensing and geographic information system (GIS) to apply for zoning and decision making elements.

In the area of viticultural climate zoning, the Unit has expertise through the methodology of the Geoviticulture MCC System, with many applications, including: viticultural climate classification of reference regions of the world; identification of the climatic groups of regions and regions with similar viticultural climate; characterization of viticultural climate with Intra-Annual Variability (subtropical/tropical climate); viticultural impact evaluation associated to global climate changes; characterization of the magnitude of the viticultural climate (vintage effect); study of the relationship of the viticultural climate with grape and wine quality; identification, characterization and zoning of new potential viticultural regions. Detailed information on the subject, including bibliographies are available at <http://www.cnpuv.embrapa.br/tecnologias/ccm/ccm.en.html>.

7.4. Technologies of Pest Control including Plant Mortality by Soil Pathogens, and Virology of Grapevines and Temperate Climate Fruit Crops

Soil pathogens, insect pests and nematodes are an important mortality factor associated with planting of new vineyards and orchards. Embrapa's Grape & Wine team of plant pathologists, entomologists and breeders focus part of its research efforts in developing strategies to overcome plant mortality based on resistant rootstocks for soil pests, soil management, biocontrol and chemical control. The main species investigated in vineyards are *Fusarium*, *Cylindrocarpon*, *Eurhizococcus brasiliensis* and *Daktulosphaira vitifoliae*.



In the area of virology lines of interest for cooperation are the following: biological and molecular characterization of viral diseases and development of virus-free propagation material of grapevines and fruit crops of temperate climate, as well as production of tools for virus diagnosis such as antibodies produced against recombinant antigens.





Vineyards in the Serra Gaúcha Region
Anastácio Orlikowski

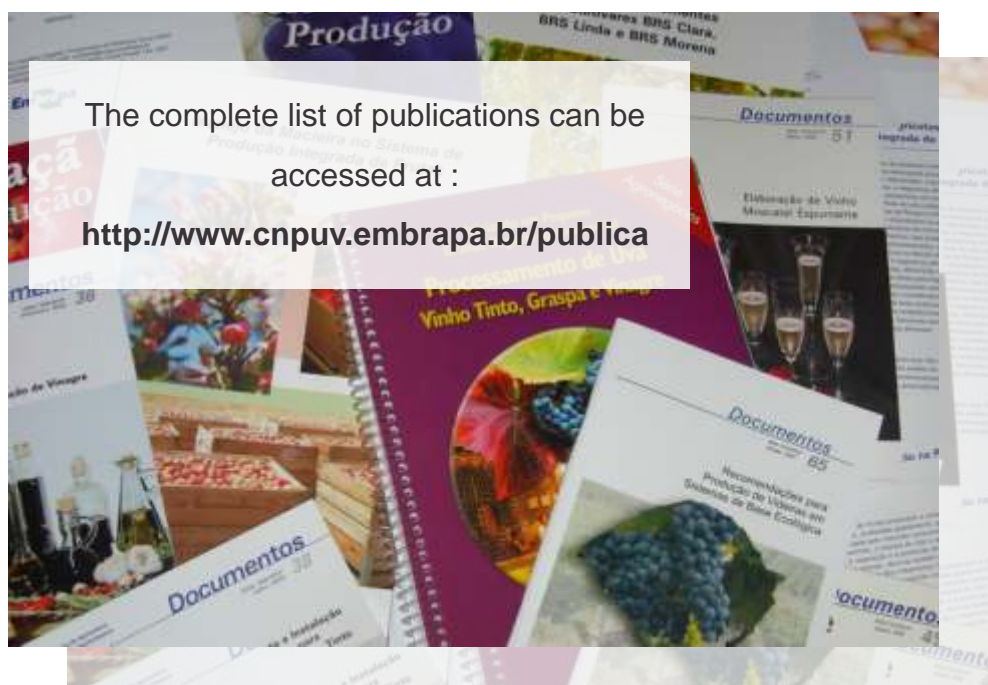


8. Publications

Embrapa Grape & Wine publishes books and journals in many themes related to its work.

The publications of Embrapa Series include:

- Proceedings
- Technical articles
- Research and development bulletins
- Technical circulars
- Technical reports
- Document series
- Books
- Lectures
- Production system
- Theses and Dissertations





Viticultural landscape in the Serra Gaúcha Region
Anastácio Orlikowski



9. National Relations

To fulfill its institutional mission, Embrapa Grape & Wine cooperates with numerous public and private institutions in Brazil.

