International Journal of Advanced Engineering Research and Science (IJAERS)
Peer-Reviewed Journal
ISSN: 2349-6495(P) | 2456-1908(O)
Vol-8, Issue-6; Jun, 2021
Journal Home Page Available: https://ijaers.com/
Article DOI: https://dx.doi.org/10.22161/ijaers.86.43

Environmental sustainability and biodynamic cultivation of Vitis viniferas grapes in the Serra Gaúcha region, Brazil

Cláudia Brazil Marques[1], Fabrício Moraes de Almeida[2], Carlos Alberto Paraguassú-Chaves[3], Delson Fernando Barcellos Xavier[4], David Lopes Maciel[5], Carla Dolezel Trindade[6], Simão Aznar Filho[7], Simão Dolezel Aznar[8], Carlos Alberto Dolezel Trindade[9]

[1]PhD in Agribusiness - CEPAN - Federal University of Rio Grande do Sul – UFRGS, Brazil.
[2]PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UFRO). E-mail: dr.fabriciomoraes001@gmail.com
[3]PhD in Health Sciences - University of Brasília - UnB, Brazil; PhD in Science - University of Havana (Cuba); Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - IT. Full Professor at the University Institute of Rio de Janeiro, Brazil.
[4]PhD in City Law -University of the State of Rio de Janeiro, UERJ, Brazil. Associate Professor at the Department of Legal Sciences at the Federal University of Rondônia Foundation.
[5]Professional Master in Master of Science in Emergent Technologies in Education. MUST UNIVERSITY, MUST, EUA.
[6]PhD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Universita deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.
[7]PhD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Universita deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.
[8]Graduated in Law. Master of Law Student, Specialist in Law. Professor at the University Institute of Rio de Janeiro, Brazil.
[9]Graduated in Law and Psychology. Specialist in Higher Education Teaching. Professor at the University Institute of Rio de Janeiro, Brazil.

Received: 09 May 2021;
Received in revised form: 11 Jun 2021;
Accepted: 18 Jun 2021;
Available online: 26 Jun 2021

***Keywords*— Viticulture, production system, Environmental sustainability, biodiversity, biodynamic practice.**

***Abstract*—** *Wine has shown a synergistic effect in a holistic context, being referenced in recent years by several areas, such as medicine, which considers it a natural antioxidant, economics, tourism, design and agribusiness, among other areas of study that perceive qualitative and quantitative characteristics of wine. In this sense, the wine sector is constantly looking for new practices for the Vitis vinifera grape, such as the use of biodynamic agriculture, which presents positive results for the sustainability of the ecosystem and the quality of the soil, thus ensuring a better terroir. The study here proposes to know: what interferes in the winegrower's decision to choose environmentally sustainable practices in vineyard management? The general objective is to characterize the environmental profile of the biodynamic vineyard. The adopted methodology is a descriptive case study of qualitative analysis. The factor that interferes, in the choice of sustainable practices for the management of vineyards, to the necessity of the maintenance, the fertility and productivity, the vineyards and in this case the biodynamic practice can be an option for the production of grapes with low impact environmental and that can result in the production of good quality wines.*

I. INTRODUCTION

Viticulture is shown to be a constant concern with vine production systems, seeking more sustainable management of land use and with more satisfactory results for the environment and for social actors. For, the history of the planting of grapes goes back to the history of mankind as well as the consumption of wine. According to Souza [1] the vine grape belongs to the Vitaceae family, whose fruit is the grape. The evolution of varietal production is indicated by the authors: Gobbato and Martins [2]; Days [3]; Sousa [1], as permanently. The production of grapes in Brazil is concentrated in the southern region. EMBRAPA Uva e Vinho is one of the references in the development of technical studies for the production processes of wine grapes, with the purpose of contributing significantly to the improvement of the quality of the raw material (wine grapes), and the competitiveness of the fine wines [4].

Since the wine sector is concerned with production techniques and with the quality and productive capacity of the soils of vineyards, in this perspective, the sectors related to viticulture start to assume an important role in the development of studies and techniques that contribute to the conservation and environmental sustainability of vineyards. In this sense, the behavior of international institutions and organizations in the wine sector, such as the International Organization of the Vine - OIV, is verified, which have promoted debates in congresses and meetings, on the development of new techniques, practices and tools that can provide the producer with ability to assess sustainable wine production systems and processes. Resolution OIV-ECO 460-2012, which establishes criteria for the production of vines in an organic system [5], is increasingly gaining strength in the design of environmentally sustainable vines.

As a result, the search for a more sustainable agriculture must be understood as a combination of economically viable, environmentally healthy and socially acceptable practices with the objective of creating a system that is capable of preserving the ecosystem's own characteristics. In this sense, sustainability is one of the factors that integrates a set of elements responsible for the formation of the “Terroir” of wine, as it results from the interaction between soil, topography, climate, biodiversity, customs and habits of a people, among others characteristics of each region [6].

In the case of Brazil, especially in the Rio Grande do Sul, wine producers are implementing programs such as good practices in agriculture and safe food, programs that are accompanied by SEBRAE (Brazilian Support Service for Micro and Small Businesses) and entities such as IBRAVIN (Institute Brasileiro do Vinho), FECOVINHO (Federation of Wine Cooperatives of Rio Grande do Sul) and others. As well as, the organic practice in vineyards since 2005 has shown growth in hectares produced in this system, according to data from the Technical Assistance and Rural Extension Company [7], which monitors the production of organic grapes. But as well, many properties have been advancing in the innovation of practices in vineyard management, as pointed out by Villanueva-Rey et al [8], the use of biodynamic practice considered an attractive and environmentally sustainable agricultural technique.

