



The new old ways of winemaking.

A study of natural winemaking, the challenges and the solutions.

Agnes-Fredrika Wedelsbäck

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Swedish University of Agricultural Sciences, SLU

Faculty of Landscape Architecture, Horticulture and Crop Production Science (LTV)

Department of Biosystem and Technology

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The new old ways of winemaking. A study of natural winemaking, the challenges and the solutions.

En studie av produktion av naturvin, utmaningarna och lösningarna.

Agnes-Fredrika Wedelsbäck

Supervisor: Ajit Nehe, Swedish University of Agricultural Sciences, SLU,
Department of Plant Breeding

Assistant supervisor: Erik Alexandersson, Swedish University of Agricultural Sciences, SLU,
Department of Plant Protection Biology

Examiner: Lotta Nordmark, Swedish University of Agricultural Sciences, SLU,
Department of Biosystems and Technology

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Abstract

The consciousness of what we eat is an ongoing trend (Eckerdal, 2020) among consumers who value environmentally and health-friendly products (Aprile, et al., 2015). This change in consumer's preference is also playing a role in the choice of beverage selections with a rise of interest in natural wine (Buranyi, 2018). Natural wine is a concept that aims to use as few additives and compounds as possible in the making of the wine (Goode & Harrop, 2011). This study focuses on the challenges and solutions of natural winemaking with the goal to deepen knowledge by answering two research questions. The method used in this study is a qualitative case study on natural winemaking based on three semi-structured interviews with producers of natural wine. To better understand the current knowledge of natural winemaking, a literature review was performed and used in the analysis for interpretation and understanding of the empirical data. The findings of this study show that there are challenges in natural winemaking such as the climate and diseases. As presented in the literature and by the interviewees the solution is a proactive approach. Thus, concluding that it is possible to make wine without the use of widespread agrochemicals.

Keywords: Natural wine, winemaking, biodynamic, organic, wine regulations, natural wine producers

Table of contents

List of tables	6
List of figures	7
Abbreviations	8
1 Introduction	9
1.1 Purpose and research questions	11
1.1.1 Delimitations	11
2 Litterateur review	12
2.1 Natural wine	12
2.2 Biodynamic agriculture	13
2.3 Organic agriculture	14
2.4 Vin méthode Nature.....	15
2.5 VinNatur	16
2.6 Terroir	17
2.7 Diseases	17
2.7.1 Phylloxera (<i>Daktulosphaira vitifoliae</i>)	17
2.7.2 Downy Mildew (<i>Plasmopara viticola</i>).....	18
2.7.3 Powdery Mildew, Oidium (<i>Uncinual necator</i>)	18
2.7.4 Black rot (<i>Guignardia bidwellii</i>).....	18
2.8 Theoretical discussion	19
3 Methodology	20
3.1 Research design	20
3.2 Data collecting.....	20
4 Empirical results	22
4.1 The producers	22
4.1.1 Erik.....	22
4.1.2 Michel.....	22
4.1.3 Guido	22
4.2 Definition of natural wine	23
4.3 Challenges of producing natural wine	23
4.4 Regulations and product labels.....	25
5 Analysis and discussion	27

5.1	Definition of natural wine	27
5.2	Challenges and solutions.....	27
5.3	Regulations, certifications and product labels.....	28
6	Conclusion.....	29
6.1	Future work	29
	List of Reference	30
	Acknowledgements.....	34
	Appendix 1- Interview guide	35

List of tables

Table 1. The preparations used in biodynamical farming and how they should be used as presented in the book Authentic Wine toward natural and sustainable winemaking (Goode & Harrop, 2011).	13
Table 2. A modified summary of the guidelines of the label Vin méthode Nature as described in the charter of commitment by Syndicat de Défense des Vins Nature (Syndicat de Défense de Vins Nature'l, 2022).	15
Table 3. A modified summary of the regulations for in the vineyard as described in Procedural regulations for "VinNatur wine" production (Associazione VinNatur, 2020).	16
Table 4. Relevant Situations for Different Research Methods as presented in the book Case study research and applications: design and methods (Yin, 2018)	21
Table 5. Interview information.	21

List of figures

Figure 1. The central parts of natural winemaking.....	19
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Abbreviations

SLU	Swedish University of Agricultural Sciences
FAO	Food and Agriculture Organisation of the United Nations
WHO	World Health Organisation
EU	European union
USA	United States of America
Mhl	Millions of hectoliters
AOC	Appellation d'Origine Contrôlée

1 Introduction

Farm-to-table produce and a growing consciousness of what we eat is an ongoing trend (Eckerdal, 2020; Aprile, Caputo, Nayga, 2015). Consumers value locally produced food and have an interest in the environment and health-friendly products (Aprile, et al., 2015). In Sweden, there is a shift in mentality with a higher interest in a state that has higher self-sufficiency for its people (Lantbrukarnas Riksförbund, 2020). Consumers care what they put in their bodies and wish for less chemicals and more environmentally friendly products. This mind shift of consumers has reached beverages as well with headlines like “12 Natural Wine to Drink Now” featured in The New York Times and many acclaimed restaurants serving natural wines to go with the locally produced food (Buranyi, 2018; Asimov, 2022). But, not everyone is sold on natural wine. Some compare the natural wine movement to the anti-vax movement, working against the years of scientific advances made in vinification also known as winemaking (Buranyi, 2018), and scientific research on natural wine is still scarce (Vecchio, Parga-Dans, González, Alonso, Annunziata, 2021; González, Alonso, Pargas-Dans, Franciscoco, 2019).

