

The integration of fungus tolerant vine cultivars in the organic wine industry: the case of German wine producers

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Abstract

While the wine industry is generally not perceived as major environmental polluter, soil erosion, chemical pesticide and fertilizer usage in addition to ground water consumption result in consequential environmental impacts. In Germany, organically certified wine production has grown exponentially since the early 1990's. However, organic wine makers are faced with a double challenge: how to achieve necessary market penetration with their products while ensuring an adequate standard of living. Fungus tolerant vine cultivars (grape varieties) have gained recent attention and received accolades from some organic winemakers. At present, there is a paucity of literature in the field of fungus tolerant vine cultivars and the marketability of the wines that are being produced. Hence, the purpose of this paper is to provide an overview of the fungus tolerant vine cultivars in Germany with a particular interest in researching the current marketability. Findings of the survey provide a clear picture of the current positioning of fungus tolerant vine cultivars in the market and provide hints on the steps necessary for the promotion and exchange of scientific and practical findings concerning disease tolerant grape cultivars nationally and internationally.

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1 Introduction

Every year, the National Restaurant Association (NRA, 2009) surveys hundreds of professional chefs, members of the American Culinary Federation, in a drive to obtain insights on the coming food and beverage trends. Among the top 20 trends, 4 out of the top 5 are directly related to issues surrounding sustainability in food & beverage including (1) *locally grown produce*, (2) *locally sourced meats and seafood*, (3) *sustainability* and (5) *locally produced wine and beer* (NRA, 2009). In the Alcohol and Cocktail trend listings, on of the multiple sub-categories, *organic wine, beer and liquor* ranked in the top 5.

When tackling sustainability issues, hoteliers and restaurateurs often turn towards ad hoc measures including energy saving measures, water saving measures, green purchasing and waste minimization practices (Sloan, Legrand and Chen, 2009). Within the food and beverage operations, green purchasing is one of the favoured activities. This is in direct response to the recognition that one of the ‘major problems in the global food production system is in the unsustainable inputs that are used’ (Sloan, Legrand and Chen, 2009). European and American consumers and restaurateurs are increasingly turning towards the purchasing of organically-grown products, including organic wines (OTA, 2009).

While the wine industry is generally not perceived as a major environmental polluter, soil erosion, chemical pesticide and fertilizer usage in addition to ground water consumption result in consequential environmental impacts. In Germany, organically certified wine production has grown exponentially since the early 1990’s. While organic consumption comprised in 2007 only three per cent (5 million of euro) of the entire German food and beverage market, organic producers occupy a niche market that bears great potential (SÖL, 2009). Currently, 1,73 % of the total cultivated area for the purpose of making wine in Germany is done so using organically certified methods (Ecovin, 2008).

At present, there is a paucity of literature in the field of fungus tolerant vine cultivars and the marketability of the wines that are being produced. Hence, the purpose of this paper is to provide an overview of the PIWI cultivars (the acronym PIWI is a short form from the German word *pilzwiderstandsfähig* literally translated as *disease tolerant* or more precisely as *fungus tolerant*) in Germany with a particular interest in researching the current marketability. The study population was restricted to the owners of wineries which are members of Ecovin, Germany’s largest organic association representing 204 wineries.

Findings of the survey provide a clear picture of the current positioning of PIWI cultivars in the market and provide hints on the steps necessary for the promotion and exchange of scientific and practical findings concerning disease tolerant grape

cultivars nationally and internationally.

2 Literature Review

2.1 Definition of Organic Wine

In wine production, *organic* has different meanings. There are multiple definitions available for *organic wine* varying on the author's country of origin. This is partly due to the fact that each country produces its own set of legislations for the production of organic food, from which the definition of organic wine is usually derived. The result is the absence of a world-wide agreed definition.

