ISSN: 2641-6379
DOI: 10.33552/WJASS.2024.09.000708
World Journal of Agriculture and Soil Science
Iris Publishers

Review Article

Copyright © All rights are reserved by Cauli Alessandra

Grape Maturation and Statistical Analysis of Wine Data

Cauli Alessandra*

Politecnico di Torino, Corso Duca degli Abruzzi 24, Torino, Italy

***Corresponding author:** Cauli Alessandra, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Torino, Italy.

Received Date: June 07, 2024

Published Date: June 19, 2024

Abstract

The natural production of vines enhances the quality of different regions where produced wine making distinguishes through flavors. Starting from wine flavors and different aromas of some Italian wines, we will analyze by means of data collection, resuming onto the description of rural soil condition, weather detections, foods matching with them, when the productivity of the regions will be characterized by excellent, exampled, and sampled products that they are conditioning international selling, during thematical events and wine feasts or festivals, often. Then, reviewing some statistical analysis onto several Italian wines we will encourage grape maturation processes and historical procedures, considering global laws in respect to international economy and markets, and safeguarding local and rural wineries quality products. Developing by groups of registered, statistical, wine data, by prices, and across Italian territories, one could compare them to international other and similar prestigious wines. Ending to discover how performed maturation and resulted, approved, flavors along the aging of wines, without chemical interventions any, we will propose some qualitative descriptions of a textual, semiotic, and statistical analysis of classified international wine data, as future research skill regarding the topic, in respect to regional territories. Indeed, collected wine data resume how aromas performed without chemical compounds and the uses of industrial technologies, enriching organic viticulture, and exhibiting how they are featuring investigated Italian Grapes.

Highlights: The paper is a virtual journey onto some Italian Regions, across quality wines produces in these territories, in respect to the soil and the environments.

Introduction

International sales of wine products conducted to visit several Italian online wineries, from which the knowledge of this Section comes. See, for example, Italian geographic distributions of wines in [1]. We want to describe these Italian territories across some selected aroma wines and to characterize them through some curiosity from an historical point of view that highlight their cultural heritage they handle. In what concern grape maturation without chemical agents, making sense of previous research studies we did, by a point of view of mathematical calculus of wine cellar depths for storing wines during aging processes, avoiding chemical products, they influence badly the quality of Italian wines. Then, the potential alcohol of the wine is determined by the sugar content of the grapes, whereas grape berry compositional changes are fundamental during development and ripening, as it is represented in [2], where great role is expressed for organic acids in the production of quality wines, in particular, when L-malic and tartaric acids control the juice pH and they accumulate in the berry during growth and ripening. In [3], curvilinear relationships between several grape maturity indices had represented for the calculation of optimum maturity values under own specific conditions. An example of how effects of vineyard potential across grape maturation establish

This work is licensed under Creative Commons Attribution 4.0 License

the aroma-volatile profile of Italian wines is reported in [4]. The main role of temperature function in grapevine cultivars is known to slow as its increase, as it is explained in [5], and it is decisive until harvesting. After the postharvest partial dehydration, authors show in [6], how potential changes of the main classes of aromatic compounds of wine grapes, they are the volatility acidity, the C6 factor and terpenes, they occur at different temperatures.

The plan of the Chapter is composed by Section 1, in which we focus on deepening into quality wine and different production stages of making quality wines in local Italian wineries; Section 2 describes some famous Italian quality wines as a result of one typical commented analysis of statistical wine data, before concluding on Section 3, where we highlight the advantages of this featured and listed, exampled Italian wines, produced by means of biological conditions and procedures of wine making without the usage of chemical agents as compounds of intertwining with aromas of Italian Region Quality Wines.

3.1. How deciding the grape is ripe

The natural production of vines: The development of the vine according to its productivity includes all the various ages of the plant, at each of its phases, without the use of additives. The vine obtained by cutting or grafting, in the first period, prepares for its production phase, not bearing fruit for the first two or three years. This phase of unproductiveness, from the first to the third year, is normal for a young vine. The period that follows, of the "adult life" is a period of increasing productivity over the years and variable. The variability is given by the type of vine (for example, Trebbiano and Merlot have abundant and constant productivity, while Nebbiolo and Picolit have irregular productivity), but also by the choices made in the vineyard. Some longer-lived vines meet it after thirty or forty years of productivity, the vielle vineyards boast more than forty years of "career". Ungrafted vines can live up to one hundred years. If the life cycle concerns the entire life of the plant, the biological cycle instead concerns the evolution and transformation of the plant during the calendar year and is divided into a vegetative sub-cycle and a productive sub-cycle. When temperatures rise after the winter and the soil slowly warms up again, the vine awakens and resumes its root activity. The sap rises from the roots into the woody vessels and a transparent liquid of minerals, sugars and acids is emitted from the pruned branches. It is the cry of the vine, tears that announce the beginning of spring and of a new biological cycle with the "working" activity of the plant.

Plant protection through different strategies of green manure management, in conditions of low downy mildew pressure is the key point of the study on the efficacy of sustainable programmes, adopted to contrast the persistence of copper in soils and its negative effects on edaphic diversity, see for example [7].

One month after this phenomenon, the first shoot appears and with its elongation, the leaves. The good weather and temperatures without sudden changes, allow the growth of the vine, up to the August phase, that it is to say the phase of maturation of the branch, moment in which the plant stores all the processed substances as reserves, through the hardening of the part exterior and lignification of the shoots.

