



INTERNATIONAL CONGRESS ON SUSTAINABLE VITICULTURE
AND OENOLOGY

Book of abstracts

13TH – 16TH OF NOVEMBER 2022

Sárospatak, Hungary





Edited by

ZSUZSANNA BENE, PhD, Vice rector, University of Tokaj

Published by

University of Tokaj

H-3950 Sárospatak Eötvös u.7.

Responsible publisher

ÁGNES HORVÁTH, PhD, Rector, University of Tokaj

ISBN 978-615-6482-05-1

INTRODUCTION

Tokaj Wine Congress - first International Congress on Sustainable Viticulture and Oenology

ÁGNES HORVÁTH – ZSUZSANNA BENE – SÁNDOR NÉMETHY

UNIVERSITY OF TOKAJ

The first International Congress on Sustainable Viticulture and Oenology has been arranged to emphasize the system approaches and synergies between the scientific fields of wine science such as viticulture, oenology, wine business, wine tourism, multifunctional agriculture, and even the relevant areas of heritage science and landscape conservation and create a new international platform to exchange knowledge, skills and experiences among professionals that is up-to-date, useful, and easy to put into practice. Therefore, this Congress adopted an interdisciplinary approach, dealing with all the aforementioned subject areas.

The character and the quality of wine depend on the grape variety, the soil, the climatic factors, the viticultural factors, the oenological practices, the methods of maturation and ageing, the treatment, time, and storage conditions. Where viticulture is successful it transforms the local landscape into a combination of agriculture, industry, and tourism. This is particularly true for the Tokaj Wine Region Historic Cultural Landscape, which was inscribed on the World Heritage List in 2002.

The grapevine is a multi-functional plant regarding the number of products, which can be extracted from it: fruit, raisins (from special cultivars), grape juice, a whole range of wines, brandies, cognac, grape seed and grape skin flour and extracts known of their medical value, grape seed oil, grape marmalades and jellies, animal feed and, finally, plant fertilizers from those vineyard residues, which could not be used for anything else. This multifunctionality is mirrored in a special branch of tourism, called oenotourism or wine tourism. There are three groups of touristic services/products in a wine region: the “core product” refers to the wine itself, “augmented services” include all services and activities within the control of the winery, such as vineyard and winemaking activities, customer service, and social or wine club events, and finally, the “ancillary services” refers to services and activities that are mostly out of control of the winery, including other regional tourist activities, local entertainment, lodging, and transportation. Augmented benefits, i. e. other factors that can be controlled by the winery such as the vineyard setting or attending a winery event, were the next most important factors while ancillary services like visiting a historical or cultural attraction or utilizing outdoor recreation services were considered important, though not nearly as important as all other core and augmented factors (Fig 1.). Multifunctional agriculture is the basis of economic viability for many wineries, particularly important for small and medium-sized enterprises.

It is our intention to create a tradition of annual or biennial congresses in this wine region, and we hope that all participants will find this Congress interesting and its outcomes rewarding.

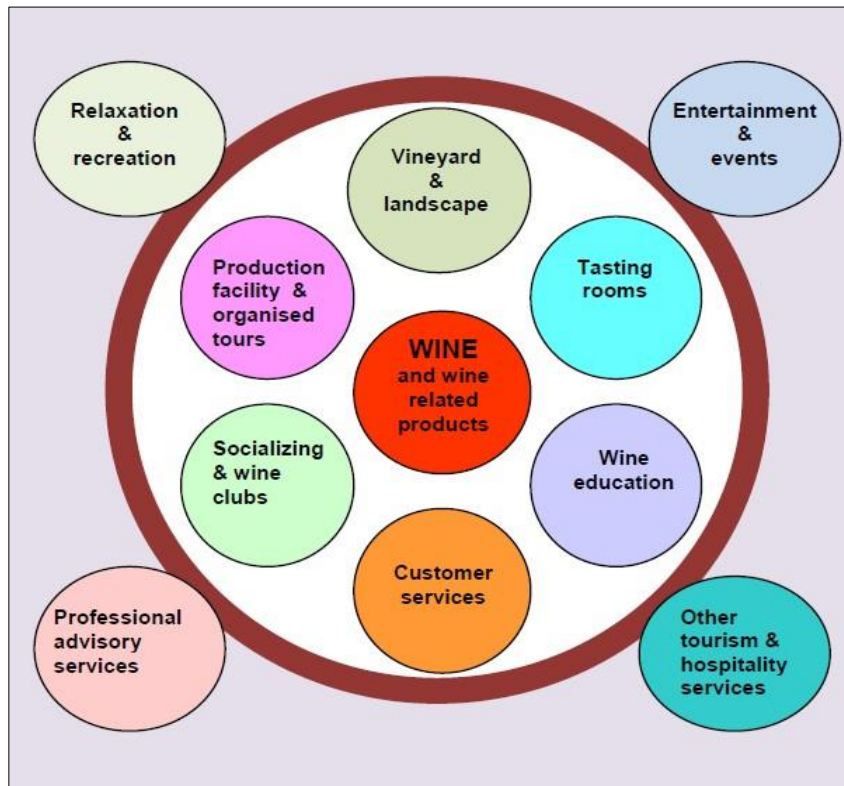


Figure 1. Core, augmented and ancillary services in a wine region (Némethy et al., 2016).

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SCIENTIFIC COMMITTEE

Bauer , Florian – Stellenbosch University, South Africa fb2@sun.ac.za	Yeast molecular and cellular biology, wine biotechnology
Bene Zsuzsanna, University of Tokaj, Hungary, bene.zsuzsa@unithe.hu	Oenology, oenological methods of Tokaj wine production, wine-chemistry and wine-gastronomy
Bordons de Porrata-Doria , Albert, Universitat Rovira i Virgili, Tarragona, Catalonia, Spain, albert.bordons@urv.cat	Wine biotechnology, Nutrition, Bromatology
Bujdosó Zoltán – Hungarian University of Agriculture and Life Sciences, Hungary, bujdosozoltan@uni-mate.hu	Tourism & wine geography, viticultural landscapes, geomorphology
Joan-Miquel Canals Bosch, Rovira i Virgili University, Spain, jmcanals@urv.cat	Oenological technology, biochemistry, biotechnology
Csapó János – University of Debrecen, Hungary csapo.janos@gmail.hu	Wine analytical chemistry, biochemistry, detecting wine counterfeiting
Dazzi , Carmelo, University of Palermo, Italy Carmelo.dazzi@unipa.it	Pedology, soil conservation, soil ecology, soil management in arid conditions
Fodor László – Hungarian University of Agriculture and Life Sciences, Hungary, fodor.laszlo@uni-mate.hu	Integrated pest management, organic farming, agricultural chemistry
Kiss István – University of Tokaj, kiss.istvan@unithe.hu	Wine technology, Food and beverages operations
Kotseridis , Georgios – Agricultural University Athens, Greece ykotseridis@aua.gr	Oenological chemistry, wine flavour chemistry
Kőmíves Tamás – European Ecocycles Society & Hungarian Academy of Sciences komives.tamas@gmail.com	Agricultural chemistry, plant physiology, irrigation systems, soil phytoremediation technologies
Kőpeczi-Bócz Tamás University of Tokaj, Hungary kopeczy.bocz.tamas@unithe.hu	Human resource development, vocational training, higher education pedagogy, regional economics
Kovács , Barnabás - Hungarian University of Agriculture and Life Sciences, Hungary, kovacs.barnabas@uni-mate.hu	Viticultural technologies, vineyard soils, soil management, irrigation technologies
Lagerqvist , Bosse – University of Gothenburg, Sweden bosse.lagerqvist@conservation.gu.se	Landscape conservation, spatial planning, conservation of cultural heritage
Lo Papa , Giuseppe – University of Palermo, Italy, giuseppe.lopapa@unipa.it	Pedology, soil conservation, soil ecology, soil management, geoinformatics, soil survey
Mas , Albert – Universitat Rovira i Virgili, Catalonia, Spain albert.mas08@gmail.com	Microbiology, oenology, wine technology, wine vinegar production, Mediterranean wine geography
Molnár Péter, University of Tokaj, Hungary molnar.peter@unithe.hu	Grapevine breeding, special oenological practices of Tokaj, history of Tokaj wines
Némethy Sándor – University of Tokaj, Hungary nemethy.sandor@unithe.hu	Wineyard ecology, biochemistry, wine flavour chemistry, wine geography, persistent organic pollutants
Novello , Vittorino – University of Torino, Italy vittorino.novello@unito.it	Viticulture and grapevine genetics, viticulture in high altitudes
Peterlunger , Enrico – University of Udine, Italy enrico.peterlunger@uniud.it	Viticulture and grapevine genetics, conservation of valuable cultivars
Remenyik Bulcsú – University of Tokaj, Hungary, remenyik.bulcsu@unithe.hu	Wine-tourism, tourism planning, sustainable tourism, wine gastronomy, wine tourism management
Vivier , Melanée – Stellenbosch University, South Africa mav@sun.ac.za	Grapevine molecular and cellular biology, grapevine genetics

ABSTRACTS – PLENARY LECTURES

OVERVIEW OF THE ACTIVITIES AT THE INSTITUTE FOR VINE AND WINE SCIENCES

Alain Blanchard

ISVV Director

The general idea for the Institute for Vine and Wine Sciences (ISVV) was launched 20 years ago and the activities really started in 2009 with the opening of a dedicated building that houses both teaching, research and innovation activities. Today, the ISVV is recognized as a success because of its international recognition and also because the original idea of boosting interdisciplinary projects is a reality.

The research activities at ISVV include three main themes that are (i) quality and identity of the wines (ii) vineyard and environment (iii) markets and consumer perception. The added value of the institute is to favor the synergy between its different laboratories. Today the context is challenging for the French wine producers with a societal demand for an environmental-friendly production in the global context of international market competition and of climate change. The ISVV develops research projects that try to anticipate the professional needs in order to be able to provide possibilities of adaptation. During my presentation, I will give a few examples illustrating this challenge.

GRAPEVINE BREEDING FOR RESISTANCE TO DISEASES: AN IMPORTANT TOOL TO IMPROVE SUSTAINABILITY OF VITICULTURE

Enrico Peterlunger

University of Udine, Italy

Global climate change needs a deep adaptation of agricultural activities to modify our approach to production and to reduce the impact on environment, climate, consumers. Grapevine is a cultivated woody species that needs heavy pesticide application to obtain the crop: two thirds of fungicide used in agriculture in Europe are applied in viticulture. Breeding to improve resistance to diseases is an important tool to improve grapevine cultivation reducing impact on environment, workers and consumers. This is part of European Green Deal, already decided by Europe (European Commission, European Parliament), aiming to reduce pesticide application of 50% by 2030.

On 1998 a grapevine breeding program for resistance to disease was started at the University of Udine. The aim has been improving resistance to downy mildew and powdery mildew. The activity started with collection of genetic material (varieties and hybrids) already improved for resistance, or material carrying resistance genes to be introduced in interesting genotypes. On 2006 the grapevine genome has been sequenced, by Italian and French research groups, including University of Udine. The sequence was helpful in selection process. The method used has been crossing and Marker Assisted Selection (MAS), using DNA markers (microsatellites) associated with resistance genes to obtain an early exclusion of seedlings not bearing resistance. An agronomic evaluation of the new selections has been performed, as well as oenological evaluation through chemical analysis and sensory evaluation. The overall result of this breeding program is that the resistance against powdery mildew and downy mildew in the selected cultivars allows a reduction of pesticide application down to 30-40% of normal fungicide application: this is a substantial improvement of viticulture sustainability, namely in areas where rainfall is relevant. This lower impact on environment and consumers implies also a lower production cost. The result is accordance with the EU guidelines for reduction of pesticide application in agriculture. The wine quality of most selected resistant varieties is comparable with the best *vinifera* cultivars. The acceptance on the market is good, at international level. On 2015 ten resistant varieties have been registered in Italian National Catalogue of Grapevine Cultivars. On 2020 four more varieties have been registered. This project has been conducted in cooperation with IGA, Institute of Applied Genomics at Udine, VCR nursery at Rauscedo, Italy.

“PROTEIN-STABLE WINES DESPITE CLIMATE CHANGE? EITHER WITH BENTONITE OR WITH A PROTEASE?”

Hannes Weninger

Erbslöh Austria GmbH, CEO
A-7011 Siegendorf, Sankt Margarethnerstr. 69a

Clear and stable wines are the prerequisite for a large part of wine consumers. If turbidity occurs due to transport and temperature fluctuations, this leads to rejection of the wine or complaints to the producer. In addition to many other parameters affecting stability, tartar and thermolabile protein represent the main part of turbidity. The latter is the least accepted due to a milky white haze.

The wine awaiting bottling must therefore be checked and, if necessary, stabilised. In the practice of wine technology, however, this measure of stabilisation has mistakenly been shifted to an earlier period. Natural changes in the wine matrix in the course of vinification, caused for example by tartar precipitation, have an influence on the isoelectric point and thus on protein stability.

Climate change is increasingly causing stress situations in the main vegetation. Water shortage and drought lead to increased and different levels of thermolabile proteins in the vine.

For decades, the clay-like mineral bentonite has been used for stabilisation. It is used in must or wine. The mode of action is based on the charge, the inner surface and the intimate contact with the wine.

In 2021, the EU allowed the use of proteases. The must must be heated to 65-75°C so that the protease can break down the unfolded globular protein. This method thus takes place before alcoholic fermentation.

The use of proteases is an alternative for large wineries to successfully react to increased protein levels due to stress situations. However, this application requires a technical effort by heating (65-75°C) and subsequent re-cooling of the must (15-20°C).

In addition to reducing the thermolabile protein, bentonite also fulfils other positive factors, such as accelerating the clarification of wines, harmonising and reducing biogenic amines (histamine).



MANAGING AN EFFECTIVE TERRITORIAL WINE BRAND

Steve Charters

Burgundy School of Wine & Spirits Business
29 rue Sambin, 21000 Dijon, France

All wine brands need to be well managed – but that also includes the ‘territorial’ brand of the place in which a unique wine style is made. In this presentation I’m going to define the territorial brand and then explore the factors which tend to make it effective. These include the story or myth of the place, a cohesive brand manager, internal and external narratives, a willingness to subsume differences in the pursuit of collective success, and an icon style. I’ll look at regions which have done this effectively, including Champagne and Central Otago in New Zealand.

EXPLORING AND CONTROLLING THE YEAST ECOSYSTEM IN NATURAL WINE FERMENTATIONS

Florian F. Bauer

South African Grape and Wine Research Institute, Department of Viticulture and Oenology,
Stellenbosch University, Stellenbosch, South Africa

The fermentation of grape juice to wine provides a globally significant ecological niche for yeast and bacterial species. Several of the species that contribute to this process have been reported in almost all natural grape juice fermentations, independently of the region or country of production, defining a core wine fermentation ecosystem. Genomic data analysis indicates that this ecological niche is of evolutionary relevance. This ecosystem therefore presents an opportunity to study ecosystem-relevant molecular mechanisms and specific adaptation of individual species to this ecosystem and / or to other common species within this environment. Such data will lead to a better understanding of evolutionary adaptations to biotic selection pressures. The presentation will highlight various datasets on specific interactions between two (binary) and of multiple species in designed consortia. These data suggest the existence of both species-specific and ecosystem generic genetic regulations. Furthermore, transcriptomic data suggest that higher order interactions lead to different transcription profiles than binary interactions with the same species. These data therefore provide fundamental insights of the molecular nature of yeast species interactions and of the evolutionary adaptation of species to the wine ecosystem. By generating large high-throughput data sets of consortia dynamics, the approach will also provide a predictive model in support of the application of natural fermentation-based wine making in future.

THE ART OF COOPERAGE, BARREL QUALITY FACTORS FOR WINE MATURATION, FIVE MAJOR INNOVATIONS OF THE LAST DECADE TO IMPROVE WINE MATURATION IN OAK

Lionel Kreff

Agriculture Engineer, Cooper

Tonnellerie Baron, 3. Le Châtelet Sud, 33330 Saint Emilion, France

After amphora, the first wooden container appeared in 350 BC and were made from palm wood. Those containers were produced to transport food and materials. In 200 BC the first shapped wooden container were produced in France. Those barrels favored considerably the exportation of wines since they made transport very easy. Few wine producer understood that wines spending more time in french oak barrel were more complex and richer.

The modern history of barrel aging for wine really started in the 70's. At this period we understood that five main parameters of barrel production are influencing the quality of aging. Barrel aging can improve a wine or destroy it.

The oak origin, tightness of the grain, duration and geographic area of staves maturation, toasting and know-how of the cooper have a huge influence on the quality of the barrel and the final impact on the wine. Those quality factors and impact on the style will be developed in details during the presentation.

Since twenty years, modern barrel production techniques have been developed to fit winemakers requirement, get more precision and reproducibility during wine aging. Above those techniques five major innovations have been developed during the last decade.

1. The Vinification Intégrale technique allows the fermentation of red grapes directly into the barrel, allow a better oak flavor integration
2. The OXOline barrel rack allowing an better barrel management, space optimization, cleaning of the barrel in place, lees steering by rotation without oxidation
3. The expanding bung allowing a better closure of the barrel, decreasing oxydation and total SO₂
4. Halo-anisoles and Halo-phénols analysis on new barrel during production process to avoid eventual contamination of wine with TCA and TCP
5. ALMA, the first hybrid barrel made from ceramic and oak

Around two hundred years are necessary to get an oak tree, allowing to produce great quality barrel. Forty months are needed to go from the tree to the finished barrel, which will be used for seventy years and more to age the best wines and spirits in the world.

This is a limited resource, which become expensive. Every cooper and winemaker have to be aware that this oak has to be coopered properly to enhance quality of the wine during aging. Coopered properly, means: time, knowledge and expertise.

MAN-MADE SOILS AND SOIL SECURITY IN VITICULTURE: ENVIRONMENTAL AND ECONOMIC CONCERNS

Carmelo Dazzi

Full Professor in Soil Science

University of Palermo (Italy). Department of Agricultural, Food and Forest Sciences
Viale delle Scienze, Palermo, Italy

The exercise of identifying the new challenges and the potential opportunities in research faced by a discipline at a given moment can be absolutely rewarding. As far as concern the new challenges faced by viticulture in specific ecotones, we would consider some environmental and economic concerns associated to pedotechniques applications in tailoring soils suitable for viticulture to increase productivity and grape quality, thus, to get substantial financial returns.

The aim of this lecture is to show one emblematic study case of pedotechniques applied in Sicily (Italy). Aims of the investigation have been: i) stressing threats to soil security derived by the generation of Man-made soils, ii) assessing the economic sustainability of pedotechniques and production, taking into consideration only the internal factors and excluding the external economic contributions that could be allocated to social sustainability and iii) stressing the role of soil science to focus on “economic value” to the soil ecosystem services and degradation processes.

Results highlight that from one side, soil transformations allow for considerable investment costs. The highest productivity and the consequent higher profitability of the cultivation amortize the start-up costs. From the other side, soil transformations and modifications could trigger considerable deterioration of both soil ecosystem services and environmental quality.

A NEW CHEMILUMINESCENCE METHOD RELATED TO MOLECULES DERIVED FROM *BOTRYTIS CINEREA* FOR CHARACTERIZATION OF ASZÚ WINES FROM TOKAJ FROM HUNGARY

Sándor Sipka

DSC professor emeritus Division of Clinical Immunology, University of Debrecen
H-4032 Debrecen, Móricz Zs. 22.

For the chemical characterization of Aszú wines from Tokaj region our aim is to develop a biochemical method which is related to *Botrytis cinerea*. In these wines there are continuously present small amounts of Cytochrome C enzyme (and other Cytochromes) derived from the grapes and apoptotic cells infected with *Botrytis* (1), and H₂O₂ produced during the oxidation of alcohols by *Botrytis* (2), and their oxidative interaction can produce reactive “ferril-peroxide” complexes inducing chemiluminescence (photon emission) (3). Thus, the principle of method is as follows: the capability of various Aszú wines is measured by luminometer how they can stimulate the production of chemiluminescence of basal biochemical reaction (Cytochrome C + H₂O₂) compared to a standard solution of „artificial furmint”. The size of stimulation is expressed numerically by „Index of Stimulation” (I.S.). Based on a great number of measurements evaluated by statistical methods three categories can be created for the characterization of *Botrytis* quality of Aszú wines valid for given laboratory conditions.

„Tokaj Aszú of poor Botrytis quality”: I. S. < 2,79

„Tokaj Aszú of outstanding Botrytis quality”: I.S. = 2,80-3,54

„Tokaj Aszú of excellent Botrytis quality”: S.I. > 3,55

These categories correlate well with other factors of Aszú quality (aroma, flavour, smell) but do not cover them totally. The I.S. values of Aszú wines show a significantly positive correlation with the concentrations of gluconic acid (p<0.012) originated from *Botrytis*. The Cytochrome C+H₂O₂ chemiluminescence assay can be used also for the numeric evaluation of *Botrytis cinerea* contents in Aszú grapes. Using mass spectrometry taxifolin was found in the Aszú grapes to show the high *Botrytis* quality. Comparing the slight *Botrytis* effects in furmint wines made by original “oxidative” or newly developed “reductive” technologies no significant differences were found between them. Summing up, this biochemical, enzymatic method measuring functionally the “ferril-peroxide” related oxidative effects of *Botrytis cinerea* in Aszú wines and grapes of Tokaj can be a new and objective assay for the characterization of their quality, furthermore, for their better marketing. The potential role of “ferril-peroxid” free radicals is discussed from the aspect of low cancer mortality rates in the wine region of Tokaj.

WINE AS A SYSTEM: FROM VINEYARD TO TANK TO BARREL TO BOTTLE TO GLASS

Melané A. Vivier

South African Grape and Wine Research Institute, Department of Viticulture and Oenology,
Stellenbosch University, South Africa

Wine production is a complex multi-step process, and the end-product is not easily defined in terms of composition and quality due to the diversity of the raw materials (grapes) and the biological agents (yeast and bacteria) used/present during the fermentation. Furthermore, linking what happens in the vineyard to the wine fermentation and ultimately to characteristics in the wine during ageing is often attempted in scientific studies, but clear causal relationships between factors are not easy to extract. Most wine research is therefore split along viticultural or oenological experimentation. Oenologists/yeast biologists seek direct links between the yeast fermenting a specific juice and the resulting changes in the wines, whereas viticultural studies explore treatments and their effects on grape production and berry quality parameters. If these studies indeed attempt to link back to the vineyards or the wines respectively, invariably one or more of the steps in the wine system is left unexplored or being handled as a black box. The scientific challenge and opportunity therefore remain to study wine as a system (from vineyard to tank to barrel to bottle to glass).

Our approaches in this regard will be explained by using examples from model vineyards under study where grape berries and their reactions to modulated environmental factors were studied using climatic monitoring in combination with molecular and metabolite profiling of the berries during all stages of development. These characterised grapes were then fermented into wines while continuing the detailed metabolite profiling of the juice and wine matrices. The wines were also subjected to sensory evaluations to complete the analysis of the final products. With these studies, we hope to contribute to the analysis of grape and wine active compounds in a holistic manner in order to identify correlations and predict outcomes under a specific set of conditions.

ABSTRACTS – ORAL

S1- SESSION 1. Recent advances in viticulture

THE RELATION OF THE TERROIR AND THE ORIGIN PROTECTION

Péter Molnár – Tibor Kovács – Antal Kneip – Péter Balling

University of Tokaj-Hegyalja, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sáropatak, Eötvös út 7., Hungary

Those wine regions, which experienced the importance of origin protection on the market established the Wine Origins Alliance in 2005. This organization effectively organizes the wine origin protection all around the world, in 2007 Tokaj region also became a member of it.

In Tokaj the role of terroir had always a unique role in the viticulture and winemaking. The knowledge of it developed together with the Hungarian history and the ascension of the Tokaji wines. The first mentionings of the viticulture are dated back to the 11th century, from the 14th century many written memories were found mentioning single vineyards as well. Based on this, in the beginning of the 18th century the first vineyard classification of the world was created in Tokaj. During the centuries after a very long process Tokaj became the first closed and denominated wine region of the world.

In my research I followed the evaluation of the regulation of viticulture and winemaking in Tokaj region. I studied the reasons of the rule strenghtening and the effect of it on the later periods, how the regulation could help the production and sales of the Tokaji wines. The connection of terroir value and origin protection is found in many documents.

SUPPORT OF PESTICID REDUCING: VITICULTURAL AND OENOLOGICAL EVALUATION OF NEW RESISTANT VARIETIES IN HUNGARY

Zoltán Madaras, István Ipacs-Szabó, Péter Teszlák

University of Pécs, Research Institute for Viticulture and Enology
H-7634 Pécs, Pázmány Péter u. 4., Hungary

Nowadays, there are many challenges we have to cope with: the tendencies of the climate change, the requirements of environment protection, the sustainable wine growing and the protection of the competitive quality. Because of these factors, we need to adapt to the changes and requirements of the natural, social and economic environment, which is pointing towards the development of new species and new technology. For environment protection purposes we have to develop the preventive methods to reduce the quantity of input matters released by us. For the three resistant grape varieties' (cv. Jázmin, cv. Pinot Regina and cv. Merlin) cultivation technology, we harvested each species at a different time (unlike sugar content-, acid-levels and pH value) and applied different vinification technology to learn the aptitude hidden in these varieties. The characteristic white-, rose-, siller-, and red wine, which were destined for maturation, was made by microvinification. After the procession, in must/maun condition, we accomplished HPLC and GC/MS analytical examinations, so we could apply the sufficient winery methods (different enzymes, nutrition, yeasts, fining agents), respectively analysing the chemical composition of the completed wines. After the summary of these experiments, together with the basic information, we will have further knowledge of these species, which we can optimize in rearing technologies and we can apply furthermore winery treatments to create top quality products.

The grape varieties included in the study were sampled on a weekly basis (with analytic examination of sugar, acid content and pH value and tasting of the must) to choose the appropriate harvest times. Grapes harvested at different times of the season were processed using different winemaking techniques to discover about the varietal characteristics. The different styles of wine (white, rose, siller and red) were vinified using different microvinification techniques and different oenological adjuncts based on the literature and our basic information.

Microvinifications were controlled. The mash in fermentation was sampled and the fermentation kinetics were monitored on a daily basis, not only to determine the optimum time for racking and pressing, but also to preserve the quality of the wines. For the 3 resistant varieties, malolactic fermentation is only desirable for red wines. Analytical analysis of the acid, polyphenol profiles and aroma components of the mashes, juices and the finished wines were carried out and evaluated. In the course of the summary and evaluation, an optimal harvest date and the best technological parameters to be extracted from the variety were determined. Those examinations provide solid foundations and information for further milestones in order to make quality wines at large-scale wineries.

USE OF UNMANNED AIRCRAFT SYSTEMS IN THE AGRICULTURE – INTRODUCTION OF THE EU AND THE NATIONAL REGULATION

Zsolt Sándor

University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sárospatak, Eötvös út 7.

Agriculture, and precision farming, is the new area where the greatest demand for the use of unmanned aircraft systems (UAS) is registered.

Their use contributes to several economic and operational success factors:

- The quantity and quality of crops can be significantly increased by the use of UASs.
- It is possible to carry out plant protection interventions even in the case of unfavourable soil conditions.
- They provide more favourable operational solutions than traditional, ground-based tools within a given economy of scale limit.

To make effective use of the advantages, it is necessary to know the regulatory framework to carry out such operations correctly and safely.

Unmanned aerial vehicles (commonly known as drones, or UAVs) are active players in aviation, as they use the same airspace as conventional piloted aircrafts. Thus, during the agricultural use of these devices, it must be taken into account that several official requirements must be met (air transport and agricultural), which are ordered by different and independently operating authorities.

In the lecture the presenter will introduce this complex control framework, highlighting the common point of the agricultural, plant protection, and aviation provisions, how they connect and also the general and joint requirements that are necessary to be met together for the missions will be revealed.

In agriculture the UASs can be used for two main tasks:

- monitoring missions where the UAV survey the general condition of the plant, and
- intervening missions where the drone drop-out plant protection material or fertilizers based on the measurements made by the monitoring mission.

The missions need to fulfil different requirements, but they have to obey aviation and plant protection rules too.

Obeying the aviation rules are focusing to minimize the potential risk of collision which comes from the possibility that another – conventional or also unmanned – aircraft may appear in the same place and at the same time as the drone.

Plant protection regulatory requirements are concentrating on the use of correct materials and doses moreover safety distances and personal protection.

During the execution of the activities plant protection and aviation regulatory requirements must be met simultaneously. Therefore mission-related processes become more complex.

ROBOTICS IN GRAPEVINE PRUNING

Zoltán Barócsi¹, László Szemethy¹, Krisztián Gaál¹, Balázs Szabó¹, Lajos Terjék², Gábor Kuser³,
Krisztián Kuser³, László Árvay⁴, László Vida⁵

¹University of Pécs, Pécs

²University MATE, Gödöllő

³Innovitech Ltd, Budapest

⁴Bay Zoltán Nonprofit Ltd., Miskolc

⁵SBS Ltd, Erdőtelek

The mechanization has nowadays a particular importance in the practice of the grapevine growing. In recent decades, the mechanization of more and more viticultural technology operations has been solved in the most diverse grapevine plantation types. Phytotechnical operations (pruning, canopy works) and the harvest are undoubtedly the most time-consuming interventions for practicing viticulturists. Nowadays, the mechanization of the harvest can be effectively implemented in most plantations, as can a significant part of the canopy works or the pre-pruning of the vines. In addition, it should be noted that some operations requiring human expertise and a large investment of working time, such as finalized pruning, shoot or cluster thinning cannot be achieved with the help of machines operating on the mechanical principle. With the development of artificial intelligence, the implementation of these specific phytotechnical operations will become feasible in the near future.