However, the biodynamic system adopts a holistic approach, in relation to the exploitation of natural resources, considering the sustainability of different elements, such as: cultural issues, the preservation of animal life, or the maintenance of a soil, how to recover, how to preserve or improve ecological harmony in order to obtain a high quality of the system as a whole. But for this, the use of practice requires: each farm is an integrated individuality; soil conservation practices; no use of chemical fertilizers and synthetic pesticides-only natural control products; nature conservation practices; social quality of work; application of homeopathic biodynamic preparations that increase the vitality of the environment, plants and the final product; non-use of transgenic products [9].

On the issue of environmental sustainability, it is noted that in biodynamic vineyards it is possible to use less intense machinery and, consequently, fuel, implementing artisanal exploration strategies. White [10]; Hassall et al [11]; Badgley et al [12]; Seufert et al [13] note that, despite the attractive gains in the marketing of wines and the reduction of inputs, there is a significant reduction in the volume of the harvest of the vines. However, the wines obtained are of exceptional quality with regard to the highest concentration of polyphenols. However, the advantages of adopting the biodynamic practice are in the balance of the entire ecosystem of the vineyard and its surroundings, allowing for the development of biodiversity.

For Villanueva-Rey et al [8], the wines obtained with biodynamic practice have peculiar characteristics, which are the result of the vineyard management system, such as the low concentration of sulphites and the excellent organoleptic quality. Even in the face of such benefits from the use of the practice, the same authors warn that the environmental benefits of applying these techniques, with regard to climate change or levels of toxicity, are still uncertain.

In this sense, the question is: What characterizes the environmental profile of the biodynamic vineyard?

II. VITIS VINIFERA L PRODUCTION SYSTEMS

The choice of the production system leads to a set of techniques and operations for the cultivation of vines, which is associated with the management and quality of agricultural soil. The use and management of the soil can lead to changes that can positively or negatively influence its quality. Therefore, changes in soil nutrients over time are essential components to assess the dynamics of soil quality and the sustainability of agricultural systems [14].

The vine is a crop that adapts well to various types of soils, and its productive performance is better in those with good nutrient supply capacity. In Brazil, the vine is cultivated in a wide diversity of soils, as it is cultivated even in highly weathered soils (soils with low content of primary minerals) [15]. According to Mello [15], most vines in Brazil are grown in soils that have some nutritional limitation, with phosphorus and boron, respectively, being the most limiting macro and micronutrients. For this, corrections are necessary, so that the plants are able to express their maximum productive potential.

The wine sector in Rio Grande do Sul - Brazil was structured based on the production of table wines, produced from American and hybrid cultivars, which, according to Melo [15], represent 80% of the total volume of wines produced in the country. In such a way, that from the 1980s onwards, there was a need for investments in the modernization of study processes for the adaptation of new cultivars, having as a driver the competitiveness with the international wine market and the domestic market with potential for the consumption of fine wines yet to be explored.

However, according to data from the Instituto de Economia Agrícola, the area of vineyards shows continuous decreases, accumulating in the period 2007-2011 the value of -2.33% in the global planted area. This deficit in the global area of vineyards results from area losses in some regions and some expansion of areas in other new producing regions such as China, Iran and Turkey, and some countries in the Southern Hemisphere (Argentina, Chile, South Africa, Australia and New Zealand) and also the United States. In the case of Brazil, the area occupied by vineyards decreased in 2015, following a trend started in 2013, with a reduction of 1.83% in the planted área. The states of Rio Grande do Sul and Santa Catarina presented area reduction of 0.51% and 0.98%, respectively. The state of São Paulo, which already presented a reduction of 12.79% in planted area in 2014, in 2015 suffered a further reduction of 5.86%. The state of Minas Gerais, however, showed an increase of 10.91% in the area planted with vineyards. According to Mello [15], the area reduction occurred in some places due to real estate speculation. The vineyards are replaced by the construction of residential condominiums in rural areas, thus reducing the wine-growing area. In other territories, the problems are: climate, lack of labor, economic crises that have discouraged growth, as well as the development of viticulture.

However, the global scenario has new wine consumers and the new consumption habits associated with it beckon with an invitation to enter a new scenario, such as the Asian market [16]. In view of the new markets for fine wines, in Brazil and in the world, the vineyard manager and other actors in the wine chain need to be efficient in their decisions for the proper use of natural resources and in an environmentally correct manner.

For this, investments in the sector must go beyond technological modernization. Technically based strategies are needed to serve as a reference for the systematic and rational modernization of the production processes of Vitis vinifera grapes, having as a reference point the human-nature alignment. A systemic look is needed so that a better convergence of the balance of biodiversity can occur. As a result of this, in many planting areas there may be a better nutritive performance of the soil, and therefore, a better quality of production and the environment.

Given the concern with issues of environmental improvement, Normative Instruction No. 42 of November 9, 2016, published in the Official Gazette on 11/14/2016, presents Specific Technical Standards (NTE) (BRASIL, 2016) for more than 13 agricultural crops, including grapes for processing. From the Normative Instruction, farmers must adopt a cultivation focused on sustainability. In order to maintain these benefits, the Technical Commission for Integrated Production of Grapes for Processing, established by MAPA in June 2013 [17], has an important mission to update the system annually, especially regarding the agrochemicals grid, to the adoption of new practices to the system and the harmonization of these norms with those adopted by the main importing countries, activities that depend heavily on the monitoring of research bodies.