The last vegetative phase is defoliation which takes place in November and December. The first leaves to appear on the vine are the first to fall. At the same time as the vegetative sub-cycle, the plant experiences a productive sub-cycle, the phase in which the vine develops its bunches. Between April and May, the first bunches appear (hibernating buds) while flowering begins in mid-June, which is the shortest phase of the production sub cycle, followed by the opening of the flowers and heterologous fertilization (the pollen of a flower fertilizes that of another flower). The wind facilitates fecundation, which, if not perfect, leads to millerandage of the bunch (presence of green or immature berries). The fertilized flowers, on the other hand, develop the berries, fruit setting, which ripen, veraison, increase the pulp and the substances contained undergo very important changes. The stage of maturation depends on the type of vine and the wine to be obtained. In addition, the use of combinations of species for a previous oenological evaluation of natural isolates from grapes described in [8].

Grape maturation procedures: To make excellent wines, it is necessary to know perfectly the various grape ripening processes, to precisely understand the right time to start the harvest.

Considerations by statistic data analyses are examined in [9], where the need to delay in ripening is typical when territories appear subjected to highly variable environmental pressure, hence, in these cases, grape maturation procedures require to delay sugar accumulation.

Grape ripening is influenced by climatic factors and by variations in the hormonal framework linked to the vegetative and reproductive activity of the vine:

a. Herbaceous Period (30-65 days)

b. Veraison Period (6-30 days)

c. Maturation Period (25-50 days)

d. Period of Overripening (Overripening)

a. Herbaceous Period (30-65 days): It is the phase that goes from the moment of fruit setting to veraison: here it usually begins towards the end of May.

In an initial phase the berries begin to grow slowly from a certain point onwards the growth is more sustained, and the berry increases in weight and volume quite quickly, thanks to cell division. The berry is green in colour and is very active in photosynthesis.

This is the real development period of the grapes but also of the plant: together with the berries, the shoots also have rapid and strong growth. It is a fundamental phase for the good formation of the bunch and some of the important factors for a good growth are the temperature, the availability of water and nutrients. Why is it essential? Because at the end of this phase the berry has almost reached its definitive development: the grape seeds reach their maximum green weight, and the composition of the berry begins to change: the acidity increases, and the sugars slowly begin to accumulate.

b. Veraison Period (6-30 days): Veraison is one of the most fascinating and most beautiful moments to observe in the vineyard! But that's not all: it is also a fundamental moment for the future perfumes that we will find in wine!

Veraison is the moment in which the berry begins to lose its green colour and turn towards the typical colour of the variety: red for black grapes and yellow for white ones. This happens because the berry interrupts the photosynthesis activity and instead begins to synthesize polyphenols and aromatic compounds. Anthocyanins, responsible for the red colour of the grapes, and the flavonic pigments, responsible for the yellow colour, then begin to form.

At this moment, the growth of the berry stops, and everything is concentrated in the synthesis of these new compounds. Veraison usually lasts between 2 and 4 weeks and initially takes place in a few berries, and then extends to the whole bunch, in a scalar way.

c. Maturation Period (25-50 days): Maturation already begins during veraison: they are two never separate phases, and the accumulation of sugars also takes place in a graduated way: in the same bunch, the berries almost never have the same sugar content!

This phase lasts from 20 to 50 days, depending on the area and the variety. In this period the berry starts to grow slightly: this time, however, not due to the mechanism of cell division but due to a phenomenon of cellular distension: the accumulation of sugars in the berry increases the osmotic pressure in the berry and attracts water.

In this phase, profound changes take place in the berry:

- The sugars accumulate and, at the same time, the acidity decreases.
- Vitamins increase.
- The synthesis of aromatic substances continues.
- The consistency of the peel changes and becomes thinner and more elastic, due to the demolition of the pectin.
- The surface of the berry is covered with pruine, a waxy substance that protects the berry from the outside.
- The seeds dehydrate, losing about 15% of their weight and complete their maturation.

The maturation phase is very delicate: it is important to observe and monitor the grapes day after day, to select the moment in which they reach the maturity suitable for the type of wine to be produced.

d. Period of Overripening (Overripening): The grape does not always reach all three levels of maturity at the same time and here the sensitivity and experience of the winemaker intervenes in selecting the right moment for his vineyard and his wine, evaluating the analysis data together from time to time tasting the grapes.

Each season is different and the vintage with its climatic trend greatly influences the various types of maturation and the synthesis of phenolic compounds.

This is also the work of the winemaker: interpreting nature and working in the vineyard to adapt to it, week after week.

How understanding when the grapes are ripe? Think of how many variations occur in the grapes during the maturation phase and all these variations must be considered for the type of wine to be obtained. When grapes ripe in a cool climate, they tend to produce lighter wines, with a low alcohol content, more acidic, and typically with aromas of clear-fleshed fruit; in warm climates more intense and rich wines are produced, with a high alcohol content, light acidity, greater body, and full of aromas of red and black fruits.

The ripening of the grapes depends on many factors: the number of bunches, the number of berries, the density of the berries, the exposed leaf surface, the amount of water in the soil, the climate. The ripening of the grapes begins when the berries become larger and colored and the pulp is soft with a high concentration of fructose, which partly replaces glucose.

Not all the substances present in the berry increase during maturation. The acids, for example, decrease above all the malice, the harsher and more aggressive, present in greater quantities in grapes that are not yet ripe and in those grown in colder areas. The important thing is that tartaric acid remains, which is fundamental in determining the acidity of the must. In past years, the moment of the harvest was established, based on the relationship between sugars and acids. In recent times, we decide based on other factors: we can in fact speak of technological maturity, phenolic maturity, and aromatic maturity, generally reached between the second half of August and the end of October.

Desired maturity levels analysed in [10], by grape ripeness estimation, through in-field maturity indices such as total soluble solids, titratable acidity, pH and interval numbers, etc., to improve precision agriculture.