Many research groups around the world are working on the development of the mechanization of pruning with artificial intelligence. The creation of the grape-pruning robots developed so far in the world was motivated everywhere by the shortage of labor in agriculture or by the lack of sufficiently skilled labor, as well as by increasing cost efficiency.

Two main types of robots are known, on the one hand, tractor-drawn machines, and on the other hand, the design of self-propelled, autonomous robots.

In this publication, first we present the types of pruning robots currently known in the world, and then we report on the development that we have been carrying out in Hungary since the previous year in the consortium cooperation of InnovITech Ltd., SBS Ltd., Bay Zoltán Nonprofit Ltd., and the University of Pécs. The goal of our development is to create an autonomously functioning GPS-controlled robot that can perform the necessary pruning independently after recognizing the organs of the vines.

From the point of view of viticulture, the developments are aimed at cordon and Guyot training systems, which are widespread around the world. In the current development phase, the training of the self-learning system and the mechanical development of the robot are taking place in parallel, while the primary testing of the artificial intelligence is expected in the next harvest period.

There are some problems, which should be solved in this phase: a) the recent 3D capturing technology cannot cope with small, 5-6 mm wide objects; b) building the necessary teaching database requires a huge annotation work; c) on 2D pictures we need to find the foreground and the background objects although they are very similar.

In summary, in this publication, the ongoing or already completed research related to the development of grapevine pruning will be presented, supplemented by the partial results that we have reached so far in our own developments.

RECENT ADVANCES IN THE SELECTION AND EVALUATION OF FURMINT CLONES

Antal Kneip¹, Laura Varga², György Dénes Bisztray³, Pál Kozma⁴, Tibor Kovács⁵, Péter Molnár⁶

^{1,2,5,6} University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sáropatak, Eötvös út 7.

³ Hungarian University for Agriculture and Life Science (MATE), Institute of Viticulture and
Enology, Department of Viticulture and Oenology,
H-1118 Budapest, Villányi út 29-43.

⁴ University of Pécs, Institute of Viticulture and Enology,
H-7622 Pécs, Vasvári Pál utca 4.

The 'Furmint' is the most important grape variety in the Tokaj Wine Region, constituting around 65% of its vineyard area. First mention of the varietal name was found in texts dated from the 16th century. Based on historical and linguistic evidences, Hungarian, French, Italian and Syrmian origin were proposed, but its diversity with many cluster and berry types found around Tokaj, point to the region as its birthplace. Based on genetic evidence, it is presumably a natural crossing between *Alba imputato* and *Gouais blanc*. Before the phylloxera disease, many types were grown in Tokaj and also in other parts of Hungary, but as selection started in the 20th century, its diversity dramatically narrowed. As a result of state selection programs after WWII, the cultivation of Furmint was based mainly on two heavy-cropping clones, T.85 and T.92 at the end of the 80's. Aims of present clone research take into account the shifting requirements for ideal clones: after solely quantity, quality emerged in the 1990's and most recently, typicity appeared as more private estates began their own selection program. During our research we observe 10 registered clones and more than 40 clone-candidates, mainly selected in the Research Institute in Pécs, at three locations in the Tokaj Wine Region. Key phenological stages, vegetative growth, fruitfulness, dynamics of maturation, characteristics of cluster and berries were evaluated. Above basic wine analysis methods, gas chromatography - mass spectrometry is used in order to characterize volatile aroma compounds of the microvinified wines. According to our results, cluster and berry size and weight fluctuate between vintages, but relative differences among clones are more stable. Effect of site characteristics and condition of vineyard are also need to consider during the evaluation process. For growers, the use of several clones for vineyard establishment is beneficiary, providing means to balance extremes in certain vintages. The laborious nature of clonal selection and evaluation often exceeds institutional possibilities, hence private selection by estates and/or cooperation between the two have great advantages. Regarding the most promising clone-candidates for premium dry wine, the official clone registration was initiated: P.101, P.10., P.120 and T.8/7575 are already in this process, enriching the assortment of available planting material.

¹H-NMR-BASED METABOLOMICS TO ASSESS THE IMPACT OF THE SOIL ON THE CHEMICAL COMPOSITION OF NERO D'AVOLA RED WINES

Paola Bambina

Department of Agricultural, Food and Forestry Sciences, University of Palermo, V.le delle Scienze 13, ed. 4, 90128 Palermo, Italy

Among the factors affecting *terroir*, soil plays a pivotal role because it provides the base for grapevine growth. However, despite its importance only few information is available on the effect of the soil on wine quality. Therefore, the aim of this study was to evaluate the effects of different soil parameters on the chemical composition of Nero d'Avola red wines through the application of two different ¹H-NMR-based metabolomics approaches: the Non-Targeted and the Targeted approaches.

Four different Nero d'Avola wines deriving from grapes grown on different soils were analysed by means of a Bruker Avance II 400 spectrometer operating at 400.15 MHz. The spectra were recorded by applying the NOESYGPPSID pulse sequence, to achieve water and ethanol signals suppression. To avoid any modification of the matrix, no artificial pH adjustment was carried out on wines prior to perform the analysis.

The identification of compounds for the targeted analysis was performed by comparison to pure compounds spectra by means of *SMA* plug-in of *MNova 14.2.3* software. Metabolites indicative concentration was calculated as percentage of the total spectral area.

The generation of the input variables for the Non-Targeted analysis was done via bucketing the spectra. The resulting datasets were pre-processed and subjected to chemometrics by means of *MetaboAnalyst 5.0* web-based tool suite.

The targeted analysis led to the identification and quantification of more than 50 compounds, including amino acids, organic acids, polyols, aroma compounds and polyphenols. The ANOVA analysis applied to the dataset containing compounds concentration highlighted significant differences among the wines. The non-targeted analysis coupled with chemometrics revealed that the differences among wines concerned not only the concentrations of the detected analytes but also the strength of the hydrogen bonds network in which the different compounds were involved. As a matter of fact, the Non-Targeted analysis gives the opportunity to achieve a holistic characterization of a wine through the study of the chemical shift dispersion. This can be a very important result because the H-bonds structure inside a wine can modulate the way how solutes interact with human sensorial receptors. This means that wines can produce different gustatory and olfactory perceptions due to different hydrogen bonding structures where solutes are involved, even if they are present at the same concentrations.

Finally, compositional data obtained from the Targeted analysis were processed together with soils physical-chemical parameters in order to point out possible relationships. It was highlighted that high cation exchange capacity and high content of organic matter in soils produce wines with low contents of amino acids, organic acids, and flavonoids. On the contrary, high contents of organic matter in soils are related with high contents of varietal aroma compounds, such as norisoprenoids and terpenes.

SENSORS IN VITICULTURE FOR MONITORING SOIL FERTILITY AND CARBON DIOXIDE EMISSIONS

Mihály István Kulmány, László Bede, Renátó Kalocsai, Zsolt Giczi, Viktória Vona

Széchenyi István University
H-9026 Győr, Egyetem tér 1.

Hungarian soil fertility has decreased due to the imbalance between nutrient input and output while the carbon dioxide (CO₂) emissions sharply increased because of the inadequate soil management practices. Simultaneously, soils have become more vulnerable due to extreme weather conditions (e.g drought sensitivity and erosion). Management of the steadily decreasing soil organic matter and lack of organic matter (manures, crop residues, etc.) There is a need for proper soil nutrient management strategies to harmonize the preservation of soil fertility with farming objectives and environmental requirements in the 2021–2027 Common Agricultural Policy (CAP) of the European Union. Monitoring the nutrient level of the soil in the vineyard contributes to the optimization of the nutrient supply with decreasing of CO₂ emissions rate, while a reduction in costs can be also observed. For established grapes, monitoring strategies can help to monitor the changes in nutrients, pH and organic matter over multiple years. Such strategies should be based on information on the actual soil fertility status. Since traditional soil testing is time-consuming and expensive, there is a need for techniques and instruments that allow rapid, affordable, and precise routine soil testing. As a result, general interest in using diffuse reflectance infrared spectroscopy testing of soil physical, chemical, and biological properties, as well as large-scale monitoring systems for predicting soil CO₂ emissions, has increased. These techniques have various advantages, such as (i) non-destructive, (ii) relatively little sample preparation, (iii) no (hazardous) chemicals, as well as (iv) real-time possibilities to monitor carbon emissions.

SUSTAINABLE SOIL MANAGEMENT IN VITICULTURE: CONCEPTS AND OPPORTUNITIES

Prof. Giuseppe Lo Papa

Associate Professor of Pedology, Department of Agricultural, Food and Forest Sciences –
University of Palermo, Italy

Soil is the world's largest terrestrial pool of carbon and approximately 98% of global food is produced in soil. Sustainable soil management is a valuable tool for climate change adaptation and a pathway for safeguarding key ecosystem services and biodiversity. Due to the incalculable value soils provide to society through ecosystem services, a sustainable soil management ensures a high return on investment by supporting and increasing these services. Widespread adoption of sustainable soil management practices generates multiple socioeconomic benefits, especially for smallholder farmers and large-scale agricultural producers worldwide whose livelihoods directly depend on their soil resources.

Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity.

The concept of sustainability in soil management is strictly linked to the concept of soil security. Soil security can be defined as the maintenance and improvement of the soil resource to produce food, fibre and freshwater, contribution to energy and climate sustainability, and maintenance of the biodiversity and the overall protection of the ecosystem. Soil security involves maintaining and optimising soil's structure and form; diversity of organisms; nutrient cycling capacity; ability to act as a substrate for plant growth; ability to regulate, store and filter fresh water; and capacity to sequester carbon dioxide from the atmosphere.

Viticulture, especially when is done in large scale or intensively, trying to satisfying the demand of high-quality products or products with required specific standard characteristics, has been traditionally associated with practices of soil management poorly secure.

In the last decades, the attention developed on the terroir as distinctive factor of the wine products, has moved closer the concept of sustainability to vineyards management. Terroir and its philosophy have been used successfully as commercial expedient to promote e valorize wine in the global market. Since the awareness on the importance of secure soils is growing worldwide and continuously, soil security in viticulture could be used itself as terroir as well, to mark products, to emphasize commercial value, and finally to increase wine economy.

CLONES IN VITICULTURE - NEW CHALLENGES FOR CLONAL SELECTION

Tibor Kovács

University of Tokaj
H-3950 Sárospatak, Eötvös u.7.

Cloning in viticulture is as old as the cultivation of grapes. When propagating the vine, the vine-grower propagated the best, most vigorous vines, initially by grafting and then, after the phylloxera had been removed, by grafting the vines. This activity could be considered cloning in some respects, but unlike today's practice, it was not the vegetative propagation of a single capital that produced all the vines in the vineyard, but the propagation of several individuals that produced the vineyard.

The selection of some of the clones we know today began in the 1960s, with the aim of being virus-free and high yielding. In the Tokaj wine region, these clones are still the almost exclusive source of vineyards. The concept of 'quality clone' was introduced in the 1980s, referring to clones with a higher must yield, often with lower yields, but with improved quality.

Since the early 2000s, climate change and the problems of viticulture and viniculture (spring frosts, harvesting in the heat of the year, high sugar content, low acidity) have brought clones back into the focus of attention. Interest has been shown in varieties that set later and flower later, thus delaying ripening by a few weeks. By varying other factors (exposure, altitude, rootstock), such a clone offers the possibility of reducing the effects of adverse climatic variations.

In order to be able to select the above-mentioned individuals and vines in clonal selection, it is essential to establish plantations where as many varieties of the given variety as possible are kept. These plantations are called conservatories, and their purpose is to preserve the variants of a given vine variety and, where appropriate, to select individuals with the desired characteristics.

It is of particular importance to preserve the biological diversity of varieties in Hungary that are not grown elsewhere. This is the case for the two main varieties of the Tokaj wine region, Furmint and Hárslevelű, but also for Leányka (Eger), Ezerjő (Mór), Kéknyelű (Badacsony), among others.

The Tokaj Research Institute started this work in 2020, visiting old plantations, identifying and monitoring vines. Genetic testing of the selected vines will begin shortly, followed by grafting, which will result in 10-10 vines being planted in the Research Institute's area, creating the first vine conservatory in Hungary. After the vines have come into production, regular annual phenological and ripening tests will be carried out to record the genetic characteristics of each clone candidate.

CONTROLLED ENVIRONMENT VITICULTURE

Tamás Kórmíves

Plant Protection Institute, ARC, ELRN
H-1022 Budapest, Herman Otto ut 15, Hungary

Controlled environment agriculture (CEA) is a technology-based approach toward food production. CEA aims to shield the crop from the elements and keep the growing environment ideal during the crop's development. Thus, crop production takes place inside a greenhouse or other enclosed growing facility. Plants are frequently grown in soilless media to provide supplemental illumination and the right amounts of irrigation and inorganic nutrients to the plant's root zone (Pisciotta et al., 2022). Overall, the technology successfully optimizes the use of resources (water, energy, space, capital and labour).

Today's closed-environment farms - greenhouses and vertical farms - are built around intelligent systems that precisely administer inputs and react to changes in crop stage or environment. In short, they provide perfect growing conditions.

Food can be grown in controlled environments using a variety of approaches. The CEA industry consists primarily of the greenhouse sector, but vertical farming technology is another rapidly expanding subsegment. Furthermore, CEA can produce crops all year round.

Table and wine grapes are specialty crops that are the leading fruit crops of the world's Mediterranean and temperate climate regions. The quality of the products heavily depends on the terroir (the environment in which the plant grows: soil, air humidity, availability of water, presence of plant pests and diseases, etc.). For this reason, CEA technologies were introduced into grape production quite early (Di Lorenzo et al., 2003) (Buttaro et al., 2012) and successfully achieved stable yields and fruit quality. The recent overview by Pisciotta et al. (2022) gives an excellent panorama of the subject: the authors thoroughly explain the rationale for the soil-less cultivation of table grapes and provide the most important details of how such systems are established and managed.

EFFECTS OF CULTIVATION METHODS ON THE COMMUNITY OF GRAPE RHIZOSPHERE

Barnabás Kovács

Hungarian University of Agriculture and Life Sciences, Hungary

The aim of our study was to supplement the generally applied “extended” agrochemical studies examining the physicochemical parameters of the soil, with more extensive and gap-filling biological studies. Exploring the effects of cultivation methods on the soil, as a multi-phase medium and its living community, provides an opportunity to formulate proposals and to develop economically and ecologically more advantageous farming and tillage practices.

Based on our results comparing three different tillage practices: integrated (I), organic (O) and biodynamic (B) methods, the mechanically less disturbed, B resulted in more favorable conditions based on several parameters (disposable water content (DV), diversity level (H), ration of pathogens to the total community of microbes) compared to the other two treatments. The same (B) and O treatment showed better values of aggregate stability compared to the I treatment where certain pesticides were applied (specifically herbicides and insecticides). Macro aggregate stability is related to the “health” condition of the soil, it can be considered as an indicator for detecting and monitoring the changes that take place. In addition, soils with higher aggregate stability values are also more resistant to erosion. The cultivation method of the integrated (I) treatment also resulted in significantly higher compaction values, due to trampling damage.

As a conclusion we can declare based on our result that, more intense soil disturbance, the usage of herbicides reduce the ability of the rhizosphere soil to suppress potential pathogens, i.e., soil suppressivity.

CULTURE AND NATURE – TWO REALITIES OF THE HERITAGE

Tomasz Pasierbek

University College of Tourism and Ecology, Sucha Beskidzka, Poland

Culture and Nature. Many people argue that these are irreconcilable realities. Nature is described as something primitive, primeval, existing independently of man and resisting his influence. In such an approach, culture is presented as a sophisticated object of human activity, evidence of his creative abilities and evidence of higher emotional states. Such a dividing line between culture and nature presupposes a constant tension between these spheres, a tension that cannot be reconciled or eliminated. But is this the correct approach? Or maybe culture and nature are two sides of the same coin, and their coexistence is not only possible but even necessary? It is no coincidence that both realities are referred to as heritage - natural and cultural. Heritage is something we have received from our ancestors, and we have a special responsibility to pass it on to our successors. It can be measurable or non-measurable. Inheritance determines identity, evokes a sense of pride, is something we do not want to lose. Two examples describe this coexistence. The first is the National Park Service in the USA - a government agency that comprehensively protects natural and historical heritage. The second example is cultivating wine traditions: they are embedded in both nature and culture. Wine is an effect of human activity, but it would not be there if it were not soil, water and sun, factors for which human influence is clearly limited - can we find better evidence of the coexistence of Culture and Nature?

INTEGRATED PEST MANAGEMENT IN VITICULTURE

László Fodor

Hungarian University of Agriculture and Life Sciences, Károly Róbert Campus, Institute of
Agronomy
H-3200 Gyöngyös, Mátrai Rd. 36, Hungary

The yield of grapevine can be severely reduced because of infestation by pests or infection by pathogens, mostly fungi. Because of this, vineyard needs frequent and regular protection interventions. It is considered as a crop protection intensive culture. Often grape grower's only response to pest and disease problems is the application of synthetic pesticides. However, plant protection is not the same term to chemical control. Chemical control is only one of plant protection methods. Beside of pesticide use, there are several other activities and methods in viticulture (i.e. agro-technical, mechanical, ecological, genetic), that aim to prevent as well as to eliminate damages done by harmful organisms. In addition, goals and tasks of plant protection include forecasting the time when pests appear, and determining the possible extent of their population to which they cannot cause economic damage.

Integrated Pest Management (IPM) is the best combination of cultural, biological and chemical measures to solve pest and diseases problems in viticulture. This is an ecology based, highly complex technology that is characterized by management of pests and manipulation of agro-ecosystems. It means that grape growers have to make the crop-environment unfavorable for pests and pathogens while maintaining a favorable environment for grapevines. IPM technologies also focus on maximizing the effectiveness of natural control factors to manage pest populations. To make reliable and appropriate control decisions IPM needs regular observation and monitoring of pest populations.

IPP requires competence of grapevine growers in three areas: prevention, monitoring and intervention. Preventative methods link to manipulation of agroecosystems with good agronomic practices and increasing the biodiversity (i.e. protecting natural habitats near vineyard, providing refuge areas for beneficial insects, introduction of cover crops). Monitoring is a regular checking of pest situation in vineyard to determine if when and how intervention should be taken. Trapping is the most often-applied monitoring technique in pest management programs.

Forecasting also has an important role in extension. Our grapevine moth (*Lobesia botrana*) monitoring activities in the vineyards of Gyöngyöstartján are proof of this. Population density of grapevine moth was observed in several areas with "Csalomon" sex-pheromone traps and based on this we developed our control recommendations for grape growers. Our investigations have shown that, in the case of low pest population, no economic damage occurs despite no control. Proper timing of control measures could result in a permanent population decline in the longer term and then keep the population below the economic injury level.

HISTORY OF GRAPEVINE IN SICILY BETWEEN BOTANY, ARCHAEOLOGY AND BIOCULTURAL DIVERSITY

Giuseppe Bazan¹ – Angelo Castrorao Barba²

¹Department of Biological, Chemical and Pharmaceutical Sciences and Technologies
(STEBICEF), University of Palermo, 90123 Palermo, Italy

²Institute of Archaeology and Ethnology, Polish Academy of Sciences, 00-140 Warsaw,
Poland

The history of grapevine utilization (*Vitis vinifera* L.) has accompanied humans throughout our history. Archaeological and archaeobotanical data shown that fruits of grapevine have been harvested by humans for fruit consumption since late Paleolithic/Mesolithic and for wine production since Neolithic period. Wild grapevine (*V. vinifera* subsp. *sylvestris*) pips have been recovered from different prehistoric site in the Mediterranean area. A single grape pip, found in the Mesolithic site of Grotta dell'Uzzo (Sicily) represent one of the most ancient remains of wild grapevine in Italy.

The earliest detection of winemaking came from Zagros Mountains of Iran, between 5400-5000 B.C, while in the Western Mediterranean, the earliest attested presence of wine-making (indicated by the presence of tartaric acid in jars) come from the Copper Age (3rd millennium B.C) site of Monte Kronio (Sicacca, Sicily).

The discovery of wine by humans gave a boost to the domestication of *Vitis vinifera* subsp. *sylvestris*. The first evidence of grapevine domestication come from different archaeological sites in Israel and Jordan which testify that *Vitis vinifera* was already under cultivation since Copper Age (second half of fourth millennium B.C.). During those millennia of cultivation, the impact of *Homo sapiens* on *Vitis vinifera* has led to a significant increase in genetic diversity and changing the reproductive biology, the diameter of berries and seeds number. In this sense, some authors recognized the two subspecies *vinifera* and *sylvestris*.

Starting from 8th century B.C., a key role in the transmission of knowledge and techniques of viticulture in the Mediterranean basin was played by the Phoenicians and Greeks through the foundation of colonies and the development of large trading network of wine that would have the greatest expansion in the Roman period. In Sicily, the wine production and wine-drinking continued throughout the Muslim domination (827-1061 A.D.). As a matter of fact, the Muslim Sicilian poets of the twelfth century dedicate many verses to wine and the pleasures of wine drinking. The cultivation of the grapevine continued in the following centuries, as evidenced by historical sources on agriculture of the seventeenth and eighteenth centuries and reached great expansion in production and trade during the so-called Sicilian golden age of nineteenth century in which the Florio family played a key role.

This long history of cultivation, across centuries, led to a number of varieties of about 105, only in Sicily, that represent an extraordinary example of Biocultural diversity.

APPLICATION OF AERIAL REMOTE SENSING METHODS IN VITICULTURE

Péter Burai¹, Réka Láposi², Annamária Szalóki Kupásné³, Csaba Lénárt⁴, Tamás Tomor⁵

^{1,3,4,5} University of Debrecen, Remote Sensing Centre

²Hungarian University of Agriculture and Life Sciences (MATE)

The use of different remote sensing methods is becoming increasingly popular in precision viticulture. In the course of our research, we processed data from high-performance aerial sensors and used it widely, from the examination of the biophysical variables of the grape plant to mapping the erosion conditions. Among the airborne sensors, in the period 2014-2021, we used airborne multi- and hyperspectral sensors and laser scanning. For the hyperspectral imagery, Specim sensor was used during the vegetation period in the range of 400-2450nm, with a field resolution of 0.8-1m, were primarily used to examine biophysical variables. Aerial laser scanning images with a point density of 8-40 points/m² during the foliage-free period were used to examine topography parameters and row-position. During the airborne laser scanning (ALS) and hyperspectral recording, we also took RGB images with a medium format camera, which were used in the geometric correction, the determination of the canopy and the resampling of the images. Since ALS data was taken at several times, it was possible to spatially analyze land mass changes. With this, we were able to spatially delineate the areas more and less affected by erosion and estimate the factors that cause erosion. The locations of the research were designated sample areas in the Tokaj- and Eger wine regions. First, we extracted the high-precision topography and surface model from the LiDAR data, then we developed a data processing method to determine the row and grape plant position. The primary goal of the research was how to integrate data with different spatial resolutions and dimensions, so that we can extract as much useful information as possible directly on the grape plant. During the research, we analyzed the spatial pattern of photosynthetic activity, plant stress and content data of berry samples. Data from spot sampling in the field were used in model construction and validation of the results.

STUDYING WINE AROMA, IMPACT OF ENOLOGICAL PARAMETERS

Yorgos Kotseridis - Despoina Lola - Elli Goulioti

Agricultural University of Athens, Laboratory of Enology and Alcoholic Drinks (LEAD), 75
Iera Odos, 11855 Athens, Greece

Wine aroma could be the main factor of commercial success of a wine. It gives the typicity and the special character of each terroir and/or variety. Main chemical families of wine aroma are mainly the terpenols, the varietal thiols, the ethylic esters, the acetates, and the superior alcohols. Most of these compounds are formed in the grape, but generated mainly during fermentation.

Studying wine aroma usually includes sensory analysis as also targeted chemical compounds research. Description of the sensory profile of a wine of a specific variety is the first step of the study, while the second step is the development of methodologies such as gas chromatography – olfactometry and mass spectrometry for the identification of the volatile compounds. Analytical methodologies to measure the selected volatile compounds are developed. Then, the impact of viticultural or enological practices on wine aroma is more accessible.

During this presentation the studies on wine aroma of greek varieties will be illustrated. An exemple of the sensory analysis results of Savatiano wines is presented on Fig 1 below. The influence of yeast strains on the aroma of Savatiano, of Malagouzia and of Sauvignon blanc will be presented as also the impact of lactic bacteria on Moschofilero wines.

INFLUENCE OF OENOLOGICAL TANNINS ON THE AGEING POTENTIAL OF TOKAJ WHITE WINES

Zsuzsanna Bene¹ – Hannes Weninger² – Tamás Reisner³

¹University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sárospatak, Eötvös út 7., Hungary

^{2,3} Erbslöh Austria GmbH
A-7011 Siegendorf, Sankt Margarethnerstr. 69a, Austria

Tannins are natural wine treatment materials of plant origin that allow us to carry out a number of beneficial interventions in winemaking. Their field of application covers the preservation of precious tannins before fermentation, antimicrobial and antibacterial effects, antioxidant protection, removal of free radicals, metals, proteins, mercaptans, colour stabilization, increasing aroma complexity, and improving structure.

Oenological tannins can be used at different stages of winemaking: crushed grapes, must, fermented new wine, clarifying, wine ripening, and before bottling. If it is used, it is always necessary to keep in mind the objective we have and what effect we want to achieve by using the given tannins.

In this study, the examination of 4 types of oenological tannins of Erbslöh GmbH is presented in the case of during an ageing period of Tokaj Kövérszőlő wine type to follow the change of chemical and organoleptic features. **Tannivin[®] EH** (oak tannins gained from French oak), **Tannivin[®] Grape** (pure grape skin tannins), **Tannivin[®] Galléol** (tannins from 100 % gallnut), **Tannivin[®] Finesse** (complex tannin product, a combination of ellagitannins and condensed tannins). Regarding the doses used, the medium and maximum doses according to the product specifications were applied.

The determination of the chemical composition was measured by NMR technique. The data analysis was performed at Bruker BioSpin GmbH according to testing method AA-72-02-06 (Wine-Profiling 4.0.4). The sensory analysis was performed by profile analysis and evaluated with PanelCheck statistical software.

No statistically significant differences were found between the individual tannins, but statistically significant differences in the measured concentrations due to storage time were found in the case of following components: acetaldehyde, proline, galacturonic acid, 2,3-butanediol, 3-methyl-butanol (increasing), caffeic acid (decreasing).

For organoleptic properties (aroma purity, astringency, structure, spiciness), there is a significant difference between tannin preparations, but these parameters do not change significantly with storage time.

INNOVATION DIRECTION OF SPECIFIED YEAST USED

Gergő Szendei

Szendei Wine Kft., Fermentis by Lesaffre regional representation, Hungary

H-1112 Budapest, Hegytető utca 20/B

The innovation of the specified yeast is one of the most challenging tasks in today's food production. A growing number of wineries are setting higher and higher expectations of fermentation and controlled fermentation takes on an important role in the technology. There are many different aspects about the yeast that could be followed and monitored, which have an impact in the winemaking process.

The specified starter cultures are defined as a preparation of living microorganisms, which are frequently used to assist the start of the fermentation, producing special changes in the sensorial and chemical composition properties of the wine. Yeast starter cultures are essential components of the fermented products. The cultures are simply defined as starter cultures which consist of microorganisms that are inoculated into the must. The cultures are aimed at bringing predictable changes to the finished products. Although fermentation can take place without a starter culture, but the inoculation of different microorganisms provides a basis for ensuring that products are produced on a consistent schedule with a consistent quality.

Cultures in use nowadays mostly include selected species each having specific properties and intended for a specific purpose. When produced with different approaches, yeasts can take different forms (won't wrinkle and keep a smooth shape), thus allowing for an easy-to-use way of running controlled fermentation, and thereby avoiding the need for rehydration.

Yeasts could be produced in a special environment where they could reproduce by way of hybridisation, through which the various yeast properties are combined in one yeast cell to perform a great flavour enhancer, thus providing for a very easy fermentation implementation with low nutrition demand and fitness for harsh conditions. Yeasts could be produced in a different way to preserve their activity for future application. This will bring the yeast to a format where it could be adjusted to fermentation without rehydration. There are several yeast species which play an important role at the beginning of fermentation – the non-saccharomyces yeast species – which give a special added value to the final product. There are many strains that could be used, including *Pichia kluyveri*, *Lachancea thermotolerans* (ex *Kluyveromyces thermotolerans*), *Torulasporea delbrueckii*. On top of the added value in the sensory profile, there are species which allow for lower alcohol production, by decreasing the pH and improving the acid level, thus fermenting sugar to lactic acid rather than alcohol. The unique species could be used in different quantities and they will serve as bio-protection pathways.

Per the above, there are many different innovations in yeast production, but the choice is in the winemaker's hand as to where, what and which quantity he will use, should he choose to use any. All fermentation will occur completed naturally without any inoculation.

