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THE “PERGOLA VALDOSTANA” AND HEROIC VITICULTURE IN AOSTA VALLEY (ITALY): A CASE STUDY ON A TRADITIONAL WINE-GROWING SYSTEM

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ABSTRACT

In order to preserve the Alpine vineyard landscape on the Piedmont, Aosta Valley and Savoy border sides, the ALCOTRA Interreg Project (“VI.A. STRADA DEI VIGNETI ALPINI”) included a series of activities and studies among which the authors were involved and this work illustrates some first results. A socio-economic survey was implemented on a small sample of micro-farms in Aosta Valley that still practice viticulture according to the typical “Pergola Valdostana” systems, in order to assess the critical points of this much less competitive cultivation system compared to the classic espalier. The first results confirm the need to enact at an institutional level various types of support (not only economic) to preserve a unique landscape in the context of heroic viticulture.

Keywords: alpine vineyards, terraces safeguard, viticulture enhancement, ALCOTRA Project

LA PERGOLA VALDOSTANA E LA VITICOLTURA EROICA IN VALLE D’AOSTA (ITALIA): UN CASO STUDIO RELATIVO AD UN SISTEMA TRADIZIONALE DI ALLEVAMENTO DELLA VITE

SINTESI

Nell’ottica di salvaguardare il paesaggio viticolo alpino nell’area transfrontaliera compresa tra Piemonte, Valle d’Aosta e Savoia, il progetto Interreg ALCOTRA denominato “VI.A. STRADA DEI VIGNETI ALPINI” ha sviluppato una serie di attività e studi nei quali gli autori sono stati coinvolti. Il presente lavoro illustra alcuni primi risultati relativi alla Valle d’Aosta. È stata organizzata un’indagine socio-economica su di un piccolo campione di micro-aziende valdostane che praticano ancora la coltivazione della vite secondo il tradizionale sistema della “Pergola Valdostana”, al fine di valutare i punti critici di questo sistema di allevamento meno competitivo rispetto alla classica spalliera a Guyot. I primi risultati confermano la necessità di attuare a livello istituzionale vari tipi di sostegno (non solo economico) per preservare un paesaggio unico nel contesto della viticoltura eroica.

Parole chiave: vigneti alpini, salvaguardia dei terrazzamenti, valorizzazione della viticoltura, Progetto ALCOTRA

INTRODUCTION

The vine is a plant characterised by a great climatic adaptability and, for this reason, it has spread worldwide. Its adaptability allowed it to be grown even in alpine areas since ancient times. In Italy, vineyards are common in many mountain areas: Trentino Alto Adige is probably the best-known example because of its vineyards' width and its renowned wines, along with Valtellina in Lombardy, specialized in Nebbiolo vineyards and wines (Mazzarino, 2006).

We can also find similar situations in the Italian, French and Swiss sides of the Western Alps, characterised by significant slopes. In Aosta Valley (North-West of Italy, on the French and Swiss borders) there are still many terraced areas cultivated with vines, although their surface is shrinking due to the difficulties encountered in cultivating them. The vineyards grow up to altitudes of 1000-1100 meters, along slopes that need to be terraced or stepped with similar land engineering works, using complex systems of dry stone walls.

The vine has a very ancient history in Aosta Valley (Di Corato, 1974). The discovery of tartaric acid in the Saint-Martin-de-Corléans archaeological site in Aosta most likely suggests the presence of the plant in pre-Roman times (Vola, 2010). The presence of vineyards destined to wine production is nevertheless generally attributed to the Roman age, based on renowned historical documents (De Tillier, 1737-1740, 1968; Berget, 1903; Zanotto, 1968) and to the discovery of amphorae, jugs and bottles dating back to the 1st century AC in environments presumably destined to wine-making. The quality of the wines produced in the area in the late-Middle Ages is proven by writings that speak of various crus highly appreciated by the local lords (Zanotto, 1968).

Despite events such as wars, changes in domination, epidemics and different plant health problems, for two millennia, vine cultivation remained well rooted in the Valley, reaching its maximum expansion around the mid-nineteenth century. The overall surface in this period is estimated to have been between 3,000 ha (Gatta, 1838) and 4,000 ha (Bich, 1896; Berget, 1903). From this moment onwards, the vineyards gradually began to recede, due to the appearance of three different pests coming from North America, completely unknown in Europe. Especially in the lower and middle Valley, two fungi that attack leaves and grapes (*Oidium tuckeri* in 1854- and *Plasmopara viticola* (downy mildew) in 1876-) appeared, followed by *Phylloxera vastatrix* (in 1896), an aphid that attacks the root system of the European vine destroying it. Because of

these diseases, in the following decades the surfaces decreased heavily, levelling at a few hundred. Only with the end of the second World War, vine cultivation slowly recovered, albeit at an alternate pace, first expanding and then contracting, eventually leading the Aosta Valley vineyard area to stabilise at little more than 460 hectares in 2010 (ISTAT, 2010).