In vinification today there are more than 80 compounds authorized by the EU as additives, processing aids, and substances used as processing aids (The European Commission, 2019). There are 45 substances permitted to use as additives or processing aids when producing organic wine (The European Commission, 2012). However, these compounds are used in the winery and not in the vineyard. There has been no legal obligation in the European Union, to have a list of ingredients on sold wine bottles. However, a regulation has been agreed on, which mandate that the producers list all of the ingredients on all wine sold in the EU market from 2023 (European Parliament, 2021). The alcohol beverage sector proposed that the list did not have to be on the bottle itself, that it instead could be a label with digital information with a QR code on the bottle (European Parliament, 2021). Calling it a U-label, the platform for it was launched on December 1, 2021 (Comité Européen des Entreprises Vins, 2021). Critics claim that it is a way to further create hoops for consumers to jump through (Wine News, 2022). Consumers that want to be sure that they consume few additives and chemicals can turn to the growing natural wine movement.

The ambition of natural wine is to strip away everything artificial in wine (Buranyi, 2018). However, there are no official regulations on natural wine which means that any wine producer could claim that they produce natural wines. Due to this, it is not possible to know exactly how much of the wine produced is produced as natural wine. Though there are private product labels such as "Vin méthode nature" and "VinNatur" (Syndicat de Défense de Vins Nature'l, 2022; Associazione VinNatur, 2020). For these labels, there are regulations regarding how the wine should be produced. Some of these regulations are that the producer must be organically certified, the grapes should be harvested by hand and the wine should only ferment using natural yeast (Associazione VinNatur, 2020; Syndicat de Défense de Vins Nature'l, 2022). It is important to understand that a product label is not regulated by a government agency. Whereas a certification label is a label that follows regulations and communicates standards regulated by government agencies (Choi, 2014). However, the label Vin méthode nature has received formal recognition by French government agencies (Wilson, 2020).

The home of the label Vin method nature, France has a rich culture of winemaking and they are today one of the world's largest producers of wine (OIV, 2021; Syndicat de Défense des Vins Nature'l, 2022). Together with Italy and Spain, they accounted for 53 % of the world's wine production in 2020 (OIV, 2021). Where France produced 46,6 million of hectoliters (mhl). There are multiple labels and certifications for wine in France and the EU. In order to get certified with the Appellation d'Origine Contrôlée (AOC) there are strict guidelines on which techniques and grapes that are used as well as how the wine should taste in order to protect the French territory (Institut National de l'origine et de la qualité, 2013).

All wine is made from fermented grapes and the most commonly used vine species varieties come from the plant *Vitis vinifera* (Skelton, 2020). A plant that is prone to disease and pests (Mölstad, 2020). Some of the common problems are mildew and black rot. Many of which are solved with pesticides. In the 2018 European Union report on pesticide residues in food it is shown that more than 86% of the tested grapes have measurable amounts of pesticide residues (European Food Safety Authority, 2020).

1.1 Purpose and research questions

The goal of this study is to deepen the knowledge of natural winemaking. The purpose is to study possible challenges the natural winemakers face and how they handle different challenges that might occur. This is done by answering the following research questions (RQ).

RQ1: What challenges do natural wine producers endure/face in the viticultural part of the process of winemaking?

RQ2: How does natural wine producers handle the challenges?

1.1.1 Delimitations

This study is delimited to in-depth interviews with experienced natural wine producers in France and Italy.

2 Litterateur review

This chapter aims to explain concepts and give a broader insight and background to the field of study.

2.1 Natural wine

There is no clear definition of natural wine (Goode & Harrop, 2011; Vecchio, et al., 2021). It is a concept with no official regulation by government agencies, though associations such as the *Défense des Vins Nature* and *viticoltori naturali* have put down guidelines for their definition of natural wine (Associazione VinNatur, 2020; Syndicat de Défense de Vins Nature'l, 2022). According to Buranyi natural winemaking comes with an ambition to take away everything artificial (Buranyi, 2018). The goal of natural winemaking is to add as few additives and manipulate the wine as little as possible (Goode & Harrop, 2011). It is also about producing with a natural approach and not using agrochemicals (Goode & Harrop, 2011).

Natural wine is often produced in an organic or biodynamic system and is broadly described as low intervention (Goode & Harrop, 2011; Maykish, Rex, Sikalidis, 2021). The natural wine movement is believed to have begun in the second half of the 1900s as a reaction to the pesticide revolution and the spread of synthetic pesticides and fertilizers (Maykish, et al., 2021; González, et al., 2022). The revolution of chemical pesticides was during World War II and in the 1940s (dichlorodiphenyltrichloroethane) DDT was made available for agricultural use (Fisher scientific, 2016). By the 1960s and the publishing of the book, *Silent Spring* by Rachel Carson shedding light on the effects of pesticides organizations called for better regulations on pesticide use (Fisher scientific, 2016). This is in line with the time period of which the natural wine movement was first discussed (Maykish, et al., 2021; González, et al., 2022).