KEY POINTS IN THE PRODUCTION OF SPARKLING WINES

Joan-Miquel CANALS

Rovira i Virgili University, Faculty of Oenology, Department of Biochemistry and Biotechnology
ES-43007 TARRAGONA, Marcel·li Domingo, 1. Campus Sescelades, Spain

The consumption of sparkling wines in the world is growing year by year, more than the still wines. There are two main methods to produce them: traditional and Charmat method. Both consist of a two steps fermentation, first one in an open tank and a second in a close container, a tank in the case of Charmat or a bottle in the traditional method. This kind of wines has a lot of key points to become a high-quality wine, since the process is different than the production of a still wine.

First point is the vineyard, usually high yields are needed to achieve the correct ripening (9-11% Alc) keeping a high acidity, not all the grape varieties are suitable. Some are specially recommended because of the protein content, related to the foaming properties, as pinot noir or xarel·lo. If the sparkling should age for years, it is very important fight against botrytis cinerea infections to avoid premature ageing.

Another important aspect is the pressing of the grapes, there's two methods, press whole or crushed grapes. In some region like champagne is compulsory the first one, which is slower but with more capacity to fractionate. It is also an interesting way to produce sparkling without sulphites. The alcoholic fermentation with co-inoculation first with a non-saccharomyces has been seen interesting to improve the foaming properties, useful in some cases. About the malolactic fermentation (MLF), it is compulsory in cool climates but interesting to avoid in warm locations, to reach enough acidity (legally should be 5 g/l as tartaric acid in Cava Appellation). For this, a new tool has been authorised in wines last year, the use of fumaric acid, it seems that a dose of 0,3 g/l can avoid the MLF, especially important also its use in the tirage, because with the decrease of sulphite doses, sometimes this fermentation takes place in the bottles.

The use of special yeasts, adapted to the tight conditions of the second fermentation is very important to have success. Second fermentation take place at low temperatures, with wines with high acidity and low pH and with alcohol in the media. Special riddling agents are used to clarify the bottles, which should respect the colloidal content of the wine with high capacity of clarification. Mixtures of alginates, bentonites and kaolin are used.

In the traditional method, with long ageing periods, it's very important be aware of the permeability properties of the closure, usually a steel crown, but traditional producers also use corks with a wire. There's some controversy about it, but an hypothesis of the role of ellagic tannins could be afforded.

About the autolysis of the yeast in the ageing period there's a lot of work done, seems that protect from the oxidation the first three years. Recent studies have seen that the constant stirring of the yeast in the Charmat method increases the autolysis in comparison of the traditional.

At the disgorging, last process in the traditional method, the injection of a drop of wine at the opening of the bottle, a technical operation called *jetting*, seems interesting to remove the oxygen from the headspace, interesting for the shelf life of the product.

HOW THE ZERO WASTE PHILOSOPHY HELPED IN VALORIZING THE BY-PRODUCTS OF WINEMAKING – HISTORY OF GRAPOILA

Marianna Pinczés

Virgin Oil Press Ltd.

H-1224 Budapest, Szakiskola u. 33-43.

The Grapoila brand currently produces 18 types of natural cold pressed oils and seed flours, cosmetics and gourmet products with our own zero waste technology. However, this all started from my university thesis and the idea of using by-products to produce value and oil. There is excessive waste in the food industry, when some of this waste is reusable and can even serve as ideal raw materials for creating new products. Grapoila follows a zero-waste philosophy throughout the production process.

More than 10 years ago this idea had started to turn into reality here in Tokaj-Hegyalja. After separating the pomace which is generated during the wine production, we recycle it in the form of grape skin and grape seed. By milling the grape skin we gain the grape skin grist, which is a great source of antioxidants. We press oil from the grapeseed, and the by-product of this step is the pellet. By milling the pellet we produce grapeseed flour. We can use the grape skin grist and grapeseed flour as a natural additive for baking bread or mixing it to cakes and yoghurt. We offer the grapeseed oil –mud generated during the sedimentation of the oil, as a natural cosmetic. It is perfect for using it as a facial mask, as it contains no additives but natural ingredients. As the other products of us are made the same way as described above, we have oil, seed-flour, and cream/mud from each type of raw-material. We even have our natural cosmetic line produced with cold press grape seed oil.

The process of Grapoila perfectly complements the wine making with valorizing the pomace. Nevertheless, we have the idea and vision to expand it further. Now, with the cooperation of the Tokaj-Hegyalja University we aim to discover options to recover tartaric acid from wine-lees. This is a new story just starting to unfold...

UTILIZATION OF THE ASZÚ MARC VIA EXTRACTION OPTIMIZATION OF EXTRACTION OF PHENOLIC COMPOUNDS

István Kiss¹, Szilvia Bánvölgyi², Eszter Dusza³, Fiina K. Namukwambi⁴, Éva Stefanovits-Bányai⁵
 and Gyula Vatai⁶

¹ University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
 H-3950 Sárospatak, Eötvös út 7.

^{2,3,6} Hungarian University of Agriculture and Life Sciences, Hungary, Department of Food
 Engineering, Faculty of Food Science
 H-1118 Budapest, Villányi út 29-43.

⁴ University of Namibia, Namibia, Department of Food Science and Technology, Faculty of
 Agriculture and Natural Resources
 Private bag 13301, Windhoek, Namibia

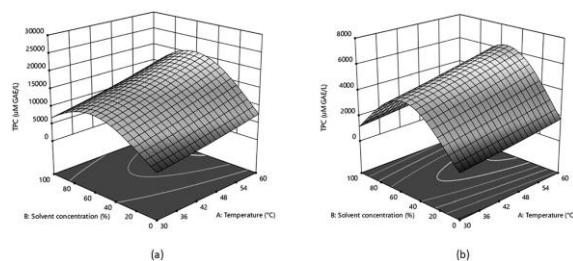
⁵ Hungarian University of Agriculture and Life Sciences, Hungary, Department of Applied Chemistry,
 Faculty of Food Science
 H-1118 Budapest, Villányi út 29-43.

Similarly to other industries wineries also increasingly attempt to minimize and utilize waste to protect our environment. The aim of this study was to determine the optimal parameters (temperature, solvent concentration, and time) of extracting total polyphenol content (TPC) from Tokaji Aszú marc using two different extraction solvents: ethanol–water and isopropanol–water (1:4 solid/liquid ratio). The extractions were achieved based on Central Composite Design with Response Surface Method (CCRD–RSM). The optimal extraction parameters in the case of ethanol–water solvent: 60,8°C temperature, 59.5% ethanol concentration in solvent, 5 h. At these parameters the probable TPC concentration is 23966.2 uM GAE/L. The optimal extraction parameters in the case of isopropanol–water solvent: 60,8°C temperature, 52% ethanol concentration in solvent, 5 h. At these parameters the probable TPC concentration is 7188.44 uM GAE/L. In both cases the binary solvent was better than the mono-solvent. Ethanol–water solvent was more efficient than the isopropanol–water solvent.

Table 1. Range of coded and actual values of extraction parameters for Central Composite Design

Level	Temperature (°C)	Time (h)	Solvent concentration	
			Water (%)	Alcohol (%)
-1	30	1	100	0
0	45	3	50	50
1	60	5	0	100

Fig. 1. Response surface plots showing the effect of solvent concentration and temperature on the polyphenols yield (uM GAE/L) from Tokaji Aszú marc waste while the time kept at coded zero level. (a) Using ethanol–water solvent. (b) Using isopropanol–water solvent



The polyphenols were extracted from Tokaji Aszú marc waste following twenty selected combinations of temperature, solvent concentration, and extraction time. A second order model was developed to predict the polyphenol content. Ethanol–water solvent was more effective than isopropanol–water solvent.

OENOLOGICAL DEVELOPMENT IN HUNGARY FROM THE PERSPECTIVE OF THE AUTHORITY

Gábor Barátossy

Head of Department, National Food Chain Safety Office
H-1118 Budapest, Budaörsi út 141-145., Hungary

Over the past decade, the Hungarian wine sector has undergone a significant transformation. It is important to be aware of the form, quantity and quality of the changes. In this presentation, I analyse the statistical data that can be seen at the central authority of the Hungarian wine sector. From an official perspective, I would like to clarify the dynamics of the changes, focusing on the marketing of wines bearing the Tokaj designation of origin. From the quantitative data concerning the authorisation of certain types of Tokaj wine, I would like to point out the effects of the product specification change on the production of certain types of wine.

In the presentation, the performance of the Hungarian wine sector will be analysed in the light of official data highlighting the indicators related to the marketing of Tokaj wines, based on the generated metrics available at the authority, which do not contain any personal data. The analysis of the data does not take into account the weather and other technological impacts of certain vintages for wines, with the aim of identifying only certain trends that can be used as output data in future planning.

COLD STAB IS OVER: SOLUTIONS FOR WINE TARTRATE STABILITY

Veronika Sziksz

Enartis Central Europe s.r.o.-Trade representation of Hungary
H-1114 Budapest, Ulászló utca 27.

Customers, and therefore the international wine trade, require stable wines making it necessary to carry out the tartaric stabilization process correctly to produce a “good” wine. Wine stabilization is a very delicate process and it is of fundamental importance to prevent tartaric precipitation. One of the most used methods that respects wine quality is cold stabilization. Cold Stabilization consists of cooling wine close to its freezing point, thus causing the precipitation of potassium bitartrate. It is a process that requires a high consumption of energy and water: consequently, it is hardly sustainable from an environmental point of view, not to mention today's energy costs. Enartis puts an end to cold stabilization with the new Zenith® product range. The intrinsic properties of potassium polyaspartate, a polyaminoacid produced from L-aspartic acid, an amino acid naturally present in grapes, make it possible for Zenith® to maintain total tartrate stability over time, able to withstand thermal stress and inhibiting the formation of tartrate crystals, without altering the organoleptic properties of wines. In addition to that Zenith® is also a milestone in environmental sustainability allowing wineries to save up to 80% of energy and drinking water and cut greenhouse gas emissions by 90%.

Zenith® is the result of years of research & development in collaboration between the universities of Milan, Turin and Zaragoza, the Council for Agricultural Research and Agricultural Economy Analysis (CREA), the Italian Association for Organic Agriculture (AIAB), as well as Australian Wine Research Institute, the Institut Rhodanien, Vinidea and the Institut Français de la Vigne et du Vin (IFV). The below experiment was carried out in the wine laboratory of the Tokaj Research Institute in Tarczal.

Distilled water was used to prepare a series of 3 alcoholic solutions of 12,14,16 V/V% alcohol. To these we added tartaric acid in such a way as to obtain a solution of 4,5,6,7,8,9 g/l. KCl was added to each of the 3 x 6 = 18 solutions prepared so far. All the samples were then split and half of the 36 samples obtained were added with Zenith®, while the pairs were left as controls. The samples were then kept at -2°C for two weeks. The main results to summarize: no precipitation was observed in the Zenith® - treated solutions when the samples were analysed, whereas precipitation was observed in all control solutions.

To sum up, Zenith® is the green revolution for tartaric stabilization of wine: it inhibits the precipitation of potassium bitartrate in all types of wine even those with high levels of instability, without altering filterability or organoleptic characteristics. Zenith® is sustainable and vegan-friendly: their use requires a lower consumption of electricity and water and generates a lower production of greenhouse gases, allowing producers significant savings. Zenith® has a long-lasting effects and are organoleptically neutral; therefore, they don't affect aroma, color and structure of wine. Additionally, it reduces the risk of oxidation and do not change filterability. All these characteristics make Zenith® a convenient product not only for producers, but also for the environment: the most suitable choice for those wineries that want to pursue the goal of sustainable production.

CLIMATE CHANGING – SPECIAL PROBLEMS OF ENOLOGY THIS YEAR
LAKTIA - A STRONG LACTIC ACID PRODUCING NON SACCHAROMYCES YEAST OF
LALLEMAND

Tamás Kovács

Kokoferm Ltd.

H-3231 Gyöngyössolymos, Csákkői út 10.

During the last two decades the climate change of our mother Earth accelerated. The last two years were critically dry on bigger part of Hungary. The 2022 vegetation period was short, dry, full with heat days and UV loaded. Because of these the grape production and the yealds were less, the grapes and mosts were pectine loaded, phenolic, poorer in nutrients, aromas and there were many acid anomalia. The enologists has to use the enlarged microbiological/biochemical possibilities to solve this problems, to supply the customers with good quality wines.

The pH regulation is obligatorial part of the wine technology. In this can help by white, rose and red mosts and mashes LAKTIA, the strong L-Lactic acid producing *Lachancea thermotolerance* yeast of Lallemand. This presentation is reporting the usage circumstances, acid production, practical experiences, cost efficiency, advantages of it's usage.

MIXED CULTURES OF *SACCHAROMYCES KUDRAVZEVII* AND *S. CEREVISIAE*
MODIFY THE FERMENTATION PROCESS AND INCREASE THE SENSORY
COMPLEXITY OF WHITE GRAPE WINES

Pawel Satora

Head of the Department of Fermentation Technology and Microbiology, Faculty of Food
Technology, University of Agriculture in Krakow

The purpose of the study was to evaluate the impact of the *Saccharomyces cerevisiae* and *S. kudriavzevii* mixed culture on the fermentation, chemical and aromatic composition of white wines. The variables tested in the experiment were the initial ratio of yeast in mixed cultures and the time of inoculation of *S. kudriavzevii* co-culture. The addition of *S. kudriavzevii* to the inoculum did not significantly change the chemical composition of the wines obtained. No reduction in ethanol yield was found in mixed culture fermented wines; even in some variants of the experiment, the ethanol content was higher. The mixed cultures of *S. cerevisiae* and *S. kudriavzevii* increased the level of volatile compounds in white grape wines. Wines fermented with the co-culture of *S. kudriavzevii* were characterized by a more diversified ester profile. The mixed cultures of *S. cerevisiae* and *S. kudriavzevii* raised the levels of terpenes in white wines. The most promising results were obtained for mixed culture variants, in which *S. kudriavzevii* was sequentially inoculated on the sixth day of fermentation.

PURE WINE - PHILOSOPHY AND PRACTICAL CONCEPTS BEHIND KARNER WINES

Fanni Karner - Gábor Karner

The artisan winery of Gábor Karner, Veresegyház, Hungary

We work in the vineyards of Vitézföld and Tavaszföld on the south-western slopes of Mátra, at the border of the Szúcsi settlement. There are various bound soils on volcanic bedrock in this region, whose good water-holding capacity and nutrient-rich composition make the areas highly suitable for growing high-quality, concentrated grapes. Its properties make it possible to achieve a fruity character, the right acidity and the appropriate level of must degree of ripeness.

For us, viticulture and winemaking are not food industry activities, but a way of life. We live together with the vine, we experience the cycles of nature and the changes of the seasons together. We work throughout the year to ensure that the plant feels good, and at the end of the cycle, i. e. at harvest time, we can bring the best and healthiest fruit into the cellar. We do all this with full conviction, faith and love. This is how a natural drink can become superior. Our defining realization was "but this can really be done", even if many experts still doubt it to this day, and the effect that the end product might have on the body and soul.

Unsurprisingly, the conditions for natural winemaking are linked to two important locations, namely the plantation and the cellar. The basic condition is ecological crop protection, where there are no absorbable plant protection agents, no herbicides and insecticides. We spray with baking powder, orange oil, minimal copper and sulphur. It is planned to supplement all of these with teas. Under and between the rows there is a natural weed flora, which is only a rudimentary solution, the aim is to sow the rows with a seed mixture between the rows. Our other long-term goals include the introduction of biodynamic farming in our areas, as the most important factors include increasing biodiversity, the existence and sustainability of living soil.

In the cellar, one's task is to accompany the developing wine and help it with as little intervention as possible. That's why perfect grapes are of key importance, since we no longer have the opportunity to correct, improve, or supplement anything in the cellar. There are no additives and auxiliary materials, no use of sulphur, no filtration or clarification. We don't use a pump either, because in the absence of sulphur, it would really spoil the structure of the wine. What we have is the gravitational movement of the wine, as well as faith and trust.

Wines made in this way must be understood, or at least we must feel their message. According to our experience, the more educated someone is, the more difficult it is for them to open up to the unknown, the stronger they stick to the patterns they have learned. When you taste it, you have the opportunity to experience purity. Its effect on the body, mind, and spirit cannot be compared to the effects of an artificially prepared drink. The taste and structure of natural wines reach over a much wider range, as life is present in it. Due to their unusual appearance and character, their commercialization faces many obstacles.

Natural wines have a substantial market in the world and are a highly sought-after genre abroad. It's worth seeing, compared to this, that we are in a backward state in our country. Our only chance to make up for this backlog is to expand education in the direction of natural wines.

OENOCOCCUS OENI, MALOLACTIC FERMENTATION AND INTERACTIONS WITH NON-SACCHAROMYCES YEASTS

Albert Bordons

Universitat Rovira i Virgili, Department of Biochemistry and Biotechnology, Faculty of
Oenology, Tarragona, Catalonia, Spain

Oenococcus oeni is the predominant lactic acid bacterium carrying out the malolactic fermentation (MLF), which is the decarboxylation of L-malic acid to L-lactic acid and CO₂. Besides the consequent acidity decrease, MLF contributes to improve sensory characteristics and increase microbiological stability of wine. However, as MLF is usually carried out after alcoholic fermentation (AF), *O. oeni* must withstand in wine, this hostile environment with low pH, high ethanol content, phenolic compounds, some SO₂, and very low nutrient content. Ethanol and low nutrient due to yeasts, mainly *Saccharomyces cerevisiae*, are the main negative interactions for *O. oeni*. During the first days of AF there are present other microorganisms, such as non-*Saccharomyces* yeasts, for which interest has recently been increased, because they are associated with an improvement in wine quality.

In this way, it is necessary to know the effects of these non-*Saccharomyces* on *O. oeni* and the MLF. In a study carried out in must with non-*Saccharomyces* yeasts used in sequential AF before *S. cerevisiae* and subsequent inoculation of *O. oeni*, the worst results in MLF performance were found with *Hanseniaspora*, and the best conditions for MLF were provided by some *Torulaspora delbrueckii* and *Metschnikowia pulcherrima* strains. Other laboratory assays using these two species showed that the positive impact was greater on sequential AF than on coinoculated AF, especially with *T. delbrueckii*, before *S. cerevisiae* sequentially inoculated at 48-72 h. Lower acidity, succinic acid and SO₂ were the main positive effects.

The effect of *T. delbrueckii* and *M. pulcherrima* on MLF has been studied also in white and red winemaking under real cellar conditions. Despite longer AF in white wines, MLF were faster, resulting in lower SO₂ and medium-chain-fatty-acids contents at the end of AF than with *S. cerevisiae* alone. Altogether, *T. delbrueckii* seemed to promote *O. oeni* development and improve MLF performance [4].

Wine lees are the residual material after AF, mainly composed by content of yeasts cells after their lysis, with significant mannoproteins and nitrogen compounds, which can stimulate MLF performance. This effect on *O. oeni* has been studied with simulated lees of *T. delbrueckii* and *M. pulcherrima* in comparison to those of *S. cerevisiae*, finding a shorter MLF and a good bacterial cell viability, especially with *T. delbrueckii* lees.

Some of these positive effects have been shown to be specific of *O. oeni* strain. So, further research is needed to a best understanding of yeast-bacteria strain compatibility, which is key to propose oenological practices to improve MLF performance.

TAKING ADVANTAGE OF THE MICROBIAL *TERROIR* FOR MICROBIOLOGICAL CONTROL OF THE ALCOHOLIC FERMENTATION

Albert Mas

Universitat Rovira i Virgili, Facultat d'Enologia, Department of Biochemistry and
Biotechnology, C. Marcel·lí Domingo, 1. 43007 Tarragona, Spain

The microbial terroir can be defined as the microbiota that can characterize a given ecosystem, conditioned by soil, climate, variety, human intervention, etc. This microbial terroir is present in the must as the microbial fingerprint. On the other hand, to produce good wines microbial control is required by modern winemaking. This is normally achieved by using selected yeast that are available as the cellar-friendly Active Dry Yeast. However, new tendencies in wine makers, the need to differentiate their products and the respect to the *terroir* characteristics generate as tendency to avoid the use starters and, thus, lose the microbial control. In fact, many cellars, driven by consumer awareness on ecological and organic handling are moving towards minimal intervention protocols.

We propose the traditional method of the *Pied-de-cuve* as an alternative to inoculation with selected yeasts in cellars. However, a spontaneous *pied-de-cuve* would repeat the same problems of uncontrolled fermentation unless a thorough knowledge of the microbiological evolution of the population in the different fermentations and conditions that could derive in the *pied-de-cuve* is available to wine makers.

In the present work, we have analyzed the effect of several stress challenges in different fermentation models. On one hand, we have analyzed those effects in laboratory conditions: either synthetic must or sterile natural must that were inoculated with a known mixture of different yeasts like those that we have found in natural grape must in our area. On the other hand, we have validated the results during harvest at semi-industrial levels. Among the tested stress challenges, we have analyzed different levels of SO₂, alcohol fortification, and temperature. After monitoring the effect upon the fermentation rate and length, we have further analyzed the changes on the microbial population. We have used this initial fermentation as the basis the *pied-de-cuve* for a second fermentation.

We compared the fermentation inoculated with *pied-de-cuve* and the inoculation with selected commercial yeast. The results yielded very similar fermentation kinetics between both fermentations. However, the diversity of the microorganism populations during the fermentation with *pied-de-cuve* is much higher, which supports the respect toward the microbial terroir. The main enological parameters (alcohol degree, volatile acidity, residual sugars, etc.) were also similar. The sensory evaluation is currently under way and will be discuss during the presentation.

BIOGNOZIS: KETO-ENOL PLAQUE BUSTER PHENOLICS OF GRAPES

Zoltán Oláh - Éva Kocsis

Bioinformatics and Molecular Surgery Unit, Acheuron Ltd, Szeged, Hungary

Forget-Me-Not B2B Ltd, Szeged, Hungary

Biodozis Ltd, Szeged, Hungary

Vásárhely's Landscaping Folks-School Society, (VaTeSZ NFE), Szeged, Hungary

In the age of human genomics new network medicines are emerging on the biomedical horizon. Resveratrol, curcumin and related phenolic pharmacophore leads have been validated to remove even well-developed human β -amyloid plaques from the brain of transgenic mice, *in vivo*. We have shown that some homologues of resveratrol are capable of a so called tautomeric “keto-enol” flip-flop “plaque buster” molecular mechanism, either prevents or demolishes β -amyloid aggregations in our brain. We have employed computational chemistry to better understand the elimination of the incorrect β -amyloid protein conformers with the discovered “keto-enol” flip-flop “plaque buster” phenolic homologues. According to our docking studies, it seems that these resveratrol homologues are competent to chop up β -amyloid plaques in Alzheimer's due to removing each hairpin-foldamers one by one from both ends of aggregated fibrils. According to the experimented models, other bi-stable “keto-enol” pharmacophores might be identified in grapes, as well as in their seeds to break up amyloid plaques. Moreover, these keto-enol homologues enhance rapid clearance of toxic aggregates in Alzheimer, and other plaque diseases, such as the α -synuclein target in Parkinson disease.

WINE COUNTERFEITING AND METHODS FOR DETECTING COUNTERFEITING

János Csapó^{1,2,3} – Sándor Némethy^{4,5}

¹MATE Magyar Agrár- és Élettudományi Egyetem, Kaposvári Campus, H-7400 Kaposvár, Guba S. u. 40.

²Debreceni Egyetem, H-4032 Debrecen, Egyetem tér 1.

³Sapientia Erdélyi Magyar Tudományegyetem, 530104 Csíkszereda, Szabadság tér 1. Romania

⁴University of Tokaj, H-3950 Sárospatak, Eötvös út 7. Hungary

⁵University of Gothenburg, Dept. of Conservation, Box 130. SE-405 30 Göteborg, Sweden

Ever since humankind began to produce food, food adulteration has appeared along with food production. We have written memories of adulteration in the Roman Empire, primarily on watering the wine, which was also severely punished. The history of wine counterfeiting began when people discovered the technology of winemaking. Wines treated with various additives, dyes, sugars, and flavourings, or fakes that did not contain grapes at all, represented significant competition for honest winemakers and made it possible for dishonest ones to get rich quickly.

Wine adulteration is the use of any technology or various auxiliary materials that are not permitted by laws and regulations during winemaking. Throughout history, wine counterfeiting has always been prohibited and even severely punished by law, but counterfeiters were always one step ahead of the law. Even in the Modern Age, the tradition of wine counterfeiting continued. Taking advantage of the cheap production of beet and cane sugar, low-alcohol wines were produced from grape pomace. The most common tricks of wine counterfeiting result in too high sulphur dioxide content, heavy metals may be added during the counterfeiting process, but even toxic compounds (during counterfeiting with apple juice), such as ethylene glycol and methanol may occur. Artificial sweeteners and often toxic dyes can also be added illegally to wine to improve its organoleptic properties or to mask its deterioration.

Analytical methods have been developed to uncover fake wines, identifying some components at an almost atomic level to establish their origin. Certain parameters can be determined in the bottle even without opening it, but in addition to classical analytical methods, large-scale analytical instruments e. g. nuclear magnetic resonance analysis, isotope ratio analysis, mass spectrometric analysis, gas and high-performance liquid chromatography, atomic absorption spectrophotometry, inductively coupled plasma emission, and other instrumental tests are widely used. With these techniques, not only the most common forgery tricks, such as excessive enhancement with non-grape sugar, dilution with water, high sulphur dioxide content or the addition of artificial sweeteners are easily detected, but almost all components in wines can be identified and quantified. If the quantity and ratio of the components are known, using the standards specific to the various types of wine, there is no such a wine counterfeiter who cannot be caught in the act with the help of these methods.

PROSPECTS OF DRY AND SWEET WINES REGARDING THE PREVALENCE OF DIABETES MELLITUS, PREDIABETES AND INSULIN RESISTANCE

Victoria Evans

Head of Wine Strategy, Vinonovi Ltd., H-1097 Budapest, Gubacsi út 15-19., Hungary

The subject of my lecture is the future changes in wine consumption regarding the carbohydrate metabolism disorders. It is an immensely relevant question in our days. I would like to introduce the potential effect of these diseases on the international wine market and discuss the possible solutions for the wine producers. Mainly for the ones producing wines in the Tokaj region where the sweet wine production is the essence of the region for centuries.

The number of people with Diabetes increased from 108 million in 1980 to 537 million (adults 20-79 years) in 2021. This number is predicted to rise to 643 million by 2030 and 783 million by 2045. Moreover 541 million adults have Impaired Glucose Tolerance (Prediabetes stage) and the prevalence of Insulin Resistance ranges from 15.5 to 46.5% among adults worldwide. These data show that it is worth to consider Diabetes, Prediabetes and Insulin Resistance as an important factor what can have a notable impact on the wine industry nowadays and in the future as well. The link between the decreasing wine consumption and Diabetes is real. Diabetes, Prediabetes and Insulin Resistance are diseases which are limiting the possibility of wine consumption or even ban it in some cases. The increasing number of diabetic people leads to the fact that the amount of individuals who are capable to drink wine is declining constantly. On the side of the other difficulties of the wine market unfortunately we have to add one more factor to the list of difficulties. According to the predictions year by year the number of people who suffer from these conditions will rise and in the same time less and less people will drink alcohol. The doctors agree on that if somebody lives with this type of health issue, the sugar intake has to be as limited as it is possible. It means that any type of glucose is strictly forbidden and the fructose (fruit sugar) should be minimalised. Any type of alcohol is also not recommended for those individuals but at least dry wines (and spirits) are not prohibited. Some countries such-like Italy and the USA support the moderate alcohol consumption (especially dry wine consumption) to prevent Diabetes type 2 and also let the diabetic people drink a unit (100 ml) of dry wine on daily basis.

Sadly the sweet wines are not on the „can be consumed in moderation” list. For the wine regions where high quality natural sweet wines have an important tradition (like in Tokaj) this is not a gratifying news. But the problem exists so the best way to handle it, is to start thinking about the wine’s prospects in the long run and to find the best way to keep the balance between sweet and dry wine production in the region. As a hungarian wine expert I absolutely support the Tokaj region and believe in the outstanding Aszú wines and in the georgeous Szamorodni wines. However maybe it would be a useful idea for the wine producers to modify the amount of their production regarding dry wines and sparkling wines. The demand for dry white wines is growing and the for sparkling wines is rising. For the people who have to follow a sugar-free diet, the only possibility to drink wine is to drink dry still wines or sparkling wines. For sure Tokaj can be a sufficient region to satisfy them with it’s fantastic products.

To sum up there are certain options for the wine producers, wine merchants, wine experts to find the best solution for the alarming wine prospects regarding the prevalence of the Diabetes Mellitus, Prediabetes and Insulin Resistance. Maybe this is also the right time for the premiumisation of the naturally sweet wine market.

IS IT POSSIBLE TO HARMONIZE TOKAJ WINE BUSINESS AND SUSTAINABLE DEVELOPMENT?

Laurent Comas

Pajzos Tokaj, H-3950 Sárospatak Nagy Lajos út 12.

Luxury industry and sustainable development seem to be a huge antinomy: luxury is about exclusivity, dream, excess or waste, when sustainability is about collaborating, recycling, reducing.

Wine and spirit business is part of the luxury industry, from Hungary especially Tokaji wine could be consider to be part of it.

As producers, should we and how should we change our minds to move from greenwashing to responsible sustainable development?

Who are the consumers of tomorrow, do they want this change? Is it a risk or an opportunity?