It is necessary to find the right balance between the technological maturation (the relationship between sugars and acids), the phenolic maturation (the concentration of the substances that give colour and structure to the wine) and the aromatic maturation of the grapes. Indeed, technically, the best time to devote yourself to harvesting is when technological and phenolic maturation coincide. It is then, in fact, that grapes with an optimal quality level would potentially be harvested. But phenolic and technological maturation do not always manage to reach the same quality levels with the same timing.

The achievement of one or the other is influenced by innumerable factors. The varietal is a fundamental element: not all vines, in fact, carry out their vegetative cycle at the same timing. The second factor that significantly affects this process is the environment in which the vine is found and the climatic context. Generally, in colder places the technological maturation tends to be delayed. On the contrary, in warmer places, the grapes reach sugar concentration levels in shorter times.

Altitude, exposure to the sun, canopy management, are crucial elements that greatly influence the technological and phenolic maturation processes.

At high altitudes, such as happens in Moselle (German wines), temperatures are lower. Technological maturation, therefore, takes place rather slowly. The direction of the sun's rays and the slate soils, capable of reflecting light, allow for a peculiar phenolic maturation. The strong temperature variations help the berries to concentrate on the sugar level during the day and to develop excellent acidity levels during the night. The steep slopes on which the vines are located allow for excellent ventilation. It is therefore understandable how, in such a context, it becomes more complex to grasp the precise moment in which the two maturations coincide.

It becomes essential for the producer to evaluate all the parameters of his grapes and decide on which type of ripening to focus on based on the style of making his wines. This happens where the physiological ripening of the grapes comes into play. By physiological maturation we mean that moment in which the vegetative cycle of the vine ends, and the mature seed can germinate. Numerous producers prefer to harvest at this moment, when the grapes have spontaneously reached their level of ripeness, regardless of that of technological maturity. How can you tell when the grape has reached its physiological maturity? With a practice as simple as it requires technique and experience: touching it, looking at it and tasting it. It is an empirical technique, probably not of taste to the more technical ones. Here it is the producer who makes the difference, the one who knows his vineyard in every little part and essence. We start with a small sampling of which we evaluate the colour, texture, taste, aromas, and appearance of the grape skins. Based on this examination, we then proceed with the possible harvest of the selected grapes.

Grape maturation is characterized by the sugar level mainly, that it is expressed in Babo degrees, based on measuring the density of the must, which it increases as dissolved sugars increase.

Ripening grapes, meanwhile, are measured by means of a percentage of total acidity: the index has optimal values between 30 and 35 but can vary in relation to the climate and the varieties.

Technological maturation: Technological maturation is evaluated based on the relationship between sugars and acids. Consequently, to favour the production of a must richer in fixed acids, especially in hot areas, the harvest of the grapes is brought forward. Tannins have preservative properties to which they owe their protective function of the wine and the ability to influence its colour. During the maturation and refinement of the wine, when the acidity tends to decrease together with the concentration of anthocyanins, the tannins give it a more orange colour. With aging in barrels, the tannins present, and the anthocyanins bind to the oxygen to give the wine a more lively colour (garnet red). The tannins also serve to determine its flavour, giving the wine characteristics of astringency (tannicity). Anthocyanins are contained in particular in fruit and vegetables. In grapes they are present above all in the skin and condition the colour with their shades which vary from red to blue. The sugars present in grapes are fructose and glucose in similar percentages. The indigenous yeasts, present on the peel, transform the glucose first, with the consequent possibility of triggering spontaneous fermentations. But, if the sugars increase, the acids decrease. In particular, the malic acid which takes away aggression and harshness. Tartaric acid, important for determining the acidity in the must, does not undergo large variations.

The phenolic maturation: In Oenology, ripening concerns the concentration of the phenolic substances of the grapes, more concentrated in the skins and in the grape seeds. This type of maturation considers the accumulation of anthocyanins and tannins and their solubility.

When the grapes reach phenolic ripeness, the skin cell membrane is in the optimal situation for maximum dissolution of the phenolic components in the must, especially anthocyanins. Leaving the grapes to ripen longer therefore increases the phenolic component which contributes to making the wine more structured and richer in tannins. The ideal case is the one in which technological and phenolic maturity coincide, confirming a perfect adaptation of the vine to the pedoclimatic environment and an excellent seasonal trend.

The Standard ITV method applied in [11], by five regional ITV units, on many regional grape varieties, across the measurements of some parameters helping to compare grape barriers, they are: the weight of 200g of grape berries, potential alcohol, total acidity, anthocyanins and total phenolic compounds.

The aromatic maturation: The aromatic maturation is linked to the accumulation of varietal aromas, above all of the terpene group. In fact, in wine we find the aromas of the vine, called precisely varietal and that is linked to the variety, to the soil (clayey soils will give more aggressive aromas, loose soil will give finer aromas), to the area, to the viticultural technique (pruning), and to maturity of the grape. Terpenes are contained in the grape skin and give hints of flowers or fruit. These substances can be free in the pulp and therefore also perceived by chewing a grape, as for moscato, or they can be linked to sugar molecules, in this case they will become volatile and therefore perceptible by smell only following hydrolysis reactions in must and wine. The accumulation of aromatic substances in the skin tends to increase during maturation, and then decrease if this is prolonged. In particular, it concerns the group of terpenes, which can be free and therefore perceived when tasting the grapes or linked to sugar molecules and therefore perceptible only following hydrolysis reactions in the must, and in the wine.