2.2 Biodynamic agriculture

Biodynamic agriculture is an agricultural system that originates from the ideas of Rudolf Steiner (Skelton, 2020). A polymath, who in 1924 launched his ideas of a new non-chemical way for the agricultural world to manage their farms (Skelton, 2020). In 1928 a movement of biodynamic farmers introduced the Demeter symbol for biodynamic growing to ensure authenticity (Skelton, 2020). Since then it has spread, and it is not uncommon for vineyards to use this system (Goode & Harrop, 2011). Biodynamic growing sees the whole farm as a system and treats it as a small ecosystem with a focus on life, life forces, and various preparations (Goode & Harrop, 2011). Working with a celestial calendar, soil health, and using different non-chemical methods for fertilizing and managing weed and pest control (Goode & Harrop, 2011). However, copper and sulfur are allowed to use and are commonly used as fungicides/pesticides against mildew (*Plasmopara viticola*) (*Uncinula necator*) and black rot (*Guignardia bidwellii*) (Goode & Harrop, 2011). In order to bring life and health to the soil of the farm, the farmer will use plant and animal parts as preparations (Diver, 1999). Partly for the nutrition value and partly because the preparations increase the life force on the farm (Diver, 1999). Goode and Harrop, (2011) summarized the different preparations and the methods of application in a table, see table 1 below.

Table 1. The preparations used in biodynamical farming and how they should be used as presented in the book *Authentic Wine toward natural and sustainable winemaking* (Goode & Harrop, 2011).

Preparation	Contents	Mode of application
500	Cow manure fermented in a cow horn, which is then buried and overwinters in the soil.	Sprayed on the soil typically at a rate of 60g/ha in 34 liters of water.
501	Ground quartz (Silica) mixed with rainwater and packed in a cow's horn, buried in spring and then dug up in autumn.	Sprayed on the crop plants.
502	Flower heads of yarrow fermented in a stag's bladder.	Applied to compost along with preparation 503-507 to control the breakdown of the manures and compost, helping make trace elements more available to the plant.
503	Flower heads of chamomile fermented in the soil.	Applied to compost.
504	Stinging nettle tea.	Applied to compost; also, sometimes sprayed on weak or low-vigour vines.
505	Oak bark fermented in the skull of a domestic animal.	Applied to compost.
506	Flower heads of dandelion fermented in cow mesentery.	Applied to compost.
507	Juice from valerian flowers.	Applied to compost.
508	Tea prepared from the horsetail plant (<i>Equisetum</i>).	Used as a spray to counter fungal diseases.

2.3 Organic agriculture

Organic agriculture is a system that, rather than using a lot of input, focuses on ecosystem management. The system aims toward a more environmental and sustainable farming (FAO, 2022). This is done by eliminating synthetic additives, enhancing biodiversity and soil health (FAO, 2022). Biodiversity in the vineyard contributes to a more resilient ecosystem (Partnership for biodiversity , 2017). Different vegetation grown in between the rows of vine attracts beneficial organisms that prey on pest, which reduces the need for pesticides. Hedges and trees act as climate control and a high biodiversity in the vineyard contributes to good soil formation, fertilization and erosion control (Partnership for biodiversity , 2017). Steiner, Grace and Bachers (2021) study show that having a high biodiversity in the vineyard can enhance the quality of grape. Although they argue that there has to be a balance between the grape varieties and the vegetation grown in-between the rows in order to achieve ecological benefits.

Organic growing characterizes itself by how it uses a prevention tactic for pests and diseases and the use of only organic fertilizers and compost (Jordbruksverket, 2022). There are official standards and guidelines for organically certified labels which the FAO/WHO Codex Alimentarius Commission has set (FAO, 2022). The goal of organic production is also to decrease harmful substances in the environment, promote locally produced food (rule applies to the EU), promote organic plant breeding, and develop the range of plants that are fitting for organic production (Jordbruksverket, 2022). In viticulture, this is applied by placing more reliance on the vine's natural ability to resist pests and diseases given the right treatment and care by the producer (Skelton, 2020).

2.4 Vin méthode Nature

Vin méthode Nature is a label created by the French syndicat de défens des vins naturel (Syndicat de Défense des Vins Nature¹, 2022). The Vin méthode Nature consists of 12 guidelines that the producers must follow in order to carry the label (see table 2) (Syndicat de Défense de Vins Nature¹, 2022).

Table 2. A modified summary of the guidelines of the label Vin méthode Nature as described in the charter of commitment by Syndicat de Défense des Vins Nature (Syndicat de Défense de Vins Nature¹, 2022).