According to Mello et al [15], viticulture, as a productive activity in the primary sector, has been experiencing new regions in the state of Rio Grande do Sul. In other regions of Brazil, vineyards were planted with the aim of reassessing and redefining planting projects and management systems, among other innovations. The viticultural sector has shown itself able to establish conditioning factors of ecological, economic and social sustainability for small family farms.

The manager's concern with reassessing the Vitis vinifera production system makes him evaluate new alternatives and make new choices, which will lead to economic, social and environmental results that may determine the direction of the vineyard's environmental sustainability.

2.1 Vineyard Environmental Sustainability

According to Iyer-Raniga and Treloar [18] and Steurer et al [19], the best known definition of the term sustainable development was presented in the Brundtland Report, prepared by the World Commission on Environmental Development (WCED). According to WCED [20], sustainable development is what meets the needs of the present generation, without compromising the possibility of future generations meeting their own needs. As well, it is a process of change in which the exploitation of resources, the direction of investments, technology and institutional changes are in harmony to guarantee current needs and guarantee the future of living conditions on the planet [20].

It is noted that environmental issues have been systematically gaining projection due to legal, social, economic requirements and new consumption habits. This, too, becomes a concern of the wine sector. Because that doesn't just mean taking care of the land, the vineyards, the wine terroir. To produce sustainably, one must be aware of other requirements such as: a) the intelligent use of technology to reduce water, energy and fuel consumption; b) the relationship with the land, which makes the wine sustainable; c) professionals working in the cultivation of vines, harvesting and processing the grapes.

In this sense, Elkington [21] points out that companies that do not consider environmental aspects in the scope of their strategic planning may lose the chance to position themselves with competitive advantages over the competition. Consequently, activities that have their environmental impacts reduced represent gains for companies, whether in relation to market requirements, or by complying with environmental legislation, or by saving resources or reducing waste, among other factors.

This makes some of the small wineries choose to use safe food standards, according to the NBR 15635 standard [22], which deals with the control of food production, contains guidelines to be followed by companies in the food sector of all sizes, especially micro and small companies that want to grow and succeed [22]. The “safe food” and “good practices” programs receive guidance from consultants from the Brazilian Micro and Small Business Support Service (SEBRAE), who act as drivers for property planning in a more environmentally sustainable manner.

As a result, managers need to establish methodologies that allow them to assess and decide, in a dynamic scenario, that uncertainties need to be managed and risks calculated. Managers need to know how to assess and measure results in terms of climate change, soil nutrients, rainfall and carbon rates, in order to manage agricultural production.

An agricultural production process is considered sustainable, according to Fernández-Zamudio et al [23], when there is a correct management of its natural resources, especially the most limiting ones, and it is economically viable for the society that manages it, and that conducts it for the continuity of the agricultural activity. Another aspect to be considered is that, for an agricultural property to be considered sustainable, it must produce with high quality, be profitable, protect the environment, conserve resources and be socially responsible in the long run [24].

Sustainability refers to three pillars according to Hayati et al [25], namely: a) combating the degradation of agroecosystems caused by the modernization process of the 20th century; b) the establishment of new rules for the agrifood system; and c) the promotion of practices that are more adequate to the preservation of natural resources and production of healthier foods. There is, however, a duality between the choices of alternatives for the sustainable use of natural resources and the objective of industrial production to obtain the greatest quantity of fruit of the best possible quality at the lowest price.

In this case, an intensive conventional production system is considered, which according to Cerutti et al [24], which in the long term, can cause environmental damage to the ecosystem, particularly caused by pest and disease control, irrigation, fertilization, exploratory soil management, damage generated by climate imbalance. For this, Fernández-Zamudio et al [23], explain that the production of grapes can be a specialty that is associated with the efficient use of water and admits water endowments that are much lower than other cultures, such as citrus and vegetables. However, the conventional production system optimizes profitability and increased production, which can result in economic and financial gain.

On the other hand, the organic system, on the other hand, adopts the management with techniques and soil treatments with a vision of environmental sustainability. In the organic system, in accordance with LAW No. 10.831 of 2003, it establishes in Art. 1 that: "the organic system of agricultural production is one in which specific techniques are adopted, through the optimization of the use of available natural and socio-economic resources and respect for the cultural integrity of rural communities, aiming at economic and ecological sustainability, maximizing social

benefits, minimizing the dependence on non-renewable energies, employing, whenever possible, cultural, biological and mechanical methods, as opposed to the use of synthetic materials, eliminating the use of genetically modified organisms and ionizing radiation, at any stage of the production, processing, storage, distribution and commercialization and protection of the environment [26] ".

In turn, Meirelles and Rupp [27], clarify the various types of grapes that are being produced in the Serra Gaucha in the organic system are mainly the American varieties (Isabel, Concord, Ives and Niagara), Vitis vinifera (Cabernet Sauvignon and Gamay) and table (Italy, Rubi and Perlona). In the classification of production systems, Titi et al [28] present the integrated as an agrarian exploitation system that produces food and other high quality products through the use of natural resources and regulatory mechanisms to minimize the use of inputs and contaminants and to ensure sustainable agricultural production. This system is regulated and established by the IOBC (International Organization for Biological Control).

Grape growers have also been introducing biodynamic farming practices into the vineyard. This means transforming the property into an agricultural organism, in a place where each component has its activities enhanced by culture, livestock, forests, water sources, wildlife corridors, windbreaks and many others [29]. These are some of the practices that have been considered in decision making for environmentally sustainable vineyard management systems according to studies by Villanueva-Rey et al [8]; Zaher et al [30]; Chiusano et al [31].