The tasting examination: The right degree of ripeness of the grapes to proceed with the harvest does not exist and it is a subtle game of balances to be calibrated between three types of ripening. First of all, the technological maturation, which concerns the relationship between sugars and acids, then the phenolic maturation, which evaluates the accumulation of tannins and anthocyanins and their solubility, finally the aromatic maturation, in relation to the concentration of aromatic substances. In all likelihood, you won't find a single line about physiological maturation.

From a Triple "A" point of view, physiological ripening is instead the fundamental one because, from a technical point of view, physiological maturation indicates the degree of evolution of the

berry at which the seed is mature, e.g., capable of germinating and giving life to a new specimen of vine. In practice, however, physiological maturation involves much more and much more.

Every year, in each naturally cultivated vineyard, the grapes develop a population of indigenous yeasts capable of transforming a certain quantity of sugars into ethyl alcohol, which coincides with that contained in the grapes at full physiological ripeness. Consequently, a grape harvested after the moment of perfect physiological ripening will not give a more alcoholic wine, but simply sweeter, as a part of the fruit's natural sugars will not be fermented. This is the surprising, almost magical aspect of nature and indigenous yeasts. On the contrary, the selected yeasts have been created ad-hoc to be able to ferment the maximum quantity of sugars and therefore to develop the maximum alcohol content. For this reason, today, most of the powerful and highly alcoholic conventional wines represent nothing but an artifice, a construction, a caricature of the true potential of wine.

During the olfactory tasting, considering the primary aromas, we must also consider the secondary aromas, characteristic of the fermentation which give the wines fruity and floral notes of rose, honey, banana, green apple, citrus, wax, etc. The tertiary aromas, typical of aging in barrels or bottles, on the other hand, recall spices, woody and mineral balsamic notes, hints of dried fruit, coffee, cocoa, and musky and animal aromas.

Business analytics in Oenology

Background literature: Establishing managed and controlled procedures, functionalities, and functions for the improvement of the aging process of wines when it is not possible to construct depth wine cellars, permit how studying water-energy-food nexus in World Countries is regulating circular economy, the analysis of Fourier's Law for the thermic isolation. Indeed, in [12], are presented some examples of calculations of optimal depths of wine cellars based on the climate adaptations and soil characteristics; in [13], sustainable development goals are evaluating in societies, in respect to a standard and holistic approach, that it is named as WqEFLC nexus, for water (quantity and quality), energy, food, land, and climate; whilst also, bioclimatic principles are applicable to the growth process in a winery building in [14], where there is a very interesting large-scale study across Spanish Census of wine cellars, their building surveys, commercial producing through textual analysis of frequent words involved in leading winery energy efficiency Journals and publications of Spain and Italy, characterizing the concept of the construction in ideal conditions. Therein, almost zero energy consumption for the aging of red wine through active participations for the databases organizations and for obtaining the contacts in cultural exchanges.

Italian soils are conditioned by winter survival of microbial contaminants in [15], and representations are showing the relationships between air and soil temperatures, simulated through the refrigerated thermostat; daily air temperature and concentration of fecal enterococci and fecal coliforms at spring "2" in [16]. Planted area in vines are relieved in [17], for Italian regions of Veneto and Friuli Venezia Giulia, which it is a case study of awareness campaigns creating and evaluating Corporate Social Responsibility activities to plan, organize and maintain sustainable certifications of wine productions. It contains graphic analyses of loss parameter of five modelled questionnaires: market drivers and the reduction of environmental impact, composed by corporate good wills. For example, the process of wine production is regarding in the vineyard of Salcheto Montepulciano the energy consumption distribution in [18]. Agronomic-environmental structures accompanied by management policies implemented for evaluating the terroir concept and a trade fair sustainability preserving farmer's interest in oenology, described in [19]. This ecological project aims to potential winemaking solutions in areas of innovation, the values of UNESCO Heritage preventing.

Success drivers of Italian Wine Sector evolution are an advising sponsorship perceived in [20], through statistic data, analysed from 1950 to 2019 across wine industry districts and four value chains connecting the cooperative and protection consortia in a wealth of knowledges with the scope to study compliance and volunteer planning programs of Italian wine area under vine, production, and consumption, formed by referring volumes and values.

In Mathematics, the study of cost functions of generating technological improvement and of marketing innovation facilitates the aging process related to the optimal aging determination and dependent variables, together to the decision variable α, that it determines the benefit or satisfaction from drinking a simple wine after a certain aging time, see other calculated details in [21]. Applying formulas of this article, the physical parameters we will consider in the statistical analysis of wine data are optimal average temperature, temperature fluctuations, humidity, light and vibrations for storage processes in Italian wineries comparing different qualities of these wines with others, abroad produced as well, cost functions, units of the grape juice, the depths of wine cellars based on chosen reference periods and soil conditions while temperature is changing. Indeed, statistical analysis of these wine data intended recognize a grape maturation as emerging environment practices, considering mainly the preservation of biodiversity, the avoidance of chemical substances, bio-building technics, and digital communications: see [22] for further details.

Finding optimal depth: Units of grapes were harvesting in wine cellars for long-term storage, and wineries specialize reusing natural conditions of the building itself programming aging process in ecologic nearly-zero energy system, and authors in [23] analysed Spain red wine warehouses of different type: basement, buried and underground aging cellars not equipped with air conditioning systems are monitoring conditions remained homogeneous, uniformly very stable temperature and relative humidity. Then, temperature fluctuations are damping evaluating by cost-benefit ratio for these indoor hygrothermal environments in €/m2. Fundamental is the Internet of Things (IoT) technologies, when the range of end-users collected implemented data from things, is supporting decisioning winemaking processes, beside the link to the territory, appreciating natural and cultural factors preventing

to limited area, characterizing the internet of grapes: see [24] for further details.