1.	The wine must be made with 100 % organically certified grapes.	7.	The use of sulfites is not permitted before or during fermentation, nor in any starter, Pied de Cuve.
2.	The grapes must be hand harvested.	8.	Winemakers should present the guidelines along with the labeled bottles during triad fairs.
3.	Only spontaneous fermentation with indigenous yeast.	9.	There are two labels; one for wines without any added sulfite and one for wines with added sulfite.
4.	Oenological additives and processing aids are not permitted.	10.	The label is awarded each year.
5.	No voluntary modification of the grapes is permitted.	11.	The label must be easy to identify and distinguish on the bottle for consumers.
6.	The use of brutal and traumatic physical techniques is not permitted.	12.	The winegrowers must commit with their own name.

In the viticulture part of the winemaking process are guidelines one and two the most relevant since they dictate the means that are allowed to be used when growing the wine. Hence, as discussed in paragraph 2.3 to be organically certified the grower must comply with the official standard and regulations, which requires the grower to only use organic compost, fertilizer, and pesticides.

2.5 VinNatur

VinNatur is a label launched in Italy by the natural wine association for the same purpose as of the French label Vin méthode Nature. It was founded in 2006 by the Italian Angiolino Maule and its goal is to unit winemakers (Associazione viticoltori naturali, 2022). The natural wine association describes the production of natural wine as:

Producing natural wine means respecting the soils, the environment, the natural cycle of life, and eliminating the use of invasive and toxic agents, first in the vineyard and then in the cellar. (Associazione viticoltori naturali, 2022)

In order to use the VinNatur label the winemaker must comply with a number of procedural regulations (Associazione VinNatur, 2020). The association has divided the regulations into the categories “in the vineyard” and “in the winery” (Associazione VinNatur, 2020). The regulations for the viticultural part, “in the vineyard”, of the winemaking process are presented in table 3 below.

Table 3. A modified summary of the regulations for in the vineyard as described in Procedural regulations for “VinNatur wine” production (Associazione VinNatur, 2020).

Permitted procedures	Procedures that are not permitted
Organic fertilization or cover crops	Mineral, organic-mineral and chemical fertilizers
Sulphur-based products against downy mildew	Chemical weed-killer or drying products
Copper based products against downy mildew	Anti-parasites of synthetic, systemic and cytropic origin, not permitted in organic farming
The use of naturally derived products, with zero residue	Phosphites
Drip irrigation, only as emergency measure	Chemical insecticides
Manual harvest	Mechanical harvesting
Resistant varieties	Cisgenic and GMO grapes or GMO-derived products

2.6 Terroir

A French word that stands for the idea that a grape grown in a specific geographic location will have a characteristic taste that represents the location (Goode & Harrop, 2011). It can be defined as different vineyards producing wines with different flavors even though they grow the same grape varieties and handle the vinification process the same way (Goode & Harrop, 2011). This is because of the difference in soil and micro climate of the vineyards. It is on this concept that the AOC classification system is built upon (Mölstad, 2020).

The concept of terroir is on a local scale, for example, if a wine is produced in Napa Valley, USA and one in Bourgogne, France several other factors will play a part in the difference of taste and terroir not necessarily being the biggest one (Goode & Harrop, 2011). Terroir is about the local conditions such as: geology (type of soil and water supply), climate (precipitation, hours of sun, wind, and fog) and topography (terrain and altitude) (Mölstad, 2020). There is also a human factor since the winemaker plays a vital part in the growing and making of wine (Leeuwen & Seguin, 2007).

2.7 Diseases

This section presents a selection of common diseases that can damage *Vitis vinifera*. All pests on *Vitis vinifera*, except Phylloxera, have not been considered in this study.

2.7.1 Phylloxera (*Daktulosphaira vitifoliae*)

The vine louse, Phylloxera, is native to north America and there it lives in symbiosis with the native vines (Skelton, 2020). The louse feeds and lives on the roots and leaves of the vines causing damages that the American vines are able to mend (Skelton, 2020). The damages that the louse causes are something that the European vine does not have a defense against (Mölstad, 2020).

Phylloxera was first observed in Europe in 1863 and soon it spread causing devastating damages to the vineyards (Skelton, 2020). At the end of the 1900th century the louse had spread and destroyed vineyards in Europe, South Africa, Australia and South America (Mölstad, 2020). Today most vinestocks of *Vitis vinifera* being planted are grafted on native north American rootstocks to avoid the damages caused by the vine louse (Skelton, 2020).

2.7.2 Downy Mildew (*Plasmopara viticola*)

Originated from America the downy mildew was first observed in Europe in 1878 (Skelton, 2020) and 2022 it is spread to most vineyards of the world (Skelton, 2020). Downy mildew is a fungus that affects the growth, quality, and harvest of the vines (Pettersson, 2009). The fungus develops a white coating on the leaves, grapes, and shoots (Pettersson, 2009). If a vineyard gets infected it is impossible to eliminate, though it can be kept in control (Skelton, 2020). The fungus is benefited by dry weather while strong sunlight inhibits its germination (Pettersson, 2009). Control of downy mildew is maintained by spraying the crop with copper (Skelton, 2020). Organic and biodynamic growers have a challenge in controlling the disease since they are only permitted to use lower quantities of copper (Skelton, 2020). There is however web-based a platform that helps the grower predict and foresee attacks based on environmental data (Vineman, 2013). The model used on the website was able to reduce the use of copper in vineyards by 20-73% since it advised the growers when to spray for maximum effect (Vineman, 2013).