However, Cerutti et al [24]), draw attention, which still does not have a consensus among producers about which system to choose and which is the most environmentally correct. What is observed as a unanimous point among producers, regulatory bodies and research agencies in the wine sector is the need to minimize and/or reduce the use of chemical and synthetic treatments in viticulture.

Therefore, the manager becomes concerned with the relevance of the results of the environmental conditions and the productivity of the vineyard. This is also in line with Food and Agriculture Organization of the United Nations (FAO - resolution 2025), cleaner production system program, with OIV [5], reduction of pesticides in viticulture, forcing the farmer to make decisions based on issues of environmental sustainability, and the agricultural manager, who does not have the capacity to assess the alternatives according to the market, may run the risk of a management with uncertainties in the sustainability of the vineyard.

In this way, there is also an appeal from the wine market to the need to rethink and reassess the vine production systems, through practices that allow for the recovery, reduction of actions that impact the use of land and natural resources on rural properties.

2.1.1 Ecodesign of Vineyards

The term design can be considered as a set of activities that includes from the territorial project, also the graphic design, passing through the architectural project to consumer goods [32].

As Niemeyer [33] emphasizes, design has been understood in three distinct groups of practice and knowledge: a) as an artistic activity, in which the professional's commitment as an artisan to the fruition of use is valued; b) as an invention, a plan in which the designer has a priority commitment to the productivity of the manufacturing process and technological updating; and c) as coordination, where the designer has the function of integrating the contributions of different specialists, from the specification of raw material, through production to the final use and destination of the product. In this last understanding of Niemayer [33], it can be seen that the development of a product design also needs to be thought of from the production of its raw material. In the case of wine, the vineyard is the place for this production, so the elaboration of its design can represent a lot in the manufacture of wine and/or its derivatives throughout its life cycle.

As well as Mansini [34] and Vezzoli [32], they understand that design for sustainability means promoting the capacity of the productive system to respond to the social demand for well-being using an amount of environmental resources drastically lower than the levels currently practiced. In addition, establishing the alignment between technique and what is possible is ecologically necessary and giving birth to new social and culturally appreciable solutions [34]; [32]. The same authors also understand that Ecodesign is a "project model" guided by ecological criteria, that is: the redesign of activities, production systems, techniques and even lifestyle habits.

In practice, the principles of sustainable agricultural systems can be described, but it is difficult to assess their sustainability in practice [35]. Macdonald and Patterson [35] mentions that sustainable agricultural systems show a greater diversity of cultures, making use of nutrients during cultivation, thus differentiating from the conventional agricultural system.

The mention of the term design related to agriculture also appears in Altieri [36], which calls attention to the use of self-sustainable agricultural design, in this case using biodiversity as a tool to implement design decisions that avoid what the author calls it the "ecological diseases" of a

poorly developed and malfunctioning system. However, Macdonald and Patterson [35] considers that ecological design strategies emerged in agriculture and that they seek to produce food for human populations in a sustainable way, in a way that they do not adversely affect environmental impacts, enable increased productivity and are reliable and consistently productive.

But, Macdonald and Patterson [35] cautions, the focus of these strategies varies and therefore their design strategies vary as well. Therefore, the design process must be flexible and dynamic. However, it is clear that agricultural sustainability has emerged as a global concern largely due to the dependence of current conventional agriculture on non-renewable inputs and fossil fuel energy [37]; [38]; [39]. Therefore, the search for projects of alternative agricultural practices, such as the case of biodynamic systems, in favor of the sustainability of vine growing systems has become constant in some wine producing regions around the world as well as in Brazil.

2.2 Biodynamic cultivation system

According to the Biodynamic Institute [9], which certifies Brazilian organic products, the Biodynamic practice, which began in 1924 with Rudolf Steiner in Europe, today corresponds to a movement that involves more than 4,900 producers worldwide. But to be considered biodynamic and receive the Demeter seal, each segment of agriculture must seek to meet criteria.

As for environmental sustainability, it is noted that the biodynamic vineyard makes less intensive use of machines and, consequently, of fuels, in addition to fewer insecticides and herbicides, but requires greater participation of human labor. Authors such as White [10]; Hassall et al [11]; Badgley et al [12] and Seufert et al [13], draw attention to the fact that, despite the attractive gains in the marketing of wines and the reduction of inputs, there is now a significant reduction in the volume of vintage in the vineyards.

Grape production (Vitis vinifera L.) is considered one of the most economically important crops in the world [40]. Cultivated vines (Vitis vinifera spp. Sativa) are considered domesticated, and their vinifera origin is in wild populations of Vitis vinifera spp. Sylvestris [41]. These wild vines are dioecious plants still present in small isolated populations in Eurasia. It is very likely that the wild grape was explored by man in the Paleolithic, but its domestication began later, linked to wine production (8,500 to 4,000 BC), even if the process before the other is not clear [42].

The species Vitis vinifera can be consumed in natura, in raisins, in the production of wines, spirits, juices and sweets of various types. In addition, it can provide other by-products such as natural dyes, tartaric acid, seed oil and tannins. When compared to other fruits, it has the following positive aspects: a) it does not need to be peeled, which prevents the juice from running off; b) it is easily handled, as it is attached to the bunch; c) it has a crunchy texture and good balance between sweet and sour flavors; and d) it supports storage and transport relatively well, as, in addition, the flavor is quite diversified and varies according to the variety [43].

However, to obtain a sustainable product, it is necessary to balance the use of natural resources (soil, water, energy), human and economic. The combination of these resources can lead to a significant increase in results, adding value to the product in a given region. But, it is necessary to consider a new design of the cultivation stages, as each stage is essential to obtain a satisfactory result in the design of a good quality wine.