SUPPORT FOR THE WINE SECTOR FROM THE CAP RURAL DEVELOPMENT PROGRAMME

Boglárka Gál, Bánné¹– Ágnes Horváth²

¹ President of the Borsod-Abaúj-Zemplén County Assembly, H-3525 Miskolc, Városház tér 1.

² Rector of the University of Tokaj, H-3950 Sárospatak, Eötvös u.7.

Every fifth settlement in Hungary belongs to a wine-growing region.

The total area of commercial vineyards in 2020 was 62,000 hectares, according to the National Council of Mountain Communities, located in 97 mountain communities in 6 Hungarian wine regions, including 22 wine regions, and geographically outside these areas.

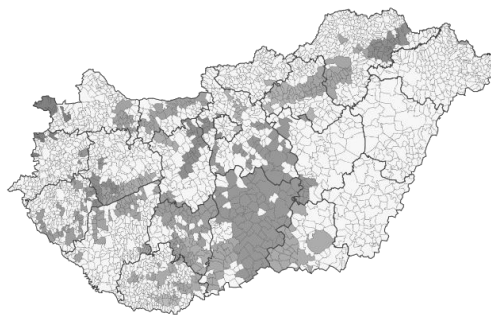


Figure 1. Settlements in Hungary's wine regions in 2020

The technological development of the wine sector is encouraged by both EU and domestic policies, which is why, according to the Hungarian State Treasury (MÁK), Hungarian wineries operating in 22 wine regions received a total of HUF 20.86 billion in support for the development of wine production facilities in the 2014-2020 budget period of the European Union (Járdány 2021)¹.

The grants were financed by the CAP Rural Development Programme (RDP) under the call for proposals for support for product development and resource efficiency in the wine sector (VP3-4.2.2-16). The two pillars of the supported activities are:

1. purchase of winemaking machinery and technological equipment, support for development investments involving construction,
2. support for improvements to environmental resource efficiency linked to the added value of wine products².

According to the publication list of the Hungarian State Treasury, a total of HUF 20.859 billion was paid to municipalities in wine-growing regions for the EU programming period 2014-2020 to support the development of wine-growing enterprises.

The Tokaj wine-growing region received the largest share of aid, with 16.05% of the total.

¹ Járdány K. (2021): Borászati üzemfejlesztési támogatások területi megoszlásának vizsgálata Magyarországon 2014-2020 között. Észak-magyarországi Stratégiai Füzetek XVIII. évf. 2021/1

² <https://www.palyazat.gov.hu/vp3-422-16-borszat-termkfejlesztsnek-s-erforrs-hatkonysgnak-tmogatsa>

DEVELOPMENT OF WINE CULTURE AND WINE TRADE IN SWEDEN

Lennart Bornmalm

University of Gothenburg, dept. of Marine Sciences, Sweden

The Vikings already brought wine home from their long-distance journeys. But wine remained an exclusive drink in Sweden for a long time. When Sweden became Christian in the 12th century, wine was needed for communion, and it began to be imported regularly, mainly by marine transport via the Hanseatic cities. Due to slow transport and preservation problems, wine often was flavoured with sugar, honey, cinnamon, ginger, cardamom, nutmeg and cloves. In the 15th century, wine was imported from Germany, France, Portugal, Spain, the Czech Republic, Hungary and Austria. When the ships loaded with wine docked at Skeppsbron in Stockholm, the barrels were transported from the harbour to the city's wine cellar. There the wine was prepared for consumption, decanted, pumped from barrel to barrel to remove the lees, and filtered before it was sold.

The wine trade increased continuously, and a wide selection of wines was available already in at the beginning of the 19th century, when wine and spirits were imported and sold by wholesalers who also traded in other goods such as leather, porcelain and sewing silk. By the middle of the 19th century, some of the wholesalers began to specialize in wine and spirits, and a new profession, the wine merchants, emerged. At the turn of the century in 1900, there were around 50 wine merchants in Stockholm. The product range was rich and varied. Here there were exclusive wines, bottled imported foreign spirits and own brands of punch, mulled wine and cognac. It was mainly the well-to-do townspeople who bought the expensive and exclusive wine.

In 1917, AB Vin & Spritcentralen got a monopoly on the import, export and production of wine and spirits in Sweden. In order to gain control over the wine handling, the private wine trading companies were bought up. A central wine warehouse was opened in Stockholm in 1923, which was the centre of Sweden's wine handling until the late 1950s, when wine consumption increased, and the house became too small. The business was then moved to Vin & Sprit's new, modern factory in Årstadal south of Stockholm. Today, the Foundation's Wine & Spirit History Museum is located in the Vinlagret (Wine Warehouse). In 1920, strong wines made up 69 percent of Sweden's total wine imports. Strong wine had its rightful place at the fine dinners. Sherry or madeira was served with the soup, madeira with the dessert and port with the cheese. Strong wines dominated wine sales until the mid-1950s when light wines passed them in popularity. More and more people vacationed in more southern countries and discovered the wine there. The food and wine culture of the Mediterranean was also brought to Sweden by immigrating Italians and Greeks.

The increased wine sales meant that Vin & Sprit AB started importing many of its wines in tanks on ships, instead of barrels. The wine was then bottled in Sweden. In 1959, the tanker *Vinia* unloaded its first cargo at the quay in Årstadal, and the enormous storage rooms that had been blasted out of the rock began to be used. Since then, wine sales in Sweden have steadily increased. The Swedes have learned to taste wine, they buy wine books, and many newspapers have their own wine writer who assesses new wines and gives advice and tips about wine drinking.

Since Vin & Sprit AB's import and manufacturing monopoly was abolished in 1995, several hundred new wine agents have started importing wines and the wine selection is constantly increasing. The Swedes have definitely become a wine-drinking people.

WINE GASTRONOMY IN THE TOKAJ WINE REGION - A BOROS CASE STUDY

Zoltán Balogh – Boglárka Bús

H-3950 Sárospatak, Rákóczi u.21.

Consumer tastes change dynamically, never coming to a standstill. It is constantly in flux, with the culinary heritage of each nation, the importance of the seasons and the rediscovery of local specialities. In a global trend known as "locavore", we consume what is grown and processed locally. Authentic cooking techniques and natural flavours have once again become very popular.

The main global gastronomic trend: local. You can call it local, or terroir, which means food made with local, quality ingredients. In addition, it is very important to use fresh, authentic products with a protected origin. It creates new opportunities to rediscover forgotten, old-fashioned products and to reinterpret the food of past generations. It is likely that local characteristics will be refined, specialities will be introduced, perhaps old vegetables, old species, rediscovering livestock.

Protecting local values is even more important in Hungary than in many other countries. In the context of global influences and global economic competition, traditional, tasty and familiar products are being pushed into the background and may even disappear without adequate support. It is important for rural restaurants to embrace local values and to reflect them in their range of products.

In the Tokaj wine region, on the main street of Sárospatak, the young owners of the local patriot Professor Kődöbocz's bourgeois house have dreamed up something new. They come from a wine-growing background, so they take great care to make sure that they can offer the wines of dozens of wineries from Tokaj wine region to guests who visit them. Equipped with a hot kitchen, they welcome guests from the region or further afield with flavours and forms that are a little different from the traditional, but certainly up to date. In their garden, you can enjoy a furmint sparkling wine or a good coffee after a long walk on the path.

A BOROS
BORBÁR SÁROSPATAK

Figure 1. Restaurant layout

WINE BOTTLES AND SUSTAINABILITY APPROACH OF BEHAVIORAL ECONOMICS

Ágnes Csiba-Herczeg - Boglárka Eisinger Balassa

Széchenyi István University
H-9026 Győr, Egyetem tér 1.

The wine market has faced a major problem in the last few years, as the production costs and environmental impact of commonly used wine bottles are becoming unsustainable for producers. As a result, researchers are looking at alternatives to replace wine bottles in the future, just as replacing corks with screw caps was a function of time and energy. In the present study the cost, carbon dioxide emissions, and EF index of a standard wine bottle were compared with a thinned wine bottle and a PET bottle. The aim of the research was to investigate what viable alternatives are available on the market to replace wine bottles that can provide a visually similar appearance to their familiar predecessors, thus helping consumers to make the transition. Research in this area is currently scarce and therefore the literature is limited. Overall, the aim of the research was to determine what competitive alternatives to currently used wine bottles are available from a cost and sustainability perspective.

IS BULK-WINE AN OPPORTUNITY FOR WINE PRODUCERS IN EMERGING REGIONS?

Tamás Köpeczi-Bócz

University of Tokaj
H-3950 Sárospatak, Eötvös u.7.

Based on the multi-year data available for the analysis of the international competitiveness of the Hungarian wine sector, we performed a trend analysis for the period 2001-2020. As a result, it has been established that there is a surprisingly large disproportion between the export and import unit prices of Hungarian wine. Based on the primary data, the competitiveness risk of the Hungarian wine sector is high, as more than half of Hungarian wine exports are low unit price bulk wine. Exports of tank wine per year from the data published by the Hungarian Central Statistical Office during the period under review, about 160-200 million liters. In contrast, most Hungarian wine imports come in the form of bottled wines. Based on the data, if the unit price of export wine is considered to be one unit, the unit price of imports is 2.6 times that. At the same time, it can be said that the volume of Hungarian wine imports is not significant (Szolnoki & Totth, 2020), therefore the difference in unit prices does not have a significant effect on the national economy, we can only get a good indicator for domestic consumption. According to our interpretation, the internal market for higher-priced bottled wines can be developed. Although Hungarian wine exports have been on an upward trend in recent years, their value in 2020 was 0.1% of total Hungarian product exports. According to our data analyzes, the Hungarian wine sector typically moves on a path of expanding but deteriorating wine exports.

Despite all this, our research proves that the export-import position of Hungarian wine is only seemingly deteriorating, because despite the data, there has been no drift towards quantitative exports. “Wine has played an important role in Hungary historically and culturally. Hungary exports wines to international markets; therefore its wine trade is influenced by geographical and cultural factors. „(Balogh, 2015)

In fact, we are witnessing the fact that Hungary has also adapted to the new opportunities of the wine market and is able to take part in the process of raising remote rural regions to a global level.

Based on our research, we can conclude that the export position of Hungarian wine should be examined by extracting the data of the Kunság wine region from the 22 wine regions and performing the wine economic analysis of the Kunság wine region separately.

Further questions are being asked about the strategy that the examined Kunság wine region has pursued or may pursue. It can be stated that this wine region is also successful, as it has found the grape varieties that it can successfully produce and sell in flat, sandy areas with high yields. Its success also required an international restructuring of the wine sector, namely the significant development of the bulk wine industry.

THE VILLAGE WINE CONCEPT AND SAMUEL TINON WINERY CASE STUDY

SAMUEL TINON

University of Tokaj
H-3950 Sárospatak, Eötvös u.7.

From 1990 political change the Tokaj wine area was going under several change and transformation. In the Tokaj Wine Region, small-region cooperations have also appeared, and currently 6 settlements (Mád, Tállya, Olaszliszka, Sárospatak, Tarcál, Herceggút) have a settlement wine as a result of a community cooperation. They are the result of the collaboration of wine producers working in a particular wine-growing commune, either by blending grapes to produce the raw material for the Community wine or by blending the wine produced in quantities offered by the producers. They are collectively branded as a community wine and the wine is the key to the destination, encouraging tourists to visit the place. Early 2010 a first village wine was created, (Mád Wine, Madikör) making an impulse for the all area. Olaszliszka started his work early 2013.

The background: Samuel Tinon was born in Bordeaux in 1969 and grew up on the family estate in Sainte-Croix du Mont, France. He graduated in viticulture and oenology in 1989 travelling the world as a flying winemaker in Australia, Texas, Chile, Italy... In 1991, Samuel was the first French man to settle in Tokaj, just after the political changes and prior to the start of the privatization of the vineyards. After working for different companies during the 1990's, he started his own production in 2000. His first wine was launched in 2005. The Tinon family settled down in a lovely little village along the Bodrog river, Olaszliszka, in the middle of Tokaj-Hegyalja. "In Tokaj, with have to rethink everything in every detail, to use the existing heritage without being to nostalgic. The Golden Ages of Tokaj are behind AND before us!"

Samuel Tinon in 10 dates

- 1969 – Birth in Floirac, next to Bordeaux (France).
- 1991 – Samuel arrives in Tokaj-Hegyalja.
- 1993 – Samuel meets Mathilde Hulot, a French journalist who came from Paris to write a story on Tokaj Wines.
- 1998 – Settling in Olaszliszka: Samuel buys a cellar with a house covering it.
- 1999 – Samuel et Mathilde's wedding, in Sainte-Croix-du-Mont (France).
- 2000 – First Tokaji Aszú Samuel Tinon. The vintage is auspicious, full of Aszú berries, and it's the perfect time to start a new winery.
- 2005 – First sale of Tokaji Aszú in the Cinq, the restaurant of the hôtel Georges V, in Paris.
- 2006 – Building of 4 typical aging cellars in Olaszliszka.
- 2012 – First Botrytis Free harvested, a Szent Tamás Furmint. The wine is sold at the First Great Tokaj Wine Auction, during the Tokaj Spring, in April 2013.
- 2016 – Launching of the Sans Botrytis range.
- 2020 – Focus on the exclusive Dry Szamorodni, the most important dry wine in Tokaj. A lot of projects and ideas coming out from this wonderful wine, the only dry wine made with botrytis!

In this presentation there is a description of the local context, the definition and explanation of the different step were taken on. Finly measuring the result and perspective of the project.

MANAGEMENT THROUGH NUMBERS

János Babos

Process Solutions Kft.

In recent years, the VUCA world - volatility, uncertainty, complexity, and ambiguity - became the determined economic surroundings for all company, all industry and country all over the globe.

Management of the companies developed rapidly due to the enormous technology development, the digitalisation and the globalisation of trade and services.

Therefore, the focus on specific management areas changed to **strict financial management** from basic management areas such financial, human resources, production, marketing, and change management. A more “problem solving” attitude and behaviour of the management teams are raised.

The short-term financial analysis, financial management on the day-to-day operation has become prevailing as the long-term strategic budgeting - although it still has great importance in certain industries – has lost its importance over the last couple of decades.

As the “so-called” statutory accounting and reporting are standard and transparent for all company in a specific country, the **management and financial accounting** - they include controlling, pricing and cost budgeting and management, ratio analysis in a broad term - vary from industry to industry, from market to market and from country to country.

As, for example, “Big Data” - also - became a new science and profession, its involvement in management tools often prevails on other traditional management tools, and management must focus on their **day-to day decisions on the most recent financial data available**. Due to the rapid technology and communication evolution those are always available for the management teams.

Besides all consideration above, what management can do in case the freight costs are increased by 5 times, as like energy costs are increased by 10 times, food prices are increased above 50-100% and exchange rates has waved like a coaster **in some months?**

The importance of the financial management in such economic situation are based on an example of a market leader service company.

The presentation may not solve all relevant managerial issues in the current economic situation, although it gives an overall summary of the issues any company must face in a severe economic crisis. It highlights the importance of the financial management of the companies over some other basic management tools.

DIGITAL TRANSFORMATION IN THE WINE INDUSTRY: CURRENT TRENDS, FUTURE DIRECTIONS AND PRACTICAL CONSIDERATIONS

Dániel Homolya¹ - Attila Loibl²

¹University of Tokaj, Lorántffy Institute, Department of Economic and Business Development, H-3950 Sárospatak, Eötvös út 7.

²Corvinus University of Budapest, Doctoral School of Economics and Business Informatics, H-1093, Budapest Fővám tér 8.

Digital transformation and the associated term, the Fourth Industrial Revolution ('Industry 4.0', 'I4.0') has been recognized as a highly important topic both by academia and practitioners since its first explicit. Technological innovations are not only expected to create operational efficiencies, development of new revenue streams and disruptions to well-established business models, but experts also anticipate that they can be used to respond to some of the key commercial challenges, such as disruptions in global supply chains, labour shortages, or the most recent energy price hikes. Despite its importance, digital transformation research is usually limited to a subset of sectors, with wine production appearing significantly underrepresented. To fill this gap, we construct a theoretical framework for digital transformation based on existing academic contributions, to understand the common ways of achieving digital transformation within an organization. We then conduct a review of existing literature to understand the state of current body of academic knowledge of Industry 4.0 in the wine industry and contrast those findings to the framework developed. Based on analysis of Scopus Database, considering the existing knowledge on the field our results indicate that digital transformation in the wine industry is motivated by multiple factors, including business model innovation driven by the need for enhanced customer value creation and the changing preferences by new generation consumers towards wine appreciation, the use of technology to improve tracking and tracing of products, or to enhance grape harvest yields in order to better adjust to changing weather patterns. Finally, we present some practical cases on how these innovations are brought to life by major wine producers and brand owners.

WINERIES IN THE BALATON REGION: SUPPORT TO WINERIES, CHANGE OF LAND USE AND PROBLEMS OF CONSERVATION – A REGENERATIVE APPROACH

Gábor Molnár¹ - Sándor Némethy^{2,3}

¹Lake Balaton Development Coordination Agency, Siófok, Hungary

²University of Tokaj, Sáropatak, Hungary

³University of Gothenburg, Dept. of Conservation, Gothenburg, Sweden

The Balaton Wine Region is one of the seven major wine regions in Hungary. It consists of six wine districts: Badacsony, Balatonboglár, Balaton-upland, Balatonfüred-Csopak, Great-Somló and Zala. These wine districts are scattered around Lake Balaton their total area is more than 9,000 hectares. The typical grape variety that can be considered endemic in Hungary is the Olaszriesling, but among the Hungarian varieties, the Kéknyelű (blue stalk), juhfark (sheep's tail), furmint, and Cserszegi fűszeres (Cserszeg spicy) are also popular. Chardonnay, pinot gris, Rhine Riesling and sauvignon blanc appear among world varieties. During the last decades, even red varieties were introduced and successfully cultivated such as Kékfrankos, Cabernet Sauvignon, Syrah, Merlot, and Pinot Noir. The wine region is geologically diverse, Permian red sandstone, Triassic dolomitic limestone, Pannonian sand, from the upper Miocene and lower Pliocene volcanic basalt and limestone layers can be found, and even Holocene loess, brown and red forest soils occur. Several wineries received both government and EU-funds for development of production technologies and infrastructure and organic conversion (e. g. Somló wine district). Many of these projects were managed and assessed by the Lake Balaton Development Coordination Agency. However, there are economic and social factors, which are changing the unique viticultural landscapes of the region and constitute a threat to its natural and cultural heritage. The unique geomorphology, the rich vegetation, the Lake Balaton with its picturesque coastal settlements and bath beaches attract a vast number of tourists every year, substantial parts of previously agricultural land have been turned into residential areas for holiday homes, open or hidden changes of land use caused a reduction in the total area of vineyards. The vineyard areas representing traditional landscape use and of significant landscape value account for the largest percentage of land use in the outskirts of the settlements of the Balaton Upland National Park compared to the other settlement groups. In the settlements of the national park, we can observe the vineyard areas II. increase due to vineyard reconstruction. On the other hand, in the settlements along the shores of Lake Balaton, due to the increasingly important recreational function, no significant replanting took place from the 1960s onwards, and the area of vineyards is gradually decreasing. The vineyards of the northern shore overlooking the lake are a defining element of the cultural landscape of Balaton. According to the cadastral point calculation based exclusively on viticultural aspects, these are among the country's most valuable vineyard areas, worth an average of 333 points. The effect of the Balaton Act, local government decrees and the mountain commune law aimed at protecting the vineyard areas were worsened by the practice developed at the land offices and government offices. In recent years, a ministerial decree authorizing and encouraging the cutting of vines in private gardens on nearly 50% of the vineyard areas here essentially overrode the original laws. Given the extremely accelerated processes and the complex, time-consuming nature of the tasks, a construction moratorium must be introduced until the review of the Balaton Act is completed and the local regulations are applied to the new situation. Furthermore, a complex ecosystem-status survey should be carried out to assess the adverse impact of overtourism and land use changes. Restoring abandoned plantations and planting new, organic vineyards in the suitable areas appear to be the only solution for these problems.

HERITAGE AND INNOVATION

Károly Kovács

Mad Wine – founder, owner
H-3909 Mád, Hunyadi János utca 2.

The presentation demonstrates the importance of innovation through my own concrete example, based on the experiences and results of Mad Wine, a winery successfully built from scratch in 10 years.

To evaluate the current situation and market position of the wine region it is essential to review the macroeconomic processes that took place in the past; we look back at the nearly 500-year history of the Tokaj wine region.

The situation of Tokaji wine in the past and today. Wine is a product for which perception, appearance, taste, and smell are important. This is extremely true for Tokaji wine. The product structure and the size of the wine region does not allow competition with New World wines. We cannot be part of the competition of the globalized wine world in volume, but at the same time we must become part of the innovative steps that are now unavoidable. The innovative approach must be incorporated into our everyday life if we want to remain competitive on the global wine market.

We emphasize the quality of the product, which cannot be mediocre; it should be at least good, but mostly excellent. In the 21st century, product presentation cannot be indifferent if we want to remain a player in the market.

The importance of innovation spans the entire supply chain, which, through the aesthetic appearance and evolving along with consumer trends, must cover energy efficiency and the minimization of the ecological footprint as much as possible.

In addition to alternative closing methods, we cover the current and expected proportions of environmentally conscious packaging technologies, including the market share of Bag-in-Box and aluminum can products, as well as the rise of smart technologies. Through the development of Mad Wine's product portfolio, based on the experience gained in international markets, we present the strategy with which a winery with excellent terroir operating in a specific economic environment can be successfully operated in the long term.

S4 – SESSION 4. Education in viticulture and oenology

SYSTEM APPROACH FOR A RESILIENT EDUCATION IN WINE SCIENCE

Sándor Némethy – Zsuzsanna Bene – Ágnes Horváth

University of Tokaj
H-3950 Sárospatak, Eötvös u.7.

The latest advances of vine cultivation technologies, the development of new grapevine varieties and the high technological requirements of the winemaking processes are responsible for the quality of wine and other grapevine-related products. However, today's well-prepared viticulture and oenology specialists have not only extensive agricultural and technological knowledge and skills but are also able to monitor the needs of the changing market, changes in customer tastes and preferences and changes in the cultural environment in such a way that they develop their own, unique producer profile in accordance with high quality requirements. The sector's training portfolio is diverse, covering viticulture, grapevine genetics, climatology, paedology, oenology, wine-technology, environmental sciences, land surveying and geoinformatics, spatial design, circular economics, wine trade, marketing, wine tourism, wine heritage conservation, and other areas directly or indirectly related to wine, thereby satisfying the training needs of the most important target groups. The training offer is not only determined by the market, but a new market can also be created by recognizing the training needs of a new generation, new delivery systems (such as hybrid and interactive online education, e-learning, virtual internships) and applying appropriate marketing. It is essential to acquire scientific and economic knowledge and broader skills necessary for the development of circular economy, and multifunctional organic farming based on a complex product structure, and the conservation of cultural heritage even on landscape-scale. The most important basic condition for the survival, further development, and international acceptance of education in viticulture and oenology is the provision of multi-faceted and top-quality, practice-oriented, resilient training system based on international good practices, which are adaptable to a changing natural and social environment.

EDUCATION IN VITICULTURE AND ENOLOGY IN THE FACE OF FUTURE CHALLENGES

Vittorino Novello

University of Turin, Department of Agricultural, Forestry and Food Sciences – DISAFA
Largo P. Braccini, I-10095 Grugliasco – ITALY

The vitivincultural education systems are very different between the states, as well as their levels of preparation: the database of courses of study referring to Viticulture and Enology of the OIV (International Organization of Vine and Wine), certainly not exhaustive, referring to the 2019, with updates to 2021, reports 342 courses of study of 9 levels, from 25 OIV members, ranging from 73 courses in France to just one course in Belgium, Lebanon, Perú, and Israel.

In 1976 the OIV approved the definition of enologist, which was then updated in 2013.

Despite lengthy discussions in recent years in the Formation working groups of Commission III- Economy and Law, the OIV has not reached the necessary agreement for the definition of a qualified technician in enology.

In 2004, the OIV approved various resolutions on the level of skills of the figures involved in the vitivincultural sector, such as:

- competencies required for wine professionals
- basic level required for professionals involved in making products derived from grapes
- basic level required for professionals involved in oenological practices
- basic level required for professionals involved in the quality control of the final product and winemaking process
- basic level required for professionals involved in the interpretation of the results of analysis.

In 2016 the resolution on training programs for oenologists was approved. After that date vitivincultural sector has advanced with innovations to face climate change, influencing both the viticulture and enology; to concern the critical review of cultivation techniques, in the short and medium term; achieving sustainability in grape and wine production; precision viticulture; the use of disease-resistant vines (downy mildew and powdery mildew) (PIWI, *Pilzwiderstandfähige*): all these must be the cornerstones of the preparation of future vitivincultural experts.

STRUCTURES AND FUNCTIONS OF THE HISTORIC VINEYARD LANDSCAPE AND THE POSSIBILITIES OF PRESERVING THE CULTURAL HERITAGE OF THESE VINEYARDS (CASE STUDY)

Alexander Fehér¹ – Martin Hauptvogel² – Iveta Fehér Pindešová³

^{1,2} Slovak University of Agriculture in Nitra, Institute of Environmental Management FESRD,
Tr. A. Hlinku 2, SK-941 76 Nitra, Slovakia

³ State Veterinary and Food Institute, Veterinary and Food Institute Bratislava, Botanická
ulica 15, SK-842 52 Bratislava, Slovakia

The current landscape structure has been developed as an interaction of natural and anthropogenic processes. The different ecosystems of the landscape with their structure and processes, which are based on the circulation of materials, the flow of energy and information, have different functions and provide different services. Despite the fact that the concept of ecosystem services and disservices is not entirely new, we still forget about all functions of agricultural land, such as cultural, spiritual or educational functions. Our research was focused on the cultural heritage of vineyard ecosystems in SW Slovakia, the roots of which can be found in their historical development. Instead of theories, we applied the case study method, choosing the village of Pohranice (Nitra wine region), which has the longest written history of viticulture in Slovakia. The history of viticulture and viniculture in Pohranice and the surrounding villages dates back to the Middle Ages and is probably related to the presence of the Benedictines, who also operated directly in Pohranice. The first written mention comes from 1075, when the Hungarian king Geyza I., donated property to the abbey in Hronský Beňadik, including vineyards in Pohranice. It is actually the first localized written data on the cultivation of vines in the territory of present-day Slovakia, together with the village of Rybník near Levice. In the 12th and 13th centuries, the vineyards here acquired e.g. the Zobor Benedictines Monastery, the Esztergom Archbishopric, the Nitra Diocese, the Nitra Chapter and the wealthy aristocratic families of the Nitra region (Forgách etc.). Already since 1232 we also know the names of more than 20 serf vineyards and in addition, there must have been specialized experts in the cultivation of vineyards or wine production, because from 1251 we learn about the murder of a local professional viticulturist. Not only medieval events but also the later history of the vineyard significantly influenced the structure and thus the functions of the vineyard, including cultural heritage. Based on data from archival documents and preserved landscape structures, we defined and reconstructed three basic historical types of vineyards, namely Romanesque, Baroque and Functionalist. Today, the institute of the viticultural mayor (peregmaster) no longer exists, but there is still an intense viticultural life. Winemakers are organized by the Civic Association of Winemakers Vinum de Pogran 1075. This association manages e.g. pilgrimages to the statue of St. Urban, wine exhibitions and other events that are the subject of this research. They are aware that many natural, landscape-historical, architectural and other monuments and heritage, as well as certain intangible cultures (e.g. traditional terms and ecological knowledge, skills and customs), can be saved *in situ* only in vineyards.

The paper was created within the framework of projects of the Grant Agency of SUA Nitra Phytoextraction of risk elements from soil substrates through selected species of fast-growing energy plants and their production potential (GA SPU/2021/1), APVV Waste and constructions – modelling the effectiveness of alternative cooperation options of administrative authorities (APVV-20-0076) and the project of the Operational Program Integrated Infrastructure: Demand-oriented research for sustainable and innovative food, Drive4SIFood.

INTEGRATED CONSERVATION FRAMING SUSTAINABLE MANAGEMENT OF VITICULTURAL LANDSCAPES

Bosse Lagerqvist¹ - Lennart Bornmalm²

¹Department of Conservation, University of Gothenburg, Box 130, 405 30 Göteborg, Sweden

²Department of Marine Sciences, University of Gothenburg, Box 461, 405 30 Göteborg,
Sweden

The concept of integrated conservation rests in the 1970s increased understanding of the historical environment's importance as resources in urban and land-use planning, and not be delimited as a secondary issue in societal development. Sir Bernard Feilden defined the concept in 1986 as the dynamic management of change in order to reduce the rate of decay. This approach on how to operate heritage practices, this paper argues, present a substantial potential for recognizing heritage as a fundamental resource for sustainable societal development. By applying the integrated conservation approach on developing cultural ecosystem services on the cultural landscapes of viticulture, a structure for the operationalisation of such services could represent opportunities to develop models for achieving activities and outcomes that addresses the challenges of the European Heritage Strategy for the 21st Century.

SUSTAINABLE WINE TOURISM IN A NON-SUSTAINABLE WORLD?

