ACTA CAROLUS ROBERTUS

Az Eszterházy Károly Egyetem
Gyöngyösi Károly Róbert Campusának tudományos közleményei
Alapítva: 2011

Különszám

ACTA CAROLUS ROBERTUS

Az Eszterházy Károly Egyetem
Gyöngyösi Károly Róbert Campusának tudományos közleményei

Alapítva: 2011

LÍCEUM KIADÓ
Eger, 2020

Különszám

A kötet megjelenését az EFOP-3.6.1.-16-2016-00001 – „Kutatási kapacitások és szolgáltatások komplex fejlesztése az Eszterházy Károly Egyetemen”
és az EFOP-3.6.2-16-2017-00001 – „Komplex vidékgazdasági és fenntarthatósági fejlesztések kutatása, szolgáltatási hálózatának kidolgozása a Kárpát-medencében” című pályázatok támogatták.

ISSN 2062-8269 (Nyomtatott)
ISSN 2498-9312 (Online)

A kiadásért felelős
az Eszterházy Károly Egyetem rektora
Megjelent az EKE Líceum Kiadó gondozásában
Kiadóvezető: Nagy Andor
Felelős szerkesztő: Domonkosi Ágnes
Nyomdai előkészítés: Csombó Bence
Megjelent: 2020-ban

LÍCEUM KIADÓ

SZÉCHENYI 2020
MAGYARORSZÁG KORMÁNYA
Európai Unió
Európai Szociális Alap
BEFEKTETÉS A JÖVŐBE

TARTALOM

THE RELATIONSHIP BETWEEN GRAPE AND FRUIT PRODUCTION IN EGER AND ITS SURROUNDINGS

Anita Berecz

Abstract

In my paper, I focus on what role fruit production played in Eger, which tree species were preferred, and how the phylloxera plague in the 1880s contributed to making vegetable and fruit production an important branch of agriculture in the hóstyas (outer districts) of Eger. The relevant, primarily ethnographic data-collection highlights that research into independent folk fruit production started only late and only in some areas. By combining these data, we can still gather much information on issues about fruit production from the studies dealing with farming. The agricultural journals of Eger launched from the second third of the 19th century provide further analysis of the fruit production in Eger.

Keywords: *the wine region of Eger, fruit production, tree species, phylloxera plague*
CODE: B19

DOI: 10.33032/acr.2020.spec.5

Introduction

In the report describing the inhabitants of Eger, a 19th-century geographer and statistician, Elek Fényes wrote in his work published in 1837 that "they live mainly from wine growing, crafts and trades." (Fényes, 1837) This statement is confirmed in his geographical dictionary of 1851: "Their main occupation is growing grapes, then the conduct of crafts and trades. The vineyard of Eger is such a vast area, produces such a famous red wine that nobody surpasses in goodness and flavour in Hungary. The best, noblest wine is produced on its high mountain of Egyed, but 4-5 years are needed for perfect development, although the one grown on Síkhegy and Tihamér grows ripe in a year. All kinds of domesticated winter and summer fruit are grown in the gardens and at the bottom of the mountains in great abundance; and on the hill of Egyed, sumac or poison ivy, which can be used well in leather factories."(Fényes, 1851) In his work published in 1853, Károly Mártonffy, a prominent figure in the viticulture of Eger, wrote about the importance of the role viticulture plays in the economic life of the city as follows: "Wine production is the major economic force of Eger. The majority of its inhabitants, the hoers live on the daily rates earned purely from wine production; there are hardly any decent citizens in Eger who would not grow grapes besides their profession or craft." (Mártonffy, 1853)

Sources

I paid particular attention to the literature and censuses related to fruit production in the 19th century, which takes into account the phenomena concerned with the situation of the surrounding area and that of fruit production in a general sense. The relevant, primarily ethnographic data-collection highlights that research into independent folk fruit production started only late and only in some areas. By combining these data, we can still gather much information on issues about fruit production from the studies dealing with farming. The agricultural journals of Eger launched from the second third of the 19th century provide further analysis of the fruit production in Eger.

Results

Thus, according to contemporary descriptions, the importance of viticulture stands out in the life of the city, and despite the fact that it was dominated by wine growing in the whole county, fruit production also gained greater impetus and developed gradually from the second half of the 18th century, as is clear from Elek Fényes'

description. This is shown by the fact that the Economic Journals published in 1854 had already dealt with the horticulture of Eger in detail, including the cultivation of the pear of Eger. Concerning the pears of Eger, they pointed out that they had a beautiful and natural pyramid shape and ripen late, so they do not offer opportunities for stealing. On the other hand, they drew attention to the fact that the soil which they are planted into should not be waterlogged, as the pear trees of Eger and pear trees in general do not tolerate it well. (Economic Journals, 1854, Vol. 6, No. 1-5)

Among other things, the phylloxera plague of the 1880s contributed greatly to the fact that growing fruit and vegetables became an important branch of agriculture in the hóstyas (outer districts). (Guszmanné, 2007) The soil along the stream of Eger, the floodplain of which provided loose, abundant soil, provided excellent conditions for vegetable production in Eger, becoming famous by the end of the 19th century. Vegetable and fruit production was an important source of income for the population of the hóstyas i.e. the outer districts of Eger. The inhabitants of Eger supplied the whole Northern Hungary with the vegetables grown in Kertész street, – still known as Zellervár –, inhabited by mainly German gardeners. Thus, the population of the Maklár hóstya profited greatly from the vegetable production evolved during the18-19th century, where there was significant vegetable production even in the middle of the 20th century (Farkasvölgy, Lajosváros, Kanada). The good location and soil were extremely suitable for the production of various fruit species. Frequently, farmers also grew and cultivated several fruit trees even in the vineyards themselves; they preferred especially stone fruits. Thus, most winegrowers had smaller or larger orchards, or at least fruit trees, scattered in or around the vineyard. "Along with wine cultivation, we can find fruit production everywhere; fruit trees, however, are still grown under unfavourable conditions in many places even today," said Samu Borovszky, a monographer presenting the county of the time, reporting on the conditions at the turn of the century. (Borovszky, 1909) The Highlands had been the only market for certain fruit species of Heves County for centuries, supplying its markets with cherries and summer and autumn's peaches. As traffic conditions improved, demand also picked up, resulting in the development of fruit production and the appreciation of fruit trees. A report from the second half of the 19th century also confirms the importance of fruit production: "Cherries, apples, pears and summer and autumn's peaches are grown in such large quantities and of such good quality in the outskirts of Eger that they are taken to the Great Plain and exchanged for wheat by the women of Eger. " (Albert, 1868) The main fruits of mountain regions were cherries, nuts, plums, sour cherries, autumn and summer peaches to a small extent, while those of the plains were apples, pears, plums, summer and peaches, cherries, sour cherries and nuts. Cherries were the most widespread and most valuable fruit species in Eger and its surroundings, because they had high yields every year. Of these, the "the First Grapes of the Season of Eger" played a major role, which were was red, sweet enough and had a pleasant taste at the

end of May; in addition, the large, black, crunchy and pink "blistered" cherries were popular. Of the nuts the common and soft shell varieties; of the plums the "Beszterce" ones and the various varieties of greengages; of the sour cherries the "Spanish" ones and the "Nagy-Kőrös" ones, and the small, so called "gypsy sour cherries" were widespread. Of the summer's peaches the "Hungarian best", of the autumn's peach species the early "Sándor" and the late "Duránci" varieties were popular. Of the apples the "golden parmen", "skin apple", "lemon apple", "Kalvil", "Bálint Török" varieties, while of the pears the "emperor", the "butter" pears, the yellow and green "purgament" varieties and the "Eger" pear were popular. The developed fruit culture of the Eger and Gyöngyös regions also laid the foundation for the widespread production of spirits. In 1890, the Chamber of Commerce and Industry of Miskolc mentioned Ferenc Preszler's distillery in Eger as a large industrial distillery. (Kriston, 1992)

In the 1920s, a special article in the Magazine of Horticulture dealt with the fact that during the ripening of cherries, 6-8 wagons of Eger black cherries were delivered to the Vienna market daily. This variety was so popular with the Vienna market that it did not accept any other variety. As a result, the growers in Eger did not take great pains to find other cherry varieties. Of course, there were other cherry varieties of good quality that also sold well. In addition, there was a widespread view that if cherries were taken good care of in a region, they would grow to a large size. (Magazine of Horticulture, 1926, No. 106) In the 1930s, the Magazine of Cities reported as special news that pilot vineyards and orchards would be established in the outskirts of Eger. An Economic Committee was established under the leadership of the social associations and representatives of Eger to organize the production in Eger, and to facilitate the sale of grapes, fruits, vegetables and other crops. The Commission wanted to provide not only advice and guidance on production and sales issues to the general public, but also practical solutions that would soon have an impact on economic life of Eger. (Magazine of Cities, 1937, Vol. 6.)

