CENTENARY OF THE OIV
45th WORLD CONGRESS OF VINE AND WINE
14-18 OCTOBER 2024 FRANCE-DIJON
OIV

Available on | IVES Conference Series vine & wine

DOI : https://doi.org/10.58233/byeRkD9y

Opportunities and challenges in the adoption of new grape varieties by producers: A case study from the Northeastern United

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Abstract. Grape breeding for resistance to fungal diseases is today very dynamic throughout the world. Though these varieties can provide several benefits and can be planted by winegrowers, they are not always systematically adopted. The aim of this work was to investigate, through face-to-face semi-structured interviews with experts and wine producers, the main opportunities and challenges to the adoption of these new varieties by the producers in the Finger Lakes, an American vineyard where grape breeding is very active. Results showed that the main drivers of adoption were the climatic constraints given the fact that these varieties are generally more cold hardy than traditional cultivars, an overall better profitability and the environmental benefits they provide. The absence of market, the lack of name recognition and the intrinsic quality of their wines were the main obstacles to their adoption. The lessons to be learned for the French wine industry are that the incorporation, in small proportions in blends, of wines from resistant varieties should not be a huge challenge, and that consumers will be the key players in the appropriation of these varieties by producers.

1. Introduction

Grape breeding for resistance to fungal diseases, mainly downy mildew (*Plasmopara viticola*) and powdery mildew (*Erysiphe necator*), is today very dynamic in France and throughout the world [1]. These new varieties are obtained by hybridization between susceptible varieties of the Vitis vinifera species and resistant genotypes, with breeding programs generally lasting between 15 and 25 years and resulting in the registration of a few new varieties [1]. Floréal, Voltis, Artaban and Vidoq from the French RESDUR 1 program, and Coliris, Lilaro, Sirano, Selenor and Opalor from RESDUR 2, were classified in 2018 and 2022, respectively. RESDUR refers to breeding programs that aimed at developing grape varieties with an elevated and durable resistance to downy and powdery mildews. Thus, according to data from the computerized vineyard register (CVI), 2,126 hectares of resistant varieties have been planted in France between 2016 and 2022. Several research have been conducted in Switzerland, Italy, the UK, or the USA on the adoption of these resistant varieties by producers or consumers [2,3,4]. These works highlighted that though these varieties can be planted by winegrowers, they are not always systematically adopted. Similarly, the market demand and the acceptability of these wines by consumers remain hypothetical. To our knowledge, no work has yet been performed in France. As part of the Ressenti project funded by the Occitanie region, researchers from the Institut Agro Montpellier, ENSAT, INRAE and the Ecole d'Ingénieurs de Purpan Engineering School have started studying the perception of these new varieties by French producers and consumers in the frame of two doctoral theses initiated at autumn 2023.

Preliminary and in parallel with this project, a pilot study funded by Toulouse INP was carried out between April and May 2023 in the Finger Lakes to investigate the adoption of new varieties including resistant genotypes by the local producers. This viticultural region located in the Northeast of the United States was selected as grape breeding has been very active for several decades and planting decisions are more liberalised than in Europe. This article summarizes the main opportunities and challenges identified.

2. Material and methods

2.1. Study area

The term ***Finger Lakes*** refers to a group of 11 narrow and long lakes, oriented North-South and located near the southern shore of Lake Ontario which moderates the climate of the region. A moderating effect is also provided by the lakes themselves, including the deepest such as Seneca (190 m), Cayuga (130 m) and to a lesser extent Keuka (56 m) and Canandaigua (79 m), which very rarely freeze. The cultivation of *Vitis vinifera* varieties in the region took place relatively recently, in 1958 under the initiative of an immigrant of Ukrainian origin, Dr. Konstantin Frank. The latter is only possible in the immediate vicinity of the lakes, typically at a distance of less than 1 mile (1.61 km), otherwise frequent frosts are deleterious for *Vitis vinifera*.