2.7.3 Powdery Mildew, Oidium (*Uncinual necator*)

Native to America the powdery mildew was first reported in Europe in 1845 (Skelton, 2020). It is a fungus that gives the affected plants a white powdery covering on the leaves and causes the grapes to split (Skelton, 2020). The fungus affects the fruit yield, quality, and growth of the plant (Britannica, 2017). Common compounds used as fungicides are copper and sulfur (Britannica, 2017). This is a way to control the disease and it is permitted to use in both organic and biodynamic agriculture (Merot, Fermaud, Gosme, Smits, 2020). By reading reports on temperature, humidity, and precipitation it can be predicted when the fungus spores and therefore are more affected by fungicides (Skelton, 2020). It is also possible to enhance plant's resistance against pathogens by triggering the plants immune system with pathogen associated molecule patterns (Vineman, 2013). Continuous use of these molecules can enhance the plants natural response towards the pathogens and lead to a stronger early defense (Vineman, 2013).

2.7.4 Black rot (*Guignardia bidwellii*)

Black rot is a fungal disease that is impossible to eliminate and there is a need for chemical control (Skelton, 2020). A clean vineyard will also help to control the disease (Skelton, 2020). The fungus affects the leaves, shoots, and berries and is a nuisance for organic growers (Weigle, 2014). This is because of the limited resources of permitted fungicides (Weigle, 2014). The disease is tricky since the grape cluster can appear healthy only to, late in the season, turn black and dry up (Weigle, 2014).

2.8 Theoretical discussion

The central parts of natural winemaking and perspectives on them are presented in the literature review. This will be further discussed and developed in the analysis to get an increased understanding of the different challenges that affect the viticulture part of the process.

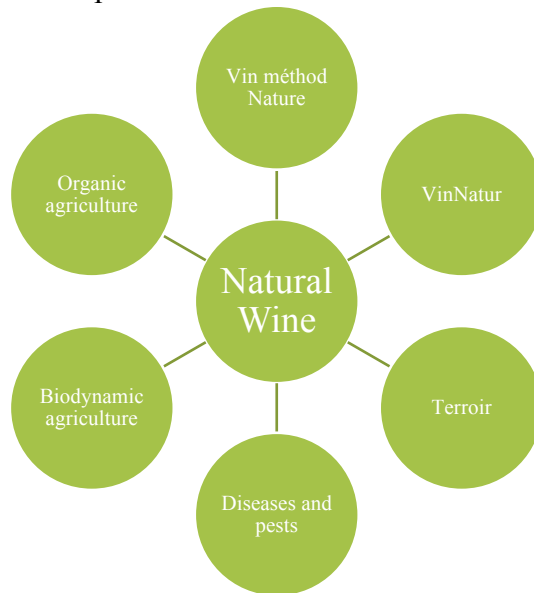


Figure 1. The central parts of natural winemaking.

Figure 1 shows the important parts in the process of natural winemaking and that the winemaking will be dependent on what the winemaker chooses considering agriculture systems, labels and includes the possible challenges that might occur. The figure also includes the concept of terroir that takes into account the unique flavors of the local area.

3 Methodology

This chapter will address the methodology used in the study as well as the theory supporting it.

3.1 Research design

This study is a qualitative study based on semi-structured interviews. According to Bryman and Bell, a semi-structured interview gives the interviewer the possibility to change the order of the questions and if needed ask follow-up questions (Bryman & Bell, 2011). The study is a case study of natural winemaking. Case studies are done when the researcher aims for an enhanced understanding to get a more holistic view of a practical problem (Merriam, 2011). Case studies most often use qualitative data and consist of various sources. Common forms of collecting data in a qualitative study include interviews, text analysis, and observations (Williamson, 2002). The study includes a literature review to give more insight and background to the research questions of this study. A literature review is a way to determine the most relevant questions of the topic (Yin, 2018). In the analysis of the empirical data of this study the literature review is used to interpret and understand the empirical data from the interviews.

3.2 Data collecting

When constructing the interview guide the questions why and how were primarily used. This since they apply to the three conditions put forth by Yin as seen in table 4 below (Yin, 2018).

Table 4. Relevant Situations for Different Research Methods as presented in the book Case study research and applications: design and methods (Yin, 2018)

Method	(a) Form of Research Question	(b) Requires Control Over Behavioral Events?	(c) Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

In the first stages of this study, it became apparent that I required experienced natural winemakers as interviewees. I decided to turn to experienced European natural winemakers. I came in contact with a French natural wine producer through a mutual acquaintance. Bryman and Bell describe this as a convenience sample (Bryman & Bell, 2011). It was this said French natural wine producer who helped me get in contact with two more interviewees, one French and one Italian. Bryman and Bell describe this as a snowball sampling (Bryman & Bell, 2011). In the table below, it is shown details of the interviews and the interviewees. For the purpose of protecting the interviewees' identity only their first names are stated in the study. One interview was conducted in Swedish and therefore some of the quotes have been translated from Swedish to English.