In the wine production process, it is also necessary to consider the occurrence of uncertainties, considering the possibility of variations from season to season, due to climatic issues and the vegetative cycle of the soil. Because of this, some criteria in the ecodesign of vineyards must be considered, such as: a) the geographic characteristics of the region; b) the rainfall index; c) the type of vines; and d) the natural conditions prevailing in a given crop [43].

In the case of southern Brazil, and particularly in Serra Gaúcha, the most used criterion to evaluate a production is the glucometric degree (sugar content). This concern is due to the fact that wine is the product resulting from the process of transforming the sugar contained in the grape into alcohol and other secondary products. In this case, the aromatic compounds and phenolic compounds contained in the grape are related to the increase in sugar content [43].

In a way, for Villanueva-Rey et al [8], the wines obtained with biodynamic practice have peculiar characteristics, which are the result of the vineyard management system, such as the low concentration of sulphites and the excellent organoleptic quality. Even in the face of such benefits from the use of the practice, the same authors warn that the environmental benefits of applying these techniques, with regard to climate change or levels of toxicity, are still uncertain.

Thus, biodynamic agriculture can be an ecodesign project of great challenge for winegrowers in Brazil, in view of climatic uncertainties and soils that still have a history of agriculture with intensive use of pesticides. Therefore, the need for a rebalancing of the ecosystem is perceived, and this requires adequate management and the involvement of

human resources that seek results in a systemic way, as well as believing in the redesign of production systems.

III. MATERIAL AND METHODS

This work is a case study, descriptive of qualitative analysis. For Yin [44], "the case study is an empirical investigation that investigates a contemporary phenomenon in depth and in its real life context, especially when the boundaries between the phenomenon and the context are not clearly evident". The research carried out was descriptive, which allows measuring or evaluating different aspects or components of the researched phenomenon [45].

The sample was intentional, for convenience and not probabilistic. For Levine et al [46] non-probabilistic samples can offer certain advantages, such as convenience, speed and low cost. The research subjects were consulted through semi-structured interviews. The identification of the names and characteristics of the participants is reserved to preserve confidentiality commitments. Interviews were carried out with open questions, applied to the technicians responsible for the wine estate, named in this study as follows: Vineyards "D" and "U", respectively, with the use of audio recording and annotations. In order to interpret the data, qualitative analysis was used, which for Vieira and Zouain [47] attaches fundamental importance to the testimonies, contents and meanings conveyed by the interviewees.

Next, for the treatment of responses and reports, the technique of content analysis was used, which consists of a set of techniques of systematic and objective procedures, the description of the content of the messages, which allows the inference of knowledge related to the conditions of production and/or reception (inferred variables) of messages [48]. But Richardson [49] emphasizes that the analysis of interviews also means describing the text according to its form, that is, the symbols used, words, themes, expressions, phrases and its background, which tries to verify the trends of the texts and the adequacy of the content, which here too, was carried out. Thus, it follows an analysis of the audios and notes of those responsible for managing the respective vineyards studied here as a case of adequacy of the use of biodynamic practice for the production of Vitis Viniferas grapes, in the region of the Serra Gaúcha, Brazil.

Map 1- Study Region, 2017

Source: Research, 2017

The winemaking properties participating in the study are located in Serra Gaúcha, RS-Brazil, Northeast Mesoregion of Rio Grande do Sul, a region with a humid and rainy climate, characteristics that are present in the characteristics of the wine as well as interfering in the results of identity and product quality, mainly in its climatic precipitation.

But that, the winemakers and technicians try to seek cultivation practices that allow the production of wines that can result in unique wines, in balance with the ecosystem in convergence with the needs of all stages of the wine production chain. As shown in the following results.

IV. RESULTS AND DISCUSSION

Therefore, studies for the use of biodynamic practice in agriculture in rural properties in **Serra Gaucha** are still being developed gradually and can still be considered experimental. According to the winemaker from the "U" vineyard, "interests remain only centered on the monetary interest that wine produced in biodynamic practice can add, and not on the benefits it can provide for better use of the soil and for the quality of the biodiversity of the environment, what still leaves something to be desired in the use of biodynamic practice is the lack of conviction of some adepts". It is noticed that biodynamics can be a relearning of soil management, necessary for the producer to understand the relationships within the production unit.

Biodynamic cultivation signals the desire to pay more attention to vines and wines, as it requires discipline, work

and sensitivity on the part of the winegrower. Therefore, biodynamic agriculture requires deconstructing and detaching from conventional concepts and techniques and seeking to innovate on rural properties, but for this, the expected results must go beyond business profits, they must be sustainable in social, environmental and economic matters.

In view of the observations and analysis of the contents, it is evident that the choice of the winegrower to use the biodynamic practice must balance biodiversity and improve soil quality, taking into account the principles of living soil, an ecosystem in balance and respect. to the cycles and rhythms of nature. Because, according to IBD-DEMETER standards, the practice significantly reduces the use of fungicides and eliminates the use of herbicides. As the winemaker from Vinhedo "D" says, "adopting biodynamics means seeking results in the production of grapes with more intense flavor, with a greater concentration of aromas and color, and thus, having a balance between the production system and the results, ensuring a better terroir".

According to the winemaker of the "U" vineyard "make use of biodynamic practice to preserve vineyards, soil, biodiversity and human health". In this same perception, the winemaker from vineyard "D" agrees that Yes "...the biodynamic practice is a sustainable way to manage vineyards".