It should be emphasised that during the nineteenth century the Aosta Valley rural landscape, more so than today, was strongly characterised by vineyards. Regarding this point, the impressions reported in the mid-nineteenth century in travel journals by English tourists interested in Mont Blanc ascents (Seymour, 1827; Trench, 1847; White, 1854; Malvezzi, 1982) are greatly significant. During their travels along the Valley they were fascinated by the vine landscape, noting the differences with the nearby French one. In fact, in that period the typical and dominant form of vine growing in Aosta Valley was the Pergola, a cultivation form that linked the terraced land arrangements to a horizontal and vertical structure of wood stakes, sometimes accompanied by stone columns. This particular growing system involves much longer shoots arranged along the horizontal wooden framework, often embedded in the dry stone wall, exactly modelling a pergola. The generated landscape was consequently completely different from other areas but of absolute value, thanks to the materials used and the geometries produced on the slopes involved.

About thirty years later, in 1887, Laurent Argentier (2004) during one of his lessons dedicated to the vine stated that in the Aosta Valley vineyards can only be grown in 27 municipalities¹ because of problems regarding grape maturation. Moreover, referring to the Pergola growing system, he highlighted that this cultivation form, in spite of having been widespread along the Valley in the past, had been gradually replaced because of the increasing price of wood used for piling.

Nowadays in the Aosta Valley the Pergola is no longer the dominant form of vine-growing, as it has been progressively replaced in most areas by the more modern Guyot rows. The reasons are linked to the extremely uncomfortable conditions in which grape-growers must operate, with regard to vineyard management as well as to wall maintenance and wooden stake replacement. Nevertheless, the Pergola remains the predominant vine-growing form in two distinct areas of the Valley, at the boundary with Piedmont and in the upper Valley at the foot of Mont Blanc. In these two areas, the Pergola is adopted in two different forms (high Pergola in the Lower Valley, and low

¹ Aoste, Arnad, Arvier, Aise, Aymavilles, Bard, Chambave, Champdepraz, Chatillon, Donnas, Hône, Issogne, La Salle, Montjovet, Morgex, Nus, Perloz, Pont Saint Martin, Quart, Saint Christophe, Saint Denis, Saint Pierre, Saint Vincent, Sarre-Chesallet, Verrayes Verrès, Vil-leneuve. The vineyards were also cultivated in Challant Saint Victor, Pontey, Fenis, Saint Marcel, Issogne, Pollein, Charvensod, Gressan, Jovençon, Introd and Saint Nicolas, but were not so important mainly because of the difficulty of the grapes to reach ripeness.

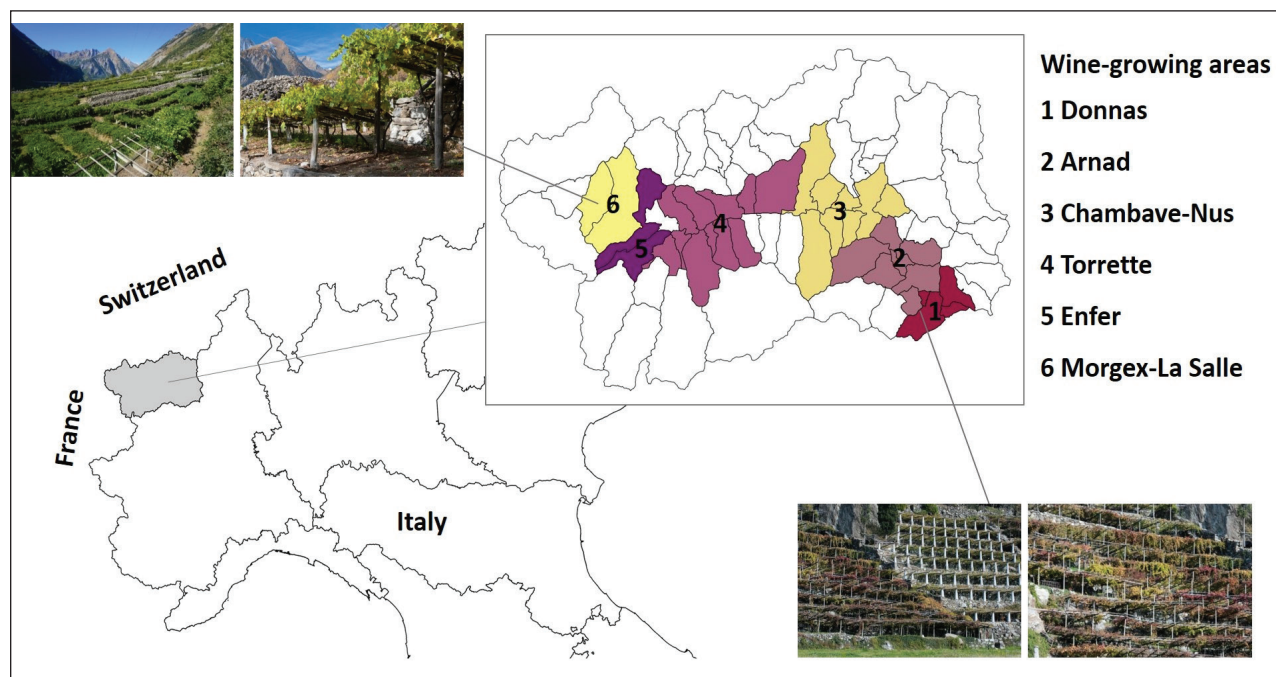


Figure 1: Vineyard areas in Aosta Valley.

Pergola in the Higher Valley) that respond to different needs of adjustment to extreme growth environments.