László Dinya

Hungarian University of Agriculture and Life Sciences (MATE), Institute for Rural Development and Sustainable Economy, Department of Sustainable Tourism
H-3200 Gyöngyös, Mátrai út 36., Hungary

The 6-th Conference of wine tourism organized by the United Nations World Tourism Organization (UNWTO) in September of this year dealt with very important questions regarding the future of wine tourism. It is obvious that the rapidly growing and increasingly complex social-economic-political and natural environmental challenges create a chaotic (non-sustainable) world in which the answers are possible through broad cooperation and radical innovations. This is the case with tourism, including wine tourism, because they are especially sensitively affected by these changes. All of this goes far beyond the boundaries of the sector, but at the same time creates broad opportunities for active participation of all members in the value chain of wine tourism. Innovation in services, marketing and partnerships creates broad opportunities for all members of the value chain including travelers, companies, authorities and locals at a critical moment when active participation and conscious thinking can increase the value of wine tourism destinations and their environment. Failure to do so can significantly weaken the competitiveness of a given region. The work aimed at this may be the key to the future development of wine tourism and the survival of those interested who have lived from it until now. The last two years have brought significant changes in wine tourism, transformed travel logistics, wine experience planning and consumer behavior. In addition, a number of challenges that had already appeared came to the fore - from digitalization to sustainability and network cooperation. Sustainability increasingly determines the services offered by wineries and vineyards, as well as the attitude and purchasing decisions of travelers. Meanwhile, digitization and e-commerce have become key tools in the hands of producers, distributors and wine tourism businesses, as well as destinations. Necessary innovations in experiences, marketing and partnerships create broad engagement opportunities for all members of the value chain. It is advisable to focus on answering the following questions:

- What is the role of innovation in the future of wine tourism?
- How can wine tourism be more sustainable?
- What are the possibilities of digitization and socialization in the development of the value chain of wine tourism?

Based on the analysis of international experiences, we try to provide domestic answers to these questions.

CREATING VALUES BY SOCIAL ENTREPRENEURSHIP AND COLLABORATION IN ORDER TO KEEP OUR WORLD HERITAGE AND EVOLVE INTO EXCELLENCE

Zsuzsanna Szili

Pedagogue, Adult Educator and Social Entrepreneur

The **la casita project** was born during the COVID Pandemic in Uruguay, created by Hungarian values to keep our tradition in the Centralised Political system when it might be under risk of globalisation and endanger of losing its core tradition. When we talk about the World Heritage site, it includes everything, the architecture of the region, the way of living, the integrated communities.

The aszú harvest is the most challenging one, it requires both professional knowledge and skillset. Today, in 2022 in the Tokaj wine region Gypsy and Hungarian women work together during the Aszú Harvest season, they earn 8000 HUF / day. This amount of money is today less than 20 EURO/day with the skills what only few people have. (This is also our World Heritage, and we need to stand together to protect this.) Because after all foreign (or not) investors sell this precious wine abroad with 200%-500% profit. In Hongkong in a 6 stars hotel the lowest price of one bottle Aszú starts from 100USD. This is very far from fair trade. There is a tendency in modern businesses to create win-win-win situations.

My view on this topic is far from judgement, I see the situation more like an opportunity to involve and create higher value behind each bottle of Aszú.

The possibilities are:

- **Creating working tourism** into the region (we can give education about the meaning of this extraordinary gift of ours.) // The example can be New- Zealand or we can do it in our unique way=in collaboration of international voluntary service(s)
- Create a **Union** in Tokaj wine region within those who share values, knowledge, vision
- by this **creating a community** which can be 100% **self sufficient** and open for national and international **collaborations**
- **Creating Education Programme** for the Hungarian youth (even for summer)

To sum up, in the case of the examined parameters, there are significant possibilities to come out from the Shadow side and bring Tokaj in to the map again, but this time reframe all the judgment of “Borsod” and show example to the World that we –together-can do- extraordinary.



TRANSFORMING EDUCATION, THE „CLOUD CAMPUS PROJECT”

István Németh

University of Pannonia, University Center of Zalaegerszeg
H-8900 Zalaegerszeg, Gasparich M. u. 18/A

Education is an industry, which nowadays through technological advances and new teaching methods can support individualized learning in the framework of its mass production. Our „Cloud Campus” project aims to create a technological and methodological platform, which will integrate the resources of multiple universities and their industry partners to form such a learning environment. The goal in operating such a learning environment is to integrate „the manufacturing process of education” into a vast intelligent system with the economic processes that it serves and what in turn serve it, to maximize production efficiency of the dispensed knowledge.

COMPLEX FAMILY FARMS IN THE BALATON WINE CULTURE AT THE BEGINNING OF THE 21ST CENTURY

Szilvia Gyanó

curator, ethnographer

Thúry György Museum, Nagykanizsa, Hungary

This study is based on the academic research program entitled “Lake Balaton at the turn of the millennium – in the footsteps of János Jankó” (OTKA TO48831) held between 2005 and 2008. It was the ethnographic study of the settlements on the lakeside, with a complex theme, method and approach.

Viticulture and oenology are one of the main characteristics of some European region, including today’s Lake Balaton. It is not only important as an agricultural sector, but also more and more frequently as a major motivating factor for tourism. The initial ethnographic-ethnological perspective needs to be expanded with a wider, cultural-historical approach, because the significance of viticulture requires a more complex framework for interpretation. Viticulture is still a living, changing phenomenon on both shores of Lake Balaton, influenced by recent and present economic and historical changes. These changes are connected with new challenges in the 21st century and leave a mark on the cultivated landscape, too.

Until the end of the 19th century almost everyone was engaged in viticulture in the villages on the shores of Lake Balaton. Peasant viticulture of small parcels were determining factors for the development of the vineyard hill image. The traditional farming method, which can be traced back to its medieval roots, survived to a certain extent until the end of the 19th century (the replantation following the phylloxera epidemic), indeed, until the middle of the 20th century, when it was abolished by the socialist mode of farming. After the political changes in the 1990s in Hungary the establishment of large state wineries ceased to exist. Balaton’s viticulture had to face new challenges. New strategies had to be developed based on the size and professional level of the holdings.

Smaller and larger wineries operate today on the shores of Lake Balaton, a few are really large and deal only with grape and vine. There are a lot of hobby-vineyards with or without ancillary incomes, too. The majority of vine-companies are defined in this study as complex family farms. These complex family farms (size between 7 and 25 hectares) are the focus of my study, as I define them and elaborate on their main characteristics.

The adjective “family” here is not necessarily an economic category, but a greater or lesser degree of cooperation between family members, which involves a great deal of legal flexibility. Winemaking is also a continuation of the family tradition in many cases. In family wineries, the primary source of income comes from winemaking. However, due to their small size compared to large agricultural companies, they have to resort to other solutions if they want to ensure their independence. Thus, in all the examined wineries we can observe the tendency to stand on several legs (e.g. restaurants, hotel services, production of handicrafts). Professional events (wine competitions), various local events (harvest parades, wine festivals, etc.) play an important role in the life of family wineries, which also help to maintain quality. Old traditions in cultivation mode, toolbox and wine processing go hand in hand with technological innovations.

THE NEED OF INTERDISCIPLINARY EDUCATION IN WINE SCIENCE TO ENSURE THE CONSERVATION OF VALUABLE VITICULTURAL LANDSCAPES

Anna Ternell

EP Architecture, Sweden and University of Pécs, Dept. of Earth Sciences, Hungary

The grapevine is a multifunctional plant, the cultivation of which carries a wealth of knowledge and skills from all disciplines, natural sciences, economics, social sciences, and humanities accumulated during the last eight thousand years of the cultural history of humankind. Vineyards were often created in extremely special, dry-hot or cool and humid climates, specific exposures, with unique soil conditions, geomorphology and extremely diverse ecosystems (e. g. mountain areas, volcanic environments, sub-Mediterranean slope steppes, river valleys), which are of outstanding conservation importance in terms of rare and special plant and animal species, landscape character and cultural heritage. In addition, intensive grape growing methods (intensive soil cultivation, use of fertilizers, herbicides, fungicides and insecticides) result in physical, chemical and biological soil degradation, minimal biodiversity, and also endanger the surrounding natural ecosystems by the drift of chemicals and the introduction of nitrates and other nutrients into groundwater. Therefore, intensive viticulture is often at odds with environmental and nature protection. This conflict can only be resolved by the implementation of ecological cultivation of grape-growing areas, application of low-input multifunctional agricultural systems. This requires professional, practice-oriented education, which is based on the sustainable utilization of ecosystem services and takes into consideration the appropriate scale of cultivation with particular emphasis on the carrying capacity of ecosystems. There are numerous good practices, which offer solutions on system level where the most important condition of economic viability is circular economy and complex product- and service structure. Therefore, knowledge and practical skills in nature and heritage conservation should constitute an integral part of wine science education.

THE POTENTIAL OF SOCIAL COOPERATIVES IN REDUCING WORKFORCE SHORTAGE IN WINEGROWING ENTERPRISES THROUGH INFORMAL AND ADULT EDUCATION AND CAPACITY BUILDING

Ágnes Horváth¹ - Boglárka Gál Bánné²

¹University of Tokaj, Rector

²Assembly of Borsod – Abaúj – Zemplén County, President

Viticulture is one of the most labour-intensive agricultural sectors, which requires a lot of attention almost all year round, from winter pruning to green work to harvest. Farmers who cultivate grapes in a larger area therefore need manual laborers who perform these tasks. Recently, in most Hungarian wine regions, partly as a result of large-scale emigration, farmers almost have to compete for workers. The opinion is spreading more and more that in the long term, full mechanization can be the only solution, which would require significant investment. Another reason for the labour shortage is that there are many people who choose social assistance instead of work due to low wages in the agricultural sector. Creating new types of social cooperatives can be the solution to this problem, especially in the case of organic agricultural businesses that require more manual labour. A social cooperative meets local community needs and creates alternative economic collaborations, operates as a community enterprise related to the organization of an alternative community lifestyle, and mostly implements the employment integration of disadvantaged people. Special forms of social cooperatives are school cooperatives and employment cooperatives. Both forms are suitable to establish cooperation with agricultural enterprises suffering from workforce shortage, depending on the qualification and skills of their members and the establishment of possible combined work and education programmes through internships. The vast majority of the problems of viticulture and wine enterprises could be dealt with if they participated more intensively in secondary and higher-level practical training and organised capacity building programmes. By accepting pupils and students and creating the conditions for long-term commitment, businesses could train their own supply of specialists. In order to deal with the labour market problems that have intensified in the recent period, it is recommended to strengthen the forms of adult training and professional consulting services covering companies operating in the sector and even suitable social cooperatives, which lay the foundation for more conscious and sustainable human resource management, as well as the promotion of good practices that effectively respond to employment problems.

VITICULTURE AND ENOLOGY EDUCATION AT THE UNIVERSITY OF UDINE, ITALY

Enrico Peterlunger

University of Udine, Italy

The University of Udine was founded in 1978 in Friuli region, North-Eastern Italy. The actual number of students is 16000, with 8 Faculties/Departments. Among the first faculties to start the activity there was Agriculture.

A specific course for Viticulture and Enology started in 1992 with a three-years course (University diploma, technical course): this year there will be the celebration of 30 yrs of courses, with 1200 students graduated as “Enologist”.

After a few years there was a transformation into a Bachelor in Viticulture and Enology (3 yrs, 180 ECTS). The areas covered in the education activity are Chemistry, Biology (mostly Botany), Agronomy, Viticulture, Enology, Microbiology, Marketing and Economics of Wine, Internship.

A cooperation with Istituto Agrario San Michele all’Adige, now Foundation FEM, was established, and it lasted from 1998 till 2016.

In 1998 an agreement for a “double title” of Enologist was signed with Hochschule Geisenheim University: the agreement offers to students to follow lessons and activities of the **third year** in the partner university. The mutual recognition of activities abroad allows the student to get the double title, German and Italian. Similar agreements for a double title have been as well established with Universidad Nacional de Cuyo, Mendoza, Argentina (since 2004), and double title with Instituto Federal Rio Grande do Sul, Bento Gonçalves, RS, Brasil (since 2012).

In 2002 the Master in Viticulture, Enology and Wine Marketing was started, in cooperation - Consortium with the Universities of Padova, Verona and later Bolzano (Udine coordinator).

The Udine master has been one of the six founding members of EMaVE, European Master in Viticulture and Enology, together with University of Montpellier Institut Agro, Hochschule Geisenheim University, Universidade Politécnica de Madrid, University of Torino, Universidade de Lisbon. EMaVE since 2007 is giving the “VINIFERA” Euromaster, still running with 30 students each year, starting their courses for the first year in Montpellier, with professors coming from all the partners. The second year is chosen by the student in one of the partners, finalising the master course in that university. The students come from many countries all over the world.

A parallel and similar agreement for double master title is running since 2014 between University of Udine and Hochschule Geisenheim University, denominated VITIS-VINUM.

A cooperation with University of Torino, a similar master is running as well, with exchange of students. The international activity in this area is very relevant. Participation in three INTENSIVE PROGRAMS, as well as many Erasmus+ agreements.

Bachelor graduates: 1200 (highest number in Italy)

Master graduates: 200.

PRACTICE-ORIENTED EDUCATION IN CHEMISTRY AND BIOCHEMISTRY FOR STUDENTS IN VITICULTURE AND OENOLOGY

János Csapó^{1,2,3}– Sándor Némethy^{4,5}

¹MATE Magyar Agrár- és Élettudományi Egyetem, Kaposvári Campus, H-7400 Kaposvár, Guba S. u. 40.

²Debreceni Egyetem, H-4032 Debrecen, Egyetem tér 1.

³Sapientia Erdélyi Magyar Tudományegyetem, 530104 Csíkszereda, Szabadság tér 1. Romania

⁴University of Tokaj, H-3950 Sárospatak, Eötvös út 7. Hungary

⁵University of Gothenburg, Dept. of Conservation, Box 130. SE-405 30 Göteborg, Sweden

In recent decades, both the pedagogical theory applicable to the teaching of chemistry and the technological background of practical implementation have greatly improved in higher education. It is precisely for this reason that, despite the unfavourable situation from many points of view, it is very necessary that the tried and tested and authentic knowledge collected by specialists becomes public property in a usable way, especially for practical specialists such as viticulturists and winemakers. The education of chemistry and biochemistry in developed countries is increasingly moving in the direction of practice-oriented knowledge that serves the understanding of natural phenomena and helps environmental awareness. Despite this, the previous "chalk chemistry" focused exclusively on lexical knowledge is moving in this direction more slowly than desired. For viticulturists and oenologists practically useful knowledge and skills are more important than heavy and abstract theory, keeping in mind the right proportions between theory and practice. The world's viticulture and winemaking has reached a turning point. Climate change plays a role in this, in addition to the ever-increasing market competition, cheap products must be produced, and there are expectations from society towards clean food. While pesticide residues were found in one hundred percent of non-organic wines from France, Germany, Austria, Italy, Portugal, South Africa, Australia and Chile, many higher education institutions lack the appropriate education in environmental chemistry, wine flavour chemistry is rarely thought, the professional training through high-quality internships is not sufficiently developed. Therefore, the practice-based education in chemistry and biochemistry for viticulturists and oenologist is of key importance to meet the aforementioned future challenges.

INTERGENERATIONAL, PROJECT-BASED EDUCATION AT UNIVERSITY OF TOKAJ

Tamás Köpeczi-Bócz

University of Tokaj
H-3950 Sárospatak, Eötvös u.7.

One of the main challenges of Tokaj University, which was established in 2021, is that students of different ages and life experiences must be organized and taught in a unified group. The different age characteristics also induced a new experimental approach in the organization of the university's educational services and classes.

The higher education institutions of the small towns - which includes Sárospatak - also fulfill important local social organizing tasks, therefore the community of the campuses is of greater importance here.

Within the framework of intergenerational higher education, older learners can more effectively and better compensate for their IT and language knowledge deficits, while younger generations can get to know the work organization solutions and work culture of their chosen field more directly. The solution can lead to an improvement in the quality of education for students (of any age), and an increase in efficiency for the university.

Over the past decade, the strategic framework for higher education has evolved simultaneously with technological and methodological innovation in the education sector. The development of Information and Communication Technologies (ICT) has brought a breakthrough in the methodological renewal of education. Implementers of almost seventy years of "programmed theories of education" (Skinner, 1954) have been given a new and effective tool. Flexible frameworks developed by IT professionals have made the practical application of these theoretical results widely available. Perhaps one of the most common such frameworks is Moodle, which is available as a central service in several higher education institutions. In the framework of the presentation, we will show how effectively the Moodle framework has been able to support the cooperative learning goals that play a key role in the complex skills development of students.

The educational history of "Blended Learning" (BL) is also more than half a century old, as the Swansea University pilot program was introduced to the profession in 1970. BL combines frontal teaching with online learning. In higher education, we have been using this model for more than 10 years in conjunction with various ICT-based tools, including Moodle. Within BL, the proportion of traditional classroom instruction and online platform learning is not clearly defined, although the majority of professionals (Siirak, 2012) consider BL to be the determining direction for the future of education.

We observed that before 2019, typically 80% had classroom instruction and 20% had online individual preparation. During the coronavirus epidemic, higher education has completely "moved" into the online space. As of the second half of 2021, there was no COVID restriction in Hungarian higher education. In this presentation, we examine whether the pandemic has modified the typically 80 - 20 percent of traditional BL? We have found that in some cases this ratio may even have reversed. However, this change depends on a number of factors, such as the availability of appropriate teacher and student pedagogical practices that Moodle can effectively support to achieve cooperative learning goals. In our experiment carried out at the University of Tokaj, we included students participating in university courses at different levels who had already gained experience in using the system even before the pandemic and were completely "Moodle virgins" who also encountered the BL methodology for the first time. During the design of the questionnaires, Davier and Halpin (2013) examined skills related to interpersonal trust as a willingness to cooperate and competencies required for successful cooperation. The collaboration of the group was continuously monitored based on a weekly electronic activity log.



OENOLOGIE AT UNIVERSITY ROVIRA I VIRGILI

Joan-Miquel Canals

Rovira i Virgili University, Faculty of Oenology, Department of Biochemistry and Biotechnology
ES-43007 TARRAGONA, Marcel·li Domingo,1. Campus Sescelades. Spain

Tarragone was the first place in Spain in develop a full program of oenology at university level, it was in 1988. Since that epoque the university has created a full program of bachelor, master, and Ph Doctorate program to form professionals in oenology of first level.

The bachelor program takes four years in achieve it; first one is on basic subjects and on second and third the student focus in oenology and viticulture, according OIV recommendations and fourth year consists in an internship and one semester of optional subjects and finishing with a bachelor thesis.

There are two master programs. A local one of 60 ECTS, one academic year, that focuses on fermented beverages, especially wine and beer. This is the sole official program in Spain on beer technology. The other Master program (120 ECTS) is an Erasmus Mundus Joint master's degree (EMJMD) on Innovation in Wine Tourism (Wintour-master.eu) created with University of Porto and University of Bordeaux. This is the master with more demand in our university and has been granted two times as EMJMD.

There is also a Ph Doctorate program on Oenology and Biotechnology, with 25 positions, with 5 research groups as possible tuitions.

INTERNATIONALISATION OF HIGHER EDUCATION IN HUNGARY – OPPORTUNITIES, CHALLENGES, AND PRIORITIES

Gabor Dobos

Director, Directorate for Internationalisation of Higher Education - Tempus Public
Foundation

Tempus Public Foundation, the Hungarian national agency is coordinating international educational cooperation programmes, aiming to support the internationalisation of the Hungarian Higher Education.

Internationalization is not a policy goal, rather a policy tool, mechanism aiming at comprehensive purposes in the higher education such as improving the education quality, effectiveness, and relevance. Therefore it is important that the implementation of relating policies can occur in a comprehensive, integrated way.

The presentation will outline possible ways of cooperation with Hungarian universities and partnership-building activities in several, national, regional and European programmes like Stipendium Hungaricum, CEEPUS, Erasmus+. It will also introduce how HEIs can deepen their cooperation using these schemes and mobility in general.



THE HISTORY OF WINETOURISM

Bulcsú Remenyik

University of Tokaj, Lorántffy Institute, Department of Tourism and Catering
H-3950 Sárospatak, Eötvös street 7., Hungary

Wine has been produced for thousands of years, the oldest place of its production is located in Georgia, its origin is approximately. It dates back to 6000 B.C. A mixed fermented drink of grapes and rice was found in ancient China, its production can be dated to 7000 BC. The ancient Greeks worshiped Dionysus, and the ancient Romans celebrated the cult of Bacchus. The consumption of ritual wine has been part of Jewish practice since biblical times and has become part of the liturgies of the Christian Church as part of the Eucharist commemorating the Last Supper of Jesus. Although Islam nominally forbade the production or consumption of wine, in its golden age, alchemists such as Geber pioneered the distillation of wine for medicinal and industrial purposes.

Wine was a common drink of all social classes in the Middle Ages, mainly in the Mediterranean areas where grapes were grown. In the north and east, where few grapes were grown, beer remained the drink of the common people and the nobility. Although the wine was also exported to the Nordic countries, it was rarely consumed by the lower classes due to its relatively high price. However, since wine was needed to celebrate the Catholic Mass, ensuring supplies was key. Benedictine monks became one of the largest wine producers in France and Germany, they were closely followed by the Cistercians. Other orders, such as the Carthusians, Templars, and Carmelites, are also notable as wine producers, both historically and in modern times. The Benedictines owned vineyards in Champagnes (Dom Perignon), Burgundy and Bordeaux. In Rheingau and Franconia, Germany, the great nobility planted Riesling, the most important German grape, next to Frankfurt for the first time. Nearby winemaking monks turned it into an industry and produced enough wine to be shipped throughout Europe for secular use. Portugal, one of the oldest countries with a wine tradition, created the world's first naming system.

Wine production and consumption spread throughout the world from the 17th century due to European colonization. Tourists traveling on Grand Tours also visited the Rhine wine area, which led to the spread of European wine tourism.

Despite the devastating phylloxera infection of 1887, industrial wine production and consumption, adapted to modern science and technology, now occurs worldwide.

At the end of the 19th century, phylloxera widely ravaged grapes, wine production and those whose livelihoods depended on them; far-reaching consequences were the loss of many native breeds.

The development of wine tourism is associated with the 20th century, already in the 1930s wine routes were established in Germany and France.

ONLINE WINE MARKETING - A NECESSARY EXTRA OR AN UNNECESSARY WASTE OF TIME?

Zoltán Bujdosó – Edit Pallás

Hungarian University of Agriculture and Life Sciences (MATE), Institute for Rural Development and Sustainable Economy, Department of Sustainable Tourism
H-3200 Gyöngyös, Mátrai út 36.

During the COVID-19 epidemic, the closure of wineries and the cancellation of wine events had a major impact on Hungarian wineries. During this period, consumers who had previously bought directly from wineries chose other wine-buying options. Wine consumption has not decreased, but the demand for online wine buying has increased rapidly.

Smaller - larger wineries, which already had a web shop or sold their wines through wine merchants, were able to realize higher demand. Most of the wineries that did not use online marketing tools understood that their winery was not "visible" to most wine buyers, and that their income would fall sharply, and their business could go bankrupt.

Increasingly, winemakers have built up online communication channels to get back into the public consciousness of wine buyers.

The question arises as to whether online wine marketing is really an effective tool to support consumption and sales, or whether it is a time-consuming activity that requires both adequate resources (financial, technical and professional) and a change in mindset.

The 2019 Big Wine Test survey in Hungary shows that 4% of shoppers shop online often, 18% have tried online shopping and 32% would like to try it. This is an increase compared to the previous 2 years and shows a positive trend. (<https://nagyborteszt.hu/eredmenyek> 2019)

Weighing up the pros and cons is essential, but it is important to bear in mind that future wine consumers will primarily shift their information and communication channels to the online space.

In the following, we will look at the benefits of being active in the digital space and what is holding wineries back from adopting online wine marketing.

TOURISM FOCUSING ON LOCAL PRODUCTS IN THE CIRCULAR AND SUSTAINABLE ECONOMY

László Dankó – Melinda Godzsák

University of Tokaj, Lorántffy Institute, Department of Tourism and Catering
H-3950 Sárospatak, Eötvös út 7.

The circular and the sustainable economy is one of the crucial points of the European green agreement: the wide availability of the sustainable products and services within the EU, the support of the conscious consumer behavior – besides others - in the transportation and in the catering industry based on the farm to table principle. The aim of the EU is to decrease the environmental and ecological footprints of the European food system, to strengthen its resiliency, to provide food security under the climate change and the decreasing biological diversity.

Catering businesses operating according to the farm-to-table principle are more and more common abroad, the main concept is that the restaurants procure the raw materials and ingredients directly from the producers without the mediation of a third party. Discovering local products for the support of the farm-to-table approach is a touristic activity of the visitors and the service providers of the slow life philosophy which helps to define the regional identity and to discover the cultural inheritances in line with the culinary traditions and which appreciate the traditional foods and drinks of the local communities. This along with the tourism provides a great opportunity for the visitors to encounter the foods at certain levels of the short value chain and to acquire knowledge from the creators of these foods.

Besides the search for the traditional foods, meals and drinks and the service development, the presentation highlights those methods which can help to discover the local foods – including the Tokaj wines – of a rural area, and the conscious visitors of the region might gain memorable food experiences due to the local gastronomy.

Under the first step of our research the evaluation of the available supply was necessary. As a result, the final aim is the promotion of the local products of the area, the introduction of a trade mark on the products so the visitors might achieve the above mentioned memorable food (local product shopping) experience with a higher certainty. The products meeting certain quality standards qualify for the application of a trade mark under the agreement of the application of the registered trade mark.

Local primer data collection and analysis experiences discovered during the set up and the testing of the database, methodologies supporting the sale of the local products for touristic purposes as a result of the analysis of the Hungarian and international literature and good practices were collected. As a result of our research, we suggest the application of twelve solutions for the conscious practical development of the food tourism activities in the natural and man-made heritage and destinations rich in value treasures.

Based on the set up and the testing of the local product database methodology and the research for the good practices of the food tourism, we could conclude that the increase of the demand for the local foods and drinks support the establishment of the circular economy and the long-run sustainability of the local agriculture, food system, communities and culture.

VINOTHERAPY – AN OPPORTUNITY AMONG THE SERVICES OF HEALTH TOURISM

Kata Feketéné Benkó - Lajos Szabó

Hungarian University of Agriculture and Life Sciences Economic and Regional Doctoral
School of Sciences, H-2100 Gödöllő, Páter K. u. 1.

The beneficial physiological effects of grapes are widely known, but primarily the fruit is raw its consumption is known, and the wine culture made the benefits associated with the fruit really known. A little-known tourist product in Hungary is possible the purpose of the research is to examine its breaking points, which can represent a new service not only in famous and high-quality wine-growing areas, but also in smaller, smaller good areas, since different grape varieties have different effects. It is widely known for its high vitamin C content, but in addition to many other "popular" vitamins, it also contains rare vitamins. However, it is mostly known for its high mineral content, but due to its nutrient content, it is an important source of energy for athletes and those engaged in mental work. The grape diet is known for its effects on digestion, but due to the high calorie content of the fruit, it does not belong to weight loss diets. Wine also has many beneficial effects, but its promotion is limited due to its alcohol content, although people have known grape juice for thousands of years and use it in various areas. The most well-known beneficial effect is manifested in the effect of antioxidants on the cardiovascular system, in the regulation of cholesterol levels, and in the protection against free radicals. In contrast to grapes, it can be a tool to fight obesity. According to some research, the moderate consumption of wine increases the body's resistance, strengthens the bones, and has even been shown to improve vision and protect against tooth decay. The most well-known effects are therefore related to the consumption of grapes and wine, despite the fact that there are thousands of years of experience using it externally. It has long been known that its alcohol content played an important role in wound disinfection when no other medical tools were available for this purpose, but it has been observed that wounds treated with wine heal faster and more beautifully than injuries not treated with wine. Even in ancient times, grape and wine wraps were used for cosmetic purposes: they make the skin more beautiful and flexible. With the combined use of all these well-known and little-known beneficial effects, vinotherapy provides a wellness service that has a beneficial health effect on both body and soul.

The research results of foreign vinotherapy were used for the research, the domestic familiarity and in terms of acceptance, we conducted a questionnaire survey and analyzed the results. Foreign research shows the popularity of vinotherapy procedures for their beneficial physiological effects attributed, as well as to the traditional procedure, which was already very popular in ancient times. The wine culture is known for its raw consumption of grapes and its use as a cosmetic ingredient other uses of grapes - as they can also be used in gastronomy, you are a very healthy green grape verjus is not known at all, and in connection with vino, the image of bathing in wine is associated, and they are averse to it, as they do not know its true content and effect. All this is coupled with the fact that - due to the alcohol content - the wine's intoxicating effect is an obstacle to its promotion. Moderate wine consumption - 1 dl per meal - can indeed be a part of wine therapy, but all under strict supervision, at the same time, it is not absolutely necessary to use this supplement in order to achieve favorable results. It already works in some places in Hungary vinotherapy service, but this is more of an expensive, exclusive category option, which is why only a few can afford it. The high price and the limited popularity of vinotherapy means that the service has not spread. It is a more well-known option in our larger wine regions, but it would also provide a new service where grapes are grown on a larger area.

The spread of vinotherapy as a tourist product is not simply a service, but because of its favorable physiological effects, it could be an important health tourism product, primarily large, of good quality in our grape-growing regions, but it can also promote its generalization in traditional but lesser-known areas. The spread of wine therapy could thus contribute to expanding the services of these smaller wine-growing regions, increasing tourism and increasing the employment of the local population.