In what concerns annual distribution of Indoor Air Quality (IAQ), indoor climate thermal parameters, they are reporting in [25], where there is a statistic analysis, describing in terms of thermal comfort, the temperature, and the relative humidity, measuring instrumentation characteristics, position and period.

Flow cytometry showed faster yeast growth, greater population size and rapid viability decline at the higher fermentation temperature in [26], in which wine samples from each tank are measurements of volatile esters, collected at specific gravity daily, with a density meter trading on Fourier Transform infrared spectroscopy. This statistic analysis through sensory attributes evaluating in 5-11 months after bottling and preparation of reference standards highlights quality wines in cellars through three temperature programs for energy saving, investigating cellar ambient heat, dissipated by the cooling system, describing Riesling sensory attributes.

Optimal wine storage conditions can register collecting Country, description of the winery, the point for the designation, the designation, attributes of winery placement, wine variety, adding to the dataset [27], weather featuring examples about the average annual Regional temperatures, those for contemporary fifteen days, the ones for single month, relative humidity, light, if it is an area of seismic soil, thermic conditions of the soil, the type of soil where it is located the wine cellar, the periods of aging wine, the typology of the greatest thermal inertia solutions.

3.2.3.Wine datasets: In this subsection, we listed main famous, analysed, Italian wines whose we collected data from [28], they are exampled wine data about blind tasting, representing their nature and territories of production wineries, comparing them with the same qualities made in the rest of Europe and international wine markets by prices. Reported sampled wine Italian data are examples of organic viticulture in some Italian Regions as quality wine products for describing these Italian territory conditions, in the aim of characterizing them through different wine flavours and aromas in respect to all vineyard productions. A sentimental and textual analysis is conducted around word collections about some selected Italian wine data to know more about main Italian wines produced in particular Italian Regions, highlighting soil conditions, weather conditions and food matching with them in order to learn quality wines that they are producing there. The thoughtful results come from all comments contained in this Kaggle wine dataset.

a. Alicante: We analysed different European wine dataset to compare territory relevance and importance. The first dataset we considered is the one for Alicante wine, it is spread onto Countries of Australia, Italy, Portugal, Spain and US.

What we know from these data is that the 25.45% of registered Alicante wines scored more than 90 points and they are all produced in Portugal, except than one it is made in US. In what concern their organoleptic characteristics, Alicante wines produced in Portugal are describing as superbly ripe and rich without overwhelming. It has the dark black colours of the grape that are followed by full-bodied black fruit flavours and impressive spice and pepper flavours.

The Alicante wine produced in US is characterized by its old vines, they have yielded an extraordinarily dark, dense wine, the quintessence of black cherry flavours, but weighty with currants. It is extremely dry and tannic, with a puckery grape skin finish, and should age well.

Alicante red wines spread in centre and south Italy, especially in Tuscany (32%) and Sicily (20%) Regions, thanks to their great environmental adaptability. In upper Maremma of Tuscany Region, the clay soils of vineyards are planting Alicante when viticulture means enriching traditions, producing this native variety of black berried grapes, characterizing richer quality wines by delicacy, lightness, and harmonious flavours. Maremma Tuscany DOC grape varieties are produced in vines require a medium-late ripening period, handling a medium vigorous savour due to ideal soil conditions, they are typically inland, and hilly soils, well exposed and ventilated. In particular, Giglio Island terraced vineyards populate a yet untamed wilderness and clayey nature of soil makes wines of an intense ruby red colour, tending to crimson or amaranth, they lend to match with land appetizers, savoury first courses and more or less mature cheeses. In Giglio Island, stone structures are still used to press the grapes before being cellared, giving a traditional Alicante coming from a cultivation method involving the use of small, crossed cane partitions supporting short spurs. Vineyards in Tuscany Italian Region denote Alicante quality wines with a perfume that it is fine, fruity with an aroma of red fruits and spicy notes, sometimes a little wild. The aging processes of Alicante maturation grapes transform their taste as dry, with typical hints of bitter almond and they are often excellent combinations with grilled meat and feathered and furred game.

b. Bovale: We collected two types of this famous Sardinian wine, they had 85 points all.

Regarding zones of production in Sardinian Region, they are Alghero, Ittiri, Olmedo, Ossi, Tissi, Usini and parts of the Municipality of Sassari, and the Municipalities of the Provinces of Nuoro and Oristano of the Mandrolisai historical area.

Effects of viticulture, canopy side and light regime and their combinations on the vegetative growth of vines during ripening season are studied in [29]. In addition, Bovale grape pomace extracts were loaded in nano emulsions tailored for cosmetic application and analysed in this article.

The origins of this Sardinian variety are still unknown, although the first appearances on the island are most likely to be found in the period of Aragonese domination (1324-1700). From an historical point of view, Sardinian Region viticulture, produced Bovale wines by viticultural techniques they were traditional, and they not yet present irrigation while dry farming techniques are the only ones used by these winemakers. They consisted of saplings, a low deck with three or four branches depending on the force. A good part of these vineyards was planted between the 50s and the

70s and even today the management of soil, given the particularly narrow planting layouts with distances between rows varying between 1.5 and 1.8 meters, it is conducted by animal traction. Since the 2000s, the newly planted vineyards have been trained in counter-espalier, using a cordon bilaterally spurred scaffolding approximately 60 centimeters from the ground level. With the use of this new cultivation model, with which approximately 20% of the total hectares of the district are currently grown examination, the distances between the rows have been modified to allow easier transit of vehicles mechanical, while the distances between the vines along the row have remained practically unchanged and less than one meter linear. The currently certified organic wine production amounts to just over 50 hectares and they affect a small area of the range. The traits of the sector that characterize this district are represented by strong senility of viticultural workers, strong pulverization and fragmentation company, with a surface area of 0.5 hectares and with a rather limited number of companies that reach the hectare. However, a reversal of direction should be noted which in recent years has favoured a slight trend increase in the vineyard surfaces. Sardinian Bovale territories harm life, aromas and harmony to these wines: high quality bottles, organic processing and production of niche, often limited and aimed largely at foreign markets, as Switzerland one, in particular.