It is not easy to find bibliographic sources about the Pergola, intended as a form of wine-growing, mainly because the subject, which has important implications at the agronomic, landscape and socio-economic levels, is often included in larger subjects and treated in the different national languages. The same term "Pergola" is an Italian word of Latin derivation that mostly finds completely different corresponding terms in other languages. The discussion of its diffusion worldwide could constitute an interesting research topic to be developed with an interdisciplinary approach. However, there is evidence that outside Aosta Valley, the Pergola training system is widespread, in Italy and abroad. It is predominantly used in vine cultivation but also for other crops like kiwifruit vines (Xiloyannis *et al.*, 2000). It is particularly suitable for fertile soils with good water availability. It includes higher or lower shapes, making use of different materials (wooden or concrete stakes, monolithic stones, metal frames, steel wires). Regarding the shape adopted in the vine cultivation, it can be simple (particularly suitable for hilly or mountain areas) or double (most commons in the plains). Other possible distinctions may concern the type of pruning and the tilt of the "roof", as in the Pergola "Trentina" (with the shoots developing along an upwards sloped roof) (Bertamini *et al.*, 2000), "Veronese" and "Romagnola" (with a horizontal roof) (Consorzio Tutela Vini Soave e Recioto di Soave, 2019).

With regard to Eastern Europe, the Pergola vine-growing system in the past was also widespread in the Karst areas. A non-recent source (Fazinić, 1961) indicated the Pergola wine-growing system as a useful solution in Croatia to have inter-rows between the vineyards with a minor use of soil, in response to criticism from economists who opposed the construction of large rows in the vineyards, which took away more land from cultivation, thus reducing the grape-growers income. More recent sources indicate the traditional use of the Pergola also in Slovenia.

A tourist website advertising Štanjel as one of the oldest human settlements in the Karst region ([https://www.stanjel.eu/en/vine and wine](https://www.stanjel.eu/en/vine%20and%20wine)) indicates the traditional presence of the Pergola (Latnik) in Slovenia, giving a comprehensive description. Like in other geographical contexts, this cultivation system is being lost because of the hard work and high production costs implied (Svetina, 2010). However, it should be noted that many studies concerning the presence of grapevines in the Karst area deal with the topic of terraced landscapes related to its cultivation (Lah & Ažman Momirski, 2018; Andlar *et al.*, 2018), rather than as forms of training used. The Pergola wine-growing system is also traditionally widespread in Albania (MAF&CP, 2007), and, with regard to non-European areas, in China (Li, 2001), India (FAO, 2000), and is widely used also in Brazil (Pereira *et al.*, 2007), particularly with the European vines traditionally adopting this growing system.

THE ALCOTRA VI.A. PROJECT - ROUTE DES VIGNOBLES ALPINS

The abandonment of the mountain vineyard has different causes: on the one hand the great difficulties that wine-growers have in maintaining vineyards on steep slopes, because of the total impossibility of mechanizing the cultivation; on the other hand, the high costs of the related management that limit the profitability for the farmers. These causes are further worsened in Aosta Valley, because farms are generally very small and because of the strong attractiveness of more profitable economic activities, such as the tertiary sector and tourism.

The European Project INTERREG ALCOTRA VI.A. – Route des Vignobles Alpines – The Alpine vineyards road, launched in mid-2017 as part of the 2014–2020 programming, has among its main objectives the promotion of alpine viticulture to counter the abandonment observed in recent decades. To achieve this goal, different tools have been identified, involving several local stakeholders interested in vine cultivation at different levels:

- First of all, the grape-growers, who for a very long time have dealt with the vineyards management, are called to consider their activity not only in terms of production but also in terms of landscape;
- The local administrators, to contrast the abandonment of the rural areas, are called to identify subsidies and indirect measures enhancing the quality of the local wines and the territorial organization (road networks, tourist and food and wine accommodation) to which they are linked;
- The tour operators are called to promote the area's characteristic features, not only from a naturalistic and landscape point of view, but also concerning local food production;
- The tourists and all the Valley inhabitants are called upon to recognise and to safeguard the cultural and identity values related to the vine.

The project has therefore been developed from different stances and with the support of various stakeholders, ranging from local administrations and municipalities, to tourism bodies, to research institutions, to single and associated grape-growers in three different cross-border regions: Aosta Valley, Piedmont and Savoy. The possible identification of a path to obtain a certification for the heroic vine landscape is another important objective of the project, aiming to maintain this landscape and to cope with the strong urban and industrial pressure to which these areas are often subjected. The goal is to promote the Alpine vineyards through tourism, thus increasing their visibility and usability, with a structured approach

that includes their eno-gastronomic, naturalistic and experiential dimensions, increasingly appreciated by national and international visitors to the Alps. The challenge is to develop a multi-target tourist offer not only by providing winter and summer tourist packages typical of the Alpine mountains, but also by capturing the attention of different segments, more interested in typical products, conviviality, landscapes, cultural values, historical heritage, biodiversity.

This work is part of the project that takes into account the productive dimension of the vine in the Valley. It develops different actions aimed at identifying the vine farms, the critical issues facing the grape-growers adopting the Pergola Valdostana system as opposed to the Guyot row, their sensitivity to the issue of the landscape produced by the vines grown in the Valley. The ultimate goal is to evaluate a possible public economic aid specifically targeted to those grape-growers who adopt the Pergola form, since nowadays it represents a historical testimony of the vineyards in the Aosta Valley.