However, the interviewees are unanimous in stating that the use of biodynamic practice in viticulture in Serra Gaúcha "...it's a long way to go". For the respondent from vineyard "D" "...the biodynamic practice is a start to minimize the use of synthetic additives in the production of Vitis vinifera, but it is necessary to be aware of the climatic variations of the Serra Gaúcha, which configures a humid and subtropical climate. Under these conditions, the biodynamic practice in viticulture requires care, as it is in an environment of constant climatic imbalance. However, it is possible to make adjustments between the conventional and the biodynamic process for the production of vines, using less pesticides and an environmentally sustainable vineyard".

Note that the production of vines requires care and behavioral changes in the management of production techniques. The respondent from vineyard "D" reports that: "...the use of insecticide and herbicides in viticulture is present on the surface of the grape, which is in contact with the must, in a two-phase system, composed of a liquid phase (must) and a solid phase (dregs). Cabras and Angiorni [50] draw attention to the fact that such residues can still be found in ready-to-drink beverages, even with the reduction in the concentration of most agrochemicals during fermentation processes.

However, in order not to use pesticides in the production of the vine, it is necessary to be careful with the vine to balance it in the face of climatic variations and improve the quality of the vines, not compromising the harvest with the attack of fungi and diseases during the maturation phase. According to Turinek et al [51], biodynamic preparations are important for the application of the practice, and in addition, the rituals involving the preparations are unconventional actions and sometimes difficult to understand the mechanics of the underlying updated natural science, which is still under investigation, which in at first, they were explained as repairs with less nitrogen fertilization.

However, Koepf, Pettersson and Schaumann [52]; Koepf, Schaumann and Haccins [53], point out that the use of preparations in the practice of biodynamic agriculture should be applied in very small amounts to the soil and crops, and the expected effect is to stimulate the nutrient cycle, in photosynthesis and in better evolution of compost, increasing the quality of the soil and crops rather than the amount applied.

Finally, the use of biodynamic practice goes far beyond the understanding of an agricultural technique, because, according to Steiner [54], the ecosystem is formed by hidden forces such as: "gnomes, undines, sylphs and spirits of fire are actively involved in plant growth" [54]. But, despite the eccentricity and the lack of an obvious connection with the production of high quality wines, adherence to the practice of biodynamic cultivation gained a favorable reception from critics and consumers, and its use became related to a quality standard. in viticulture.

Thus, it is understood that there is a lot to learn about biodynamic practice, and to be willing to innovate and build new concepts of soil management techniques, which not only produce productivity in the production volume, but cherish the good quality of the environment , this is the only way to guarantee the sustainability of the vineyards for the use of future generations.

V. FINAL CONSIDERATIONS

Therefore, the environmental profile of the biodynamic vineyard is characterized by the balance of biodiversity, not the use of insecticides and herbicides, but the use of compounds, biodynamic preparations, a calendar based on the phases of the moon and also in the philosophy of a production system in balance with living things.

Therefore, the use of biodynamic practice in vineyards will depend on the viticulturer's ability to adjust behaviors,

beliefs and economic and social conditions delimited by market behavior. As well as the climatic, geographic and morphological conditions of the territory, which may allow for desired results in cultivation with biodynamic practices. But, it is essential for all this to converge with technical monitoring, to make use of soil analysis frequently as a monitoring tool, especially in the intercrop phases, for the preparation and use of nutrients in an adequate manner for the new phase of planting and restructuring of vines, as well as evaluation of foliage, sprouting and fruit.

However, for the specific case of vines, the fruit stage is the period considered critical for winegrowers in the Serra Gaúcha region, due to pests and diseases caused by the climate, in the period before harvesting, especially for those who need greater grape maturation to obtain a greater degree of sweetness and less acidity of the fruit. With the occurrence of rain, followed by humidity and high temperatures, it causes the emergence of diseases and pests that compromise production. This leads many winegrowers to give up the biodynamic cultivation system and others even seek to adapt the use of biodynamic preparations at the beginning of cultivation, but at the end of cultivation they end up resorting to herbicides and fertilizers to avoid crop loss.

In these cases, they choose to use biodynamic agriculture, but give up the certification of the product, because at some point they still use chemical fertilizers for treatments, but how to solve this? What was noticed from the reports is that the winegrowers need tools that allow them to alleviate uncertainties and measure their risks in this type of cultivation in a more timely manner. Therefore, what needs to be taken as a path for the production of wineries requires technical monitoring that is effective and efficient, because you cannot be an amateur, it is not enough to have passion, you must master the knowledge of processes and technology as well as having the knowledge of the system and all interfaces, manage decision-making in the agricultural unit.

Finally, what these winegrowers actually consider when choosing to manage sustainable vineyards is due to the urgent need for soil recovery and the longevity of vineyards, which can be provided by the use of low environmental impact techniques, which consequently enable maintain and restore the balance of the vineyard's biodiversity. As a result, better productivity and wines as an identity.

The final considerations of the study showed that the wine growing system in the country is still very incipient and amateur, rooted in feelings of ancestry. It is recommended for the search for the professionalization of cultivation based on research, technique, design, training and adequate and conscientious preparation of the vineyard for the use of natural, human and financial resources for production.

However, it is faced with research limits such as access to data, the lack of a history of production areas, as well as studies of soil morphology and the seriousness that must be given to each cultivation system by the actors involved in the production chain of wines.

The suggestion for future work is to carry out research with monitoring of all stages of the wine production process in the biodynamic system and to identify the main resistances and bottlenecks in the application of the practice in the southern region of Brazil.