According to the European legislation the term *organic wine* is not yet defined. The term *organic* however is defined as; 'coming from or related to organic production' (Council of the European Union, 2007). However, this excludes the wine product. The official terminology to utilise when referring to what is known in the general public as *organic wine* would be the formulation: *wine made from organic grapes*. The current Council Regulation (EEC) No 834/2007 (replacing the Council Regulation No 2092/91 which was in place since 1992) on organic agriculture and the corresponding labelling of agricultural products and food and the relevant implementing regulation 889/2008, does not provide for rules on vinification of grapes. The regulation consequently states that only the *production* of the grapes needs to adhere to organic guidelines while the *processing* of the grapes which includes fermentation and aging for example can follow conventional methods (Council of the European Union, 2007). The EU regulation is understood as the minimum requirement for organic production. Stricter guidelines do exist within each individual European country or with accredited environmental labels. In countries with relatively high humidity levels such as Germany, the use of pest control containing sulphur and copper is allowed and is considered 'common practice' in the production of organic wines. For purpose of clarity, the term *organic wine* is used throughout this paper.

The USA and Australia have a more specific definition of *organic wine* compared to the EU. The United States Department of Agriculture (USDA) regulation of 2002 distinguishes between two product categories, which can use the term *organic*: (1) Wine: which is labelled as *organic wine* needs to be made out of organically produced grapes and must be produced without the addition of sulfites besides naturally occurring sulfites with a total sulfite level less than 20 parts per million (USDA, 2009). Sulfite or sulfur dioxide is used as a preservative in wines. Wine made after traditional winemaking techniques including added sulfites, but made out of organic grapes is categorised and labelled as *wine from organically*

grown grapes (USDA, 2009). The latter category includes a much wider range of wines than the strict *organic wine* simply due to the use of sulfites. Winemakers not willing to take high risks in having spoiled wines is the main driver for using sulfites.

As the current research focuses on the German wine growing regions, the EU legislation serves as a base when referring to *organic wine*.

2.2 Organic Production and Consumption

In Germany the overall agricultural area under organic cultivation increased significantly during the last decades. While in 1990 only about 80.000 hectares were under organic cultivation, the area decupled up to 865.000 hectares in less than two decades (SÖL, 2009). This represents a 5.1% share of the overall area used for agriculture. Two-third of this share is cultivated by individuals or companies members of organic associations such as Bioland, Ecovin or Demeter. Parallel to the development of organic agriculture, the sales of organic products grew steadily in the last years increasing from 2.1 billion of euro in 2000 to 5.3 billion of euro in 2007 (BÖWL, 2009). This represents a 3.1% share of the overall food market in Germany and is considered the largest market for organic products in Europe (SÖL, 2009).

Organic wine is produced in all parts of the world today from Hungary to California, from Chile to Australia. However, it is in Europe where the largest proportion of organic vineyards versus traditional vineyards can be found (Willer, Schmid and Römmelt, 2009). France, Italy and Spain being amongst the largest wine producing countries of the world also have the largest vineyard area under organic cultivation. However, in percentage share of organic versus traditional vineyard cultivation, Austria with 5.0% ranks number *one* within the EU. Germany currently cultivates 4400 hectares organically which represents a 4.3% share of the total vineyards area under cultivation (Rippin et al., 2008).

A study conducted in 2006 and 2007 on the development and the future potential of the organic wine market corroborated with the previous example and found that a general increasing demand for organic wine can be observed for Germany and the other countries researched (Jonis et al., 2008). In 2007, organic wine sales had a total value of 42 million of euro. While considerable on its own, this represented a share of 3.5% of the overall 1.2 billion of euro wine market value in Germany (Behr and Schaack, 2009). The average price for an organic cask wine increased by 25% in 2007 (Behr and Schaack, 2009).