METHODOLOGY

Vine-growing in the Aosta Valley covers a limited portion of the territory but has a high visibility, since it develops for about 90 km along the main road axes and the river – the Dora Baltea – that runs from the Higher to the Lower Valley (Figure 1). The vine areas are located both on the left and on the right riverbanks, affecting the valley floors and slopes and climbing up to over 1,000 m in the Morgex municipality. Despite different microclimates, the areas concerned are characterised by hot summers, low rainfall (especially in the middle-high Valley), constant ventilation and significant daily temperature excursions. To contrast the small size of the plots and the low yields, the planting density here is higher than in other Italian vineyards.

The vine-growing forms are not the same in the different areas. Particularly in the Lower Valley, on the border with Piedmont and in continuity with some neighbouring Piedmont municipalities, vines are grown with a high Pergola, where the horizontal wooden framework thanks to special joints between the stones, exploits the presence of the dry stone walls that were built over the centuries to make the slopes productive. In the middle Valley vineyards, they are mainly grown in rows, along terraces or steps artificially built to allow for greater mechanization or made following the land's natural conformation; the rows follow the slope of the land or lie along the contour lines. Finally, in the Higher Valley they are located partly along terraced slopes, partly across the valley floor; in this case the rows are often single because they were originally used to contain the cultivated plots.

The present work aims to characterize farms and viticulture landscapes in this non-homogeneous

Table 1: Data and information from 2010 Agricultural Census.

Data about the farmer	Gender, age class, education, full-time/part-time operator
Data about relatives working on the farm	Number of relatives 28 to 40 working on the farm
PC and internet use	PC, internet, farm web site existence
Farm/non-farm (production for self-consumption)	Info about sales/self-consumption
Organic farming	Area of organic farming
Sales channels for grapes	Direct sales, sales to other farms, to wineries, to wholesalers, to cooperatives
Sales channels for wine	Direct sales, sales to other farms, to wineries, to wholesalers, to cooperatives
Existence of dry stone walls	Maintenance in the last 3 years, new creation in the last 3 years
Active/passive subcontracting	Working days in the year
Utilization of RDP measures	Setting up aid for young farmers, payments for areas facing natural constraints, agri-environment payments, aid for productive and non-productive investments, diversification into non-agricultural activities, encouragement of tourism activities

territorial context, identifying actions that allow their conservation and recovery. From this perspective, an historical research was developed to verify the vineyard evolution in the Valley and the vine landscape modifications throughout history, highlighting the causes that led to the progressive abandonment of the Pergola Valdostana. The study used the literature available in the local Library System, especially by consulting the Fondo Valdostano. In addition, photographic research was carried out by consulting the archives at the media library of the Bureau Régional Ethnologie et Linguistique (BREL – Valle d'Aosta Regional Administration).

At the same time, distinct and relatively homogeneous wine-growing sub-areas were identified based on land layout, cultivated vine varieties, methods of land settling, vine cultivation forms (high Pergola/low Pergola/Guyot row).² Carried out in 34 municipalities³ corresponding to 1,293 farms and roughly 444 hectares of vineyards (ISTAT, 2010), this survey led us to identify six different grape-growing areas, corresponding to at least 3 distinct "landscape units". These six groups of farms and surfaces represented the statistical base on which we extracted data and infor-

mation from the questionnaire administered during the last Agricultural Census, to verify the existence of common and distinctive traits in the different territories.

The information and data extracted concerned the operator and his/her relatives working on the farm, the degree of computerization, the farm's surface, the presence of dry stone walls and any organic agriculture, the production of grapes and/or wine and the sales channels used, the Rural Development Programme (RDP) measures used (Table 1).

Two out of the six wine-growing areas identified (Donnas and Morgex-La Salle) were therefore chosen to conduct a further in-depth analysis with local grape-growers on the problems related to vine cultivation adopting the Pergola system, which is almost exclusively concentrated there. Taking advantage of two cooperative wineries operating in these areas⁴ and by submitting a very detailed questionnaire (Table 2), a technical-economic survey was conducted with some cooperatives members who can be considered as privileged witnesses of an extremely fragmented production situation.⁵ So far, the survey is only preliminary because of the quantity of technical and economic

2 So called: Donnas; Arnad-Montjovet; Chambave-Nus; Torrette; Enfer; Morgex-La Salle. The representativeness is 94.2% in terms of farms and 95.9% in terms of surfaces, as compared to the regional total registered by ISTAT in 2010.

3 Aosta, Arnad, Arvier, Avise, Aymavilles, Bard, Challand-Saint-Victor, Chambave, Champdepraz, Charvensod, Châtillon, Donnas, Fenis, Gressan, Hône, Introd, Issogne, Jovençon, La Salle, Montjovet, Morgex, Nus, Perloz, Pont-Saint-Martin, Pontey, Quart, Saint-Christophe, Saint-Denis, Saint-Pierre, Saint-Vincent, Sarre, Verrayes, Verrès, Villeneuve.

4 Six cooperatives are active in the entire Aosta Valley.

5 In agreement with the respective Boards of Directors and given the complexity of the questionnaire, we decided to consider a low number of members with good technical skills.

Table 2: Data and information from the farm questionnaire.