Conclusions

The main objective of agricultural history research is to study which tree species were preferred and how contributed the relationship between grape and fruit production in Eger and its surroundings. To sum up these things, the vineyard of Eger and its produces such a famous red wine has become modern, famous area and vine from the beginning of 19th century in Hungary. The best wine is produced on its high mountain of Egyed, but 4-5 years are needed for perfect development, although the one grown on Síkhegy and Tihamér grows ripe in a year. All kinds of domesticated winter and summer fruit are grown in the gardens and at the bottom of the mountains in great abundance; and on the hill of Egyed.

Reference sources

[1.] Fényes Elek (1837): Magyarországnak, s a hozzá kapcsolt tartományoknak mostani állapotja statisztikai és geographiai tekintetben. [The current state of Hungary and its annexed provinces in terms of statistics and geography]. III., Pest.

[2.] Fényes Elek (1851): Magyarország geographiai szótára. [Geographical dictionary of Hungary]. I, Pest.

[3.] Mártonffy Károly (1853): Eger szőllőgazdászata munkája Magyarország és Erdély képekben, [The vinticulture of Eger, Hungary and Transylvania in Pictures]. Kubinyi Ferenc és Vahot Imre IV., Pest.

[4.] Gazdasági Lapok. [Magazine of Economics], 1854. 6. évfolyam, 1-5. szám.

[5.] Guszmanné Nagy Ágnes – Miskolczi László – Petercsák Tivadar (szerk.) (2007): Az egri hóstyák. [The hóstyas (regional districts) of Eger], Eger, Varga Nyomda Kft. 61-74.

[6.] Borovszky Samu (szerk.) (1909): Magyarország vármegyéi és városai. Heves vármegye. [Counties and cities in Hungary. Heves County]. Budapest.

[7.] Albert Ferenc (1868): Heves és Külső Szolnok törvényesen egyesült vármegyéknek leírása. [Description of the legally united Heves County and Outer Szolnok County]. Eger. 79-80.

[8.] Kriston Pál (1992): Heves megye iparosítása a dualizmus korában. [Industrialization of Heves County in the Age of Dualism]. Studia Agriensia 13. Eger. 55.

[9.] Kertészeti Lapok. [Magazine of Horticulture]. 1926. 10. szám.

[10.] Városok Lapja. [Magazine of Cities] 1937. 6. szám

Szerző

Anita Berecz
Assistant research fellow
Eszterházy Károly University
Department of History
berecz.anita@uni-eszterhazy.hu

KÜLÖNBÖZŐ EREDETŰ FURMINTOK ÖSSZPOLIFENOL- TARTALOM NYOMONKÖVETÉSE AZ ERJEDÉS SORÁN

Bogárdi-Tóth Kitti Irén – Patonay Katalin – Szabó-Hudák Orsolya

Összefoglalás

A borban előforduló polifenoloknak fontos hatása van a bor érzékszervi tulajdonságaira (összehúzó hatás, kesernyésség, testesség, bársonyosság), így a borászati termékek fenolos érésének tanulmányozása sok szempontból figyelmet érdemelnek. A bor polifenoljainak jelentős része a szőlőből származik, és a bor feldolgozása, erjesztése és érlelése során különböző átalakulásokon megy keresztül. Mindamellett, hogy a bor fenolos érettsége érzékszervi szempontból fontos paraméter, mégis, a mustok polifenol-tartalmának az erjedés alatt bekövetkezett változásáról adatot nem találtunk. Jelenleg a piacon kedveltebbek a friss, könnyed fehér borok, amelyek alacsonyabb összpolifenol-tartalommal rendelkeznek, ezért figyelmünk az e kategóriába sorolható egyik fajtaborra irányult. Munkánk céljául tűztük ki, hogy megfigyeljük a magyar furmint minták összespolifenol-tartalmának változásait a 15 napos erjedés során, így eldönteni, hogy a fermentációs folyamat nyomon követhető-e egy viszonylag olcsó, egyszerű fotometriás méréssel.

Adaptáltuk a Magyar Borkódexben található, Folin-Ciocalteu-index meghatározására szolgáló módszert, úgy, hogy azzal az összpolifenol-tartalmat számszerűen mérni tudjuk, valamint minta-és reagensigényét méretcsökkentéssel redukáltuk. Az összes mintában a kiinduló értékek az irodalom alapján várható 300–500 mg/l galluszsav-egyenérték (GAE) között mozogtak. Az 5-6. napon minden mintában hirtelen változást észleltünk az összpolifenol-tartalomban. A hátralévő időben az összpolifenol-tartalom átmeneti hullámzásokkal, de végig csökkenő tendenciát mutatott. A megfigyelt ingadozások háttere – a polifenol-összetétel változása, átrendeződések az erjedés folyamán – további vizsgálatokkal felderítendő.

Kulcsszavak: *Furmint, Folin-Ciocalteu, galluszsav-egyenérték, összpolifenol, erjedés*

DOI: 10.33032/acr.2020.spec.11

FOLLOWING CHANGES OF TOTAL POLYPHENOL CONTENT OF FURMINT SAMPLES DURING FERMENTATION

Abstract

Polyphenols occurring in wine have important contributions to the sensory properties (astringency, hardiness, bitterness) thus the study of phenolic maturity of oenological products deserve attention. A major portion of wine polyphenols are derived from the grape (others from the material of the wooden barrels). Nevertheless, data dealing with the polyphenol content of grape juice during fermentation were not found. Nowadays the white wines with fresh character, less astringency, and lower total polyphenol content (TPC) are more popular on the Hungarian market thus the study is focusing to the Furmint wine which represents this category. The aim of the study is to observe changes of TPC in Hungarian Furmint grape juices during the 15-day fermentation period and thus decide if the fermentation is follow-able via a simple and relatively low-cost spectrophotometric method. Furthermore the standard method of determination of Folin-Ciocalteu indices in white wine referred to in the Hungarian Code of Wine was adapted to perform quantitative measurements of total polyphenol content in gallic acid equivalents (GAE). The sample and reagent demand of the method is reduced with keeping the original concentrations and reaction conditions thus it may be applicable to large sample numbers.

The initial TPC values were 300-500 mg GAE/L in the examined Furmint samples. A sudden decrease of TPC values was observed at the 5-6th day of fermentation, and after this a decreasing tendency was observable with temporary fluctuations. The background of these processes (changes and rearrangements of polyphenol composition during fermentation) needs to be further investigated by chromatographic methods.

Keywords: *Furmint, Folin-Ciocalteu, gallic acid equivalents, total polyphenolcontent, fermentation*

Introduction

Polyphenols occurring in wine deserve attention from many viewpoints because of their influence of the sensory properties of wines. Astringency, bitter aroma, hardiness, colour and in a lesser proportion the scent, the bouquet of it are in connection with the presence of wine polyphenols [1][2]. Like many other plant polyphenols, they also can influence the metabolism of low density lipoproteins [3] and in in case of some flavonoid type compounds the permeability of capillaries (vitamin P activity) [4], thus may have role in prophylaxis of atherosclerosis and/or other cardiovascular diseases [1]. A significant proportion of wine polyphenols is derived from the grape and may undergo different transformations during the processing, fermentation and ageing of wine. Another phenolic compounds become present via dissolution from the material of the barrel. Most of wine polyphenols can be classified into different subclasses of products of the shikimate pathway, a fundamental process of plant metabolism. Nevertheless some phenolics are produced by yeasts. Groups of the most important wine polyphenols are summarized in Table 1 [1] [2] [4] together with their direct sensory character and other traits which may influence these properties of wine (e.g. browning by oxidation of polyphenolic antioxidant/antiradical agents).