2.3 Fungus Tolerant Vine Cultivars

In Europe, the grape varieties commonly used for wine production are part of the botanical family called *vitis vinifera*. Grape varieties such as Chardonnay, Merlot and Riesling are part of that *vinifera* family. All varieties within the *vitis vinifera* family are usually grafted on the rootstock of an American variety (for example *vitis riparia*) which has a tolerance towards grape phylloxera, downy and powdery mildew (Basler, 2003, Schwab, Knott and Schottdorf, 2001). As downy and powdery mildew affect the upper, green part of the plant, grafting offers a positive effect on tolerance against grape phylloxera, but does not lead to a tolerance towards mildew for the overall plant. In central Europe, the most dangerous or harmful fungi in grape production are downy and powdery mildew (Köpfer and Gehr, 2000). *Disease tolerant*, or *fungus tolerant* vine cultivars (a cultivar is a variety of a plant developed from a natural species or a hybrid of two species and maintained under cultivation) are especially of interest in regions with a high infection risk due to nightly dew formation and thunderstorms (Schärer, Amsler and Tamm, 2008). Similar to phylloxera, downy and powdery mildew were brought to Europe during the mid-19th century from the United States, where wild grape varieties are in generally immune towards both types of fungus (Basler, 2003). European grape varieties within the *vitis vinifera* family are in general not resistant towards these fungi.

In order to obtain fungus tolerance, hybrids are formed through grafting between European and American grape varieties and species. In order to obtain the most beneficial traits from both roots; (1) the fungus tolerance obtained from American varieties and (2) the superior taste and aromas from the European varieties, both varieties are crossed to form hybrids cultivars. In some cases the grape varieties are simple crossings between one American variety and one European variety. In other cases multiples simple hybrids with different origins are further crossed with each other. For most of the varieties, the fungus tolerance is incomplete but under normal conditions it is possible to save most of the sprayings against funguses (Schwab, Knott and Schottdorf, 2001).

This system of creating new varieties of vine cultivars can be dated back to the second half of the 19th century. French growers, in particular Louis Bouchet de Bernard in 1828, tried to overcome the vine diseases introduced from the US (Basler, 2003, Gallet, 1956, Schwab, Knott and Schottdorf, 2001). In the past two decades, fungus tolerant grape varieties are mainly bred in Germany, France, Switzerland, Austria and Hungary as well as in Canada and the US (Basler, 2003). The average duration from the crossing and therefore the initial breeding of a new hybrid variety to its market introduction takes between 22 and 30 years (Jörger,

Boos and Ludewig, 2004). Although extensive research in the field of fungus tolerant grape varieties has taken place for decades, consumers may have to wait to enjoy wines from these new breeds. Germany has taken active steps towards fungus tolerant vine cultivars and many have entered wine production over the past 10 years (Basler, 2003). New varieties in Germany need to be approved by the authorities before these can lead to the production of wine. In 2003, 12 fungus tolerant grape varieties were being approved or licensed for wine production in Germany (Schmidt-Tiedemann, Ebersberger and Köglmeier, 2004). The long time span from the initial research, first grafting, planting, cultivating and introduction to the market place make it difficult to currently estimate how many fungus tolerant grape varieties are under cultivation by winemakers or under research in nurseries.

The share of fungus tolerant vine cultivars of the total area of organic wine production in Germany is still relatively small. According to the survey done by Schmidt-Tiedemann, Ebersberger and Köglmeier (2004) of organic wine growers, the share of organic vineyards planted with fungus tolerant grape varieties was 7.9% in 2003. Although in general more white grape varieties are grown in organic viniculture than red grape varieties, the share of red grape varieties is by far higher for fungus tolerant grapes. According to this study, more than three quarters of the area cultivated with fungus tolerant grape varieties is planted with red cultivars. The red fungus tolerant cultivar Regent is the second most popular grape variety followed by the conventional grape variety Pinot Noir with a share of about 15% of the area of organically farmed vineyards planted with red wine varieties or 5% of the total area of organically farmed vineyards, including white wine making areas (Schmidt-Tiedemann, Ebersberger and Köglmeier, 2004).

In regards to the planned area to be cultivated with fungus tolerant vine cultivars and other grape varieties, 40% of the new plantings planned for the next 5 years will be fungus tolerant vine cultivars in Germany. This is in direct response to the increased demand for organic wines (Schmidt-Tiedemann, Ebersberger and Köglmeier, 2004).

Fungus tolerant vine cultivars were developed to bypass the use of pesticides in plant protection. Fungus tolerant cultivars are especially useful for organic grape production (Kauer, Schultz, and Rodehuth, 2002). German wine growers see plant protection as the main problem in organic viniculture (Kauer, Schultz, and Rodehuth, 2002). Downy mildew is especially problematic in a relatively cool and humid climate and infects plants mainly around a temperature of 5 to 20 degrees (Deil, 2003), which makes fungus tolerant grape varieties of special interest to Central European countries. Southern European countries in comparison have fewer difficulties with plant protection in organic viticulture (Hofmann, 2003).