General data	Information about the operator and relatives, farm history
Short vineyard description	Main vineyards characteristics, information about terraced plots
Farm Utilized Agricultural Area	Surface distribution
Grape variety subdivision	Information about vine growing system
Sets of problems	Comparison between the different vine growing systems
Vineyard investment	Vineyard development and construction
Crop cycle	Cultivation operations
Farm revenue	Grape and/or wine sales

data collected. The questionnaire, with open and closed questions, involved nine cooperative members and allowed us to collect data and useful information to compare the Pergola to the row cultivation system in terms of harvested production and costs incurred during planting and cultivation.

RESULTS

The data from the VI Agriculture Census (ISTAT, 2010) clearly show that in the Aosta Valley wine-growing farms have a very low average size (0.34 ha), since 87% are below 0.5 ha (Figure 2). The vine areas are distributed over a great number of classes, even though mainly concentrated (61.6%) in farms with less than 1 hectare of vineyards (Figure 3).

This viticulture has been directed towards the production of quality wines for various decades, mainly due to the presence of six, highly skilled, wine-making cooperatives.

The establishment in 1985 of the "Valle d'Aosta – Vallée d'Aoste DOC" designation of origin (now included in the corresponding Protected Designation of Origin, PDO), currently articulated in 31 sub-designations referring to different cultivation areas and/or specific vines, led the regional production to increasingly high levels of quality.

In 2010, 65% of the vineyard areas were involved in the production of PDO wines (Figure 4). In comparison with the total number of wine-growing farms, those entailing quality productions appear to have, on average, larger vineyards available (about 4,500 m² or 0.45 ha) (Bagnod *et al.*, 2015).

Within this regional framework, the analysis of data and Census information, in the six wine-growing

subareas considered, highlighted important elements not only about the farms' structure and organization, but also about their effects on the landscape.

The six wine-growing sub-areas differ in their vineyards' average size. In particular, Donnas, Morgex-La Salle, Arnad and Chambave-Nus include farms with an average vineyard area that is lower than the regional average (Table 3).

This explains why a non-negligible portion of farms produce primarily for their own household use, while the sales-oriented ones mainly deliver to local cooperatives for wine-making.⁶ As for non-sales-oriented farms, it should be emphasized that although they have no productive/commercial weight, they still play a very important role in maintaining the vineyard landscape. Altogether, they amount to 240 in the considered areas, with an average share of around 18-19%, except for the Arnad area where their share rises to about 32%.

The farms are mostly managed by male operators, with a female presence that still reaches about 1/3 at the regional level. The share is quite similar across the different areas, except for Enfer and Morgex-La Salle where it falls to 23 and 26% (Table 4).

The average age is high everywhere, ranging from a minimum age of 58.7 in Torrette, to a maximum of 62.0 in Donnas, with a general mean of 59.7. This indicator poses serious threats both for the future survival of farms, and for the maintenance of the vineyard landscape in the Region, as the generational turnover seems insufficient. In fact, the uptake of the RDP measure for the setting-up of young farmers until 2010 was scarce in these areas (15 cases out of 129³⁷).

Given the high average age, schooling generally does not go beyond primary education, with the

⁶ This data is also confirmed by AGEA (Personal Communication, 2014) relating to the declarations of grape harvest and wine production of the sales-oriented farms (Bagnod *et al.*, 2015), based on which in 2012 the members of local cooperatives were 415, against 303 individual producers.

⁷ Distributed among all the areas considered, except Enfer. For Donnas 1 only case, Morgex-La Salle 2 farms.

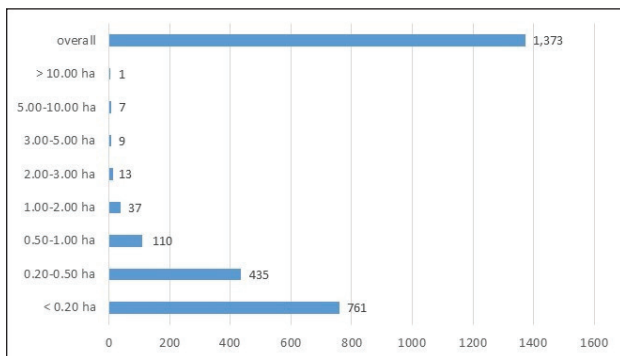


Figure 2: Grape-growers farms (n.) by vineyard size class (expressed in ha) (ISTAT, 2010).

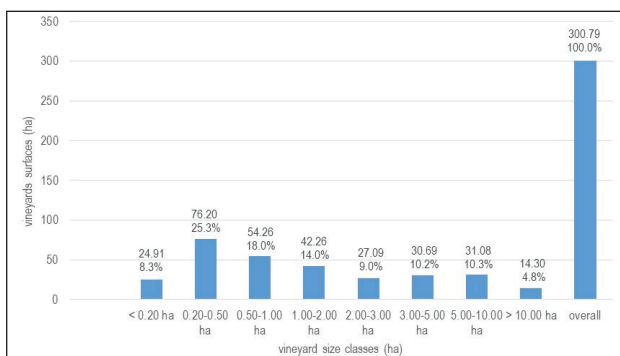


Figure 4: PDO areas (ha) by vineyards size class (ISTAT, 2010).

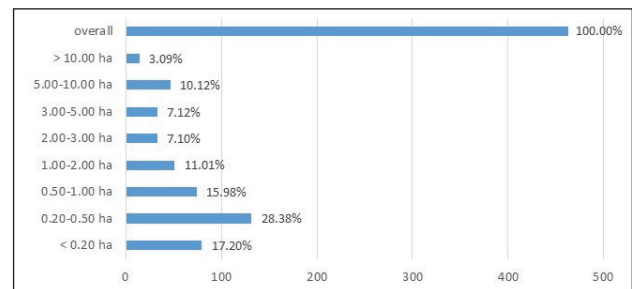


Figure 3: Vineyards surfaces (ha) by vineyard size class (expressed in ha) (ISTAT, 2010).