Table 5. Interview information.

Name	Land of operation	Date of interview	Length of interview	Type of interview
Erik	France	05-05-2022	1 hours and 30 minutes	Zoom call
Michel	France	12-05-2022	40 minutes	Zoom call
Guido	Italy	19-05-2022	1 hour	Phone call

4 Empirical results

In this chapter the empirical data is presented. The data is collected through interviews and structured using a content analysis of the interview texts.

4.1 The producers

In this section a short background on the producers and their vineyards is presented.

4.1.1 Erik

Erik is an attorney turned natural wine producer, operating in France since 2006. This year 2022 he has 9 hectares planted with vinestocks and one employee. The vineyard grows nine different varieties of grape in a biodynamic system and produces 30 000 to 35 000 bottles a year.

4.1.2 Michel

Michel is a natural wine producer operating in France. He has a family-owned vineyard with vinestocks on 10 hectares grown in a biodynamic system. He and his family are the only employees except during harvest season when they have 4-6 seasonal workers. With a background in advertising, he is since the year 2000 a fulltime wine producer. The vineyard grows 10 different varieties of grape and produce 35 000 to 40 000 bottles per year.

4.1.3 Guido

Guido is a part time university professor and a part time natural winemaker operating in Italy. He started in 2001 when he bought an already producing vineyard with the aim to make wine the way it was made in ancient times. In 2022 the vineyard consists of 4.5 hectares planted with vinestocks and 40 different varieties of grapes grown in an organic system. Producing 15 000 to 20 000 bottles of wine a year.

4.2 Definition of natural wine

When asked about what natural wine mean to the producers and how they define it the producers had a similar view. They all said that natural wine is about having low intervention, keeping the grapes pure and letting the wine tell a story. This is illustrated in the quote below.

I would say that at least that it has to be based on organic farming and then not adding or taking anything away in the vinification except grape peels and stuff like that. But not adding yeast, nothing, not even sulfur dioxide. For me it is very simple, it is about minimal intervention. (Erik)

However, one producer stated that he primarily cared about the taste and making a good wine and how it was created was secondary. Because if the wine is not appetizing it should not be sold and drunk by consumers for the sole reason that it is natural wine. This, he meant, will just harm the natural wine movement and make consumers skeptical towards natural wine. This, he describes, is one reason for why they are not actively marketing their wine as natural wine.

We don't have a flag upon our head said we are making a natural wine. First, we are making wines. And we are expecting to them to be as good as possible. And then if you're interested we can discuss Yes, so organic Yes, they are natural, but we expect them to make them life by themselves. For example, in Stockholm if two ladies order a bottle in a restaurant they could easily find it tasty juicy and good. Without knowing its natural or without knowing everything. [...] like if you are going to a restaurant you're expecting the food is good. That's it. You don't want well after all it's better if it's kilometers zero if it's organic and so on. But first of all, it has to be good and sometimes we are forgotten this point and many natural wines are too natural if I may say and they are not very precise they are not very well and enthusiastic. (Michel)

The interviewees were all keen on the taste of the wines. Erik stating that he often made wines with just one grape variety to showcase its character, quality and terroir. This is further strengthened by it being produced as a natural wine.

4.3 Challenges of producing natural wine

One of the biggest challenges in the viticultural part of natural winemaking is, according to Erik and Michel, infestation of mildew. However, Erik said that he has a good plan and system which prevents any major breakout of the disease. This he attributes to the biodynamic system. He also stated another challenge, which is getting enough natural yeast on the grapes for them to ferment in the winery. This is connected to having good quality grapes. Moreover, Michel explains that the mildew is a recurring problem partly because of the climate which some years is too dry and the vineyard does not use irrigation for their plants.

Guido stated, as illustrated in the quote, that the biggest challenges for people to produce natural wine is their mindset. As a natural wine producer, you have to be ready to think outside the box and the rules of today's way of making wine.

The biggest challenge in the vineyard is probably to it's your bias in how people think. They think they have to fertilize the thing they have to use products that is just a frame of mind. People are not ready to do that (produce wine with low intervention in the vineyard), you know, they're so used to work the soil and fertilize that they cannot do that. It's true that my yield that it can be a little smaller, but you know, the quality is higher and, and the production is steady [...]. (Guido)

On the other hand, he said that his biggest challenge in the vineyard is the climate since it is out of his control. He describes that pathogens are not a big concern since he is able to keep them under control by constant monitoring of the vinestocks.

Erik and Michel are producing wines in the biodynamic system. This means that the rules of Rudolf Steiner determine which compounds the producers can use against disease and challenges. These vineyards use the biodynamic preparations 500-508 and some additional ones. Erik states that he uses stinging nettles, rosemary and field horse tail in a concoction which he sprays on the grapes in order to get increased resilience against mildew. Michel explains that he uses stinging nettles, lavender and mint. He also uses a concoction of wild fennel which he finds unclear if it really works but he does so because his gut tells him.