According to Schwab, Knott and Schottdorf (2001) an average of 4.8 sprayings can be saved per year with fungus tolerant varieties in comparison to conventional grape varieties. Visible benefits are reduced treatment costs and time savings for winegrowers. Schwab, Knott and Schottdorf (2001) expect that the time saving through cutting out sprayings is between 8 and 10 working hours per hectare, depending on the degree of fungus tolerance of the grape variety. Further savings include avoidance of pesticides and a decrease in use of machinery. Based on the accrued decrease in fuel consumption, winemakers can expect savings of between 460 euro and 815 euro per hectare per year (Schwab, Knott and Schottdorf, 2001).

It is evident, that besides these monetary reasons and time savings winegrowers can profit from the cultivation of fungus tolerant vine cultivars in a sustainable way. Depending on the degree of fungus tolerance at least part of the sprayings for plant protection if not all are made redundant and leads to a reduction in fuel consumption and therefore to a reduction in carbon dioxide (CO²) emissions. The use of fungus tolerant vine cultivars decrease fuel consumption by 40 to 60% in the long run, depending on the cultivation style and the grape variety (Strasser and Coray, 2009). This decrease in spraying also results in less soil compaction from the wheels of tractors. The saving of sprayings and the decrease in the use of heavy machinery over the land results in less soil compaction. This contributes directly to a healthy soil and decreases the risk of erosion (Strasser and Coray, 2009).

Since copper is a heavy metal, it has negative effects on the soil. The European Union is considering either prohibiting the use of products containing copper or at last to decrease the amount of copper allowed per year. Therefore practice and research in organic viniculture are looking for alternatives in plant protection with lower negative environmental impacts. More than 100 alternative products that have been tested in laboratories and in viniculture are already available on the market. Results from tests indicate that under humid conditions, none of these products available offer a real alternative to copper derivative products (Schärer, Amsler and Tamm, 2008; Hofmann, 2003). Fungus tolerant vine cultivars offer the only alternatives to bypassing the use of copper and sulphur in the vineyard (Becker, 2000).

It is quite common in German to have wines made out a single grape variety (often referred to *single varietal wines*). Therefore, the name of the grape variety written on a label is a decisive factor when it comes to the selection of a wine by the consumer in a store. Fungus tolerant grape varieties have a clear disadvantage compared to classical grape varieties as Riesling or Pinot Noir by being relatively unknown to the general public while ‘the consumer is fixed to the names of classical grape varieties when buying a wine from Germany’ (Becker, 2000).

Additionally, the very first wines made out of fungus tolerant grape varieties received somewhat bad press due to their relatively inferior quality, which led to a negative image among winemakers and consumers alike (Becker, 2000). However, in comparative blind tastings with newer types of fungus tolerant grape varieties such as Regent or Johanniter and traditional grape varieties such as Pinot Noir, experts and winegrowers rated some of these newer disease tolerant varieties to be of better quality than traditional grape varieties (Schwab, Knott and Schottdorf, 2000).

3 Methodology

In order to provide a clear picture of the current positioning of fungus tolerant vine cultivars in the market and provide hints on the steps necessary for the promotion and exchange of scientific and practical findings concerning disease tolerant grape cultivars nationally and internationally, a survey was conducted online accessible for one month in spring 2009. In Germany, the Chambers of Agriculture of Rhineland-Palatinate and Baden Württemberg are in charge of controlling all organic viticulture in Germany. The link to the survey was facilitated by both Chambers of Agriculture which have contact data of all wineries organically accredited. The survey included various types of questions ranging from simple yes/no questions to questions based on a 5 points likert scale on the importance of different variables. Some open-ended questions are provided in order to gain a deeper insight into the mindset of wine growers regarding fungus tolerant vine cultivars.