Table 1. Legends A = aged wine, G = grape, G-S = grapeseed, W = wood, Y = yeast

Phenolic acids and related compounds (plant metabolites, shikimate pathway)					
Subclass	***Origin***	***Examples***	***Presence in wine***	***Sensory function***	***Other character***
benzoic acid derivatives	G/W	hydroxybenzoic, salicylic, gallic acids	General	Astringency	Antiradical activity, protein binding*
hydroxybenzoic acid polymers	W	ellagic, hexaoxodiphenic acids	Wines stored in barrel	Astringency	Antiradical activity, protein binding*
hydroxycinnamic acids	G	caffeic, ferulic acids and their tartrates	General	Astringency	Antiradical activity, protein binding*
cinnamic aldehydes	W	sinapyl-, coniferyl aldehide	Wines stored in barrel	Scent and aroma	
Flavonoids (plant metabolites, shikimate pathway)					
Subclass	***Origin***	***Examples***	***Presence in wine***	***Sensory function***	***Other character***
flavonols/kaempferol glycosides	G	kaempferol-3-O-glucoside, -3-O-glucuronide	General	Color - pale yellow	Chelator activity**
flavonols/quercetin glycosides	G	isoquercitrin, quercetin-3-O-glucuronide, rutin	General	Color - yellow	Antiradical and chelator activity **
catechins	G	catechin, epigallocathecin and their gallate esters	Higher concentration in red wines	Astringency	Antiradical activity
anthocyanins	G	malvidin-3-O-glucoside, malvidin-3-O-glucuronide	Red wines only	Color - red, purple	Antiradical and chelator activity **

pyranoanthocyanins	A	pyranomalvidin glycosides	Red wines only	Color - deep red	Antiradical activity, protein binding*
procyanidins	G-S, A	procyandin A and B oligomers	If grape seeds break; ageing red wine	Bitterness, undesired	Antiradical activity, protein binding*
Stilbenoids (plant metabolites, shikimate pathway)					
Subclass	***Origin***	***Examples***	***Presence in wine***	***Sensory function***	***Other character***
aglycones	G (skin)	cis and trans-resveratrol	Higher concentration in red wines	Astringency	Antiradical activity
glycosides	G (skin)	piceid	Higher concentration in red wines	Astringency	
Others (yeast metabolites)					
Subclass	***Origin***	***Examples***	***Presence in wine***	***Sensory function***	***Other character***
phenolic volatiles	Y	phenylethanol	General	Scent and aroma (floral)	

*Polyphenols having the ability to precipitate proteins, alkaloids and polysaccharides called collectively *tannins*. [2]. These are strong astringents when ingested. **Chelator ability of flavonols may influence the color, e.g. ferric ion chelates of flavonols can turn it to stronger/reddish from pale yellow. Chelation also can delay ferric/ferrous ion catalyzed oxidative deterioration.

The total polyphenol content and polyphenol profile of wines are mostly determined by the type of the grape. White grape and wines, lacking anthocyanins (and pyranoanthocyanins) [5], poorer in stilbenoids show much lesser TPC than red types. Steps of processing (contact of the musts with grape skins, occasionally with broken seeds), storage (maturation in oak barrels) and ageing also influence it.

There are many studies on polyphenols of mature wine [1], [6], or on following some wine ageing processes from the viewpoint of polyphenol contents [7] or polyphenol composition. Data dealing with the polyphenol content of grape juice during fermentation were not found. However, it would deserve attention as the phenolic maturity of the wine is important from the sensory viewpoints. White wines with high total polyphenol contents are less demanded in the Hungarian market than the ones bearing lower TPC and being fresher, less astringent. Therefore the present study aimed the followings

- 1) to observe the changes in the total polyphenol content of Hungarian Furmint samples during fermentation, thus decide if fermentation process is follow-able with a relatively inexpensive, simple photometric method.
- 2) adaptation of the method established to determination of Folin-Ciocalteu indices by the Hungarian Codex of Wine, to determine total polyphenol contents on wines, partially in the case of high sample numbers and/or restricted quantity of samples.

Materials and Methods

Sampling

Furmint grape samples were collected in duplicate. Vineyard plots (fields) were Betsek, Király, Nyúlászó, Szt. Tamás, Dancka at Tokaj-Hegyalja region. Grapes were crushed and pressed, must was temperated in cellar. $K_2S_2O_5$ was added (1ml/L) at inoculation with yeast (20 g/hL) (Mycroferm Arom, Interker-Wein Kft.). The fermentation passed in glass balloon. The must undergoing fermentation was sampled on the 1-15th days daily. These samples were filtered on Millipore 0.22 μm, 47 mm, sterile filter and stored in deep freezer till analyses.

Reagents and instrumentation

Folin and Ciocalteu's reagent, 2N, AnalAR Normapur, Na_2CO_3 anhydrous a. r., gallic acid, a. r. (VWR) Instrumentation: double-beam spectrophotometer (Shimadzu UV-VIS 1800).

Analyses

The original EU standard method to determine Folin-Ciocalteu indices on wine [8], referred in the Hungarian Codex of Wine [9], prescribes the followings. 1 ml white wine, 50 ml distilled water, 5 ml Folin and Ciocalteu's and 20 ml 20 m/V% aqueous solution of Na_2CO_3 should be filled to 100 ml with distilled water in a volumetric flask. After 30 min at room temperature, absorption at 750 nm is immediately to measure in a 1 cm cuvette. The downsized method keeps these reaction conditions and concentration ratios of sample and reagents but can be processed with one tenth of all the required quantities. Thus to 100 µl sample, 5 ml distilled water, 500 µl Folin-Ciocalteu's and 2 ml Na_2CO_3 were filled to 10 ml in a volumetric flask. The samples are homogenous solutions thus downsizing may not increase margin of error. To convert the absorption to total polyphenol contents (which is usually given in gallic acid equivalents, GAE [10]), a calibration made with aqueous solution of gallic acid in 0-1000 mg/l interval. All sample measurements were performed in duplicate, here means are provided. The expected total polyphenol contents for white wine are 200-700 mg GAE/L [6] [7].

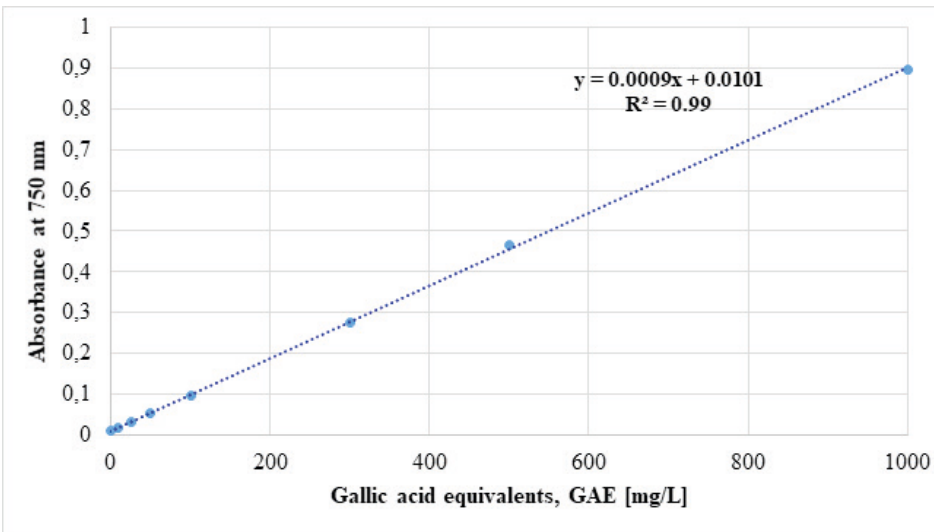


Figure 1. Gallic acid calibration used at the analyses

Results and discussion

The TPC of all samples during the whole fermentation time was found to be in the interval expected based on the literature data. Figures 2A-E and Table 2 shows the

TPCs in dependence of time, arranged as sample pairs of the five different vineyard plots.