The bunch has a conical shape and medium-large dimensions; it is compact and generally winged. The grapes are large and ovoid in shape; they have a thick and not very pruinose skin, dark blue in colour. The pulp is colourless and firm, with a sweet flavour, often. The ripening time of the grapes is rather late, and the harvest is generally carried out in the month of October.

The vine is always used in winemaking together with other black grape varieties, to which it provides a bright purple colour and a good acid component. The very rare pure vinification's - mostly experimental - produce a very fresh and vinous product, with strong sensations of small red fruits, with a full and fragrant body, marked by a rather tannic finish. The wine obtained is characterized by its richness in extract, alcohol content and polyphenols.

Sardinian Bovale wines are particularly suitable for balanced dishes, which do not exceed excessive fatness or succulence or spicy notes. The younger versions go very well with roasted red meats, sheep meat or game. Wine aged for a long time in wood are often in combination to braised meats, stews, stewed meats with long-cooked sauces. Finally, it is appreciated with hams, dried sausages, vegetable appetizers prepared in the oven, au gratin or in savory pies, pizzas, second courses of red and not too fatty meats, as well.

c. Monferrato Piemontese: It is a wine ranged from 83 to 90 points, 31 bottles were analysed for our study, and we reported these variety of Piedmont wines.

Monferrato Piedmont wine, when it is crisp and slightly sweet, it has an attractively creamy texture. Four lions symbolize four winemaking families of Piedmont.

The Monferrato vineyards, carefully cultivated, were one of the few areas where, starting from 1840, the slow spread of the use of thread had begun of iron.

Monferrato Piedmont wine includes the provinces of Alessandria and Asti. This area is therefore divided into macro-areas which have predominantly sandy soils, with a calcareous and alkaline structure and rich in marine sediments.

The bunch is pyramidal in shape, very compact, with medium oval berries, intense blue in colour maturation.

Monferrato Piedmont wines have the celebrity with in particular the Dolcetto of Ovada: it is sufficient to mention Carlo Porta (1775-1819), who in the heroic-comic poem in Milanese dialect Olter disgrazzi de Giovannin Bongee (1814) by the Milanese poet Giovannin advises his wife, who declares herself "indisposed", to free herself from that discomfort by drinking "on bon biccer de vin from Roccagrimalda". From the point of view of scientific recognition in terms of the Oenological level reached by the wines of the area, it is sufficient to remember Giorgio Gallesio, the famous naturalist-botanist, who precisely in the period 1817-39 published his pioneering studies on the "Italian Pomona", stating that «the wine made with Dolcetto takes on different characteristics, depending on the locality where it is grown and the methods with which it is made", adding that among the wines bearing this name "the most esteemed are those from Ovada and its surroundings. In Ovada especially the deposits and selections are made, and from there it is sent to Genoa and the Milanese area".

d. Montepulciano d'Abruzzo: The 22.58% of bottles of Montepulciano d'Abruzzo, in this Italian Region, scored more than 90 points.

The concerned Italian territory, which embraces the entire coastal and internal hill of the province of Teramo city, it is characterized by large hills sloping down towards the Adriatic Sea to the east and by the presence of the imposing Gran Sasso massif and the Monti della Laga to the north-west. Weather conditions of this Abruzzo Italian Region are a good ventilation (sea and mountain breezes) which is associated the excellent exposure, the rather loose nature of the soil and the consequent absence of stagnation water. They guarantee the Montepulciano vine optimal conditions to vegetate and produce grapes with high quality and typical characteristics. The interaction of these natural factors with historical-cultural and above all human ones, both in type cultivation - such as farming methods, high number of plants per hectare, low yields per plant - and oenological - such as long aging and refinement, allow us to obtain wines with structured, complex, strong distinctive elements, typical of the vine and characteristic of the territory.

Montepulciano d'Abruzzo wines have a colour which is ruby red with violet reflections. The smell is red fruit, with hints of morello cherry and fine notes spicy. It tastes medium-bodied, savoury and slightly tanned.

Typical aromas of Montepulciano d'Abruzzo wines are described in [30], where basic winemaking parameters and some key chemical analysis for aroma compounds were considered.

e. Sangiovese: 1.437 bottles from 3.082 (46.63%) of Sangiovese wines in Tuscany Region points from 90 to 99. It offers aromas suggesting forest floors, porcini mushroom, grilled herb, leather, and mature berry. Forest floor, truffle, baked plum, eucalyptus, and baking spice unfold on this structured red. The linear, elegant palate offers dried black cherry, clove, ground pepper and tobacco framed in polished, fine-grained tannins.