BEER TOURISM

Andrej Balogh

Hungarian University of Agriculture and Life Sciences (MATE)
H-2100 Gödöllő, Páter Károly street 1.

In the world market for beers, you can meet an amazing selection and beer brand, type, but a significant part of global beer production, concentrated only in the hands of a few companies.

The total value of the world beer market was \$623.2 billion in 2020, with the five most mature beer brands being Corona, Heineken, Budweiser, Bud Light, and Victoria. The world's 6 largest beer producers dominated 58.9% of the total market. Craft beers have increased their popularity around the world, they are still lagging behind greatly. The Czech Republic leads in beer consumption per 1 person, with annual consumption fluctuating around 140 litres per person, followed by Germany with 104 litres per person, followed by Austria with 100 litres per person Hungary 65 litres per person.

The growth of demand-induced production received a greater boost from 2015, this momentum lasted until 2018, when it reached its peak with production of 420167 thousand hl. Beer is clearly one of the popular drinks in Europe, while in 2010 there were 4000 breweries operating on the continent, in 2013 the number of active brewing units was already 5000, in 2015 there were already 7500, in 2019 their number has already risen to over 10000. In addition to the increase in consumption, beer has become a major export item from the European Union to different parts of the world. In 2020, there will also be a huge break in the field of beer production, the pandemic ruined everything, there was a drop in production even greater than the crisis of 2008, in 1 year production decreased by 28721 thousand hls.

After the pandemic, the opening of more and more small-scale breweries, the expansion of the range, the emergence of beers with a moderate alcohol content all attracted an increase in consumption, and within the family of alcoholic beverages, beer broke forward, and beer tourism shifted in a qualitative direction. Beer tourism has become best known through beer festivals, beer museums and famous breweries to visit, but beer routes, beer weekends and beer dinners are also becoming more and more popular. In the course of my research, I examined beer consumption habits in Hungary in a questionnaire survey.

In Europe, beer is a traditional drink, it symbolizes prosperity, and beer drinking has a positive message through groups of friends to the consumer. The beer sector plays a significant role in the food economy in the European Union in terms of capital flows and retail trade from cereals to forks, is one of the pillars of employment, one of the engines of economic development in the European Union, and this is also a good message to consumers. Governments generally support (tax exemptions) and incentives (tax incentives) the functioning of the sector and this is also due to the increase in production, the reduction of excise duty through the price effect and the increase in consumption.

IMAGE EXAMINATION OF NORTHERN HUNGARY

Dániel Horváth

Hungarian University of Agriculture and Life Sciences, Doctoral School for Economic and Regional Sciences
H-2100 Gödöllő, Páter Károly utca 1.

9% (1.152.610 guests) of tourists registered in Hungary arrived to Northern Hungary touristical region. During my research, I looked for the answer, why the region keeps its position for decades with 8-9% share in number of tourists, why region cannot benefit from improvement of its touristical image. Results of researches pointed out that official message about the image of region (healthy-mountainous region, Healing Northern Hungary) is not well-know by local residents and tourists either. Character of region is still determined by natural sights and mountains, Eger and its region play also a key role. While studying the impact of baths developments we got the result that developments in the area of Eger are mostly useful. In regards to future, question of sustainability is more and more important, barrier-free tourism in the region improved the image a lot. While observing the life-cycle of touristic region, a positive progress can be noticed in Tokaj-Hegyalja.

Based on my in-depth interviews it can be stated that judgement of image of Northern Hungary and its touristical function is basically positive but discrepancy can be seen between the opinion of local residents and tourists. Compared to tourists, local residents valued their daily life more differentiated, as they face the difficulties of their life within the region. We can find examples for intention to create an unified image of the region but such efforts are prevented from central governance however increasing competition required to build up the individual brand of touristical region. Results of my researches show that image play a crucial role in the success of destinations. With help of image examination, we can get to know formed pictures, imaginations about destination, which allows us to reveal determining elements of image and main problems, areas to improve. As a result, conscious improvement and management of image will be possible, which contributes to strengthening the position of destination on the market. Current research can be a base for observing the self-image of local residents within the region, which was not allowed by low number of sampling and representativeness. It would be useful to examine opinion beside the local residents' and visitors' of those, who never visited Northern Hungary.

SUSTAINABLE WINE TOURISM – A SUCCESSFUL COMBINATION IN PROGRESS

Botond Sikó

Hungarian University of Agriculture and Life Sciences (MATE)
H-2100 Gödöllő, Páter Károly u. 1.

While wine as a product and pleasure item goes back thousands of years, in recent decades we can meet it in many new areas. Wine as a product goes beyond its gastronomic role, and it is no longer only encountered in hospitality, but also in tourism, among other things. Wine as a tourist product includes wineries' visitor centers, getting to know individual phases of wine production, as well as thematic wine tastings, whether they are purely entertainment or high-level, professional programs. Wine routes have been implemented in many parts of the world, which, as one of the important tools of tourism marketing, collect program opportunities and locations and present them around a wine region, a variety or other special characteristics.

While the role of wine is constantly growing and has an increasing importance and attraction in the field of tourism, another trend can be observed in tourism as well as in the field of wine production. This is the pursuit of sustainability. Due to the ever-increasing and ever-necessary rise of environmental protection, the countries of the world are striving to formulate regulations that protect the Planet, and these directly affect and apply to various businesses as well. In addition to these regulations, many large companies have recognized the importance of sustainability. On the one hand, large companies can achieve greater results with their efforts in a given time, and on the other hand, in parallel with the global spread of the idea, the purchase of sustainable products, the use of such services, and the preference of companies that take this into account are becoming more and more important for customers and buyers. Slowly but surely, the pursuit of sustainability is also gaining strength in terms of tourism and hospitality. In addition to environmental protection, waste management and reduction, energy saving and efficiency, and the reduction of harmful emissions are all increasingly important. All this, in addition to protecting the environment, helps to reduce the energy costs and other expenses of companies after the implementation of the necessary investments. The aspirations appear, for example, in hotels ("green hotel"), restaurants and other areas of tourism.

For companies, in addition to the goals and results already mentioned, sustainable operation can serve as a great marketing opportunity. Consciously planned and properly advertised, their activities can gain a competitive advantage and use their sustainability efforts as a strong attraction.

These efforts can also be recognized in the field of wine production, and more and more literature discusses and researches the connections between wineries, tourism and sustainability.

On the one hand, the research investigates the actuality of the topic by means of a literature analysis, and on the other hand, it examines the importance and possibilities of sustainability in the field of wine tourism with the help of questionnaire research.

With the research results, the author wishes to prove that sustainable wine tourism is a truly effective combination capable of attracting large crowds of guests, and can greatly contribute to the protection of our environment, as well as the success of companies' marketing activities.

NEW TRENDS IN HOSPITALITY, SUSTAINABLE GASTRONOMY

Richárd Vetró

Hungarian University of Agriculture and Life Sciences (MATE)
H-2100 Gödöllő, Páter Károly street 1.

As a result of the pandemic, hygiene and cleanliness have come into the spotlight. On the one hand, it is necessary to comply with epidemiological measures, and on the other hand, it is necessary to assure guests that they can keep themselves and their loved ones safe. The placement of hand sanitizers has already become essential in catering establishments, the continuous disinfection and cleaning of more visited sites, and the role of cleaning staff has also become more valuable.

Today, even in the field of hospitality, continuous digital communication cannot be ignored. It has become more important than ever for actors to be online, have a unified image and be featured on social media. Gastro-tourists before visiting a catering establishment, more and more people read reviews on the Internet, ask friends about their personal experience. That is why great emphasis should also be placed on high-quality and friendly service and establishing a good relationship with guests, as only in this way will a service provider receive positive reviews.

The FAO defines sustainable gastronomy as the kind of mindset and practice when paying attention to the sourcing of raw materials, ingredients, and growing methods. By following this philosophy, all hosts and guests can take action to protect the soil, preserve natural waters and biodiversity. Environmentally friendly farming methods and the availability of raw materials produced with environmentally friendly growing methods will continue to be important. The main goal of organic farming is to restore natural processes, use renewable energy sources, strive for the circulation of organic materials. Austria had the highest share of organic farming in the EU in 2018.

A new trend is emerging from the "reductionary" dietary trend, with moderation at its core. So it's healthier to eat less meat, but being completely meat-free isn't a feasible way of life for everyone. The English have already coined a term for the group of people who are looking for the "golden mean" between a vegan/vegetarian diet and "excessive meat consumption": those who consciously seek to reduce the consumption of animal products rather than exclude them from their diet altogether are called "reducetarians".

In my research, I looked at changes in the eating habits of generation Z. The younger generation is becoming more and more conscious consumers, it is important for them where the given product or raw material comes from on their table. Hungarian restaurant also have to keep up with these demands if they don't want to lose guests. The „farm to table” approach is not new in international practice, and chefs already pay special attention to the fact that the menu is composed of seasonal and preferably regionally produced vegetables, fruits and meats.

SURVEY OF WINE TOURISM IN TOKAJ-HEGYALJA

Peter Huszár

Hungarian University of Agricultural and Life Sciences Doctoral School of Economics and Regional Sciences, H-2100 Gödöllő, Páter Károly utca 1.

About the tourism of Tokaj-Hegyalja, it can be said that approximately 60% of the guests are under 30 years old, which also means that it is worthwhile to offer them existing and new program options during the summer period that satisfy the needs of this group. The questionnaire research carried out on Tokaj Bornapok shows that many tourists visit the area who come alone, without husband or wife and children.

The respondents had to select from a table the settlements that they think belong to the Tokaj wine region. It was surprising that, apart from Tokaj, Tarcal, Mád, Tállya and Szerencs, the respondents barely knew the other settlements. More than half of the respondents cannot name a single winery or winery in the Tokaj Mountains. Most of the respondents knew Király Winery, Oremus Winery, Hétszőlő Vineyard and Disznókő Winery. I have already received more encouraging answers to my question about the settlements belonging to the wine region. Mád, Tarcal, Sátoraljaújhely, Tolcsva, Szegi, and last but not least Tokaj were the settlements listed by the interviewees, which without exception form the core of the world heritage area.

Regarding the wine consumption habits of the respondents, it can be said that we prefer the consumption of white wine over red and rose wine, clearly in the case of women, and in the case of men, they could just "win" over red.

In my next question, I touched on the wines and wineries of the wine region. Of course, among the wines, Aszú is the one that everyone knows and mentioned first. This is followed by late-harvest and dry wines, of which Furmint and Muscat were mentioned in equal proportions, while Hárslevelű was mentioned a little behind.

Festival visitors were completely satisfied with the quality of the Tokaj Wine Days. With this question, it is assumed that the respondents were thinking about wines, because the question about the programs did not get such a good rate. They are also satisfied with the range, which makes sure that the exhibitors arrive at the festivals with excellent wines. It is a fact that - in most cases - the best producers take the effort, time and money to invest energy in participating in the festival in the hope of recognition. Most of the other program offerings of the wine festivals received the inadequate rating. This probably explains the low participation of wine consumers at wine festivals. The wine selection is adequate, but in order for the guests to pay the rather expensive entrance fee to the wine festivals, they expect better programs. This is understandable, because a wine festival should not only be about wine. This is a full-day program, for which you can expect high-quality other program offerings. In my opinion, the organizers should put more emphasis on this aspect.

WINE TOURISM IN MÁTRA

Lajos Szabó – Kata Feketéné Benkó

Hungarian University of Agriculture and Life Sciences, Department of Tourism and Catering
H-2100 Gödöllő, Páter Károly street 1.

Mátra is the second largest wine region in Hungary and covers a large area that includes the Mátra Mountains, the eastern foothills of Börzsöny, Vác, Veresegyház and part of Budapest. The vineyards of the region extend from Hatvan to Domoszló through the towns and villages of the Heves County.

The first mention of the vineyards of Mátra is made in the 13th century when there was much attention paid to the vines of the Gyöngyös area. From the 15th century, the wines began to gain a good reputation and it was decided that the local wines could be sold only as Gyöngyösi if after inspection it reached the necessary quality levels.

The total wine production area of the Mátra region is 32 497 ha, of which 24 261 is planted with 1st class grapes.

The climate of the region is temperate continental, and the Mátra Mountains protect the vines from the north winds. The spring arrives late in the region and the climate remains relatively dry throughout the year. The little rain that does fall, comes in the early summer months for May to June.

Across the region the soils are incredibly diverse and include chemoses brown forest soil, erubase clay, luvisol forest soil, loess, andesite, rhyolite tuff and humus. The soils are mostly low in lime content.

In the Mátra wine region, significant changes have also taken place in wine tourism and winemaking since the change of regime. In the late 1990s, early 2000s, foreign investors bought vineyards in eight settlements, and today we can find partly or fully owned wineries by French, English and German. Foreign investors brought with them a new technology in the region, reductive winemaking. The essence of reductive winemaking technology is to preserve the primary aroma and flavor in the wine by eliminating oxidation. Due to the complete blockage of oxygen, these wines are aged and stored in steel tanks. In Mátra hill, as a result, the traditional oxidative process is present, and 75% of the wineries produce wines using both reductive and combined processes. In the combined process, the wines are also aged in wooden barrels and steel tanks.

WINETOURISM IN GERMANY

László Guth

University of Tokaj, Lorántffy Institute, Department of Tourism and Catering
H-3950 Sáropatak, Eötvös út 7.

Wine tourism can be defined as visitation to vineyards, wineries, wine festivals and wine shows for which grape wine tasting and/or experiencing the attributes of a grape wine region are the prime motivating factors for visitors (Hall 1996).

Germany has a total of 13 wine regions, or Anbaugebiete ("ahn-bow-je-beet"), as they're called. The majority of German wine production is found in the Southwestern part of country.

In the far southern regions of Baden, Württemberg, and parts of Pfalz, you'll see a strong focus on red wines, particularly Pinot Noir and Blaufränkisch.

Rheingau, Rheinhessen, Nahe, and Mosel Valley produce the most Riesling. Some of the world's top Riesling wines come from Rheingau and Mosel Valley.

The Ahr is a tiny region noted in particular for exceptional Pinot Noir.

Finally, the satellite regions of Sachsen and Saale-Unstrut make remarkable Pinot Blanc.

Prädikatswine is wines are qualified by ripeness level and have minimum alcohol requirements. They are not allowed to be chaptalized.

Qualitätswine is wines are made with approved grapes sourced from one of Germany's 13 regions (Anbaugebiete). Chaptalization is legal.

Landwine is from 1 of 26 larger regions called Landweingebiete. Must be trocken or halbtrocken in sweetness.

Deutscher wine is wine without a geographical designation.

Sekt is Non-German sparkling wines with minimum EU quality standards.

The development of ownership relations is similar between the areas because 85% of the examined wineries are family wineries, while 90% of wineries are also concentrated in the hands of local entrepreneurs in Hungary. In the Germany wine region, the wineries keep a register of the number of visitors, which does not appear in Hungary. There are no official statistics on the number of wine tourists or their trends in Hungary. Technological innovations have had a positive impact on wine tourism, but cooperation between local businesses has been identified as the direction for development.

Perhaps not surprisingly, given the regional element of wine promotion and production, greater linkages were identified at the local level than the national level. However, results also possibly suggest the extent to which some wineries are product rather than experience focussed with respect to wine sales.

In their study, the author highlighted the importance of adopting competitive strategies and adapting, but both tradition and innovation need to be present in the product structure.

TOURISM ANALYSIS OF TOKAJ-HEGYALJA AND THE TOURISM DEVELOPMENT OPPORTUNITIES OF THE REGION

Ali Bagdadi

Budapest Business University, H-1054 Budapest, Alkotmány street 9-11.

The Hungarian government declared the developments in the Tokaj-Hegyalja a priority national project, and in 2022 the Department of Tourism of the BBS participated as a project partner in the preparation of the tourism development concept. The aim of the study to present the results obtained during the research of the region and to analyse the tourism situation of the 27 settlements in the micro region. Another objective is to examine the future tourism development opportunities of Tokaj-Hegyalja and to market the area's situation. The development of health tourism in Tokaj-Hegyalja plays an important role in reducing seasonality, which is mentioned why our analyses related to vino therapy services were also presented. The Zemplén region is one of the most economically under developed areas at the EU level, so it can also apply for significant EU subsidies in the next 7-year EU development cycle (2021-2026).

THE ROLE OF „BULL’S BLOOD WINE ORDER OF EGER” IN DEVELOPMENT OF REGIONAL WINE TOURISM

Tibor Kovács - István Vas

Eszterházy Károly University, Institute of Economic Sciences, Department of Tourism
H-3300 Eger, Eszterházy Square 1., Hungary

Eger is the heart of a famous Hungarian wine region (Upper Hungarian Wine Region) that is located in the northeast of the country, in the Bükk Mountains. Located mid-way between Budapest and Tokaj, it is the meeting point of the Northern Hungarian Mountains (Északi-középhegység) and the Great Plain (Nagyalföld).

Eger is a really complex and unique (touristic) brand: history, culture, architecture, spa, education, religion, vine and wine etc. meet under this name.

Based on wine culture there are several wine touristic events all the year round (e. g. Egri Csillag Wine Festival, Egri Bikavér Festival, Festival of Eger Wine, etc). To organize and to promote these events mean real multiple challenges and activities for each and every stakeholder in the city and in the wine-, gastronomy- and tourism business as well.

The aim of our study is to analyse a special professional civil society (“Bull’s Blood Wine Order of Eger”) and its activity in organizing, promoting and supporting these events as main organizer (or just helper) – ideas, tools, innovations, personal and collective activities in organization of these events and what the possible future look like concerning wine tourism in Eger wine district.

Methods used are analysing statistics, development strategies, scientific papers and personal in-depth interviews with leaders and members of the order.

WINE TOURISM GOOD PRACTICES FROM EUROPE AND THEIR POSSIBILITIES OF ADAPTATION TO THE TOKAJ WINE REGION, PLACED IN A COMPLEX DESTINATION MARKETING SYSTEM

Zoltán Szakál

University of Debrecen, Faculty of Health Sciences, Department of Health Informatics
H-4400 Nyíregyháza, Sóstói út 2-4.

The Tokaj wine region has been part of the world heritage for 20 years, and laws and regulations ensure that the protection of the 7 value-bearing attributes is realized. The balance of innovation and tradition must be maintained in the examined destination in the Tokaj wine region. This must be done not only from the point of view of viticulture and winemaking but must be interpreted jointly in several sectors. Wine tourism is a priority area and an important source of income for the region. In a complex destination marketing system, wine tourism already contains elements that have an indirect, direct, immediate, or long-term effect on the values of the wine region. Today, region and settlement marketing means integrated project thinking in a destination, which also takes into account multiplier effects, based on each other.

The Tokaj wine region has developed a lot over the past 20 years, with varying intensity. Primarily in the field of infrastructure, but today you can also find hard and soft developments. The development council and work organization of the Tokaj wine region do an excellent job, in order to ensure that all actors are present together at the decisions and that decisions are made by mutual agreement based on a common interest, for example in the field of tourism.

Based on the author's European experiences, study trips, in-depth interviews, and the international and domestic literature, this article presents elements of good practice and places them among the adaptation possibilities. There is never a one-size-fits-all item, customization is always required. The international trend focuses on consumer behavior and takes SWOT and STEEPLE factors into account. In terms of time horizon, to provide good alternatives in both the short and long term. The Tokaj wine region is on the right track, sustainability and the maintenance of stable tourist attractions and offerings is a very important issues. The complex destination marketing system gives us the opportunity to see the possibilities and prioritize them in financial terms, and then after the implementation comes the operation. The total communication and multi-actor model places cooperation at the center, the driving force is motivation, dedication, finding, involving, and valuing cooperating partners.

COMPARING „GOOD PRACTICES” OF SUSTAINABLE WINE TOURISM IN ITALY AND HUNGARY

Anikó Klausmann-Dinya

Hungarian University of Agriculture and Life Sciences (MATE)
Institute for Rural Development and Sustainable Economy, Department of Sustainable
Tourism, H-3200 Gyöngyös, Mátrai út 36.

Hungary Sustainability as a challenge (threat and/or opportunity) has become increasingly tangible for all economic actors since the 1970s. The three interrelated dimensions of this are economic – natural environmental – social sustainability, which appear from time to time with varying weight in managerial decisions – depending on which one is more strength, either on the demand side or on the supply side (or both). Sustainability as a challenge (threat and/or opportunity) has become increasingly tangible for all economic actors since the 1970s. The three interrelated dimensions of this are economic – natural environmental – social sustainability, which appear from time to time with varying weight in managerial decisions – depending on which one is more strength, either on the demand side or on the supply side (or both). This trend is also valid in the case of tourism, more narrowly the wine tourism, the characteristics of which we examined in the case of the Mediterranean region (Italy) and Hungary. Since this service (like the sector as a whole) is fundamentally globalized, global challenges of varying content and extent appear everywhere. The only peculiarity is that changes in both supply and demand sides are "enriched" with local specialties, which primarily affect the scope for responding to challenges (limitations related to financial and human resources). The last few years have been particularly hectic with regard to such challenges, see the increase in demands for classic environmentally friendly ("greening") services, then the social (and economic) effects of the Covid-19 epidemic, and finally, most recently, the incredibly accelerated inflation due to international conflicts (energy and food and livelihood crisis). Their intertwining effects (building on each other) pose an amazing amount of challenges for wine tourism as well. Moreover, today it is still impossible to assess how long this latest crisis will last and what outcome it will end with. In connection with case studies, we review and compare some "good practices" that can be thought-provoking in terms of survival in times of crisis. At the same time, we point out that it is not appropriate to consider these as universal "best practice", because they are always linked to a specific geographical location.

POLISH WINE CULTURE AND THE CULTURAL GEOGRAPHY OF POLISH WINEMAKING

Marek Durmała - Krzysztof Borkowski

University College of Tourism and Ecology, Sucha Beskidzka, Poland

Poland imports as much wine annually as Denmark, Switzerland, Sweden or Belgium, around 117 million litres (1.17 million hl - of which 3 million litres are Hungarian wine, approx. 2.5% in the January-November 2020 period, according to KSH data). The difference compared to other countries is primarily that the annual consumption per capita in Poland is only 4 litres. Polish wine consumers are typically younger and more interested in wine from other countries, preferring American or Chilean wines to European wines.

However, Polish wine production is not very well known despite its long historic traditions. In Poland, the XII. They started making wine in the 19th century, in the period that climate scientists call the medieval climatic optimum. During this period, grapes were also grown in England for the purpose of making wine. In Polish history, the names of some of the towns founded at this time - Winne Góry, Winiary, Winogrody - preserve this tradition. In the beginning, the Cistercian and Benedictine monks were involved in this, but they were soon joined by the free citizens living in Krakow and other cities.

The wine industry in Poland will develop very dynamically in the coming years. Many wineries have already been established, as the area of plantations increases, so does the number of wine lovers. It should be taken into account that, according to statistics, the number of vineyards is increasing every year, there are currently around 400, of which 200 are registered. There are five wine regions in Poland: Zielonogórski, Podkarpacki, Lesser Poland (Małopolski), Małopolski Gorge of the Vistula and Sandomierski. In Poland – due to its cooler climate – cold tolerant and resistant grape varieties are popular, such as Solaris, Muscaris, Johanniter Regent, Seyval Blanc, Aurora, Bianca, Jutrzenka, Marechal Foch and Leon Millot, but other varieties such as Riesling, Müller Thurgau and Pinot Noir also occur. One of the specialties of Polish wines is ice wine. It is made from grapes frozen on the stems, strongly acidic, but very sweet thanks to the low temperature and the special vinification technology.

Currently, the development of wine-tourism in Poland is experiencing its most dynamic period in history due to the growing number of vineyards. In Małopolska, ready-made tourist packages are offered thanks to the "ENOtarnowskie" project, created in response to the growing interest in wine tourism. In 2019, the project was awarded the certificate of the best tourism product by the Polish Tourism Organization. Lubus-land, the cradle of industrial viticulture that has survived for the longest time in Northern Europe, the longest and oldest wine tourism route in Poland, the Lubus Wine and Honey Route can be found.



DE VINO TOKAIENSI

Tímea Kiss

University of Tokaj, Lorántffy Institute, Department of Tourism and Catering
H-3950 Sáropatak, Eötvös út 7.

Sámuel Domby of Gálfalva (1729-1807) defended his doctoral dissertation "De vino Tokaiensi" at the University of Utrecht in 1758, which was published in the same year. The author not only summarised what was known about Tokaj wine, but also demonstrated through a series of medical and meteorological observations and chemical experiments why these wines were so excellent, what effects they had on a healthy human body and what ailments could be effectively treated by drinking them. In many respects, his work has stood the test of time: his observations on the importance of terroir and the protection of origin are still worth considering today.

PRINCIPLES OF DISCOVERING THE WRITTEN HERITAGE OF A WINE REGION: TOKAJ-HEGYALJA BEFORE PHYLLOXERA

István Monok

University of Tokaj, Lorántffy Institute, Department of Tourism and Catering
H-3950 Sáropatak, Eötvös út 7.

It is a cliché, even for outsiders to wine and viticulture lovers, that the turn of the 19th and 20th centuries was a period of phylloxera epidemics in the history of wine production. Most of the European vineyards were destroyed, grape varieties disappeared and only recently rediscovered by experts. It is not new in common talk that climate change, continuing today, means that not only the cultivation of vines, but all crops, is on a different basis than it was even half a century ago. Soil management has also changed, so that soils are not simply studied and described in a different way, but are in fact radically different from what they were, for instance, hundreds of years ago. So, the question is: why is it interesting to research the written heritage of the history of viticulture and wine production in this context? What can we expect from a detailed study of viticulture and winemaking in a particular historical period?

The archives are basically record documents of ownership and management and its profitability. In addition to documents relating to the vine and wine trade, they also contain manuscripts describing the rules of farming (village laws, legislation of wine communes, etc.).³ Ownership is closely linked to today's protection of origin. Anyone who wants to build a market promotion for the wine they produce today based on facts and on the real - not just pretended - qualities of the grape and wine can rely on the presentation of a terroir's past. From the decisions of village authorities, or even from the text of the wine community laws, one can learn about the cultivation of a particular area, and the procedures used in the past. The first documents of this kind from the Hegyalja - Mád, Tállya - date from the last decades of the 16th century and make it possible to describe the changes of cultivation over the last four hundred years as a process.

³ See for instance the series Szőlőhegyek történetének forrásai sorozat I–V. kötetek (Budapest, L'Harmattan, 2002–2011.) edited by Melinda Égető.

LAKE BALATON ITS ECOSYSTEMS AND VITICULTURAL LANDSCAPES – ON A MARKET BASIS: THE TRAGEDY OF THE COMMONS

István Jásdi

Jásdi Winery, Csopak, Hungary

“We only infer the future from the events of the past” - Saint Augustine

The Balaton Region has been inhabited from prehistoric times, with slowly increasing population during the Roman Empire and later. However, before the 19th century Lake Balaton was mostly in its natural state, a shallow lake surrounded by marshes, wetlands, and meadows, known in detail only by the inhabitants who lived from the natural resources, which came from the lake and the nearby agricultural areas (e. g. fish, ice, reeds, wood, game, agricultural products). The most important source of livelihood for the people in the area, from which they gained income once a year, was wine. Famous wines were produced in the quite weak agricultural lands. From the second half of the 19th century the water level of the lake continuously decreased due to a range of infrastructural changes and developments such as the construction of railway on the southern shore and the lock at Siófok, first opened in 1863 and subsequently developed during the following decades, which made the regulation of water level possible and resulted in the average water depth of 3.0 – 3.5 metres and a total water mass of 1.8 km³ of four cubic kilometres. The population increased around the lake and a substantial economic development took place alongside the establishment of new touristic destinations with particular emphasis on bath and health tourism. Ultimately, this development resulted a sustainable landscape in line with the market, which remained until 1945. During the socialist era intensive, monocultural agriculture on the waterfront caused eutrophication and fish-death in the water and loss of biodiversity and reduction of soil fertility on land. Large-scale fish farms producing eel, silver carp, grass carp were established, and parcelling out plots for the party elite in the basin was common. From 1990 even more intensive exploitation continued, new concrete housing estates and hotels were built, residential parks in the place of reeds were raised and piers deeply into the lake were constructed severely disturbing the sensitive habitats. To ensure the future existence of the lake, quality tourism based on nature, cultural landscape, silence, personality, and reasonable sport activities should be encouraged. Prohibition of over-expansion compliance with legislation must be enforced. Furthermore, the conservation of viticultural landscapes, introduction of organic agriculture and the restoration of vineyards needs to be intensified while land use changes, the conversion of agricultural land into building plots shall not be permitted. Maybe we're late? Let's not forget that certain aspects of the economic crisis can help nature. In a crisis, you can and should change your strategy. The economy is a bicycle. If it stops, it falls. You can go in a new direction. Maybe now is the time?

GLOBAL WINE TRENDS IN A NUTSHELL

Attila Radvánszki

Horwath HTL Hungary

Wine tourism worldwide has great potential for success as it is part of the “experience tourism” trend, providing an authentic and also hands-on experience. Social media can play a great role in this, not only making information more accessible but also giving individual companies a voice to communicate their stories, again adding to authenticity.

Many trends observed in wine tourism, as in the hotel industry, pertain to individuality and personalisation:

Wine making not only as an educational experience but also being able to make own blends, mixes and labels.