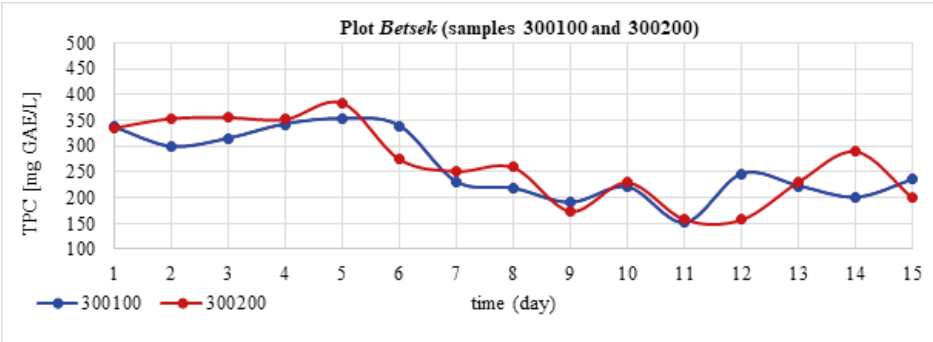


Figure 2A. Total polyphenol content (TPC) in the samples of Betsek wineyard plot

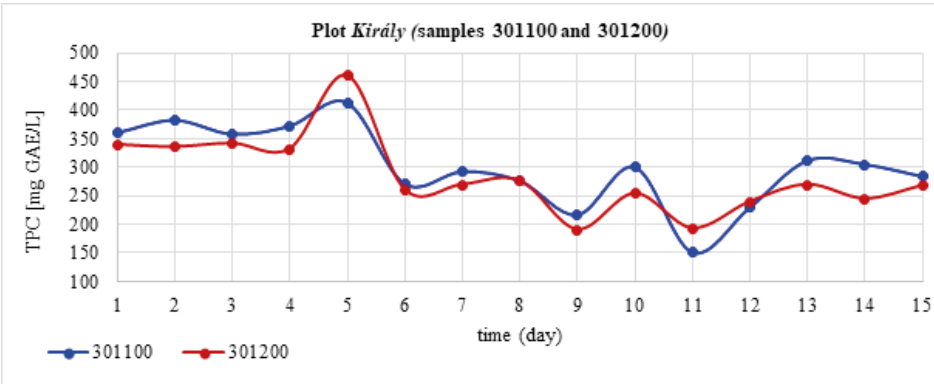


Figure 2B. Total polyphenol content (TPC) in the samples of Király wineyard plot

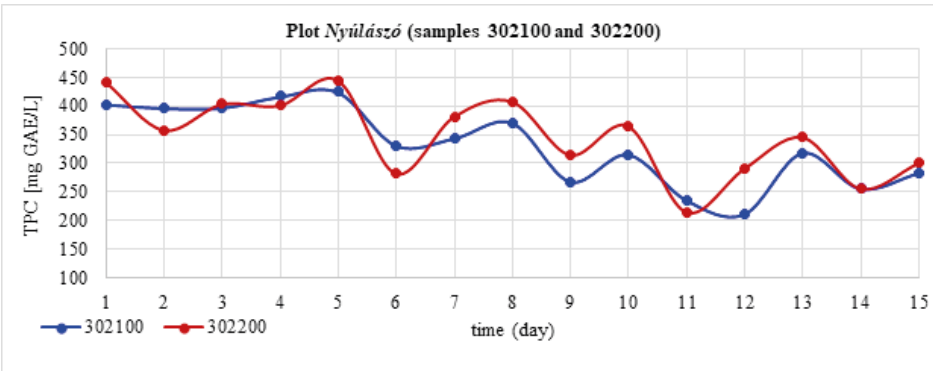


Figure 2C. Total polyphenol content (TPC) in the samples of Nyúlászó wineyard plot

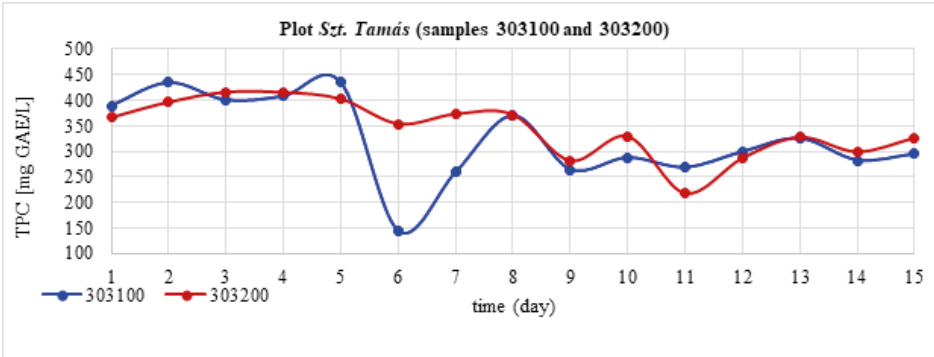


Figure 2D. Total polyphenol content (TPC) in the samples of Szt. Tamás wineyard plot

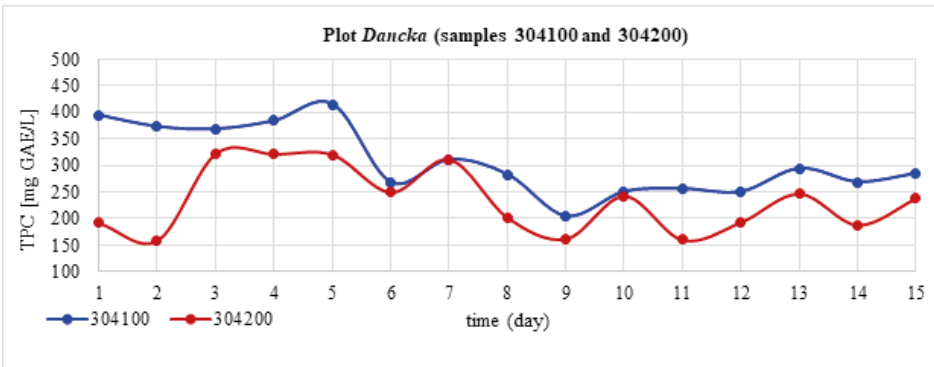


Figure 2E. Total polyphenol content (TPC) in the samples of Dancka wineyard plot

Table 3 The total polyphenol and its changes in the five sample pairs of Furmint

Plot	Sample ID	TPC [mg GAE/L]															Changes in TPC*	
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	%*	Tendency
Betsek	**300100**	337	299	314	342	352	339	230	218	191	220	152	246	223	201	235	**-30,1**	**decreasing**
	300200	336	354	356	352	384	275	252	259	174	230	158	158	232	290	199	**-40,7**	
Király	**301100**	360	382	357	372	412	271	292	276	217	300	152	230	311	305	284	**-21,1**	**decreasing**
	301200	339	335	341	332	460	260	269	276	191	253	193	239	269	244	268	**-21,1**	
Nyúlászó	**302100**	403	396	397	416	424	331	343	371	268	315	235	211	318	256	283	**-29,9**	**decreasing**
	302200	442	358	404	401	445	282	382	408	315	365	215	291	346	256	300	**-32,2**	
Szt. Tamás	**303100**	390	434	400	408	434	143	259	370	264	287	268	299	325	282	295	**-24,4**	**decreasing**
	303200	366	396	416	415	402	354	373	372	281	329	217	286	327	298	326	**-10,9**	
Dancka	**304100**	394	373	368	384	415	268	311	282	204	250	256	250	294	269	284	**-27,8**	**ambiguous**
	304200	192	160	322	321	320	250	311	202	162	242	160	193	247	188	238	**24,1**	

***Change of TPC in percentage is calculated as: [TPC(day 1)-TPC(day 15)/TPC(day 15)]*100**

As it can be seen, in days 1-5 there is no major change in TPCs. In all of the samples values were between 300 and 500 mg GAE/L with one exception (Dancka 2 sample, ID: 304200, initial TPC = 192 mg/L). On day 5-6, in every sample a sudden change of TPC was observable. After this, decrease of TPC was follow-able (expect Dancka 2 sample, ID: 304200). Contrary to the fluctuations, to day 15 (the end of fermentation), this loss in polyphenol content has become significant, reaching 10-30 percent of the initial TPC.

The sudden decrease in the TPC around day 5 may be connected with the changes in the composition of the microbiota of the samples under fermentation and thus with emission of yeast metabolites. According to literature data [10] a must (or juice under the beginning of fermentation) has an own flora. This, called apiculate microbes contains low, 10^6-10^8 cfu/ml germ count including other taxa than of *Saccharomyces* genus, namely e. g. *Kloeckera* and *Hanseniospora* spp. (Otherwise, apiculate microbes have important role in formation of volatile composition of the wine). These microbes has lower tolerance towards ethanol as of *Saccharomyces* thus the latter becomes dominant around the 4-6th days of fermentation. Intensified metabolism of *Saccharomyces* may increase the quantity of reactive oxygen species (ROS) in the juice thus consume a part of the polyphenols of wine through oxidative processes. [7].