The Finger Lakes region is part of the 269 American Viticultural Area (AVA) and probably one of the most diverse wine growing regions in the world with respect to grape varieties. Indeed, winegrowers have the freedom to plant the varieties they wish and there are around thirty varieties used for wine production, divided into native varieties from *Vitis labrusca* (60%), interspecific hybrids (25%) and *Vitis vinifera* (15%). Among these hybrids, there are old French varieties such as Vignoles (Ravat 51), Baco noir, Chancellor or Chambourcin, and more recent selections. This diversity is regularly enriched by new hybrid varieties developed by researchers from Cornell University at the New York State Agricultural Experiment Station in Geneva, NY. Since 1885, Cornell University has developed 70 table and wine varieties, including 15 since 1980 under the responsibility of Dr. Bruce Reisch. Cayuga white (Figure 1), Traminette, Valvin Muscat or Noiret are among the most notable varieties whose pedigree can be complex but generally includes a cross with *Vitis labrusca* or one of its descendants, a local species giving resistance to mid-winter cold temperatures. However, this species and its offspring have an earlier budbreak than *Vitis vinifera* making it particularly prone to spring frost. Resistance to fungal diseases is another breeding objective of increasing importance nowadays. The University of Minnesota is another player which more frequently uses *Vitis riparia* or descendants of Vitis riparia in its crosses. The most successful varieties developed are Marquette, Frontenac, and Crescent.

The region now has around 120 wineries with an average size of around 10 ha, although a minority of winegrowers cultivate several hundred hectares. One of the peculiarities of the region lies in the fact that all the wine estates share the same trajectory. Until the early 1980s, most winegrowers were delivering their grapes to the Taylor Wine Company, whose bankruptcy forced them to find new markets for their grapes, to make their own wines, causing a rapid change in the region's wine landscape with the arrival of new players.

Figure 1. Vineyard planted with Cayuga white located on the western shore of Seneca Lake.

2.2. Qualitative research interviews

Face-to-face semi-structured interviews were conducted between mid-April and mid-May 2023 according to a procedure previously described [5] which can be summarised here briefly. These interviews whose duration varied between 1 and 2 hours were organized around a set of predetermined open-ended questions on grape breeding, changes in varieties and reasoning factors for new plantings, motivations of adopters, drawbacks of new varieties, extension based on research findings, consumers and market, and climate change. Other questions also emerged from the dialogue between the interviewer and the interviewees. The 19 in total interviewees were either experts selected among grape breeder (x1), academic researchers working on new varieties (x3), extension people (x3), nursery managers (x2) or manager of grower association (x1), or wine producers with different expected points of view towards new varieties (x10). Interviewees were recruited with the assistance of Cornell professors and extension staff who had a good knowledge of the region. Interviews were stopped when saturation was reached and no new categories emerged [6]. Data analysis occurs concurrently with data collection. Interviews were recorded and their contents were transcribed the same day, analysed according to the principles of content analysis, and classified by theme..

3. Results and discussion

3.1. Main drivers of adoption

Even if grapevine is less sensitive to freezes during its dormant period, temperatures below -15°C can affect all its organs and be fatal. If the drop in temperatures is gradual, the plant will better tolerate freezing due to acclimation [7]. Certain species of wild vines present in North America, such as *Vitis riparia* and to a lesser extent *Vitis labrusca*, can withstand very low winter temperatures, down to -30°C [8]. These species have been used in crosses to develop hybrids that are very resistant to cold, like Marquette. In the Fingers Lakes, when ***climatic***

constraints are too great (i.e., site located far from the lakes not allowing a sufficient moderating effect), winegrowers frequently turn to new hybrids developed by Cornell University or the University of Minnesota.

Wines made from new hybrids or native varieties are generally sweet, priced between 10 and 13 US dollars per bottle, typically 3 to 5 dollars less than *Vitis vinifera* wines, as a likely consequence of their lack of name recognition. On the other hand, their production costs are lower due to their greater resistance to diseases, around $3,500/ha compared to $6,500/ha for vineyards planted with *Vitis vinifera*. The higher yields of hybrids, which can easily reach 25 tons/ha in the most fertile soils, where *Vitis vinifera* do not exceed 10 tons/ha, give them a ***better overall profitability***, which is a strong argument in favour of their adoption. As one expert points out, *"we must not deceive ourselves, it is very often the native and hybrid varieties that keep the farms alive".*

The ***environmental benefit*** provided by these varieties is another key factor. The number of phytosanitary sprayings can be reduced from around fifteen, for *Vitis vinifera*, to two to five for hybrid varieties. These environmental concerns are even stronger among the younger generations who, according to an advisor, *"may feel guilty of contributing to water pollution, as vine protection products inevitably end up running off into the lakes."*

These new varieties can be marketed under a specific range, often with eye-catching labels (Figure 2), or integrated into the classic range alongside *Vitis vinifera*. While most cellars have a mixed production of native varieties, hybrids and *Vitis vinifera*, some are more specialized, such as Bully Hill or Hermann Wiemer, which only produce hybrids and *Vitis vinifera*, respectively.