As all organic winegrowers were contacted, without prior knowledge of the grape varieties they plant, the online survey was designed in a way that additional data could as well be collected from those not planting fungus tolerant grape varieties. A total of 67 organic wineries responded to the survey. 14 of those organic wineries responded although they did not grow fungus tolerant grape varieties. 53 organic wineries growing and making wine from fungus tolerant grape varieties answered the questionnaire. In absolute terms that number is rather low, but the area cultivated by all participants of the survey equals with 645 hectares or 15% of all the vineyard area in Germany under organic production. The survey can be seen as representing the status quo in the use of fungus tolerant grape varieties in organic viniculture in Germany. Since the use of fungus tolerant grape varieties does not only depend on the grafting activities in a country but as well on the climate, the results may not be directly transferred to countries with different climatic conditions (e.g. the Mediterranean).

4 Findings and Limitations

The first organic winegrowers from all participants in the questionnaire started with fungus tolerant grape varieties in 1985. However, it was between 1998 and 2000 that a significant increase in number of winegrowers working with fungus tolerant grape varieties can be seen. More than two thirds of the respondents had started with fungus tolerant grape varieties by the year 2000. It can therefore be assumed, that the survey participants have an in depth knowledge both of the production and of the marketability of fungus tolerant grape varieties which adds to the quality of the results of the survey conducted overall and makes the results of the survey especially valuable.

The share of the area under cultivation with fungus tolerant grape varieties is usually rather low. The market for organic wine and the segment market for fungus tolerant grape varieties can be considered as a sub-niche product in the niche market of organic wine. Half of the survey participants have less than 10% of all their organic vineyards under cultivation with fungus tolerant grape varieties. One third of all participants have up to 20% of all the area under fungus tolerant cultivation. Two participants of the survey have their vineyard planted with more than 80% with fungus tolerant vine cultivars (See Table 1: Share Fungus Tolerant Area). There is no significant relation between the starting year (year first planted with fungus tolerant vine cultivar) and the share under cultivation with fungus tolerant vine cultivars ($r=0.057$).

Table 1: Share Fungus Tolerant Area

| | Share of total vineyard are planted with fungus tolerant vine cultivars (in percent) | Frequency (number of respondents) | Percent (of respondents) | Valid Percent | Cumulative Percent |
|-------|--|---|--------------------------------|---------------|-----------------------|
| Valid | 10,00 | 23 | 46,9 | 46,9 | 46,9 |
| | 20,00 | 11 | 22,4 | 22,4 | 69,4 |
| | 30,00 | 4 | 8,2 | 8,2 | 77,6 |
| | 40,00 | 3 | 6,1 | 6,1 | 83,7 |
| | 50,00 | 4 | 8,2 | 8,2 | 91,8 |
| | 60,00 | 1 | 2,0 | 2,0 | 93,9 |
| | 70,00 | 1 | 2,0 | 2,0 | 95,9 |
| | 90,00 | 2 | 4,1 | 4,1 | 100,0 |
| | Total | 49 | 100,0 | 100,0 | |

4.1 Sales Channels, Production Costs and Marketing

The history of the development of wine regions and winemaking is directly related to the potential of marketing and selling the wines produced. Similarly, for fungus tolerant vine cultivars to be cultivated, harvested and processed into wine, there must be a market. Direct to consumers (e.g. winery visits and cellar sales), trade (e.g. wholesalers and retailers) and gastronomy (e.g. hotels and restaurants) form the major and traditional sales channels for winemakers. After the exclusion of data sets with missing data, 38 valid data sets could be analysed. 71.3% of the wine made from fungus tolerant grape varieties is sold directly to end consumers, while 22.5% is sold to wine traders and retailers and 6.2% are sold to restaurants. Although significant differences exist between wineries in their preferred sales channels. Some wineries will sell up to 50% of their production to restaurants while others heavily rely on wholesale distribution. For example, more than one quarter of the participants do not use wholesale distribution at all as sales channel. However, four responders sell 40% of their production through wholesale distribution while another three winemakers sell all their production in this way. Overall, the direct to consumer sales channel is preferred. Winemakers see it as a necessity to be in direct contact with the consumer in order to properly inform and educate them about the advantages of fungus tolerant grape varieties. This may also include a free tasting of the grape variety in order to convince the consumer of the quality of the wine. For those producers having no direct contact to the end consumer it may be difficult to convince intermediaries to sell a product which is unknown to the consumer and needs further information.