We are enjoying also to make fennel also for example. Fennel, wild fennel are growing in the vines and it smelling so good. I say okay, let's make a kind of soup with that. And yeah, I'm enjoying that. I don't know if he if he if he does an effect. Really effect. But I don't care. Finally I'm doing it. (Michel)

All three producers use copper and sulfur in the viticultural part of the winemaking process. Erik claiming that sulfur is such a volatile compound that, with the dosage they use in the vineyard, there is no danger in using it. Furthermore, the sulfur is imported from a mine in Italy which means that it is pure sulfur and not produced with petroleum. In his opinion this makes it better and are in line with the definition of the production of natural wine. However, all producers agree that it is impossible to produce wine without sulfur and copper today. They do think that it is possible to use it in very small dosages if you care for your grapes and work with preventive actions in order to keep healthy and disease resistant plants. This is explained in the quotes below.

The Sulfur is against two diseases. The one is the Oidium (Powdery mildew) and the other one is the black rot. Yep. And without sulfur you couldn't have beautiful grapes and we also use some copper. Against mildew but very few. (Michel)

Unfortunately, it is the case that against oidium and mildew it is only copper sulfate that is really effective. Everything else helps but you will get mildew (downy mildew) without copper sulfate if it is a difficult year. The same thing goes for the Oidium (powdery mildew), you can't control it without sulfate. (Erik)

All of the producers use minimal intervention and keeps the lanes, in-between the grapes, green with natural flowers such as herbs, poppies, lavender, wild arugula and grasses. The lanes are cut a few times a year and the plant material get used as green manure.

They all state that in order to solve the challenges of natural winemaking it is important to strive for the best quality grapes by taking preventive measures and care for the plant from the early stages of its life. This is exemplified by the quotes by Erik and Guido.

It is what biodynamic is about, being proactive and not reactive. Because if you are reactive [pause] If you haven't done the job from the start, then you have to spray 20 kilos of copper sulfate and nothing good comes from that. (Erik)

So yeah, it's just natural. It's very biodiverse. So, there is a lot of plants. I believe that you have to keep trees around the vineyard, then you have to keep a lot of different weeds. And right now, for example, there's a lot of flowers in the vineyard. Because they, you know, not working the soil all the time and not using herbicides. There's a lot of biodiversity in terms both flora and fauna. (Guido)

When asked the question of why not more people choose to produce natural wine the winemakers agreed, it is more demanding. Producing natural wine demands a broader understanding of viticulture, there are no margins of error. It is harder to keep a consistent quality and there is a higher risk. There is a risk that you are not always succeeding.

I think it's mostly in the high risk of winemaking. Because natural fermentation with no sulfites, they can go wrong. And so people are really scared of doing that. (Guido)

4.4 Regulations and product labels

When asked about an official label for natural wine the producers had different opinions. Erik said that for him it was important that the label kept up with his standards and values for natural wine. He had previously made the decision to leave the French certification for biodynamic, Demeter since he thought they had lost sight of what biodynamic stand for and thought that if an official natural wine label was created it would go the same way.

I believe that (a product label) would become too watered down and it would not stand for what I call natural wine. [...] In fact, I don't think that it would change a lot if there was a label. I don't have much confidence in all of these regulations. I believe that it is better that everyone stand for their own product. What really is important is transparency. The best thing that could happen is if there becomes a strict regulation on a list of ingredients. That would be the best thing. Then I would only write grapes. (Erik)

Guido shared some of the scepticism with Erik meaning he thought that creating an official label was often time consuming. He compared the process to the process of the organic label in EU which took 25 years to establish. On the other hand, he agreed with Michel that an official label would give the consumer some clarity and not give producers a chance to market themselves as natural wine producers, when in fact they are not.

Well, for me, it doesn't change much, I think, but for the consumers will be more comfortable, I think. Right now, you have to trust the producers, because there's no legal requirement. (Guido)

[Yes] ...because sometimes for the consumer who are not aware, they [the consumer] say okay this is organic. Or many people say that when it is organic they don't use any fungicides or pesticides. They are a little bit confused. We are living in this world we are working in it and we think that everybody knows as much as we do. (Michel)

The empirical findings in this chapter will be further interpreted and analysed in the next chapter.

5 Analysis and discussion

This chapter will analyse and discuss the empirical result in order to develop a conclusion.

5.1 Definition of natural wine

There is a general view of what natural wine is. This view is expressed by Goode and Harrop, they state that the common goal of natural winemaking is to use as few additives as possible (Goode & Harrop, 2011). It is evident that the wine producers of this study confirm this view as all interviewees strive for low intervention in their production. Although, their opinions differed on what to prioritize in the viniculture process.

5.2 Challenges and solutions

The challenges, as expressed by the interviewees, of natural winemaking are the following: diseases e.g. downy mildew, powdery mildew and black rot, climate and having enough indigenous yeast on the grapes. The interviewees all agreed upon these challenges. However, in the literature there are no explicit explanations for what challenges that could be exactly related to only natural winemaking.