Some of them are listed below:

ABC - Agência Brasileira de Cooperação/Ministério das Relações Exteriores

ABE - Associação Brasileira de Enologia

ABIN - Agência Brasileira de Inteligência

ABPM - Associação Brasileira de Produtores de Maçã

ACAVITIS - Associação Catarinense dos Produtores de Vinhos Finos de Altitude

AFAVIN - Associação Farroupilhense de Produtores de Vinhos, Espumantes,
Sucos e Derivados

AGAPOMI - Associação Gaúcha dos Produtores de Maçã

AGROPADO - Cooperativa Agropecuária Pradense

APROBELO - Associação dos Produtores de Vinho de Monte Belo do Sul

APROMONTES - Associação dos Produtores dos Vinhos dos Altos Montes

APROVALE - Associação dos Produtores de Vinhos Finos do Vale dos Vinhedos

APROVINIS - Associação dos Produtores de Vinhos Finos do Vale do Submédio
São Francisco

ASPROVINHO - Associação dos Produtores de Vinhos de Pinto Bandeira

CAP - Cooperativa Agrícola de Pirapora

CATI - Coordenadoria de Assistência Técnica Integral/São Paulo

CEAGESP - Companhia de Entrepósitos e Armazéns Gerais de São Paulo/MAPA

COROL - Cooperativa Agroindustrial de Rolândia

CPEG - Consórcio de Produtores de Espumantes de Garibaldi

EMATER-PR - Instituto Paranaense de Assistência Técnica e Extensão Rural -
Paraná

EMATER-RS - Associação Riograndense de Empreendimentos de Assistência
Técnica e Extensão Rural - Rio Grande do Sul

EPAGRI - Empresa de Pesquisa Agropecuária e Extensão Rural de Santa
Catarina

EPAMIG - Empresa de Pesquisa Agropecuária de Minas Gerais

FEPAGRO - Fundação Estadual de Pesquisa Agropecuária do Rio Grande do Sul

IAC/APTA - Instituto Agrônomo de Campinas/Agência Paulista de Tecnologia dos Agronegócios

IBRAVIN - Instituto Brasileiro do Vinho

IB-SP - Instituto Biológico de São Paulo

IBt - Instituto de Botânica de São Paulo

INMETRO - Instituto Nacional de Metrologia, Normalização e Qualidade Industrial

INPE - Instituto Nacional de Pesquisas Espaciais

INPI - Instituto Nacional da Propriedade Industrial

LANAGRO - Laboratório Nacional Agropecuário/MAPA

LAREN - Laboratório de Referência Enológica/Secretaria da Agricultura, RS

MAPA - Ministério da Agricultura, Pecuária e Abastecimento

MMA - Ministério do Meio Ambiente

MRE - Ministério das Relações Exteriores

SEBRAE - Serviço de Apoio às Micro e Pequenas Empresas

SPVINHO - Instituto Paulista de Vitivinicultura

UCS - Universidade de Caxias do Sul

UDESC - Universidade do Estado de Santa Catarina

UEL - Universidade Estadual de Londrina

UEM - Universidade Estadual de Maringá

UERGS - Universidade do Estado do Rio Grande do Sul

UFPEL - Universidade Federal de Pelotas

UFPR - Universidade Federal do Paraná

UFRGS - Universidade Federal do Rio Grande do Sul

UFRPE - Universidade Federal Rural de Pernambuco

UFSC - Universidade Federal de Santa Catarina

UFSM - Universidade Federal de Santa Maria

UNESP - Universidade Estadual de São Paulo

UNICAMP - Universidade Estadual de Campinas

URI - Universidade Regional Integrada

USP - Universidade de São Paulo

UVIBRA - União Brasileira de Vitivinicultura

VALEEXPORT - Associação de Produtores e Exportadores de Hortigranjeiros e Derivados do Vale do São Francisco

VINHOVASF - Instituto do Vinho do Vale do São Francisco



Embrapa Grape & Wine
Anastácio Orlikowski



10. Contacts

For more information on the work of Embrapa Grape & Wine, you can contact directly with the Unit at the address below:

Embrapa Uva e Vinho

Rua Livramento, 515

95700-000 - Bento Gonçalves, RS, Brazil

Phone: +55-54-3455-8000

Fax: +55-54-3451-2792

E-mail: sac@cnpuv.embrapa.br



The internet site can also be accessed for information about Embrapa Grape & Wine.

<http://www.cnpuv.embrapa.br>

For more information in english about Research Centers of Embrapa in Brazil and Virtual Laboratories and Projects of Embrapa abroad (LABEX)
- North America, Europe, Africa, Asia and Latin America:

<http://www.embrapa.br/english>





Ministry of
Agriculture, Livestock
and Food Supply