Regarding the data of the sample pairs as duplicates of the grape harvested at same time and conditions, our observations are the followings: The data series of Brix values (20.4 -22.6, detailed data not shown) and pH values (3.12-3.31, data not shown) of the 5×2 grape samples contained no outliers and they have shown the optimal interval to harvest [4], thus their initial oenological parameters did not differ significantly. As it was expectable their fermentation is also shows similar tendencies regarding TPCs. Nevertheless there are two exceptions which may be noteworthy to mention. The sample Szent Tamás 1 (ID: 303100) at the 5-6 days has shown a temporary s relapse of TPCs from 434 mg GAE/L to 143 mg GAE/L which in part has restored to day 8 (TPC = 370 mg GAE/L) then slowly decreased till day 15. The parallel sample has not shown this behavior. (Fig 2D) Dancka 2 sample (ID: 304200) may deserve more attention as its fermentation is totally different than the Dancka 1 (ID: 304100) when TPC is regarded. The data suggests differences in its polyphenol composition but this background in this study is not investigated yet. There are deviation in the TPCs of Dancka 1 (ID: 304100) and its parallel Dancka 2 (ID: 304200). It may originate in some differences in the fermentation process of these two samples.

This phenomenon may make probable if some types of deviations or faults in the fermentation process of a grape juice may be follow-able via measurement of TPC. But this problem have got to perform further investigations by all means for to make the answer clear, because our observations origin in only a lesser number of samples.

Concluding remarks. Proposals

The described (downsized) method to determine total polyphenol content of grape juice under fermentation resulted in TPC data inside the interval of literature data of white wines. We would like emphasize that the TPC measurement has no international or domestic standard and in this case the method can be connected/ deduced to a standard spectrophotometric determination accomplished with a gallic acid calibration. The reduction of the requested quantities of reagents and sample (in comparison with the original Folin-Ciocalteu method may make it to applicable large sample series with low costs. In long term, the follow-up of TPC, the establishing of phenolic maturity in a white wine may be performed using this method if needed. Based on our examinations, phenolic maturity of white wines can be characterized via continuous monitoring of TPC levels during fermentation, however further studies are needed to improve the method.

The tendency of changes in TPC during fermentation is accordance with expectations. But the background of it, partially of the temporary fluctuations need further investigations. They are probably connected to redox reactions and rearrangements in the polyphenol composition of the samples, which composition may clarify with high performance liquid chromatography HPLC investigations on the polyphenol profile.

Acknowledgements

The creating and publishing of this scientific proceeding was supported by the project entitled: EFOP-3.6.2-16-2017-00001 "Complex rural economic development and sustainability research, development of the service network in the Carpathian Basin."

References

[1.] Soleas GJ, Diamanidis EP, Goldberg DM (1997) *Wine as a biological fluid: History, production and role in disease prevention*. Journal of Clinical Laboratory Analysis 11, 287-313.
https://doi.org/10.1002/(SICI)1098-2825(1997)11:5<287::AID-JCLA6>3.0.CO;2-4

[2.] von Elbe JH, Schwartz SJ (1996) *Colorants/Flavonoids and other phenols*. In: Fennema OR (Ed.) Food Chemistry. 3rd Edition, p. 681-703 Marcel Dekker Inc., New York, ISBN 0-8247-9346-3

[3.] Shahidi F, Naczk M (2004) *Phenolics in Food and Beverages*. pp 270-271 CRC Press, Boca Raton, ISBN 0-2035948-1 (electronic, Adobe e-Reader) or 1-58716-138-9 (print)

[4.] Eperjesi I, Kállay M, Magyar I (1998) *Polifenolok, színanyagok*. In: Borászat. pp 280-289. Mezőgazda, Budapest. 4. kiadás. ISBN 963 286 075 6./ Polyphenols, colorants. In: Oenology. pp 280-289. Mezőgazda, Budapest. 4th edition. ISBN 963 286 075 6. (In Hungarian)

[5.] Marquez A, Serratosa MP, Julieta Merida J (2013) *Pyranoanthocyanin derived pigments in wine: Structure and formation during winemaking* (review article) Journal of Chemistry, 2013, ID: Article ID 713028, 15 pages
https://doi.org/10.1155/2013/713028

[6.] Lugasi A, Hóvári J (2003) *Antioxidant properties of commercial alcoholic and nonalcoholic beverages.* Nahrung, 47(2)79-86.
https://doi.org/10.1002/food.200390031

[7.] Lužar J, Jug T, Jamnik P, Košmerl T (2016) *Comparison of total polyphenols content and antioxidant potential of wines from 'Welschriesling' and 'Sauvignon Blanc' varieties during ageing on fine lees*. Acta Agriculturae Slovenica 107, 473-482
https://doi.org/10.14720/aas.2016.107.2.18

[8.] The European European Economic Community, Council (1990) Commission regulation (EEC) No 000/90 *Determining Community methods for the analysis of wines.* Method 41, Folin-Ciocalteu index) The Official Journal of the European Communities L 272, pp 178-179. (**Important note**: The directive is partially amended in 2005, see https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01990R2676-20050309&from=EN but amendments do not cover Method 41)

[9.] Magyar Borkönyv - Codex Vini Hungarici. Borok vizsgálata: A Folin-Ciocalteu-index meghatározása. pp 192-198. /Hungarian Code of Wine –Codex Vini Hungarici. *Analysis of wines: Determination of Folin-Ciocalteu index.* (In Hungarian).

[10.] Waterhouse AL (2002) *Determination of total phenolics. Current Protocols in Food Analytical Chemistry* I1.1.1–I1.1.8.
https://doi.org/10.1002/0471142913.fab0102s00

[11.] Gil JV, Mateo JJ, Jiménez M, Pastor A, Huerta T (1996) *Aroma compounds in wine as influenced by apiculate yeasts*. Journal of Food Science 61, 1247 – 1250
https://doi.org/10.1111/j.1365-2621.1996.tb10971.x

Szerzők

Bogárdi-Tóth Kitti Irén
Intézmény: Eszterházy Károly Egyetem
Munkahely: Élelmiszertudományi és Borászati Tudásközpont
toth.kitti@uni-eszterhazy.hu

Patonay Katalin
Intézmény: Eszterházy Károly Egyetem
Munkahely: Élelmiszertudományi és Borászati Tudásközpont
patonay.katalin@uni-eszterhazy.hu

Szabó-Hudák Orsolya
Intézmény: Eszterházy Károly Egyetem
Munkahely: Élelmiszertudományi és Borászati Tudásközpont
hudak.orsolya@uni-eszterhazy.hu

THE ROLE OF FRUIT PRODUCTION IN EVERYDAY LIFE IN BÜKKALJA IN THE 19-20TH CENTURY

Zoltán Borbély

Abstract

Fruit-growing played a very varied role in the folk culture of the settlements of Bükkalja. Fruit was one of the most important commodities in the trade between the Great Plain and the Highlands; nevertheless its production was based on extremely low quality cultivation. In spite of the fact that it was only a supplement to the livelihoods of the local population, it played an extremely important role. However, intensive horticulture was not developed in the area.

Keywords: *agricultural history, Bükkalja, fruit production, agricultural statistics*
CODE: B19

DOI: 10.33032/acr.2020.spec.25

Introduction

Bükkalja, geographically, a group of small-landscapes, consists of the region south of the border of Southern-Bükk, between the valleys of the rivers Tarna and Sajó, running southwards to Heves Plain and Borsodi-Mezőség, dissected by mountain ridges. This area carries, both in terms of wildlife and folk culture, the characteristics of the transitional landscapes that have been developed by the traditional division of labour and product exchange between the Great Plain and the Highlands over the centuries. This so-called trade line, which runs through the transitional areas of the Carpathian Basin, has shaped the way of life and farming of the people living there in each region in different ways. (Frisnyák, 1995)

However, Bükkalja as a natural geographic region does not form an independent region in terms of Hungarian folk culture. From the north it comes into contact with Palócföld and Barkóság, and from the south the folk and agricultural culture of the area was influenced by the ethnographic landscape of "Borsod-Heves Tisza mente" (the Shoreline of the River Tisza in Borsod and Heves Counties)." (Baráz, 2014) In my study, I analyse a single element of the myriad factors forming the intense social and economic relationships resulting from unique landscape cultivation and dynamic land use, the role of fruit production and fruit trade at the turn of the 19th-20th centuries.