To solve the problem of mildew and black rot the natural winemakers use sulfur and copper. This is the same method as the conventional growers use, but natural growers use smaller dosages. The interviewed producers buy their sulfur directly from mines and not synthetically made. Stating, that since it is naturally occurring it is in line with natural winemaking. All of the interviewees confirm what the theory states, that a proactive approach, a high biodiversity in vineyard and constant monitoring of the vines, requires smaller doses of both copper and sulfur (Vineman, 2013). This approach makes it possible to predict the most effective time to apply the copper and sulfur, thus requiring less compounds to control and manage the disease outbreak. Furthermore, as the interviewees strive not to use any pesticides the natural winemaker relies more on the vines natural resistance towards diseases. All of the interviewees explain that the winemakers need to have a deep knowledge of wine, since the margins of error is lower for natural winemakers. This because

they use fewer additives than conventional winemakers, which makes it tough to make wine out of low-quality grapes and still maintain a desired taste. This indicates that the process of natural winemaking demands a higher quality of grapes.

5.3 Regulations, certifications and product labels

Natural wine is often made in an organic or biodynamic system, which has certifications and regulations on how to produce the wine (Goode & Harrop, 2011). As shown in this study, there are no official certified labels or regulations for natural wine. The interviewees' opinion on the question if there should be an official certified label differed. One potential risk of introducing a label is stated by one of the interviewees is that it will become watered down and not be in line with the essences of natural winemaking. Though, what they all agreed on was that if such a label was created it would benefit the consumers, making it easier for them to choose among the vast assortment of wines available on the market. The making of natural wine and consumer's demand for it is in line with Aprile's study that shows that consumers want sustainable food (Aprile, et al., 2015). The methods of producing natural wine differed between the interviewees. Perhaps this is the essence of natural wine as it allows for a level of freedom when producing it. There are no rules for producing natural wine as long as you produce the wine as natural as possible (Goode & Harrop, 2011). Techniques and methods are allowed to be different, which makes the natural wine category diverse. I herewith consider that the drive of natural winemakers is the freedom in the process which easily can be limited with a certified label.

The findings propose that the producers of natural wine see no need for an official certified label. Because it would not add any additional drive as the main driver is their ideology. However, this study shows that it could be beneficial for the consumers, by making it easier for them to buy sustainable food/wine. Notwithstanding, it could be problematic for the industry as regulators need to improve a framework for the winemakers to be able to regulate them and as a guidance for the customers. This may contribute to an increased understanding but may take away the driving forces for the natural wine producers.

6 Conclusion

The goal of this study is to deepen the knowledge of natural winemaking. The purpose is to study possible challenges the natural winemakers face and how they handle different challenges that might occur.

This study shows that there are challenges in natural winemaking. These challenges being diseases, climate and grape quality which answers research question one. The study also show that it is possible to make wine without the use of a large number of agrochemicals. These findings support research question two concerning how the producers handle challenges by constantly monitoring the vineyard. By doing this, producers may act proactive to prevent diseases, while keeping the intervention at a minimum. Moreover, the grapes are required to be of a high quality, which the producers constantly strive for. Biodiversity in the vineyard is one method that helps achieve that by creating a more resilient ecosystem which contributes to enhance the quality of the grape.

About the possibilities to develop official certified label for natural wine this study conclude that the officials must consider including all the different forms of techniques and methods, in order not to risk killing the spirit of natural winemakers. I herewith conclude that natural winemaking is a sustainable choice for both the producers and consumers making it the new old way of making wine. The vineyard and the winery go hand in hand and to produce natural wine both of them must apply to the common goal of natural winemaking.

6.1 Future work

This study has contributed to an understanding in a complex and large movement, but further research is needed. Doing a quantitative study and expand to the rest of Europe could be of interest. Another possible future research could be to include the winery and the whole production cycle of natural wine. This since the process in the winery is just as important as the viticulture part of the process.

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Appendix 1- Interview guide

The interview guide that was used during the interview of the natural wine producers.

- Personal background
 - Name
 - Name of vineyard
 - Age
 - Education
 - Role
 - Your history in the winemaking trade
- How is your vineyard structured?
 - How many acres of wine do you grow?
 - How many vinestocks do you have?
 - How many bottles do you produce annually?
 - Which varieties of grapes do you produce?
 - Which agricultural system do you use? Biodynamic, organic...?
- As a producer how do you define natural wine?
 - What is natural wine to you?
 - For how long have you grown natural wine? What did you do before?
 - Why did you start growing natural wine?
 - When did you do your transition from industrial wine?
 - Why did you do the transition?

- What is the biggest challenge in producing natural wine?
 - What is, in your opinion, the biggest difference between industrial wine production and natural wine production?
 - What are the major challenges in pest and pathogen control?
 - When not using pesticides against common problems such as mildew how do you go about it?
 - How do you prioritize when making natural wine? Taste, resistance in the vinestocks or something else.
- Regulations and labeling
 - So far there are no official regulations on natural wines. Do you think that the natural wine producer would benefit from regulations and official certified product labels?
 - Would the market benefit from an official certified product label?

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