Hybrid wines are almost systematically integrated into blends with slightly more flexible regulations than in Europe. If the name of a single grape variety is used on the label, the wine must be at least 75% from the variety mentioned, compared to 85% for us. This possibility constitutes a real ***opportunity to substitute***, without modifying the sensory profile, a substantial proportion of *Vitis vinifera* by an alternative hybrid exhibiting a comparable typicality. Aravelle, a variety obtained from a cross carried out in 1981 and registered since the beginning of 2023, is particularly promising for this use since it has characteristics similar to Riesling, with much better resistance to *Botrytis cinerea* as well as downy and powdery mildews.

Farm structure is another criterion determining adoption. An estate that produces and vinifies its grapes and can directly communicate with consumers, at the cellar door, on the benefits brought by the new varieties, will be more inclined to take the plunge. As illustrated by the words of a producer, *"the further you are from the estate, the more difficult it is to sell the wines of these new varieties".*

Figure 2. Examples of eye-catching labels used for wines made from hybrid or native varieties, generally having a significant residual sugar content.

This finding is particularly in accordance with another work conducted in Switzerland that demonstrated that the less distant the producers are from the final consumer, the more likely they use fungus-resistant varieties [3]. The local character of these varieties, developed by Cornell University a few dozen miles away, is sometimes highlighted (Figure 3). Cornell, which like Yale or Harvard is one of the 8 universities of the prestigious *Ivy League*, enjoys an excellent brand image, which constitutes an indisputable commercial argument.

Climate change, which in the region partially takes the form of warmer and more humid nights favourable to the development of downy mildew, could constitute an opportunity and an accelerator for the deployment of new varieties, particularly those with good resistance to this pathogen. This phenomenon is amplified by the emergence of more virulent strains less sensitive to fungicides. As one technical advisor points out, *"if winegrowers did not systematically spray against downy mildew 15 years ago, it has become a real problem in the region"*. Similarly, these changing conditions contribute to reducing the must acidity and increasing the risk of *Botrytis cinerea* development, which should force winegrowers to change strategy.

3.2. Main spoilers of adoption

The ***market*** is the main obstacle to the adoption of new varieties. The two signature varieties of the region, namely Riesling and Cabernet Franc, whose wines are highly sought after, are generally favoured by winegrowers, if the location of the vineyard and the climatic constraints allow it. Saperavi and Grüner Veltliner are two other more original *Vitis vinifera* varieties which give good results and arouse increasing enthusiasm despite still limited surfaces under vines. Things could change quickly since an alternative stream favourable to native and hybrid varieties, called "*Anything but* Vinifera*"* and led by young sommeliers from New York City, is emerging within the neighbouring megalopolis, creator of trends and potential outlets for the wines produced in the Finger Lakes.

Figure 3. Back label of a Noiret wine produced by the Swedish Hill winery. Note the reference to Cornell University and the scale indicating the sugar content.

The ***lack of recognition*** of a new variety and the ***choice of its name*** are decisive elements that can generate contrasting responses. Some wine estates with an established reputation sometimes choose to market their hybrids without any reference to the name of the variety on the label. Varieties are traditionally named by the breeder, with or without a consultation phase with the industry. According to several people met, "*Traminette and Chardonel, which evoke Gewurztraminer and Chardonnay, their two respective parents, are among the best successes".* Conversely, certain names with similar French connotations such as Aromella, Aravelle or Arandelle could cause confusion among consumers. According to another person, *"the name is perhaps the largest problem with breeding. For a new variety to be successful, we need good behaviour in the vineyard, quality wines but also a marketing company to name it".* It is worth mentioning that since 2019 the International Organization of Vine and Wine (OIV) and the Permanent Technical Committee for the Selection of Cultivated Plants (CTPS) have advised against the use of names likely to lead to confusion with those of other existing varieties.