Unique, personalized tours – touring the vineyard by tractor or adding other elements such as fishing.

Unique partnerships and “pairings” of vineyards with golf, spa, art, architecture, food, traditional artefacts, etc.

Other trends and success factors are:

Focus on ecotourism and environmental friendliness whether it is an educational program on organic wine making or environmental certifications.

Development of wine villages contribute to the success of wine regions, designing the area around wine and accordingly opening restaurants, shops, boutique hotels and so on.

Wine events and festivals – these events offer good opportunities for marketing, special experiences for tourists (by including elements otherwise not part of the “wine experience” e.g. concerts) and bringing together the local community.

Quality wine tourism in Hungary has been developing for 25 years, despite the fact that wine making and viticulture have a much longer (BC 2.000-year) tradition in the Carpathian Basin, but due to historical reasons of the 20th century, major wine regions have been significantly developing since early 2000s in terms of general and hospitality infrastructure, as well.

The supply of quality wine hotels in the major wine regions of Hungary Wine started to develop in the last decade when demand for the combination of quality wines and hospitality services started to increase significantly. It is important to note that not only wine makers and their wines create demand for wine tourism but the destination itself including ancillary natural and man-made attractions such as nature, events, wine routes, etc.

The majority of existing wine hotels in Hungary targets all age groups due to a less diversified and mature market than in Austria.

The level of attractiveness of wine theming depends highly on the subject market’s attitude towards wine consumption and general enthusiasm for wine.

A real wine hotel concept has to involve a wine maker, a wine brand, signature products, location at an established wine region, long term strategy and investment, sufficient capex for FF&E, cooperation between stakeholders is essential in order to be able to organise destination-wide events all year round, etc.

Wine themed hotels rarely exceed a room count of 50 keys. Exceptions exist mostly in mature markets attracting guests with high purchasing power, and in case of respective properties with well-established wine brands.

THE TOKAJI AND THE VINICULTURE IN ANTAL SZIRMAY'S *NOTITIA MONTIUM, ET
LOCORUM VINIFERORUM...* (1798)

Áron Orbán, PhD

University of Tokaj, Comenius Institute
H-3950 Sáropatak Eötvös u.7.

Antal Szirmay (1747-1812), nobleman of Zemplén county, composed a number of historical, geographical, political and other works in the late 18th and early 19th centuries. In 1798 he published the *Notitia montium, et locorum viniferorum...* (1798), in which he described Hegyalja and the wine region. Beyond the contemporary conditions of the region, he collected data about the history of the specific settlements. In spite of the significance of the whole work with regard to geography, history and economy of the wine region, it has barely been investigated by modern scholars. In this paper I focus on that part which describes the Tokaji and the viniculture, with a special regard to Szirmay's sources. To what extent drew Szirmay on previous literature about the Tokaji? Can we say that this part of the *Notitia montium* is a relatively independent description?



UNIVERSITY
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ABSTRACTS – POSTER

S1- SESSION 1. Recent advances in viticulture

EFFECTS OF DROUGHT STRESS ON GRAPEVINE VEGETATION IN THE TOKAJ WINE REGION

Péter Balling¹ – Tibor Kovács² – Péter Molnár³ – György Zsigrai⁴

^{1,2,3} University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
 H-3950 Sárospatak, Eötvös út 7., Hungary

⁴ MATE Research Institute Karcag, H-5300 Karcag Kisújszállási út 166.

Numerous scientific publications on climate change predicts the average temperatures are likely to rise and it will have a significant impact on the productivity of viticulture. Meteorological data showed that the 2022 grapevine vegetation suffered a significant water deficit and that warm period exacerbated the negative effects of drought. This stress factor was assessed by several studies in the Tokaji Research Institute's Collection of Grapevine Varieties. In this collection, different Furmint clones and clone candidates were planted on rootstocks of Teleki 5C, Fercal and Ruggeri 140. The study included the bonitation of the vine foliage, clusters and capital condition and the recording of leaf area index (LAI) values using the VitiCanopy® application. A significant difference in the dissections was found between Teleki 5C and Ruggeri 140 (Figure 1). Based on this, Ruggeri 140 rootstock appears to be less susceptible to the negative effects of drought. The LAI values showed that Teleki 5C had a significantly larger leaf area than Fercal and Ruggeri 140 (Figure 2). The discrepancy could be explained by the fact that the larger leaf area is more transpiral and thus less resistant to the stress of higher temperature. However, the LAI measurement is more inflexible in detecting reduced growth vigour. This is based on the possibility of overestimating the leaf area between the upper wire pairs in a drought outlier year such as 2022. The study shows that the use of different rootstocks is justified for the purpose of yield safety in the Tokaj wine region. If more vegetation with a similar climate occurs in the future, it will be advisable to use new drought-tolerant rootstocks in addition to the Teleki 5C, which is widely used in plantations.

Figure 1 Summary of the visual assessment values for the three rootstock

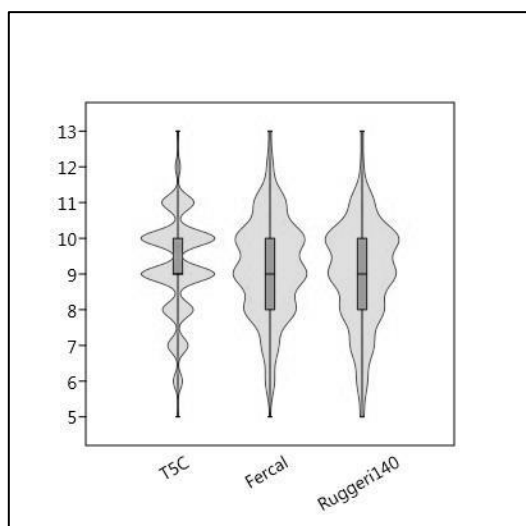
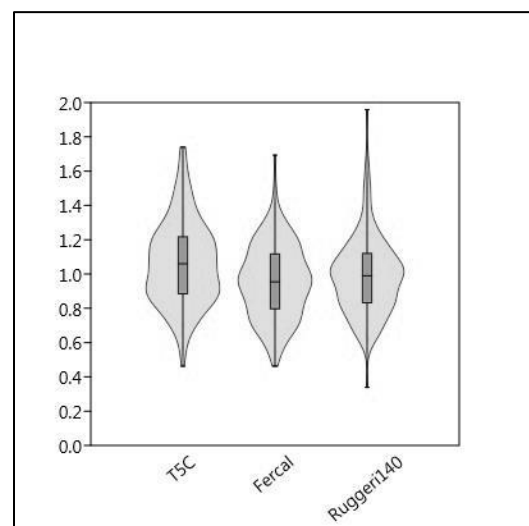


Figure 2 Values of LAI for the three rootstock



MONITORING BERRY AND CLUSTER DEVELOPMENT OF FURMINT CLONES DURING RIPENING

Laura Varga¹ – Péter Bodor-Pesti² – Antal Kneip³ – Zsuzsanna Varga⁴

^{1,3} University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sárospatak, Eötvös u.7.

^{2,4} Hungarian University for Agriculture and Life Science (MATE), Institute of Viticulture
and Enology, Department of Viticulture and Oenology,
H-1118 Budapest, Villányi út 29-43.

The subject of my research is the monitoring of cluster and berry development of Furmint clones during ripening.

The designated Furmint clones: ▪ Furmint T-508 ▪ Furmint P-51 ▪ Furmint T-509

▪ Furmint T-8/7575 ▪ Furmint T-8/7275 ▪ Furmint T-506

Ten clusters were selected from each type of Furmint. The bunch was photographed and weighed using a kitchen scale. The number of berries and their total weight were then determined. Berries were cut in half and scanned using a scanner. The length, width and extension of the clusters were determined from the photographs of the clusters. The scanned images were used to determine berry diameter, seed length, seed width and seed-shell distance. Based on previous test experience, the closest result to reality was the number of berries/cluster length.

The results are shown in Table 1.

8/7275	P.51	T.85	8/7575	T.509	T.506	T.508
0,950539	1,080665	1,265462	1,196274	0,983151	0,966221	1,131137

The most compact category was the T.85 clones, while the loosest category was the 8/7275 clones. This is a realistic result, since clone 8/7275 is a loose structure type with small berries.

Description of berry section at highest and lowest value

Table 2 shows the size of the berry sections of the most compact and loosest types and the data of seeds. The measurements were taken before the onset of defoliation, giving the result that clone T.85 has larger berries. These berries are also more affected by botrytis. Clone 8/7275 has small berries, which was confirmed by the measurements.

For seed length, I found that clone T.85 has a longer seed than 8/7275. In the lateral positioning of the seeds I found a larger difference. For the distance between seed and shell, I obtained a clearly higher result for clone T.85. This was to be expected, as a larger berry size is associated with a larger seed-to-flesh ratio.

The main result of berry sections and the data of seeds shows Table 2.

	Seeds front pages(mm)	Seeds other sides(mm)	Seeds lenght(mm)	Seeds widht(mm)	Berry diameter (mm)
T.85	4,59	4,24	7,77	2,81	12,69
8/7275	3,10	3,38	6,73	2,97	10,56

GRAPE VARIETIES CHANGE WITH SPITALER'S GREEN GRAFTING IN TOKAJ REGION

Monika Márkus¹ – Ágnes Kun² – Eszter Sipos³

¹Hungarian University for Agriculture and Life Science (MATE)
H-1118 Budapest, Villányi út 29-43.

²Kun és Fodor Szőlő Nursery and Table Grape Company, Kővágószőlős, Hungary

³ University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sáropatak, Eötvös út 7., Hungary

In the Tokaj wine region in 2006 the variety of 500 vines were changed for the first time with Spitaler's green grafting method. Since 2010 this technique has been used to change the variety of 10-15 thousand stocks per year in Tokaj alone, and about 25-35 thousand stocks in Hungary. The only method of re-grafting used in the Tokaj region is that Spitaler.

This filed or green grafting process starts at bloom and applies splice graft – diagonal (60-70°) single cut - onto green shoots sprouted on recut trunks that are fixed by flexible, non UV resistant rubber. Scions must be collected in winter like those for bench grafting, and stored at 1-4°C. Proper aftercare is extremely important, removing suckers and tying the grafted shoots specifically. This grafting process is very short, takes less than a minute per trunk. Probably 200-300 trunks can be grafted per person per day depending on personal skills and the condition of the vineyard.

With Spitaler's green grafting technique very promising results can be achieved. The variety of a whole vineyard of industrial scale can be changed: hectares within a reasonable period of time. Besides volume, the grafting success is satisfactory. In the course of following vegetation period arms can be trained and approximately 70 % of the average yield can be attained. The success of the grafting depends on the quality of the scions, the accurate grafting and the systematic aftercare.

In my study grafting of the past 5 years were tested in the Tokaj region. Furmint was the most frequently grafted variety with share of 55-96 %. Inoculation rate calculated per vineyard falls between 58.9% - 98.6%.

PROTECTION OF GENETIC DIVERSITY: MAINTENANCE AND DEVELOPEMENTS OF GRAPEVINE GENE BANK IN HUNGARY

Krisztián Gaál¹ – János Werner² – Balázs Szabó³ -
Péter Teszlák⁴ - Martin Pour Nikfardjam⁵

^{1,2,3,4} University of Pécs, Research Institute for Viticulture and Enology
H-7634 Pécs, Pázmány P.u.4., Hungary

⁵ Staatliche Lehr- und Versuchsanstalt für Wein- und Obstbau
D-74189 Weinsberg Weinsberg Traubenplatz 5, Germany

Maintaining biodiversity on Earth is humanity's fundamental task for the long-term sustainability of life. Effectively responding to today's global and rapidly changing challenges is only successful, if the variability of genetic resources is as large as possible. In the case of grape growing, the genotype is the most important tool of cultivation, which determines the success of farming for 30-35 years. Among the items preserved in gene banks, the old basic varieties and autochthonous varieties represent an increasing value, since these varieties may have properties to make their cultivation more effective under changing climatic conditions. The increasingly extreme weather, (the lack of available precipitation in the vegetation period and the more frequent occurrence of hot days are) is a huge challenge for the viticulture. Collectional varieties can also play an important role in protection against newly appearing pests and pathogens. The gene bank ensures not only the preservation of rare (displaced from cultivation) special varieties, but also gives opportunity for more knowledge and research of the varieties. The obtained results can provide solutions for winegrowers and winemakers.

We currently reserve 1570 items in the gene bank of Pécs, including wine grapes, table grapes, rootstock varieties and more than 50 items that can be found neither in national gene banks nor in large international collections, as Bagó szőlő, Bakhtiori csernűj, Balsare blanc, Cornucopia, Jabizlak, Piros gránát, Kárpáti rizling, Krabljak, Sesh i Zi, Polombina, or Tuingirni kara. Some of them are native to the Carpathian Basin, while others are of Western European origin. Our collection includes 32 *Vitis* species, 379 interspecific hybrids, 34 rootstock varieties and clones of 206 *Vitis vinifera* varieties, which are the defining varieties for wine grape cultivation.

The most important international and domestic grape varieties of the gene bank ensure the research of berry skin and flesh anthocyanin profiles, furthermore the correlation analysis between these and the molecular biological data.

The gene bank contains individuals propagated from the ancient vines of Europe, such as the 450-500-year-old Rosa Menna di Vacca variety in Pécs (validated by SSR markers). Our topic is also enriched by the Zametovka variety growing Maribor, which is considered as the oldest vine in Europe.

Variability provides a basis for breeding, viticultural and oenological varietal value research. The development of the gene bank means exploring and collecting of additional varieties, but as a further step, the digitalization of the stored information and the construction of a database are important tasks for the future.

Our main goal is to further develop the Pécs grape database, namely collecting and managing ampelographic descriptive data, imaging files, providing information on the origin of the varieties, based on the data related to their breeding, including parents, family trees and descendants. As a result of our work, the database system can also store the data obtained by molecular methods (SSR, SNP), which identify the genotypes providing support for the discovery of further relationships and for further research about the origin of the domesticated grapevine.

ENDOGENOUS COMPONENTS OF DIFFERENT EXTRACTS OF MERLOT GRAPE

Kornélia Kőszegi¹ - Igor Gaspar¹ – Erzsébet Kiss-Bába² – Andras Koris¹ – Éva Stefanovits-Bányai³

¹Hungarian University of Agriculture and Life Sciences, Institute of Food Science and Technology, Department. of Food Process Engineering,
H-1118 Budapest, Ménesi út 44.

²Hungarian University of Agriculture and Life Sciences, Institute of Agronomy, Department of Plant Physiology and Plant Ecology,
H-1118 Budapest, Ménesi út 44.

³Hungarian University of Agriculture and Life Sciences, Institute of Food Science and Technology, Department of Foodchemistry and Analytical Chemistry,
H-1118 Budapest, Villányi út. 29-43.

Winemakers in Eger have been producing white wine since the Middle Ages, but from the 17th century onwards blue wine grapes became more characteristic of the wine-growing area. Although 'Merlot' is a blue grape variety of French origin, it also thrives in the climate of the Eger wine region. Blue grape varieties and the wines made from them contain many valuable endogenous components that are important for health protection, of which polyphenols and organic acids are particularly important in addition to vitamins and minerals.

In our experiment, we tested 'Merlot' grapes harvested from the Eger wine region at the end of September 2022. The aim of our work was to determine which solvent and which extraction method would be the most effective is to extract endogenous components from the seedless and grapes containing seeds.

Different solvents, distilled water, 80 % ethanol and acetone were used to extract the valuable components. The concentration of the solutions were the same in all cases, for a better comparison of results Continuous stirring and ultrasonic treatment were chosen to increase the efficiency of extraction. Determination of endogenous components that can be extracted from the berries was performed both from seeded and seedless berries.

For the determination of polyphenol content, antioxidant capacity and essential anthocyanin content in blue grapes, the spectrophotometric method was chosen for its simplicity and low cost, but vitamin C was measured by ELISA Reader.

Our results show difference in both polyphenol and anthocyanin content, due to the different solubility of the polyphenolic components present in grapes. A similar close correlation can be observed in the antioxidant capacity and vitamin C content, which play a role in health protection. These results are true for both samples, seeded and seedless grapes. Naturally, the values obtained were higher for samples containing seeds due to the valuable endogenous components in the seeds.

Naturally, the measured values were higher for samples containing seeds, because of the valuable components they contain.

COMPARISON OF THE CLUSTER COMPACTNESS OF TWO FURMINT CLONES WITH DIFFERENT ROT SUSCEPTIBILITY ON DIFFERENT GROWING AREAS

György Lukács Reiser – Laura Varga

University of Tokaj, Department of Viticulture and Oenology
H-3950 Sárospatak, Eötvös út 7.

The main objective of this research is to compare the cluster compactness of two Furmint clones with different bunch rot tendency, and observe them in different growing areas. The two clones selected are Furmint T.85 and Furmint 8/7275.

Areas of sample collection:

- Kővágó vineyard, Mád
- Pajzos vineyard, Bodrogolaszi

From both areas, 12 clusters per clone were collected and photographed individually on a calibration line. The weight of the individual clusters was also measured using a digital scale. An image analyzing software was used to evaluate the photos and determine the length, width and area of the clusters. Based on the measured data, certain density indicators were determined, which were used to characterize the density of the clusters.

The density indicators are the following:

- Cluster weight/Cluster length
- Cluster weight/Area
- (Cluster length*Cluster width)–Area

The results of the measurements can be observed in Tables 1 and 2 (mean values).

Kővágó vineyard				
	Length (mm)	Width (mm)	Area (cm ²)	Mass (g)
T.85	160,35	77,03	88,23	140,3
8/7275	169,57	80,42	94,64	144,8
	Weight/Length (g/mm)	Weight/Area (g/cm ²)	(Length*Width)–Area (cm ²)	
T.85	0,8642	1,5666	37,13	
8/7275	0,8496	1,5268	42,70	

Pajzos vineyard				
	Length (mm)	Width (mm)	Area (cm ²)	Mass (g)
T.85	164,58	98,79	109,01	222,4
8/7275	184,91	99,98	130,03	233,2
	Weight/Length (g/mm)	Weight/Area (g/cm ²)	(Length*Width)–Area (cm ²)	
T.85	1,3645	2,1867	57,48	
8/7275	1,2998	1,9114	56,27	

According to the baseline data, the clone 8/7275 gave higher length, width and area values for samples from both vineyards. This was to be expected, as this type is a clone with a longer stem structure and more branched clusters. In terms of cluster density, clone T.85 was the more compact clone in both vineyards. These results are in accord with literature data, as this clone is referred to as having a dense cluster structure. Comparing the data from the two places, it can be concluded that in all cases the samples from the Pajzos vineyard gave higher length, width and area values than those from the Kővágó vineyard. This can be linked to the different growing conditions, such as soil quality and water supply.

COLD HARDINESS OF GRAPEVINES GROWN IN COOL AREAS

Gąstoł M. - Banach P. - Zemczak M. - Kiszka A.

Department of Horticulture
Agricultural University in Kraków, Al. 29 Listopada 54, PL 31-435 Kraków

Low temperature is one of the most important stressors for plants. The cold resistance is even more challenging when we grow grapevine in a cool climate area. Freezing temperatures during mid-winter along with no snow cover, and early spring frost can seriously damage vineyards, resulting in fruit production losses. Although there are some methods preventing (to some extent) vines against the winter cold (e.g. soil burial), but they are not sufficient nor practical. Therefore, to seek new, high-quality cultivars with an increased cold tolerance is crucial for developing the grape industry in cold regions.

The visual assessment, carried out in natural conditions, after a cold winter ($-26\text{ }^{\circ}\text{C}$), showed differentiated cold hardiness of the cultivars tested. The smallest buds' damage among the red varieties was found for Frontenac, Marechal Foch and Leon Millot (respectively: 2.60, 4.20 and 5.10 according to a 10-point scale, in-vivo assessment). Among white cultivars, Sibera (4.50), Aurora (4.80) and Muskat Odesskij (5.80) had the most cold-resistant buds. Regent (9.50) and Rondo (8.80) turned out to be the least resistant to cold; among the whites it was true for Bianca, Hiberna and Jutrzenka. Hiberna also had the least frost-resistant shoots and conductive bundles (phloem).

In order to carry out more precise determinations, shoots from all 13 cultivars were subjected to controlled freezing in a climate chamber. The obtained results indicate that the buds of the studied cultivars revealed the resistance down to $-20\text{ }^{\circ}\text{C}$. As the temperature drops further, the symptoms of damage increase. The shoot strength is slightly higher and for our varieties it is $-22\text{ }^{\circ}\text{C}$.

At the critical temperature of $-15\text{ }^{\circ}\text{C}$, the variety has no effect on shoot damage, but for the buds, some variation in resistance can be observed - the Rondo variety reacted the worst. At a temperature of $-20\text{ }^{\circ}\text{C}$, some variation in the resistance of shoots was proven, but it is clearly visible for the buds. The group with a low percentage of damage includes: Marechal Foch and Frontenac of red varieties, and of the white varieties - Aurora. For the Frontenac variety, high bud resistance was also found at $-22\text{ }^{\circ}\text{C}$. At the critical temperature of $-25\text{ }^{\circ}\text{C}$, the buds of the following varieties: Regent and Rondo (respectively: 52.55 and 50.57%) have the lowest resistance. In the case of the lowest applied critical temperature - no differences between the shoot resistance were observed. The highest frost resistance for the buds was demonstrated for the Aurora, Bianca and Sibera cultivars (35.8; 34.8 and 45.3%, respectively), and among the red ones - Frontenac (35.1%) and Marechal Foch (36.82), and followed by Leon Millot (44.1%).

EXAMINATION OF SPECIAL CHEMICAL COMPOSITION AND WINE STABILIZATION DIFFICULTIES OF TOKAJ ASZÚ WINEMAKING

Zsuzsanna Bene – Máté Varga

University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sáropatak, Eötvös út 7., Hungary

Tokaji Aszú is known all over the world as one of the oldest botrytized wines. Special microclimatic conditions (due to the Bodrog and Tisza rivers, Indian summer), soil conditions (clay, loess on volcanic bedrock) and grape varieties (Furmint, Hárslevelű) of the Tokaj region offer favourable parameters for the formation of noble rot caused by *Botrytis cinerea*.

The grapes undergo complex chemical modifications as the joint result of the enzymatic activity of *Botrytis* and the physical process of concentration: 1. *Sugar content*. 2. *Polyol*: Three main polyols are responsible for the increased viscosity and “body” of Botrytis wines: butanediol, glycerine and sorbitol. 3. *Acid composition*: The effects of *B. cinerea* activity increases the quantity of citric acid and succinic acid in the must. 4. *Aroma compounds and other constituents*: significant roles are played by furfural, benzaldehyde, a phenylacetaldehyde and benzaldehyde cyanohydrin, as well as the so-called mushroom alcohol (1-octen-3-ol). Sotolon (3-Hydroxy-4,5-dimethylfuran-2(5H)-furanone) 3-hydroxy-4,5-dimethyl-2 (5H) furanone) produced by *Botrytis cinerea* is one of the most important components that gives the distinctive “Aszú” aroma (caramel flavour). 5. *Polyphenols*: During botrytization the three main hydroxycinnamic acids, p-coumaric acid, caffeic acid and ferulic acid, accumulate in the berries. 6. *Free amino acids*. 7. *Biogenic amine*.

In our work, we examined Aszú base wines and a 6 puttonyos Aszú wine before bottling. The determination of the chemical composition was measured by NMR technique and 6 types of stabilization options were used: 1. conventional montmorillonite clay minerals (BW200 PRO) focused strictly on protein stabilization; 2. conventional clay minerals supplemented with a minimum polyphenol-reducing harmonizing agent; 3. conventional clay minerals supplemented with a higher dose of the polyphenol-reducing agent intervening more drastically to reduce polyphenol compositions; 4. the use of a very gentle plant protein, extracted from pea protein; 5. combined detergent: Na-activated bentonite, silica and chitosan content; 6. combined detergent supplemented with vegetable protein.

As a result of the examination, it can be stated that the chemical composition of wines containing botrytised raw materials differs from that of normal sweet white wines. Particular attention should be paid to glycerine, succinic acid, galacturonic acid, citric acid, 2,3-butanediol, arginine, proline, caftaric acid and epicatechin and to test their proportions in different vintages. In the case of wine stabilization, it can be found that protein stabilization was achieved in all cases except plant protein, but in sensory evaluations the use of combinative agents showed less loss of aromas compared to control, cleaner, more intense scents and aromas came to the fore compared to the conventional method of detection. By itself, although very beneficial for organoleptic properties, the vegetable protein is gentle but it is not enough to achieve the protein stability of Aszú wines, presumably due to the high extract content.

Global warming makes the development of *Botrytis cinerea* more difficult too, polyphenols and mineral material content increase, the grape skins thicken while the new difficulties regarding wine stability that arise must also be taken into account.

LIGHT TRANSMISSION INTO WINE BOTTLES: RELATION TO LIGHT-STRUCK FLAVOUR AND ESTIMATION OF SHELF LIFE

Zsófia Laposa¹ – Ernő Keszei²

PTE Research Institute Viticulture and Enology, University of Pécs, Faculty of Sciences, H-7622 Pécs, 48-as tér 1.

Eötvös Loránd University, Institute of Chemistry, H-1053 Budapest, Egyetem tér 1-3.

Wine is typically bottled to deliver it to consumers. Bottled wine displayed in wine stores or supermarkets is exposed to ambient light that can deteriorate its quality. Here we discuss some photochemical processes responsible for this damage, then report our measurements of light entering wine bottles. Tasting experiments of bottled white wine illuminated by a compact fluorescence bulb support deterioration of taste and appearance of off-flavour notes. Using optical and photochemical modelling we can calculate shelf life in good agreement with tasting results.

Two major photochemical pathways are mainly responsible for the development of light-struck flavour (or „gout de lumiere”). Redox reactions with the help of iron(III) complexes involving singlet oxygen consume sulphites, result in photodegradation of important flavour notes and lead to formation of acetaldehyde. This process can also turn diphenols in quinones, leading to browning of white wine. Riboflavin and pantothenic acid photocatalyse degradation of sulphur-containing amino acids resulting in the formation of low threshold volatile off-flavour compounds as hydrogen sulphide, dimethyl sulphide, dimethyl disulphide and ammonia.

Measuring transmittance of light within different bottles (clear Bordeaux, bluish green slender-shape Alsace, light amber Burgundy and a somewhat bulky dark amber Alsace). we have found that the intensity of light entering bottles depends – in addition to the colour of the glass material – also on the shape of the bottle and placement of the capsule and label(s). According to our studies, intensity of transmitted light into the bottles is typically half or less than the transmission of the glass material, depending on the size and placement of capsule and label(s). We have also made shelf-life calculations based on optical and photochemical modelling of light transmission and subsequent reactions. Organoleptic tasting experiments revealed that white wine in clear (flint) and bluish-green bottles suffer light strike to a detectable degree within a few days. Model calculation results were in good agreement with these findings. Thus, we also calculated the protection of amber bottles based on our in situ light transmission measurements.

Results of these calculations have shown that wine in amber bottles survives light damage for several months to a few years, depending on the hue of the glass. In accordance with recent findings, we also consider that it is better to avoid bottling wines in clear (flint) or bluish green (and green) bottles. In case if wine is contained in these bottles, avoiding lighting in the harmful wavelength of 320 to 440 nm can largely increase the shelf life of white wines.

MEDICINAL WINES – SOME SENSORY AND ANALYTICAL ATTRIBUTES ASSESSMENT

Gąstoł M.¹ - Szewczyk A.² - Krośniak M.³ - Kiszka A.¹

¹Department of Horticulture, Agricultural University in Kraków, Al. 29 Listopada 54, PL 31-435
Kraków

²Department of Pharmaceutical Botany

³Department of Bromatology, Faculty of Pharmacy, Collegium Medicum, Jagiellonian University

Medicinal wine (*vina medicata*), now almost forgotten, is one of the oldest forms of medicine that has been eagerly used since antiquity. They are obtained by extracting medicinal raw materials in wine or by dissolving drugs in it. The purpose of medicinal wine is to fortify the medicinal herbal function by extracting the functional components with wine and then condensing the extract, concentrating the effective agent. Usually, plant materials or their extracts, less often organic, chemical and mineral compounds, were used. Due to the presence of alcohol and organic acids in the wine, medicinal substances are easily extracted from the raw material, which ensures their stronger action. The obtained macerates are very stable mainly due to the tannin content. Wine also acted as an agent improving the taste and aroma, which made the patients more willing to take this form of the drug. It is also important that the wine itself has a strengthening effect (*tonicum*) and an increase in appetite (*stomachicum*).

As it is important to choose the right substances dissolved in the wine, the aim of the study was assess 17 different recipes of medicinal wines (hydroalcoholic herbal extracts obtained by maceration). The following herbal material were taken for the maceration process: aloe vera, common nettle, elderberry, hawthorn, sea buckthorn, lavender, mint, sage, English walnut, common dandelion, juniper, calendula, birch, rosemary, rose, rowan and pine. Each of herbal components was cold macerated for 6 months in two different base wines: 'Aurora' (white grapes) and 'Leon Millot' (red ones).