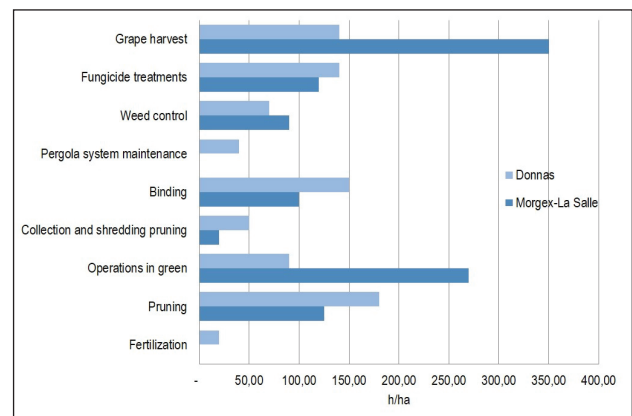


Figure 5: Average annual labour requirement (Authors' elaboration).

exception of the Enfer and Torrette areas. Despite the fragmentation of production units, full-time operators (74%) prevail over part-time operators, apart from the Enfer area where they are equally distributed at 50%. These data can probably be related to a higher education level, which favours employment in other sectors. A further critical figure is that only a few farms (16.5% on average) have young (under 40) family members. Consequently, the use of PCs on the farm is not very widespread (7.6%) neither is the use of Internet, with or without a website (Table 5).

Some final data concern the recent (since the 2010 Census) maintenance work and new construction of dry-stone walls, an important element in the Aosta Valley landscape. The maintenance concerned almost 26% of the farms considered, particularly in the Enfer areas (71%), Arnad (38%) and Donnas (28%). The lower share in the Donnas area is probably due to the smaller size of the vineyards. Small grape-growers are not particularly interested in applying for subsidies for dry stone wall construction or maintenance, because of the heavy bureaucratic burden of these procedures.

Despite the small farm size, the use of passive sub-contracting is not very widespread (8%), also because many of the operations in the vineyard are carried out by hand due to the prevailing configuration of the plots and their limited accessibility (Table 6).

The technical-economic survey based on the Donnas and Morgex-La Salle viticulture areas, the typical Pergola Valdostana areas, confirms the Census data.⁸ The average size of the vineyards is small, although above the regional average, both in the Morgex-La Salle (0.48 ha) and the Donnas (0.91 ha) areas.

It should be noted that all results collected in this phase need to be interpreted with some caution, since, due to the need to collect reliable technical and economic data, the sample was chosen among operators with good technical skills.

According to the Census data, these two areas specialise in quality wines: 100% of the vine area in the Morgex-La Salle and 97% in Donnas are for PDO wines.

The whole vineyard area in Morgex-La Salle is cultivated using the low Pergola Valdostana, of which a small part is on terracing (20%), while the remaining

⁸ It should be noted that all results collected in this phase are to be interpreted with some caution since, due to the need to collect reliable technical and economic data, the sample was chosen among operators with good technical skills.

Table 3: Farms, vine surfaces and self-consumption orientation in the six wine-growing areas identified (Authors' elaboration on ISTAT, 2010).

Wine-growing areas	Municipalities, n°	Farms, n°	Vineyard area, ha	Average vineyard area, m2/farm	Overall farms share, %	Overall area share, %	Total self-consumption farm, n°
Arnad	7	154	43.90	2,851	11.91	9.89	49
Chambave-Nus	8	322	81.13	2,520	24.90	18.28	55
Donnas	4	158	42.55	2,693	12.22	9.59	29
Enfer	2	35	12.43	3,551	2.71	2.80	8
Morgex-La Salle	2	106	29.51	2,784	8.20	6.65	8
Torrette	11	518	234.40	4,525	40.06	52.80	91
Total	34	1,293	443.92	3,433	100.00	100.00	240

Table 4: Demographic data on the operator (Authors' elaboration on ISTAT, 2010).

Wine-growing areas	Male operators	Female operators	Average age	Prevailing operator's education	Full time operators	Part time operators
Arnad	105	49	60.1	Elementary school	121	32
Chambave-Nus	213	109	59.6	Elementary school	243	79
Donnas	107	51	62.0	Elementary school	118	39
Enfer	27	8	60.1	Junior high school	17	17
Morgex-La Salle	78	28	61.2	Elementary school	80	25
Torrette	350	168	58.7	Junior high school	373	141
Total	880	413	59.7	Elementary school	952	333

part is located on the Valley bottom. By contrast, in the Donnas area, characterised by very steep slopes, 74% of the vineyards are on terracing and are cultivated with the high Pergola Valdostana. It should be noted that 80% of the operators interviewed in the Donnas area also use the Guyot growing system, but on a small part of their vineyards.

The steep slope, the high fragmentation and the small size of the plots - which implies a difficult access to the vineyards - lead to low levels of mechanization in both areas (100% of the responses in Donnas and 75% in Morgex-La Salle indicate a low level of mechanization).