Sources

The aim of the basic research on interdisciplinary agricultural landscape use at the Károly Eszterházy University is to identify fruit varieties from the period of organic landscape use in the eastern part of the Eger wine region, i.e. the Bükkalja group of small landscapes, and to establish a nursery from the trees searched for and in parallel with this, to determine their role in folk and agricultural culture through ethnopomological research. The fruit trees found during fieldwork are mostly located on the borders of Eger and Noszvaj. As the fruit production and agricultural culture of Eger is very different from the organic landscape use in Bükkalja, and its economic and social character is also different, I focus on Noszvaj, which gives the most saved grafts.

Noszvaj is located in the Bükkalja settlement network, in the middle of a wide mountain foot surface, mostly belonging to the middle settlement belt extending onto the rhyolite tuff surface. (Baráz, 2014) This settlement is characterized by a landscape forming a transition between plains and mountains, where during the 18-19th century, livestock and arable farming competed with each other as the dominant form of farming. (Baráz, 2014) It is also important to point out that, although ancient viticulture and horticulture were of different importance from

settlement to settlement, and having survived the period of Turkish rule, and having even developed in certain elements, it is still decisive to the present day. However, during the 18-19th century, vine monoculture developed mainly in the surroundings of Eger, and it gradually spread to Bükkalja as well.

Results

In the map entitled "Wine Map of Hungary by Wine Regions" published by the Royal Hungarian Ministry of Agriculture, Industry and Commerce in 1884, the western part of Bükkalja belonged to the Eger-Visonta wine region of the Tiszáninnen wine district (III.), forming its easternmost point.[1] From an ethnopomological point of view, this is important because fruit was also grown in the ridges of the vineyards, which gained new impetus after the destruction of the grape caused by phylloxera in the late 19th century. Although the Fruit Society, which had already spread its scope to the area of Borosd County, was trying to boost fruit production in 1859, there were primarily only poor quality trees and a low level cultivation system until the middle of the 20th century. We do not know about contiguous orchards on the outskirts of the villages; fruit was grown mostly in the gardens and vineyards around the house.

Examining the data of the 1895 statistics on fruit trees, we find it striking that fruit production was of outstanding importance in Noszvaj among the settlements of the region. (Viga, 1985) In general, the undemanding plum varieties, which do not need regular care, were the most popular, followed by apple, sour cherry, then peach and finally cherry trees. This order did not change much by 1935, either, but the importance of intensive varieties slightly increased.

Comparing Bükkalja's excellent fruit-growing capacities and tree population, we can see a rather contradictory picture about the area's fruit culture and its place in the traditional culture. Fruit growing was carried out fundamentally in an extensive way, although all the conditions for intensive production were in place for developing intensive production methods. Gyula Viga sees the resolution of this contradiction in the absence of sales opportunities, as fruit buying-in was essentially unorganized in this area. (Viga, 1985. 292.)

It was only from the 1920s that the cherry-producing monoculture of Szomolya and Noszvaj was developed, primarily due to the market of Eger. On the whole, however, fruit production played a decisive role only in small-scale family farms, which, due to their scarce financial resources and lack of draft animals, were unable to take the fruit produced by them to distant markets. "That is, – because of the stagnant economic and social structure –, the population of the area could not take advantage of the capacity of the area and what would have brought prosperity to them." (Viga, 1985. 282.)

In the first half of the 19th century, Noszvaj, which was the subject of a closer investigation, was largely owned by the Almásy family; then István Steinhauser, resident of Eger, imperial purveyor and wholesaler bought the whole Almásy estate in 1869. Later he gave it as dowry to her daughter Berta, who married chief quartermaster Gyula Gallasy in 1878. (Pap, 2017.)

In 1895 the utilizable land area of the village was 3272 cadastral acres, of which 1272 acres were arable land, 88 acres were used as meadows, 493 acres as pasture, 961 acres as forest and only 43 acres were registered as vines. (Viga, 1985) The remaining 246 cadastral acres were registered as gardens and orchards, which is a very high number compared to similar figures in the surrounding settlements. (By comparison, in the neighbouring Szomolya and in Bogács, which is much larger in terms of population, the size of gardens and orchards was 95-95 cadastral acres.). However, at that time nearly 30,000 plum trees, which was an extremely high number, were registered in the statistics mentioned above. Two-thirds of the fruit trees of Novaj were plum trees, with cherries being in second place, with only 6574 trees. It is worth noting that in the farm statistics of 1935 only 7645 plum trees are included. The issue of the outstanding plum tree population of Noszvaj at the turn of the century is worth further research.

Conclusions

What role did fruits play in the everyday life of the people living in Novaj? It is typical of small-scale family farms that they were basically trying to meet their own consumption needs, so fruit is also supposed to have been an important part of the nutrition of the local people primarily. In addition to raw consumption, the most important processing method was making jam, which has preserved its popularity up to our own day. In the region, first of all, the Noszvaj plum jam was most widely available, which was also sold at the market of Eger and Mezőkövesd, but it was not uncommon that it was offered by market women in Miskolc, too. In addition to cooking jam, drying was another way of preserving; "home canning", which is very popular nowadays, was not known at that time. Fruits of inferior quality or which started to deteriorate, unsuitable for sale, landed in the mash, which was used to make brandy, and it was also popular because of its high price.

Fruit trading was only an additional part of the livelihoods of people living in Noszvaj, but it was still one of its significant bases. On the basis of the research carried out by Gyula Viga, we can distinguish two main lines of the fruit trade in Bükkalja. (Viga 1986.) One is trade within the boundaries of the group of small landscapes, a kind of local trade, while the other is trade between the much smaller

landscapes crossing the borders of the region primarily towards the Great Plain. In the latter, the plums produced in large quantities were mostly exchanged by the product surpluses of the people living on the Great Plain, which were most often crops or one of the fodder plants. From the turn of the century, the transportation on the Great Plains was carried out by drivers of animal-drawn carts specialized for long distances, who were occasionally hired by 5-6 women. Local sales were also usually performed by women who carried the plums in carrying baskets made from hazel twigs locally, to the markets of Kövesd or Eger.

By the first decades of the 20th century, plums were gradually replaced by short-stemmed black cherries, which were more and more produced intensively. The reason for this was that in the 1930s even 2-3 wagons of them were bought by merchants of Pest, who delivered the high quality fruit to the German markets.

On the whole, it can be stated that fruit-growing played a very varied role in the folk culture of the settlements of Bükkalja, including Noszvaj. Fruit was one of the most important commodities in the trade between the Great Plain and the Highlands; nevertheless its production was based on extremely low quality cultivation. In spite of the fact that it was only a supplement to the livelihoods of the local population, it played an extremely important role. However, intensive horticulture was not developed in the area.

Reference sources

[1.] [1.] Frisnyák Sándor (1995): Magyarország történeti földrajza. [Historical Geography of Hungary]. Budapest 51-53.

[2.] [2.] Baráz Csaba (2014): Tájművelés és táji kapcsolatok a Bükkalján. [Landscape Cultivation and Landscape Relationships in Bükkalja]. Történeti Földrajzi Közlemények 2. évf. 1-2 sz. 111-112.

[3.] [3.] Viga Gyula (1985): Gyümölcstermesztés és gyümölccsel való kereskedelem a Bükkalján. [Fruit Production and Fruit Trading in Bükkalja]. A Herman Ottó Múzeum Évkönyve XXII-XXIII. (Annales Musei Miskolciensis de Herman Ottó Nominati) Miskolc 287.

[4.] [4.] Pap József (2017): Egerből Noszvajra : Térbeli és társadalmi mobilizáció Borsod és Heves határán. [From Eger to Noszvaj: Spatial and Social Mobilization on the Border of Borsod and Heves Counties]. Acta Academiae Agriensis. Nova Series tom. XLIV. Sectio Historiae. (Tanulmányok Gebei Sándor 70. születésnapjára. Szerk. Borbély Zoltán – Kristóf Ilona. Eger 489-507.