Interestingly, almost three quarters of winemaker market their wines as single variety wines rather than producing cuvees (the term cuvee is used to specifically indicate a blend which is a mixture of two or more grape types). While grape types such as Chardonnay, Merlot and Riesling have captured a wide audience, fungus tolerant vine cultivars are still relatively unknown. However, it can be expected, that these wines are marketed under the name of the grape variety the wine is made from.

60 % of the participants agree that the production costs both for white and red wines from fungus tolerant grape varieties is lower than the production costs for conventional grape varieties. The lower production costs do not directly result in lower sales prices for the wines. The majority of participants expect the sales price for wines from fungus tolerant grape varieties to be on the same level as for wines from conventional grape varieties.

Winemakers tend to draw a relatively positive picture of the future market acceptability of fungus tolerant grape varieties. 64% of the winegrowers observe

an increase in the acceptance of fungus tolerant grape varieties in the market. Reasons for the increase in acceptance is linked to an increase in the recognition of fungus tolerant grape varieties combined with an increased demand for wines, which are *truly organic*. This is linked to a general interest in the protection of the environment both among wine producers and consumers. Parallel to this, there is a growing audience for wines away from mainstream products, often referred to as *terroir wines*. Fungus tolerant grape varieties offer an escape from mainstream.

4.2 Future Growth of Fungus Tolerant Vine Cultivars

The combinations of environmental protection and market demand for organic wines are undisputable factors in the development of fungus tolerant vine cultivars. 58% of the wine growers, who already grow fungus tolerant vine cultivars stated, that they plan to increase the share of vineyard under organic cultivation. Besides the two above-mentioned factors, a decreased use of pesticides and energy savings and a decrease in costs and efforts necessary for the wine production are added benefits. A majority of winemakers stated that the quality of new fungus tolerant grape varieties is making marketability simpler.

Three winemakers have decided to decrease the general area planted with fungus resistant vine cultivars. Arguments against fungus tolerant varieties were the difficulties in marketing these new grape types compared to conventional grape varieties such as Riesling and Pinot Noir and the perceived lower taste qualities.

Table 2: Future Changes in the Number of Fungus Tolerant Vine Cultivars

| | | Frequency (number of respondents) | Percent (of respondents) | Valid Percent | Cumulative Percent |
|-------|----------|---|--------------------------------|---------------|-----------------------|
| Valid | Increase | 26 | 57,8 | 57,8 | 57,8 |
| | Same | 16 | 35,6 | 35,6 | 93,3 |
| | Decrease | 3 | 6,7 | 6,7 | 100,0 |
| | Total | 45 | 100,0 | 100,0 | |

5 Conclusion and Recommendations

Fungus tolerant vine cultivars are varieties, which show a certain level of tolerance towards fungi, which makes them especially interesting for the organic wine production in countries with a cooler climate and relatively high humidity such as Germany, Austria and Switzerland. Fungus tolerant grape varieties are currently perceived as a niche product in a niche segment.

However, both literature and the present research indicate, that the area planted with fungus tolerant grape varieties will increase in the future. This result not only indicates an increase in the share of fungus tolerant grape varieties in organic wine production, but can as well be seen as an indicator for the future success and the future potential of fungus tolerant grape varieties.

Whether the quality of the new generation of fungus tolerant grape varieties approximates to conventional grape varieties is a matter of taste and as such will remain an issue of discussion in future.

While the concept of branding goes beyond the objective of this study, it is interesting to understand the importance of name recognition (may it be a grape type of a winery name) when marketing wines. It is recommended that the organic wine industry develop an umbrella brand, under which fungus tolerant grape varieties can be marketed and that information should be provided on the bottle back label of bottles about the grape variety and the agricultural conditions under which it grows.

While this study investigated a population already convinced of the organic methods of agriculture, a future research could investigate conventional wineries and their stance towards (1) organic agriculture and (2) the possible use of fungus tolerant vine cultivars.

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