Despite the cultivation difficulties, only a part of the wine-growers interviewed leaves some terraces uncultivated (25% in the case of Morgex-La Salle, 20% for Donnas). They did however express an interest in starting production again (100% in both areas).

Regarding the social aspects of the sample under investigation, the average age of the operators interviewed is 64.5 in Morgex-La Salle (above the regional average) and 50.8 in Donnas (below). The level of education, however, is medium-high in both areas, although these data are probably sample-specific.

With regard to the main crop operations, and especially to the average demand of annual labour - expressed in hours of work/hectare - harvest and green operations are more costly, both in absolute and relative terms, in the Morgex-La Salle area compared to Donnas (Figure 5). The harvest needs to be carried out working on ones knees or lying under the Pergola, due to its limited height, generally not exceeding 1.40 m, and this alone meant no less than 350 h/ha of work.

In the Donnas area the most expensive operation (both in absolute and relative terms, compared to Mor-

Table 5: Information on young family members working in the farm and on computerization (Authors' elaboration on ISTAT, 2010).

Wine-growing areas	Number of relatives 28 to 40 working on the farm	% farm interested	N. of farms with a PC	N. of farms using the Internet	N. of farms with a website
Arnad	25	16.2	6	3	2
Chambave-Nus	53	16.5	19	6	5
Donnas	37	23.4	6	3	2
Enfer	6	17.1	3	1	2
Morgex-La Salle	12	11.3	11	5	7
Torrette	80	15.4	53	25	29
Total	213	16.5	98	43	47

Table 6: Farms with dry stone walls and use of passive sub-contracting (Authors' elaboration on ISTAT, 2010).

Wine-growing areas	Dry stone walls, maintenance last 3 years	Dry stone walls, new construction, last 3 years	Passive sub-contracting
Arnad	59	6	11
Chambave-Nus	74	11	37
Donnas	44	9	5
Enfer	25	1	1
Morgex-La Salle	22	3	0
Torrette	108	30	48
Total	332	60	102

gex-La Salle) is winter pruning (on average 180 h/ha) followed by binding (rigorously carried out by using willow) and harvesting, as well as maintenance work on the walls and wooden stakes, which are critical for continuity in the farm activity.

The average annual labour requirement was therefore estimated at around 1100 hours/ha in the Morgex-La Salle area and 880 hours/ha⁹ in the Donnas area, consistent with the high labour demand (1000 h/ha) of the vineyards cultivated on slopes in South Tyrol observed by Zelger (1989).

To better understand the Census data analysed, as well as those collected during the preliminary technico-economic survey, some of the vineyards cultivated

with a high and low Pergola were directly visited. The inspections confirmed the above, especially the high fragmentation of the plots, the slope steepness (especially in the Donnas area), the very difficult access for the operators, and consequently the almost impossible mechanization of most of the areas involved. Furthermore, in some vineyards, particularly in the Donnas area, some operators had to find ways for channelling and storing rainwater. If not managed, rainwater can be a danger for the stability of walls and slopes, but on the other hand, it is needed for treatments, since no municipal water network is available for this purpose.

To sum up, while on the one hand some factors suggest the risk of a difficult future for these vineyards, on

⁹ Further surveys on a larger group of local wine-growers, carried out in 2019, highlighted that this value, although high, is however to be considered underestimated.

the other hand some favourable elements are to be noted. They are, for example: the positive characterization of the landscape conferred by the vineyards cultivated with Pergola, the operators' active role in stabilizing the slopes, and the role played by the Pergola vineyards in protecting both the local and the downstream environment, also thanks to the heritage of knowledge transmitted from father to son.

DISCUSSION

The high land fragmentation we can observe in Aosta Valley is certainly one of the causes responsible for the decrease in agricultural activities and the ageing among agricultural farmers, especially wine-growers. A similar situation can be easily found in many other Alpine regions, such as, for instance, in Slovenian mountain areas, characterised by very small farms and by a progressive ageing of rural populations (Bojnec & Latruffe, 2009; Pažek *et al.*, 2012; Borec & Prišenk, 2013).

The fragmentation of the farms, the objective difficulties in mechanizing the cultivation operations, the high average age and the very slow generational change are the main factors that led to the progressive reduction of the vineyard areas that since the 1980s has affected the whole Region (Barrel, 2001; Bagnod *et al.*, 2015). On the other hand, the existence of typical growing systems -such as the high and low Pergola Valdostana- is a historical heritage from the past that contributes to give the concerned territories a strong connotation and an identity, both of which should be absolutely preserved.

The data from the preliminary farm survey highlighted the high number of working hours especially needed for the cultivation of the vineyard, not only because of the practices made difficult by the peculiar form of the cultivation system, but also because of the high land fragmentation and the maintenance needed for the supporting structures (walls, replacement of wooden stakes and stone supports when present).

Interventions aimed at:

- supporting the generational turnover and the small-scale mechanization in the wine-growing sector;
- integrating the other components connected to wine economy, such as food and wine tourism;
- enhancing and better promoting the local wine production;
- safeguarding and promoting the Alpine vineyard landscape;
- preserving the strong identity connotation of the territory connected to the traditional Pergola Valdostana system;
- are fundamental to keep the wine sector alive and sustainable over time, in terms of economy, landscape and environment.

Therefore, different interventions should be planned appropriately and must be shared among all stakeholders involved in the supply chain. They must be coordinated to safeguard the different positive effects of vine cultivation in the Aosta Valley.