Significant differentiation in the chemical-analytical compositions reflect an important sensory analysis did in [31], in which differences among wines established for intensity of colour, astringency, and dryness mouthfeel perception. A similar study around our research topic, is a sentimental analysis did in [32], enlarging wide knowledges in what concerns agricultural practices adopted for the winemaking techniques used to produce Sangiovese wines, based on characteristics of the soil: these territories are described as specific regions and areas where Sangiovese wine is produced, such as Umbria, Lazio, Tuscany and Abruzzo Regions. In addition, it is considerable the ability of Sangiovese wines to adapt to foreign contexts outside the Italian borders. Then, Sangiovese wines are cultivated in the United States (Washington State, California), Argentina, Chile, New Zealand, Canada (Ontario, British Columbia), and most of Australia. In particular, Australian location winemakers demonstrate to select clones capable of adapting to the soil and climate conditions of the local territory, distinguishing their production through high-quality wines and not too similar to the Italian, especially the Tuscan ones. In this sentimental analysis, different brands are crafting, and experiencing in terms of aromas, flavours, colours, how Sangiovese wines are joining typic foods during catering tips the most common are reusable ready. In fact, these denominations of the Made in Italy oenological outline are produced to suit. More emotional types of descriptive words retrieved in our analysed dataset regarded Sangiovese food pairing, suggesting dishes such as pizza, pasta, ribollita, ragù, roasts, etc., to accompany with Sangiovese wines.

Sangiovese variety had underlined in [33], where it shows that also if it is grown outside its original terroir, it seems a fresh and fruity wine without neglecting the contribution of regional characteristics to the composition of wine.

f. Nero d'Avola: 15.53% of bottles of these wines in Sicily Region range from 90 to 94 points.

Under all that are notes of toasted almond and pistachio, they are characteristic of matching Nero d'Avola grapes.

The beginning of ripening of this Italian wine occurs in the first ten days of August and therefore can be considered early. The development of sugar accumulation is regular until almost the time of harvest, when, in some cases, in addition to slowing down, it tends to remain constant until the harvest. The kinetics of titratable acidity shows a mirror trend compared to that highlighted for sugars. The variations over the years in these values are particularly modest for this vine, showing a good ability to control acidity during maturation.

g. Pinot Nero: 4 over 19 bottles of these wines point 90 and we refer to Piedmont Italian Region.

Pinot Nero wines are the most important international vines originating from Burgundy, they found in Monferrato in Gabiano, a large territory where they can express as a great red wine. The white lands of Gabiano give Pinot Noir wines with great flavour and unique typicality also given by the expert winemaking techniques with particular maceration on whole grapes. The colour is of medium intensity ruby red with purple hues. The nose is elegant with fruity hints, integrated with hints of leather, tobacco and chocolate. On the palate, the taste is rich and deep with hints of red fruits, fruit in alcohol, soft and captivating with a strong alcoholic component integrated with aromas of fine woods. Pinot Nero wines go well with red meat dishes, game, medium-aged cheeses and truffles.

Conclusion

Describing the organoleptic characteristic of famous Italian wines across their production territory, and statistical textual analysis based on quality wine data, we had made a virtual journey in Italy, understanding how empowering soil characteristics, and selling quality wines of Alicante, Bovale, Monferrato Piemontese, Montepulciano d'Abruzzo, Sangiovese, Nero d'Avola and Pinot Nero, preventing a safe knowledge of wide applicability of this touristic data and information of some exampled and high scored wines, enabling potential biological instruments through the reception of the main indicators of excellent Italian wines. Wineries can decide, if it is the case, optimizing energy costs, and if they can construct an underground wine cellar to improve their products in Oenology. Across several flavours of Italian wines, we collected several data of these wines, featuring them and having more knowledges, and this data collection was useful to identify the featuring exampled wine and characterize the safeguard of local Italian territories and wine makers activities during the grape maturation and the aging of wine procedures, even if by an historical point of view. Hence, these Italian wine examples are reported in the aim of this Chapter to make textual comments from collected statistic data of some Italian prestigious, and quality wines, in order to study for future works, their sides of international knowledges and the preservation of Italian Region territories, considering local environments and the adopted technologies used during the report of wine data through different datasets, and in order to classify as modelled examples these descriptions of aromas obtained from statistic textual analysis of registered public data of some exampled Italian quality wines. Indeed, it is clear, reading these descriptors of organoleptic characteristic of some Italian wines, how to employ biological techniques or architectural interventions by means of underground wine cellars, to maintain internal temperature of cellar to be constant at thirteen Celsius degrees, the perfect ideal internal temperature for storing wines in a local wine cellar.

Declarations

Data and materials are not available.

Funding

No Funding information is available.

Acknowledgement

None.

Conflict of Interest

The authors declare no conflict of interest any.