[5.] [5.] Viga Gyula (1986): Tevékenységi formák és a javak cseréje a Bükk-vidék népi kultúrájában. [Forms of Activities and Exchange of Goods in the Folk Culture of the Bükk Region]. Borsodi Kismonográfiák 23. Miskolc

[6.] [6.] "Wine Map of Hungary by Wine Regions" published by the Royal Hungarian Ministry of Agriculture, Industry and Commerce. Accessed on 20.12, 2019.

[7.] https://dspace.oszk.hu/handle/20.500.12346/50788

Szerző

Borbély Zoltán
PhD., adjunct
Eszterházy Károly University
Department of History
borbely.zoltan@uni-eszterhazy.hu

NÉHÁNY MAGYARORSZÁGON IS TERMESZTETT BORSZŐLŐFAJTA FAGYTŰRŐ-KÉPESSÉGÉNEK VIZSGÁLATA 2018/2019 TELÉN

Bozó Ádám – Zsófi Zsolt

Összefoglalás

Kutatásunk során négy borszőlőfajta téli rügyeinek fagytűrő-képességét vizsgáltuk (Kékfrankos, Ménesi Kadarka, Merlot, és Syrah). A mintákat a Kőlyuktető dűlőből (Eszterházy Károly Egyetem Szőlőbirtok) gyűjtöttük közvetlenül a mérések előtt. A vizsgálat 2018 decemberétől 2019. március végéig tartott. Méréseinket egy differenciális hőelemzésre alkalmas eszközzel (DTA) végeztük, felhasználva a növényi sejten kívüli és sejten belüli víz megfagyásakor történő látens hő képződését. Eredményeink alapján a téli időszakban a Kékfrankos bizonyult a leginkább ellenállóbbnak, majd a Ménesi Kadarka, Syrah és Merlot. A rügyfakadáshoz közeledve a Ménesi Kadarka fagytűrő-képessége a többi fajtához képest nagyobb mértékű csökkenést mutatott.

Kulcsszavak: *borszőlő, fagytűrő-képesség, differenciális hőelemzés, DTA, téli rügy*

BUD COLD-HARDINESS OF SOME VITIS VINIFERA L. CULTIVARS DURING THE DORMANT SEASON OF 2018/2019

Abstract

In our research we examined the bud cold-hardiness of four Vitis vinifera L. cultivars (Lemberger, Cadarca de Minis, Merlot and Syrah). The samples were collected from vines growing outdoors in the Kőlyuktető vineyard (Eszterházy Károly University). The work was conducted between December 2018 and March 2019. A Differential Thermal Analyser had been used to define the low temperature exotherms during the intracellular fluid freezing. According to our results, Lemberger showed the highest hardiness among all tested cultivars, followed by Cadarca de Minis, Syrah and Merlot. Cadarca de Minis appeared to lose hardiness more rapidly in spring, indicating it could be sensitive to spring frosts.

Keywords: *bud cold-hardiness, differential thermal analysis, DTA, dormant bud, grapevine*

DOI: 10.33032/acr.2020.spec.31

Introduction

Bud cold-hardiness can be a limiting factor at the production of *Vitis vinifera* L. cultivars in cool climate areas, where critically low temperatures can occur during the dormant season. Frost events after budburst can cause substantial yield losses as well, but (unlike against the hard winter frosts in midwinter) we can find effective methods to protect the different plants against these events (Poling, 2008; Lakatos, 2017a). Site selection and choosing frost tolerant cultivars for planting seems a reliable way to prevent frost damages in the dormant season.

Buds are usually one of the most sensitive parts of the dormant grapevine, however they are able to avoid freezing injury by deep supercooling (Andrews et al., 1984). Frost damage occurs, when the intracellular fluid freezes and the ice crystals penetrates the cell compartments. In order to describe the bud cold-hardiness we need information about the freezing temperature of the intracellular water. According to Mills et al. (2006): "*When supercooled water freezes extracellularly, the heat released is referred to as a high-temperature exotherm (HTE); extracellular freezing is considered nonlethal. On the other hand, the freezing of intracellular water creates a similar, low-temperature exotherm (LTE) and is lethal (Burke et al., 1976)*". These exotherms can be detected by differential thermal analysis (Quamme, 1991).

Another methodology was used by Ferguson et al. (2014) to predict the cold-hardiness of the dormant buds for 23 Vitis genotypes at the Washington State University. The WSU cold-hardiness model uses daily temperature data and genotype-specific parameters to predict bud cold-hardiness between 7th September and 15th May. In Hungary, the same model was used to estimate the occurrence and frequency of frost damage in autumn, winter and spring in several wine regions of Hungary (Lakatos, 2017b and Lakatos et al., 2017).

The objective of this study was to examine the bud cold-hardiness of four commonly grown *Vitis vinifera* L. cultivars in the Eger Wine Region, Hungary, by using a Differential Thermal Analyser.

Materials and methods

Plant materials

The following *Vitis vinifera L*. cultivars were examined during the experiment:

- Cadarca de Minis (convar. pontica. subconvar. balcanica.; *Ménesi Kadarka* in Hungary, which is a subvariety of *Kadarka*; Werner et al., 2013), planted in 2004
- Lemberger (convar. orientalis. subconvar. caspica.; also known as Blaufränkisch, *Kékfrankos* in Hungary), planted in 2001

- Merlot (convar. occidentalis. subconvar. gallica.), planted in 1999
- Syrah (Dureza x Mondeuse blanche; also known as Shiraz; Bowers et al., 2000), planted in 2004
- The experimental site is located in the Kőlyuktető vineyard, Eger, Hungary. For each variety a parcel including 130 plants was used to collect cane and bud samples.

Bud cold-hardiness determination

Cane samples were collected randomly from the experimental parcel just before the measurements from 5-5 different plants. One bud between the 6th - 8th nodes were removed from each cane samples respectively, by a sharp scalpel with approx. 2 mm of intact cane tissue surrounding and underlying the bud. The surface of the cuttings were coated with *Vaseline* and then the 5 buds/cultivars were placed on the thermoelectric modules inside the freezing chamber of the Differential Thermal Analyser (previous studies show that: "*thermal contact can be increased by applying silicon grease or a thermal conducting paste to the surfaces of the sensor and tissue that are in contact*"; Quamme, 1991). Two *Vitis vinifera* L. cultivars were measured at the same time (Lemberger with Cadarca de Minis and Merlot with Syrah). We used the -6 °C h^{-1} cooling rate and the freezing process lasted for 5 hours (lowering the temperature of the freezing chamber from 0°C to -30 °C in total). The signals have been recorded at 5 sec intervals from each thermoelectric module. Low temperature exotherms were identified manually from the output curves in Excel (Fig.1). The cultivars were tested weakly between December 2018 and March 2019 (except the winter holiday season).

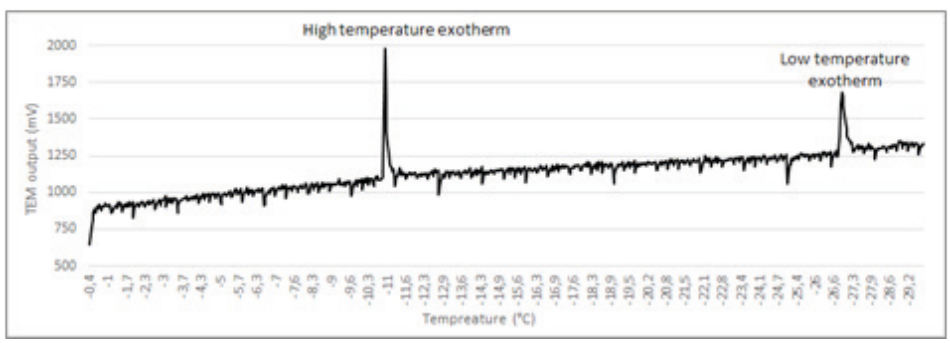


Fig.1: The identification of the Low Temperature Exotherms (LTE)
Source: Ádám Bozó

Results

Bud cold-hardiness for all tested cultivars increased from December to January in the dormant season and decreased from February (Fig.2). All four varieties gained maximum hardiness levels during a cooling period at the beginning of January (daily temperature data on Fig.3). Lemberger presented the highest cold-hardiness among the tested cultivars. Lemberger LTEs were approx. 4°C lower in December and January compared to the other cultivars. Bud cold-hardiness of Syrah and Merlot were similar to each other in December and March, but in midwinter Syrah acquired higher hardiness. Cadarca de Minis buds had a stronger cold-hardiness than Syrah in the dormant season, however this behaviour was disappearing more rapidly than any other cultivars from the end of February, indicating the sensitiveness to spring frosts of this variety.