Although mainly represented by PDO wines, the Aosta Valley wine sector cannot reward the environmental and landscape benefit produced by wine-growers through a price premium, consequently it seems important to reward these positive externalities in two ways.

First, it is possible to envisage specific forms of income support to maintain the small and very small farms (mostly part-time) that are still producing and that largely contribute to the maintenance of the territory and of the landscape through the management of the Alpine vineyards. In this perspective, financial assistance deriving from specific measures to aid heroic viticulture would be desirable and justifiable. For instance, the national law 238/2016 (the new Testo Unico della Vite e del Vino), in article 7 considers the protection of heroic vineyards, although, so far, the decrees necessary for the provision of possible dedicated funds are yet to be issued. Alternatively, support could be given within the regional RDP- for example through a "landscape award". In this way, the further environmental/landscape benefits produced by these farms would be rewarded, in addition to the already existing subsidies for the maintenance and the rebuilding of dry-stone walls.

Second, it becomes more and more relevant to implement a series of common and differentiated promotional strategies aiming at communicating to wine consumers, tour operators, restaurateurs, tourists and to the valley inhabitants themselves, that Aosta Valley wines contribute, with their presence on the market and with prices necessarily higher than those found in other neighbouring areas, to the maintenance of cultural models and uses that are unique and unrepeatable in other territorial contexts.

CONCLUSIONS

In Aosta Valley the value of wine is not merely economic because it also conveys the history, culture and identity of the local population. Nevertheless, the analysis of the statistical data, together with the survey carried out, highlighted many elements of fragility that characterize grape and wine production in Aosta Valley. At the same time, it showed that wine production and the related employment helps in creating a strong cultural and landscape identity in the Valley.

Tourism strategies taken into consideration by the ALCOTRA Project specifically aim to accomplish these objectives, by involving restaurateurs, tour operators, tourists and inhabitants in various activities. The overall output should be the proposal of a diversified

tourism, alternative to the one now prevailing in the Valley. It will be implemented through the creation of a thematic itinerary of rediscovery, conceived as a "Cross-Country Road of Alpine Vineyards". It will call for the rediscovery of the wine heritage, of the vineyards and of the tourism, landscape, cultural/historical points of interest that characterize the ALCOTRA vineyard area ("slow" enjoyment routes, e-bikes, guided vineyard tours, museums, wine bars, documentation centres, castles, organisation of cultural events, training, promotion and awareness raising events, etc.). It will be combined with cross-border programming aimed at developing the perception of the whole ALCOTRA area as a "single destination", also through specifically designed apps.

Another possible result that could be obtained from the historical and the socio-economic analysis is the evaluation of the possibility of a certification of the landscape created by the Alpine vineyards. This is an ambitious goal, which might find its highest level in the recognition as a UNESCO site, but that in the specific case of the Aosta Valley vineyards might not necessarily be achieved in this form. In fact, varied and hierarchical levels of landscape certification are contemplated at the national and international level. This project, through the set of activities planned, aims to assess the feasibility of this long path, in the firm belief that the certification of the vineyard landscape of the Alps can be an important tool to support the survival of heroic viticulture in mountain areas.

PERGOLA VALDOSTANA IN HEROJSKO VINOGRADNIŠTVO V DOLINI AOSTE (ITALIJA): ŠTUDIJA PRIMERA O TRADICIONALNEM SISTEMU GOJENJA VINSKE TRTE

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POVZETEK

Vinogradništvo v dolini Aosta je zgoščeno vzdolž njenih pobočij in morenskih gričev ter tako značilno zaznamuje pokrajino doline do več kot 1.000 metrov nadmorske višine. Interregov projekt ALCOTRA ("VI.A. STRADA DEI VIGNETI ALPINI") je namenjen izmenjavi metod in dobrih praks v regijah Piemonta, Aoste in Savoje za ohranitev značilnosti alpskih vinorodnih krajin. Raziskave v okviru projekta so obravnavale predvsem dve območji (vinograde območij Morgex-La Salle in Donnas), pri čemer so bile izdelane ocene relativnih povprečnih stroškov saditve in gojenja vinske trte v skladu s tradicionalnimi oblikami (nizke in visoke) tehnike Pergole Valdostane, ki se razlikujejo od klasičnega špalirja zaradi zelo posebnih podpornih konstrukcij, ki so postavljene na majhnih parcelah terasastih zemljišč. Prvi rezultati raziskave poudarjajo visok delež človeške delovne sile zaradi gradnje in vzdrževanja te tehnike v okviru skupnih stroškov pridelave grozdja. Tehnika Pergola Valdostana se namreč uporablja na območju, za katerega je značilna velika razdrobljenost zemljišč s povprečno površino vinogradov celo pod 2.000 m² in z zelo nizko stopnjo mehanizacije. Zato je nujno, da lokalne uprave izvajajo raznolike in celostne ukrepe za zaščito teh podeželskih območij, pri čemer naj zagotavljajo predvsem gospodarsko podporo majhnim pridelovalcem oziroma mikro kmetijam, katerih lastniki se postopoma starajo. Lokalne uprave naj oblikujejo tudi vsestranski in celovit projekt za turistično vrednotenje herojskega vinogradništva v dolini Aoste.

Ključne besede: alpski vinogradi, varovanje teras, krepitev vogradništva, projekt ALCOTRA

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