References

1. Vineyard, https://vineyards.com/wine-map/italy#pid=20, (2024).
2. Zelmari A. C., Site and vintage response of malic and tartaric acid in Vitis vinifera L. cv's Cabernet Sauvignon and Sauvignon Blanc, Stellenbosch University, (2013).
3. Du Plessis C. S., Van Rooyen P. C., Grape maturity and wine quality, S. Afr. J. Enol. Vitic., (2017).
4. Escudero A., Arias I., Lacau B., Astraìn J., Baron C., Fernandez-Zurbano P., Ferreira V., Effects of vineyard « potential » and grape maturarion on the aroma-volatile profile of Grenache wines, Oeno One, (2019).
5. Cameron W., Petrie P. R., Barlow E. W. R., Patrick C. J., Howell K., Fuentes S., Advancement of grape maturity: comparison between contrasting cultivars and regions, Australina Journal of Grape and Wine Research, (2019).
6. Mencarelli F., Bellincontro A., Recent advances in postharvest technology of the wine grape to improve the wine aroma, J. Sci. Food Agric., (2020).
7. Perria R., Ciofini A., Petrucci W. A., D'Arcangelo M. E. M., Valentini P., Storchi P., Carella G., Pacetti A., Mugnai L., A study of the efficiency of sustainable wine grape wineyard management strategies, Agronomy, (2022).
8. Mas A., Padilla B., Esteve-Zarzoso B., Beltran G., Reguant C., Bordons A., Taking advantage of natural biodiversity for wine making: the WILDWINE Project, Agriculture and Agricultural Science Procedia, (2016).
9. Previtali P., Giorgini F., Mullen R. S., Dookozlian N. K., Wilkinson K. L., Ford C. M., A systematic review and meta-analysis of vineyard techniques used to delay ripening, Horticulture Research, (2022).
10. Bazinas C., Vrochidou E., Kalampokas T., Karampatea A., Kaburlasos V. G., A non-destructive method for grape ripeness estimation using intervals' numbers (INs) techniques, Agronomy, (2022).
11. Cayala L., Renard R., Estimation of the phenolic maturity of red grapes using the standard ITC method, Internet Journal of Viticulture et Oenology, (2008).
12. Cadeddu L., Cauli A., Wine and maths: mathematical solutions to wine–inspired problems, International Journal of Mathematical Education in Science and Technology, (2018).
13. Kalvani S. R., Celico F., The Water–Energy–Food Nexus in European Countries: A Review and Future Perspectives, Sustainability, (2023).
14. Ruiz F. A., Estrategias bioclimaticas de las naves de crianza de las bodegas de vino en Espana como modelo de edificios de cosumo de energia casi nula, Tesis Doctoral, Universidad Politecnica de Madrid, Escuela tecnica superior de ingenieria agronomica alimentaria y de biosistemas, Departamento de Ingenieria Agroforestal, (2021).
15. Bucci A., Allocca V., Naclerio G., Capobianco G., Divino F., Fiorillo F., Celico F., Winter survival of microbial contaminants in soil: An in situ verification, J. Environ. Sci., (2015).
16. Allocca V., Celico F., Petrella E., Marzullo G., Naclerio G., The role of land use and environmental factors on microbial pollution of mountainous limestone aquifers, Environ. Geol., (2008).
17. Pizzol L., Luzzani G., Criscione P., Barro L., Bagnoli C., Capri E., The role of Corporate Social Responsibility in the Wine Industry: the case study of Veneto and Friuli Venezia Giulia, Sustainability, (2021).
18. Alimonti C., Pecci G., Back analysis of a horizontal geothermal plant implemented in a Wine Production Process, Sustainability, (2021).
19. Biagioli G., Prats M., Bender J., (2012). European guidelines for wine cultural landscape preservation and enhancement - with special regard to endangered areas and vineyards, ViTour European World Heritage vineyard, printed in Italy, Oct./Nov.
20. Pomarici E., Corsi A., Mazzarino S., Sardone R., (2021). The Italian Wine Sector: evolution, structure, competitiveness and future challenges of an enduring Leader, Italian Economic Journal.
21. Gonen L. D., Tavor T., Spiegel U., The positive effect of aging in the case of wine, Mathematics, (2021).
22. Bandinelli R., Acuti D., Fani V., Bindi B., Aiello G., Environmental practices in the wine industry: an overview of the Italian market, British Food Journal, Emerald Publishing Limited, (2020).
23. Gómez-Villarino M. T., Barbero-Barrera M., Mazarrón F. R., Cañas I., Cost-Effectiveness Evaluation of Nearly Zero-Energy Buildings for the Aging of Red Wine, Agronomy, (2021).
24. Kudryashova E., Casetti M., The Internet of Things - the Nearest Future of Viticulture, Agris on-line Papers in Economics and Informatics, (2021).
25. Panaras G., Tzimas P., Tolis E. I., Papadopoulos G., Afentoulidis A., Souliotis M., Combined Investigation of Indoor Climate Parameters and Energy Performance of a Winery, Appl. Sci., (2021).
26. Schwinn M., Durner D., Wacker M., Delgado A., Fischer U., Impact of fermentation temperature on required heat dissipation, growth and viability of yeast, on sensory characteristics and on the formation of volatiles in Riesling, Australian Journal of Grape and Wine Research, (2019).
27. Fernandes de Oliveira A., Nieddu G., Vine growth and physiological performance of two red grape cultivars under natural and reduced UV solar radiation, Australian Journal of Grape and Wine Research, (2015).
28. Kaggle, https://www.kaggle.com/datasets/zynicide/wine-reviews, (2024).
29. Castangia I., Fulgheri F., Perra M., Bacchetta G., Fancello L., Corrias F., Usach I., Peris J. E., Manca M. L., Manconi M., A Cocktail-Based Formula for the Design of Nanosized Cosmeceuticals as Skincare and Anti-Age Products, Nanomaterials, (2023).
30. Tofalo R., Patrignani F., Lanciotti R., Perpetuini G., Schirone M., Di Gianvito P., Pizzoni D., Arfelli G., Suzzi G., Aroma Profile of Montepulciano d'Abruzzo Wine Fermented by Single and Co-culture Starters of Autochthonous Saccharomyces and Non-saccharomyces Yeasts, Front. Microbiol., (2016).
31. Romani C., Lencioni L., Biondi Bartolini A., Ciani M., Mannazzu I., Domizio P., Pilot Scale Fermentations of Sangiovese: An Overview on the Impact of Saccharomyces and Non-Saccharomyces Wine Yeasts, Fermentation, (2020).
32. Nosi C., Mattiacci A., Sfodera F., Online wine ecosystem: the digital narrative of Sangiovese, British Food Journal, (2019).
33. Canuti V., Cantu A., Picchi M., Lerno L. A., Tanabe C. K., Zanoni B., Heymann H., Ebeler S. E., Evaluation of the Intrinsic and Perceived Quality of Sangiovese Wines from California and Italy, (2020).