The ***intrinsic quality*** of wines resulting from hybridization with native varieties from the Northern United States is often judged to be inferior. These varieties, in particular *Vitis riparia* and to a lesser extent *Vitis labrusca*, and the hybrids resulting from crosses with these species, present oenological characteristics different from *Vitis vinifera*. Hybrid wines are characterized by a particularly high acidity mainly due to a high malic acid content, from 4 to 6 g/L or even 10 or 20 g/L for certain descendants of *Vitis riparia*. Red wines are low in tannins as a result of low extractability and their interactions with the more numerous grape proteins. The elimination of these proteins may require higher doses of bentonite for white wine stabilisation and generate qualitative and quantitative losses. Grapes and musts richer in pectin may prove more difficult to press and settle, respectively. From an aromatic point of view, the wild strawberry notes known as ***foxy notes*** found in Concord wines or other descendants of *Vitis labrusca* are generally little present, or even completely absent in the new hybrids. These aromas attributable to methyl anthranilate [9] would take their name from the name *foxy vine*, used by the native people to describe a vine running on the ground, like a fox. The sugar concentration is generally not discriminating and varies between 11 and 13% of potential alcohol. Due to their high acidity, these hybrids are particularly suitable for the production of sweet wines, a characteristic appreciated on the local market.

Though the differences with *Vitis vinifera* tend to be reduced in new varieties whose quality has greatly improved, popular belief is that it is easy to blindly distinguish hybrid wines. This prejudice could find its origin in the fact that the first adopters are not necessarily the best technicians, and that the oenological potential of these varieties is not always well maximised. According to a producer, *"the problem with hybrids is that winegrowers do not know how to work with them, tend to treat them like* Vinifera *and seek advanced maturity. When you wait too long, the ancestry of hybrids and their foxy notes tend to come out".*

The above quote highlights the importance of having ***research and extension*** specific to these new varieties. In addition to the viticultural and oenological experiments carried out by Cornell University, the Finger Lakes Grape Program through Cornell Cooperative Extension has a showcase vineyard to support winegrowers in their technical choices. This plot dedicated to training and planted with 17 varieties including 7 *Vitis vinifera* and 10 hybrids, allows the data collection on phenology, disease resistance, vigour, and grape composition. In order to quickly obtain references, breeders and nurserymen also release small quantities of plants as soon as these new varieties are available and before they are named. Analogous to the French VATE system (Agronomic Technological and Environmental Value), these evaluations carried out on limited surface, typically less than 0.5 ha, make it possible to assess the agronomic behaviour of these varieties under several pedoclimatic conditions. Experimental or commercial wines made from these new varieties are also excellent resources to facilitate their promotion.

Even if hybrids frequently produce accomplished and pleasant wines, some producers continue to consider *"*Vitis vinifera *like Rolexes".* Wines from the region usually trade for less than $20 per bottle, and only Riesling or Pinot Noir wines can benefit from market positioning above $40 per bottle. The incorporation of hybrids into a blend, even in small proportions, can constitute a psychological barrier and be perceived as a *"taint of a noble product"* for certain producers. In the collective imagination, hybrids can sometimes continue to have a bad reputation and several people interviewed expressed great

astonishment that *"the French were re-interested in hybrids, almost 60 years after having banned them and having largely contributed to their negative image "*.

Despite a certain aromatic diversity among the red hybrids developed by Cornell whose wines can present fruity, peppery or pyrazic profiles [10], there remains *"still work with the new white varieties which mostly present muscat notes "* according to several people consulted. This lack of ***aroma diversity***, particularly on Sauvignon type profiles, may constitute an obstacle which pushes certain players to take an interest in resistant varieties recently developed in France, Italy, or Germany.

The ***higher price*** of plants for these new varieties, due to the payment of royalties to the breeder (from $0.65 to $1.20/plant), is not always deleterious. Indeed, this additional cost is not a spoiler if the variety is resistant and makes it possible to reduce production costs or provides a market opportunity.

4. Conclusion

This qualitative study highlighted that even if the new varieties presented numerous advantages such as a response to climatic constraints, environmental benefits and an overall better profitability, their adoption by winegrowers in the Finger Lakes was far from assured. The main spoilers identified as part of this work are the absence of market, the lack of name recognition, and their lower intrinsic quality, whether proven or imaginary, linked to the poor reputation of hybrid varieties. The main lessons to be learned from this for the French wine market are that the incorporation, in small proportions in blends, of wines from resistant varieties should not be a huge challenge, and that consumers will be the major players in the appropriation of these varieties by producers.

We will also have to accept that certain new varieties developed in France will fall forever into oblivion, without even having one day been adopted, because their agronomic behaviour or the profile of the wines will not correspond to the expectations of the industry and consumers.

5. Acknowledgements

The authors are grateful to all the people who accepted being interviewed and participated in the study. Thay also would like to thank Toulouse INP and the Occitanie region for funding through the ETI and Défi Clé Vinid'Occ programs, respectively.

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