REFERENCES

[1] SOUSA, JSI. (1959). Origens do vinhedo paulista. (ed) Obelisco, São Paulo.

[2] GOBBATO, C.; MARTINS, J. W. (1938). Subsídios sobre a adaptação, ao nosso meio, de algumas castas produtoras de vinho. Porto Alegre: Secretaria de Estado dos Negócios da Agricultura, Indústria e Comércio, 13 p. (Boletim, 63).

[3] DIAS, MF. (1959). A variedade na renovação dos vinhedos Riograndenses. Agronomia Sulriograndense, v. 4, 43-55, Porto Alegre.

[4] CAMARGO, UA. (2008). Impacto das cultivares brasileiras de uva no mercado interno e potencial no mercado internacional In: CONGRESSO BRASILEIRO DE VITICULTURA E ENOLOGIA, 12., 2008, Bento Gonçalves. Anais. Bento Gonçalves: Embrapa Uva e Vinho, 37-42.

[5] OIV - INTERNATIONAL ORGANISATION OF VINE. (2012). Resolução OIV-ECO-460, 2012. Disponível: http://www.oiv.int/public/medias/1908/oiv-eco-460-2012-es.pdf. Consulta em 16 dezembro, 2016.

[6] LAMASTRA, L.; BALDERACCHI M; DI GUARDO A; MONCHIERO M; TREVISAN, M. (2016). A novel fuzzy expert system to assess the sustainability of the viticulture at the wine-estate scale - Science of the Total Environment, v. 572, n.1, 724–733.

[7] EMATER/RS-Ascar. (2017). Produção de Base Ecológica. Disponível: http://www.emater.tche.br/site/area-tecnica/agricultura-base-ecologica/producao-de-base-ecologica.php#.WR510GjyuM8. Consultado em 19 de abril de 2017.

[8] VILLANUEVA-REY, P.; VÁZQUEZ-ROWE, I.; MOREIRA, MT.; FEIJOO, G. (2014). Comparative life cycle assessment in the wine sector: biodynamic vs. conventional viticulture activities in NW Spain. Journal of Cleaner Production, v 65, 330-341.

[9] IBD - INSPEÇÕES E CERTIFICAÇÕES AGROPECUÁRIAS E ALIMENTÍCIAS. (2015). Diretrizes para o Padrão de Qualidade Orgânico IBD. 21ª Edição – doc. 812. IBD CERTIFICAÇÕES.

[10] WHITE, GB. (1995). The economics of growing grapes organically. In: Pool, R. (Ed.), Organic Grape and Wine Production Symposium. (ed) R. Pool. 76-85.

[11] HASSALL, AG.; KRISTIANSEN, P.; TAJI, A. (2005). Investigation of management practices and economic viability of vineyards for organic wine production. In: Proceedings of the 8th International IFOAM Viticulture & Wine Conference, Adelaide Australia.

[12] BADGLEY, C.; MOGHTADER, J; QUINTERO, E; ZAKEM, E; CHAPPELL, MJ; AVILÉS-VÁZQUEZ, K; SAMULON, A; PERFECTO, I. (2007) Organic agriculture and the global food supply. Renewable Agriculture and Food Systems: v. 22, n. 2; 86–108.

[13] SEUFERT, V., RAMANKUTTY, N., FOLEY, JA. (2012). Comparing the yields of organic and conventional agriculture. Nature v. 485, 229–232.

[14] FRANZLUEBBERS, AJ e HANEY, RL (2006) Flush of CO2 as a Soil Biological Quality Indicator. Proceedings of the 17th Conference of the International Soil Tillage Research Organization (CD-ROM), Kiel, 3 de agosto-26 de setembro de 2006, 736-740.

[15] MELLO, LMR. (2016).Desempenho da vitivinicultura brasileira em 2015. Embrapa Uva e Vinho-Artigo em periódico indexado (ALICE).

[16] PROTAS, JFA (2016). Dinâmica evolutiva da vitivinicultura brasileira: cenários 2004-2014. Revista de Política Agrícola, n.1, p. 47-54.

[17] BRASIL, (2016) Instrução Normativa N° 42 de 09 de novembro de 2016, publicada no Diário Oficial da União em 14/11/2016, apresenta Normas Técnicas Específicas (NTE).

[18] IYER-RANIGA, U.; TRELOAR, GA. (2000). context for participation in sustainable development. **Environmental management**, v. 26, n. 4, p. 349-361.

[19] STEURER, R. et al. (2005). Corporations, stakeholders and sustainable development I: a theoretical exploration of business–society relations. **Journal of business ethics**, v. 61, n. 3, p. 263-281.

[20] WCED, SPECIAL WORKING SESSION. (1987).World commission on environment and development. **Our common future**, v. 17, n. 1, p. 1-91.

[21] ELKINGTON, J. (2012) **The zeronauts: breaking the sustainability barrier**. Routledge.

[22] ABNT, NBR. 9050. Acessibilidade a edificações, mobiliário, espaços e equipamentos urbanos. **Rio de Janeiro: Associação Brasileira de Normas Técnicas**, 2015.

[23] FERNÁNDEZ-ZAMUDIO, MA. et al. (2007).Irrigation water pricing policy and its effects on sustainability of table grape production in Spain. **Agrociencia**, v. 41, n. 7, p. 805-815.

[24] CERUTTI, A. K et. al (2011). A review of studies applying environmental impact assessment methods on fruit production systems. Journal of environmental management, 92(10), 2277-2286.

[25] HAYATI, D. et. al. (2010). Measuring agricultural sustainability. **Biodiversity, biofuels, agroforestry and conservation agriculture**, p. 73-100.