The basic wine parameters (dry matter content, soluble solids content, titratable acidity) as well as total phenolic compounds and their antioxidant properties (expressed as FRAP) were measured. Moreover, the sensory analysis according to WSET procedures was performed. Red medicinal wines have a higher content of sugars, polyphenols, total antioxidant capacity and a higher degree of flavor compared to white counterparts. The highest content of polyphenols and the total antioxidant capacity were observed in red wine with the addition of lavender and rosemary (1,04 g GAE L⁻¹, 19236 μmol Fe⁺² L⁻¹). The lowest polyphenol content was found in the control wine with the addition of pine shoots and dandelion flowers (0,56 and 0,59 g GAE L⁻¹, 10258 and 9887 μmol Fe⁺² L⁻¹, respectively).

The addition of the herbal material disturbed the clarity of wines, however there was no differences among the used herbs. Dry infusion increased the intensity and the total colour perception when compared to the fresh infusions. Red medicinal wines were more aromatic. The addition of dry raw material gave a better, stronger and more persistent aroma. The sum of taste sensations was higher in the case of red herbal wines.

THE EFFECT OF DEALCOHOLIZATION ON QUALITY PROPERTIES OF WINES

Zemczak M. - Kiszka A. - Gąstoł M.

Department of Horticulture, Agricultural University in Kraków
Al. 29 Listopada 54, PL 31-435 Kraków

Increased awareness of the harmful effects of alcohol on the body, as well as the fashion for a healthy lifestyle have resulted in the great demand for a non-alcoholic beverages. The target group for zero-alcohol products is increasingly abstinents, drug users, pregnant women and drivers. Non-alcoholic wines are assumed to have all the advantages of alcoholic wines, but without the harmful effects of ethanol. According to experts, the segment of this type of wines has great development potential, however, it requires increased marketing and improvement of the quality of the drinks offered. There are many methods that can completely or partially remove alcohol. They differ not only in the technology used, but also in the quality of the final product obtained. The currently used strategy in the production of non-alcoholic wines is the strategy of a compromise between the alcohol content and the composition and sensors of the drink. Among the methods of dealcoholization, there is a group of methods based on thermal distillation, including vacuum distillation. Lowering the system pressure allows the boiling point of the liquid/solvent to be lowered. The use of this method for the dealcoholization of wine allows the alcohol to be removed from the solution at much lower temperatures than in the case of ordinary thermal distillation. Subjecting wine to heating and distillation causes major sensory changes. The obtained product is assessed as having a worse taste compared to traditional wine. It is related to the destructive effect of temperature on some volatile components of wine.

The aim of this study was to determine the influence of different temperatures during vacuum dealcoholization on wine quality parameters. The samples of Polish white and red wines were dealcoholized at the following temperatures: 47, 50, 55°C under a negative pressure of 0.09 atm. The total content of polyphenols was examined with the spectrophotometric method, the total antioxidant activity with the FRAP and DPPH methods, and the content of organic acids with the capillary isotachopheresis (ITC) method. It has been shown that the dealcoholization temperature has a significant influence on the quality of wine. Dealcoholized white wine was characterized by a reduced content of polyphenols and a lower antioxidant activity. In the case of red wine, these parameters did not change. The influence of the dealcoholization temperature on the antioxidant potential of wines requires further research. The highest concentration of organic acids was determined in dealcoholized white wine at 50°C. Red wine obtained in the distillation process, unlike white wine, showed no changes in the shade of color.

EFFECT OF CLUSTER THINNING AND CLUSTER HALVING ON QUALITY OF CABERNET SAUVIGNON HARVEST

Péter Podmaniczky

Rád-Vin Kft.

H-8638 Balatonlelle, Rádpusztá 0170/63 HRSZ, Hungary

Cabernet sauvignon from a vineyard in Szólád, Balatonboglári wine region, Hungary was subjected by cluster thinning and cluster halving in 2006. The Balatonboglár wine region is located on the south side of Lake Balaton.

Cluster thinning and cluster halving were performed at the berry sugar content 10 Brix°. The total phenol content was determined by the Folin-Ciocalteu method. The polyphenol profile measured by HPLC. The treatments had no significant effects on the sugar-, acid-, total polyphenol and anthocyanin content, anthocyanin profile.

THE IMPORTANCE OF PERFORMANCE EVALUATION IN BUSINESS SECTOR- A POSSIBLE ADAPTATION OF BALANCED SCORECARD FOR ORGANIZATIONS OPERATING IN THE WINE BUSINESS SECTOR

Orsolya Hogya

University of Tokaj-Hegyalja, Lorántffy Institute, Department of Economic and Business
Development
H-3950 Sárospatak, Eötvös út 7., Hungary

In order to get an objective and real picture of the effectiveness of organizational performance, performance evaluation has crucial importance in the life of business organizations. In order to achieve the goals of our organization, the continuous feedback of performance is essential. Successful organizations almost all apply some type of organizational evaluation methods, and at some level we can talk even about performance management than performance evaluation, which is a continuous activity of performance measurement, feedback and adaptation. Over the years several organization performance evaluation methods have been developed, by now many of them focusing on a wide range of evaluation aspects rather than only financial perspective as it was usual before. One of the most popular complex performance evaluation method is *Balanced Scorecard*, developed by Kaplan and Norton. The main advantage of the method is that it is an integrated organization evaluation system using several perspectives of performance measures, and it can be adapted to different kinds of organizations taking into consideration the specialties of the given business.

In my work I am introducing a possible way of adaptation of Balanced Scorecard for organizations operating in the field of wine business based on the literature of different authors. Performance evaluation can be a crucial issue in the life of wineries, since they are exposed to a strong competition on the market, and turbulent change of external environment affects their operation as well.

Traditional perspectives of Balanced Scorecard – financial, customer, internal, innovation and learning perspectives- can be completed by a new perspective which is element is the operation of wine businesses, namely sustainability. Sustainable development and ecological factors have a big importance in agriculture. Grape growing is one of the most intensive system in agriculture, therefore it is comprehensible that sustainability is a significant aspect of organizational performance. *Sustainability performance* is increasingly part of performance measurement of wine businesses, which may be extended to the following indicators: number of initiatives redounding preservation of natural resources and biological diversity, reuse of water, quantity of waste recycled, and environmental costs. (Gomes, 2021.) Social responsibility is also a connecting concept of sustainability.

THE IMPORTANCE OF VINEYARDS IN THE PROTECTION OF BIODIVERSITY: A REFUGE FOR ENDANGERED FLORA AND FAUNA IN SLOVAKIA

Alexander Fehér¹ – Martin Hauptvogel² – Iveta Fehér Pindešová³

^{1,2} Slovak University of Agriculture in Nitra, Institute of Environmental Management FESRD,
Tr. A. Hlinku 2, SK-94176 Nitra, Slovakia

³ State Veterinary and Food Institute, Veterinary and Food Institute Bratislava, Botanická
ulica 15, SK-842 52 Bratislava, Slovakia

The origin of steppes or forest-steppes in the territory of Slovakia is questionable. Due to the low number of so-called steppe years (with low total precipitation and high average temperature), we cannot consider the steppe as a climatic-zonal vegetation formation. However, grasslands of a steppe character are known from mosaic biotopes in the country with mesophilic vegetation, especially in places affected by local conditions (microclimate – south-facing slope, shallow soil, etc., more in Fehér, A.: *Vegetation and Cultural Landscapes*, Cham: Springer 2018). These are the conditions created by most vineyards, so a significant part of xerothermic biotopes in Slovakia is concentrated in or near vineyards. Traditional or close to traditional cultivation of vineyards does not significantly threaten these edaphic and local habitats of the steppe character, but on the contrary, human intervention can promote their occurrence (mowing, trampling, occasional grazing of farmed herbivores under supervision, etc.). In our research, we evaluated four selected vineyards in SW Slovakia, which were evenly distributed (1. Locality in the loess colline area of Vřšok near the town of Štúrovo, 2. Hilly locality Drieňova hora near the village of Nová Vieska, 3. Vineyards in the Tribeč Mountains on the southern limestone slope of Kolíňanský hill in the cadastral territory of the villages of Pohranice, Host'ová and Kolíňany, 4. Vineyard in the village of Vinosady on the southeastern slopes of the Lesser Carpathians). During the research, we observed a number of protected and endangered plant species in the vineyard landscapes. For example, the very rare *Amygdalus nana* shrub grows in the first and the second localities, and the nearby meadows of the first locality are the only place in Slovakia where *Crambe tatarica* can be found. On the third locality e.g. *Adonis vernalis*, *Lathyrus lacteus* and the critically endangered species *Althaea cannabina* were registered. In the fourth locality, we identified *Pulsatilla pratensis* subsp. *bohemica*, *Dictamnus albus* and several species of the family *Orchideaceae*. Unfortunately, some rare species are threatened by invasive plants and a reduction in the intensity of use. The vineyards also had a rare fauna, of which perhaps the most important species were molluscs, insects and reptiles. We mention e.g. *Mantis religiosa* and *Lacerta viridis*, but the presence of game animals is also significant (however, this can also cause economic damage). Vineyards can have a high share in the preservation of some rare species of plants and animals in Slovakia.

The paper was created within the framework of projects of the Grant Agency of SUA Nitra Phytoextraction of risk elements from soil substrates through selected species of fast-growing energy plants and their production potential (GA SPU/2021/1), APVV Waste and constructions – modelling the effectiveness of alternative cooperation options of administrative authorities (APVV-20-0076) and the project of the Operational Program Integrated Infrastructure: Demand-oriented research for sustainable and innovative food, Drive4SIFood.

VISUAL AND ARTISTIC ANALYSIS OF JÓZSEF SZABÓ'S GEOLOGICAL AND VITICULTURE MAP

Zsuzsa Sándor

University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sárospatak, Eötvös út 7.

József Szabó's map was made in 1865, using cartographic and printing techniques typical of the time, as well as artistic style elements. The pictorial and textual analysis shown on the poster is visual, art historical and technical in nature. It includes signs on the map: colors to represent geological properties; method of marking vineyards, forests, settlements, railway lines. The text and decoration carry definable Baroque-Rococo stylistic features. The graphics on the site are stunning, and the workmanship is incredibly detailed and plastic. Its size is quite large (69.1x69.9 cm), so it can be found folded in the famous "Tokaj-Hegyaljai Album". This map and some other centuries-old publications are arguably part of the cultural heritage of the Tokaj region. As a lithography and as a type of visual work, it is one of the most beautiful and significant prints in Hungary.

The analysis is based on the examination of the specime in the Grand Library of Sárospatak, the poster contains mainly photographs taken there.

THE HERITAGE OF JÁNOS MATHIÁSZ

Zsuzsanna Bene – Sándor Némethy – Rita Wolkensdorfer

University of Tokaj, Lorántffy Institute, Department of Viticulture and Oenology
H-3950 Sáropatak, Eötvös út 7.

The vine breeder, the winemaker, the scientist and the lawyer. The holder of all these professions and titles is János Mathiász. Until today the country and specially the Hungarian wine sector is really thankful for all his spirit, work and achievement.

He was the most prolific table grape breeder in the world. He won more than 200 hundred gold medals in different championships, with his grapes, and his wines. (Contrary to current practice at that time in those kinds of competitions only one gold medal was awarded.)

He began his career by collecting 1600 grape varieties, including many French and Italian grapes. A trip to France motivated Mathiász not only to take over grapes, but to cross-breed new ones. In 1881 he took over the management of the 100-acre Andrassy vineyards in Szőlőske (the village belongs today to Slovakia). There he started his cross breeding activity and his goal was breeding new varieties with early to late ripening, beautiful appearance, good transportability, rich yield and resistance to diseases and rot. He bred an incredible amount of 3750 varieties. The most successful were the „Ezeréves Magyarország Emléke” (Millenium Grape) created in 1887, and „Csaba Gyöngye” (Pearl of Csaba) around 1890. Later on this grape was used by other Hungarian breeders to create new varieties such as Irsai Olivér and Zalagyöngye. His last breeding happened in 1916, and the grape name is the Szőlőskertek Királynője (Queen of the Vineyards),

Count Gyula Andrassy, the prime minister of the Austro-Hungarian Reunification period said about Mathiász: „He is the king of the wines, and the prince of the grapes”.

Important experts think if there hadn't been János Mathiász, probably Tokaj wouldn't have been the region like it is today. He tried to fight with phylloxera, the way he had escaped vines to Szőlőske and to his vineyard to Kecskemét. Later on with the help of hundreds of wagons he transported back to and replanted Tokaj-hegyalja twice in his lifetime. For all his effort, he didn't really expected anything but love, understanding and recognition.

For decades he used to work by enjoying the total and personal support of Emperor and King Franz Joseph, his wife Queen Elisabeth (Sisi) and Count Andrassy Gyula.

Mathiász table and vine grapes are grown 1500 hectares in Hungary and on about 15000 hectares worldwide.

Of his breded grapes about 70 are still known by name today and a dozen of them have been used as a genetic base for new varieties, from California to Crimea Peninsula nearly every significant wine region.

On the occasion of celebrating his 185th birthday, the Department of the Viticulture and Oenology of the University of Tokaj organised a memorial meeting in February 2023. There will be a professional day, where theory and practical experts will meet and discuss their thoughts and novelties.

The value of his hard and sacrificial work hasn't faded away at all and his lifework still represents a strong base knowledge of the Hungarian Vine and Wine culture.

THE POTENTIAL OF GAMIFICATION IN WINE SCIENCE EDUCATION

Márk Szalontay - István Szalontay

No Exit Games Ltd. Budapest, Hungary

The old templates, methods, and perceptions in all levels of education have basically lost their power today, judging students based on them leads to wrong consequences. The old, 'Prussian -type' learn-and-regurgitate education model no longer appeals to anyone. Nowadays, the vast majority of students participating in higher education belong to the youth Generation Z, they are born and grown up in the 21st century, in an era in which the pace of technical and digital development has become faster than ever before. Members of Generation Z are often called digital natives, while their teachers are usually considered digital immigrants. Bridging the gap between them is not easy, but it is not at all impossible, because, contrary to some popular opinions and perceptions, the students of Generation Z are no less motivated than their predecessors and are not passive at all.

Gamification means the use of games and game elements in education to make the processes of teaching and learning more interesting, effective, and efficient through an entertaining, interactive, and problem-solving approach. Gamification is particularly well applicable in all disciplines related to wine science, since many subject areas, previously perceived by students as heavy and seemingly far from “real life” such as chemistry, biochemistry, microbiology, plant physiology, climatology, Earth System Science can be successfully taught by using game elements and interactive models in an entertaining way. However, it is important to choose the right level of information-load when designing these interactive learning games, with particular emphasis on the existing knowledge and skills of students.

Gamified systems play an extremely important role in feedback and evaluation processes. Even the simplest point and level systems can have an extremely strong impact on participating students and teachers. One of the great advantages of point systems is that they focus primarily on development, accumulation, and collection providing hereby an opportunity to experience the feeling of growth and development, as well as to visualize this growth and progress. Furthermore, gamification may enable students to increase their abilities in accurate, non-biased self-assessment. In such a learning environment, after a bad grade, the students will not remember that they failed, but that they still got closer to the next level, albeit to a lesser extent.

When rethinking the social integration of the now socializing and growing up Internet-generation, it is extremely important to recognize that the internal motivation mechanism enhanced by gamification is much more effective and long-lasting than external motivation.

THE ROLE OF WINEGROWING IN CAPACITY BUILDING AND SOCIO-ECONOMIC DEVELOPMENT IN BORSOD-ABAÚJ-ZEMPLÉN COUNTY – PREVENTING DEPOPULATION OF THE COUNTRYSIDE

Boglárka Gál, Bánné¹ - Ágnes Horváth²

¹Assembly of Borsod – Abaúj – Zemplén County, President

²University of Tokaj, Rector

Borsod-Abaúj-Zemplén County is the second largest county in Hungary, with an area of 7,247 square kilometres, a total of 358 settlements, and a population of approximately 630,000 people. The regions of the county differ significantly in terms of territory, population, and economic results and opportunities. Although in the past ten years unprecedented economic and infrastructural development took place, the performance of industry has increased by 76 percent and vast improvements were made in the public service sector, there are still problems regarding the depopulation of small but valuable settlements in the countryside with less, than five hundred inhabitants. The county has the necessary resources to increase the population retention capacity even in these micro regions, since it can boast of two world heritage sites - the Aggtelek Karst Region and the Tokaj Historical Wine Region - and seven Hungarian cities, while the territory of the county includes three national parks, six landscape protection areas, and 17 nature protection areas. In July 2013, the general assembly of the county government established the county treasury and at the same time established the County Treasury Committee, whose mission is to find unique treasures and pass them on to future generations. In addition, it is definitely worth highlighting that Borsod-Abaúj-Zemplén is one of the most diverse counties in terms of its geographical features, as its territory includes mountains, hills, plains, and forests. Viticulture and oenology appear to be probably the most powerful branches of agriculture due to the inherent multifunctionality and numerous traditional trades and crafts, which are directly or indirectly linked to winegrowing. Although the core product is wine, the grapevine is a multifunctional plant, a source for a wide range of products which complete wine production by providing a complex product structure: fruit, grape juice, grapeseed oil, grape seed flour, grape skin extract, grape jelly, grape marc and lees for animal feed, distillates and aged spirits, grapevine branches for bioenergy, uprooted grapevine stocks for artwork, etc... Furthermore, with the revival of organic viticulture, many crafts can be used, from crafted food products to ancillary trades such as wine cellar building and restoration, carpenter, cooper, blacksmith, reeds-roofer, and many other professions, which can be economically viable with the right structure of local and micro-regional distribution network, naturally linked to tourism. There are several good practices internationally, which offer solutions, such as ecomuseums, unique landscape areas developed on the basis of existing and potentially available natural, economic, cultural, human and intangible resources. In this county the Tokaj Ecomuseum might be a good and viable option, focusing on wine and the regional cultural heritage of every settlement, including the most disadvantaged ones, connected by well-developed routes, and service network providing employment opportunities for people even in the most remote and previously isolated communities.

ENERGY EFFICIENCY IN WINERIES BY USING RENEWABLE ENERGY SOURCES AND APPLYING CIRCULAR ECONOMY WITH NO-WASTE SYSTEM

Valéria Olga Giber
European Ecocycles Society, Hungary

By using renewable energies, wineries can operate with up to 30-40% less energy. With the help of solar energy, we make energy prices predictable in the long term, up to 25 years. In this way, rising energy costs and price fluctuations can easily be avoided. Machine systems with high energy consumption, such as the grape destemmer and crushing machine, mash pump, must separator, press machine, bottle washer, bottle rinser, bottle sterilizer, filling machine, corking machine, capping machine, and the waste energy generated and then wasted during winemaking technology contain a lot of energy saving opportunities. If agricultural and food industry by-products are available for free or cheaply, then the energy that can be obtained from them is cheaper than the energy that can be produced with fossil fuels. In a winery, it is therefore worthwhile to combine the types of renewable energy that can be utilized in accordance with the geographical conditions of the given area. Hungary is particularly suitable for the utilization of geothermal and solar energy, which can be supplemented by wind energy, bioenergy and biogas production. Regarding biomass as a local energy source, it is important to emphasize that it is not dependent on imports, requires little transportation, and primarily improves the living conditions of those engaged in local farming and forestry, as well as food processing. In an economy based on recycling, according to the circular management model, even waste heat can be used with good results, which can thus be considered as renewable energy. Research in recent years has shown that the amount of waste heat saved in a winery would be sufficient to heat office and social rooms as well.

LIST OF PRESENTING AUTHORS

Presenting author (First name/last name)	Presenting author affiliation	Country	Email
Ágnes Csiba-Herczeg	Széchenyi István University	Hungary	agnes@herczegagnes.com
Ágnes Horváth	University of Tokaj	Hungary	horvath.agnes@unithe.hu
Alain Blanchard	University of Bordeaux	France	alain.blanchard@u-bordeaux.fr
Albert Bordons de Porrata-Doria	University Rovira i Virgili	Spain	albert.bordons@urv.cat
Albert Mas	University Rovira i Virgili	Spain	albert.mas@urv.cat
Alexander Fehér	Slovak Agricultural University	Slovakia	sandfeher@gmail.com
Ali Bagdadi	Budapest Business School	Hungary	bagdadi1212@gmail.com
Andrej Balogh	Hungarian University of Agriculture and Life Sciences	Hungary	andrej.balogh@gmail.hu
Anikó Klausmann Dinya	European Ecocycles Society	Hungary	dinya.aniko@supportivecoach.hu
Anna Ternell	PE Architecture	Sweden	anna.ternell@pe.se
Antal Kneip	University of Tokaj	Hungary	kneip.antal@unithe.hu
Barnabás Kovács	Hungarian University of Agriculture and Life Sciences	Hungary	kbz.georgikon@gmail.com
Boglárka Bánné Gál	University of Miskolc	Hungary	banne.gal@gmail.com
Bosse Lagerqvist	University of Gothenburg	Sweden	bosse.lagerqvist@conservation.gu.se
Botond Sikó	Hungarian University of Agriculture and Life Sciences	Hungary	sikoboti@gmail.com
Bulcsú Remenyik	University of Tokaj	Hungary	remenyik.bulcsu@unithe.hu
Carmelo Dazzi	University of Palermo	Italy	carmelo.dazzi@unipa.it
Dániel Homolya	University of Tokaj	Hungary	homolya.daniel@unithe.hu
Dániel Horváth	Hungarian University of Agriculture and Life Sciences	Hungary	89daniel.horvath@gmail.com
Enrico Peterlunger	University of Udine	Italy	enrico.peterlunger@uniud.it
Florian Bauer	Stellenbosch University	Republic of South Africa	fb2@sun.ac.za
Gábor Barátossy	National Food Chain Safety Office	Hungary	baratossyg@nebih.gov.hu
Gábor Dobos	Director, Tempus Public Foundation	Hungary	gabor.dobos@tpf.hu
Gábor Karner	Gábor Karner's Artisan Winery	Hungary	karnerbor@gmail.com
Gábor Molnár	Lake Balaton Development Coordination Agency	Hungary	molnarg@balatonregion.hu
Georgios Kotseridis	Agricultural University Athens	Greece	ykotseridis@aua.gr

Presenting author (First name/last name)	Presenting author affiliation	Country	Email
Gergő Szendei	FermentisLeSaffre	Hungary	gergo@szendei.hu
Géza Balla	University of Tokaj	Hungary	geza@ballageza.com
Giuseppe Bazan	University of Palermo	Italy	giuseppe.bazan@unipa.it
Giuseppe Lo Papa	University of Palermo	Italy	giuseppe.loppapa@unipa.it
György Lukács Reiser	University of Tokaj	Hungary	drgyl@yahoo.com
Hannes Weninger	Erebsloeh Austria GmbH	Austria	hannes.weninger@erbsloeh.com
Ilona Péterffy	Lake Balaton Development Coordination Agency	Hungary	peterffy@balatonregion.hu
István Ipacs Szabó	University of Pécs	Hungary	ipacs-szabo.istvan@pte.hu
István Jásdi	Jásdi Winery, Csopak	Hungary	jasdipince@axelero.hu
István Kiss	University of Tokaj	Hungary	kiss.istvan@unithe.hu
István Kulmány	Széchenyi István University	Hungary	kulmanyi@gmail.com
István Monok	University of Tokaj	Hungary	monok.istvan@konyvtar.mta.hu
János Babos	Process Solutions Ltd.	Hungary	janos.babos@ps-bpo.com
János Csapó	European Ecocycles Society	Hungary	csapo.janos@gmail.hu
Joacim Bruus-Jensen	Nordpartners AS	Denmark	jbj@nordpartners.dk
Joan Miquel Canals Bosch	University Rovira i Virgili	Spain	jmcanals@urv.cat
Károly Áts	Grand Tokaj Ltd.	Hungary	ats3915@gmail.com
Károly Kovács	Mad Wine Ltd.	Hungary	karoly.kovacs@madwine.hu
Kata Feketéné Benkó	Hungarian University of Agriculture and Life Sciences	Hungary	dr.feketene.benko.kata@phd.uni-mate.hu
Kornélia Kőszegi	Hungarian University of Agriculture and Life Sciences	Hungary	Koszegi.Laszlone@uni-mate.hu
Lajos Szabó	Hungarian University of Agriculture and Life Sciences	Hungary	szabo.lajos@uni-mate.hu
László Dankó	University of Tokaj	Hungary	laszlo.danko@unithe.hu
László Dinya	Hungarian University of Agriculture and Life Sciences	Hungary	dinya.laszlo@uni-mate.hu
László Fodor	Hungarian University of Agriculture and Life Sciences	Hungary	fodor.laszlo@uni-mate.hu
László Guth	University of Tokaj	Hungary	guth.laszlo@gmail.com
László Mészáros	Disznókő Ltd.	Hungary	meszarosl@disznoko.hu
Laura Varga	University of Tokaj	Hungary	varga.laura@unithe.hu
Laurent Comas	Pajzos Ltd.	France	laurent.comas@pajzos-megyer.com
Lennart Bornmalm	University of Gothenburg	Sweden	lennart.bornmalm@marine.gu.se
Lionel Kreff	Tonnellerie Baron	France	l.kreff@tonnelleriebaron.com

Presenting author (First name/last name)	Presenting author affiliation	Country	Email
Maciej Gąstoł	University of Agriculture in Krakow	Poland	rogastol@cyfronet.pl
Magdalena Zemczak	University of Agriculture in Krakow	Poland	magdalena.zemczak@urk.edu.pl
Marek Durmala	University College of Tourism and Ecology	Poland	marek.durmala@gmail.com
Marianna Pinczés	Virgin Oil Press Ltd.	Hungary	pinczesm@virginoilpress.hu
Mark Szalontay	No Exit Games Ltd.	Hungary	szalontaymark@gmail.com
Martin Hauptvogel	Slovak Agricultural University	Slovakia	martin.hauptvogel@uniag.sk
Melane Vivier	University of Stellenbosch	Republic of South Africa	mav@sun.ac.za
Mónika Márkus	Hungarian University of Agriculture and Life Sciences	Hungary	markus.monika@gmail.com
Orsolya HOGYA	University of Tokaj	Hungary	hogya.orsolya@unithe.hu
Paola Bambina	University of Palermo	Italy	paola.bambina@unipa.it
Pawel Satora	University of Agriculture in Krakow	Poland	psatora@ar.krakow.pl
Péter Balling	University of Tokaj	Hungary	balling.peter@unithe.hu
Péter Burai	University of Debrecen	Hungary	burai.peter@unideb.hu
Péter Huszár	Hungarian University of Agriculture and Life Sciences	Hungary	phuszar@gmail.com
Péter Molnár	University of Tokaj	Hungary	molnar.peter@unithe.hu
Péter Podmaniczky	Podmaniczky Winery	Hungary	podmaniczky.peter@gmail.com
Péter Teszlák	University of Pécs	Hungary	teszlak.peter@pte.hu
Przemysław Banach	University of Agriculture in Krakow	Poland	przemyslaw.banach@urk.edu.pl
Richárd Vetró	Hungarian University of Agriculture and Life Sciences	Hungary	richard.vetro@webmail.hu
Samuel Tinon	University of Tokaj	Hungary	samueltinon@gmail.com
Sándor Némethy	University of Tokaj	Hungary	nemethy.sandor@unithe.hu
Sándor Sipka	University of Debrecen	Hungary	sipka.sandor45@gmail.com
Steve Charters	Burgundy School of Business	France	steve.charters@bsb-education.com
Szilvia Gyanó	Thúry György Museum	Hungary	szilvi.gyano@gmail.com
Tamás Kovács	Kokoferm Ltd.	Hungary	kokofermkft@t-online.hu
Tamás Kőmíves	European Ecocycles Society	Hungary	komives.tamas@gmail.com
Tamás Köpeczi-Bócz	University of Tokaj	Hungary	kopeczi.bocz.tamas@unithe.hu
Tibor Kovács	University of Tokaj	Hungary	kovacs.tibor@unithe.hu
Tibor Kovács	Eszterházy Károly Catholic University	Hungary	kovacs.tibor@freemail.hu

Presenting author (First name/last name)	Presenting author affiliation	Country	Email
Tímea Nemesné Kis	University of Tokaj	Hungary	kis.timea@unithe.hu
Tomasz Pasierbek	University College of Tourism and Ecology	Poland	tpasierbek@bgpn.pl
Valéria Giber	European Ecocycles Society	Hungary	valeriagiber@gmail.com
Veronika Sziksz	Enartis	Hungary	veronika.sziksz@enartis.com
Victoria Evans	Vinonovi Ltd	Hungary	victoria.eva.evans@gmail.com
Viktoria Vona	Széchenyi István University	Hungary	kulmanyi@gmail.com
Vittorino Novello	University of Turin	Italy	vittorino.novello@unito.it
Zoltán Balogh	A BOROS Restaurant	Hungary	cirokatokaji@gmail.com
Zoltán Barócsi	University of Pécs	Hungary	barocsiz@gmail.com
Zoltán Bujdosó	Hungarian University of Agriculture and Life Sciences	Hungary	bujdosozoltan@uni-mate.hu
Zoltán Madaras	University of Pécs	Hungary	madaras.zoltan@pte.hu
Zoltán Oláh	Acheuron Ltd.	Hungary	oz@acheuron.com
Zoltán Szakál	University of Debrecen	Hungary	szakal_z@yahoo.com
Zsolt Sándor	University of Tokaj	Hungary	sandor.zsolt@unithe.hu
Zsuzsa Sándor	University of Tokaj	Hungary	sandor.zsuzsa@unithe.hu
Zsuzsanna Bene	University of Tokaj	Hungary	bene.zsuzsa@unithe.hu