[26] BRASIL. Lei nº 10.831, de 23 de dezembro de 2003: Dispõe sobre a agricultura orgânica e dá outras providências. **Publicado no Diário Oficial da União de 24/12/2003**, 2003.

[27] MEIRELLES, LR.; RUPP, LCD. (2005) Agricultura ecológica: princípios básicos. **Centro ecológico**, p. 46-47.

[28] TITI, A.; BOLLER, E.F.; GENDRIER, JP. (1995). Producción integrada: principios y directrices técnicas. IOBC/WPRS. Bulletin, v.18, 22 p.

[29] MACHADO, CC.; SILVA, END.; PEREIRA, RS.; CASTRO, GP.(2014). O setor florestal brasileiro e a colheita florestal. Universidade Federal de Viçosa- Viçosa. p.15-45.

[30] ZAHER, U.; HIGGINS, S.; CARPENTER-BOGGS, L. (2016). Interactive life cycle assessment framework to evaluate agricultural impacts and benchmark emission reduction credits from organic management. Journal of Cleaner Production, 115, 182-190

[31] CHIUSANO, L et.al (2015). An Industrial Ecology approach to solve wine surpluses problem: the case study of an Italian winery. Journal of Cleaner Production, 91, 56-63.

[32] VEZZOLI, C. (2010).Design de Sistemas para a Sustentabilidade: Teoria, métodos e ferramentas para o design sustentável de "sistemas de satisfação". Salvador: EDUFBA.

[33] NIEMEYER, L. (1998). Design no Brasil: origens e instalação. 2. ed. Rio de Janeiro: 2AB, 126 p.

[34] MANZINI, E. (2008). Design para inovação social e sustentabilidade: comunidades criativas, organizações colaborativas e redes projetuais. Rio de Janeiro: E-Papers.

[35] MCDONALD, GW.; PATTERSON, MG. (2004). Ecological footprints and interdependencies of New Zealand regions. **Ecological Economics**, v. 50, n. 1-2, p. 49-67.

[36] ALTIERI, MA. Agroecologia: bases científicas para uma agricultura sustentável. Guaíba: Agropecuária, 2002. 592 p.

[37] NGUYEN, ML.; GOH, KM 1992. Nutrient cycling and losses based on a mass-balance model in grazed pastures receiving long-termsuperphosphate applications in New Zealand. Journal of Agricultural Science 119: 89106

[38] KEENEY, RL. (1994).Creativity in decision making with value-focused thinking. **Sloan Management Review**, v. 35, p. 33-33.

[39] SANCHEZ, SMA. (1994). robust design tutorial. In: **Proceedings of Winter Simulation Conference**. IEEE, p. 106-113.

[40] WANG, S.-J.; LIU, Q.-M.; ZHANG, DF. (2004).Karst rocky desertification in southwestern China: geomorphology, landuse, impact and rehabilitation. **Land degradation & development**, v. 15, n. 2, p. 115-121.

[41] LEVADOUX, L. (1956). **Les populations sauvages et cultivées des Vitis vinifera L.** Institut national de la recherche agronomique.

[42] MCGOVERN, P. et al. (2017). Early neolithic wine of Georgia in the South Caucasus. **Proceedings of the National Academy of Sciences**, v. 114, n. 48, p. E10309-E10318.

[43] EMBRAPA. Empresa Brasileira de Pesquisa Agropecuária. EMBRAPA Uva e Vinho. **Cnpuv** (Centro Nacional de Pesquisa de UVA e Vinho. Coleção Técnica, 2016.
[44] YIN, RK. Estudo de caso: planejamento e métodos. 4. ed. Porto Alegre: Bookman, 2010.
[45] SAMPIERI, RH.; COLLADO, CF; LUCIO, PB. (2006). Metodologia de pesquisa. 3. ed. (ed) McGraw Hill, São Paulo.
[46] LEVINE, JM; KAYHRYN McEACHERN, A; COWAN, C. Efeitos da chuva em plantas anuais raras. Journal of Ecology. Volume 96, Edição 4. Julho de 2008. Páginas 795-806.
[47] VIEIRA, MMF.; ZOUAIN, DM. (2005). Pesquisa qualitativa em administração: teoria e prática. (ed) FGV, Rio de Janeiro.
[48] BARDIN, L. (2004). Análise de conteúdo. Lisboa.
[49] RICHARDSON, RJ. (1999). Pesquisa social: métodos e técnicas. (ed) Atlas, São Paulo.
[50] CABRAS, P.; ANGIORNI, A. (2000) Pesticide residues in grapes, wine and their processing products. Journal of Agricultural and Food Chemistry, Easton, v. 48, n. 4, 967-973.
[51] TURINEK, SM.; GROBELNIK-MLAKAR; M.; BAVEC. F. (2009). Biodynamic agriculture research progress and priorities. Renewable Agriculture and Food Systems: v. 24, n.2, 146–154.Cambridge University Press.
[52] KOEPF, HH.; PETTERSSON, BD.; SCHAUMANN, W. (1976). Biodynamic agriculture: An introduction. Hudson, Anthroposophic Press, New York.
[53] KOEPF, H., SCHAUMANN, H.; HACCINS, M. (2001). Agricoltura Biodinamica. Antroposofica Editrice: 366.
[54] STEINER, R. (1993). Fundamentos da Agricultura Biodinâmica. 8 palestras dadas en Korberwitz,7-16/6/1924, GA (Gesamtausgabe, catálogo geral) 327. Trad. Gerard Bannwart. (ed) Antroposófica, São Paulo.