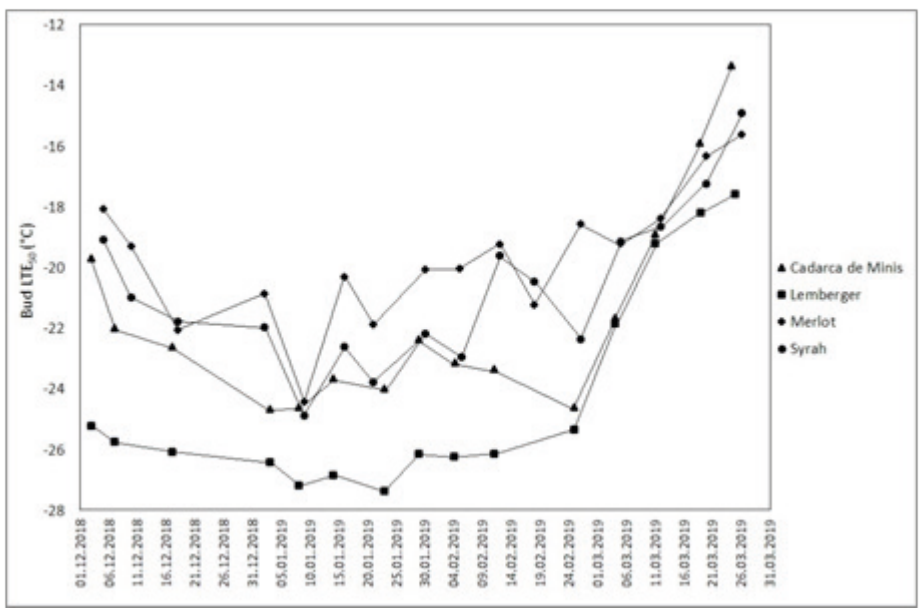


Fig.2: Bud cold-hardiness of four *Vitis vinifera* L. cultivars from December 2018 through March 2019
Source: Ádám Bozó

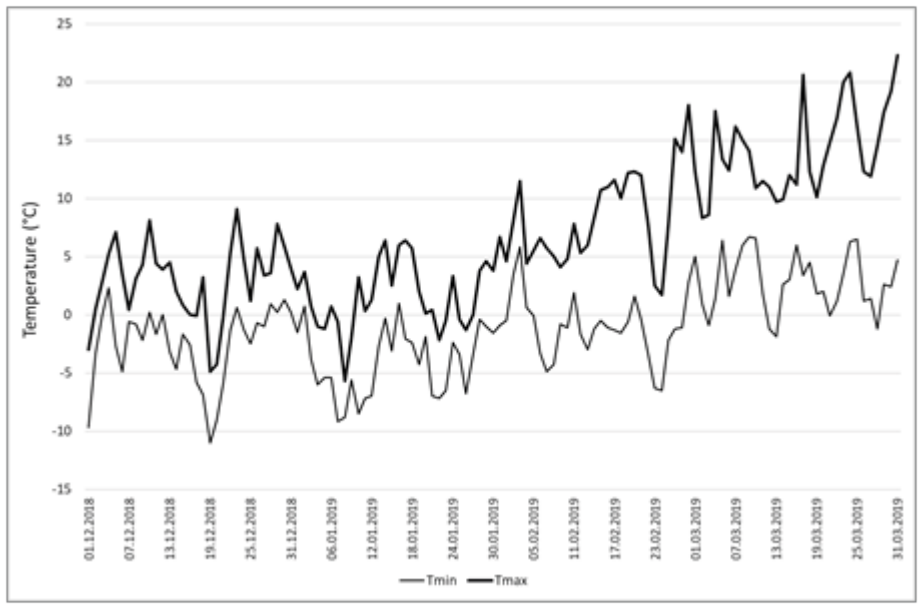


Fig.3: Daily minimum and maximum temperature in the Kőlyuktető vineyard, Eger from December 2018 through March 2019
Source: Ádám Bozó

Conclusions

In this study the bud cold-hardiness of four *Vitis vinifera* L. cultivars has been examined. Our research showed similar results to previous studies. We are planning to validate our future results by the examination of dormant buds suffered frost damage on the field, if a considerable freeze event occurs in the future seasons. Our study was undertaken to provide information to viticulturists and winemakers that will reduce the risks involved in decisions on cultivar and site selection.

Literatures cited

[1.] Andrews, P.K. - Sandridge, C.R. - Toyoma, T.K. (1984): Deep supercooling of dormant deaclimating Vitis buds. American Journal of Enology and Viticulture 35 (3): pp. 175-177.

[2.] Bowers, J.E. - Siret, R. - Meredith, C.P. - This, P. - Boursiquot, J.M. (2000): A single pair of parents proposed for a group of grapevine varieties in Northeastern France. Acta Horticulturae 528: pp. 129-132. https://doi.org/10.17660/ActaHortic.2000.528.15

[3.] Burke, M.J. - Gusta, L.V. - Quamme, H.A. - Weiser C.J. - Li, P.H. (1976): Freezing and injury in plants. Annual Review of Plant Physiology 27: pp. 507-528. https://doi.org/10.1146/annurev.pp.27.060176.002451

[4.] Ferguson, J.C. - Moyer, M.M. - Millis, L.J. - Hoogenboom, G. – Keller, M., (2014): Modeling Dormant Bud Cold Hardiness and Budbreak in Twenty-Three Vitis Genotypes Reveals Variation by Region of Origin. American Journal of Enology and Viticulture, 65 (1): pp. 59-71. https://doi.org/10.5344/ajev.2013.13098

[5.] Lakatos, L. (2017a): Tavaszi fagykárok és az ellenük való védekezés lehetőségei Magyarországon. Agrofórum - A Növénytermesztők és Növényvédők Havilapja 28 (4), pp. 110-113.

[6.] Lakatos, L. (2017b): Téli fagyok és fagykárok Magyarországon. Agrofórum - A Növénytermesztők és Növényvédők Havilapja 28 (2), pp. 14-16.

[7.] Lakatos, L. - Molják, S. - Nagy, R. (2017): Analyzes of Autumnal, Winter and Spring Frost Damage at the Wine Regions of Hungary. In: Serban, G. - Croitoru, A. - Tudose, T. - Batinas, R. - Horvath, Cs. - Holobaca, I. (szerk.) Air and water components of the environment, Kolozsvár, Románia: Casa Cartii de Stiinta, (2017), pp. 69-76. https://doi.org/10.24193/AWC2017_09

[8.] Mills, L.J. - Ferguson, J.C. - Keller, M. (2006): Cold-Hardiness Evaluation of Grapevine Buds and Cane Tissues. American Journal of Enology and Viticulture 57 (2): pp. 194-200.

[9.] Poling, E.B. (2008): Spring Cold Injury to Winegrapes and Protection Strategies and Methods. HortScience 43 (6): pp. 1652-1662. https://doi.org/10.21273/HORTSCI.43.6.1652

[10.] Quamme, H.A. (1991): Application of thermal analysis to breeding fruit crops for increased cold hardiness. HortScience 26 (5): pp. 513-517. https://doi.org/10.21273/HORTSCI.26.5.513

[11.] Werner J. - Tóth-Lencsés A.K. - Veres A. - Kiss E. - Kozma P. (2013): Morphological and molecular characterization of varieties and selected clones of 'Kadarka' grape. Mitteilungen Klosterneuburg 63 (1): pp. 38-50.

Acknowledgments

This work was supported by the EFOP-3.6.2-16-2017-00001 research grant.

Authors

Bozó Ádám
Viticulture and Oenology Engineering (Eger) BSc
III. grade
Educational assistant demonstrator, Department of Viticulture and Oenology
bozo.adam@uni-eszterhazy.hu

Dr. Zsófi Zsolt PhD
Head of department, associate professor
Faculty of Agricultural Sciences and Rural Development
Department of Viticulture and Oenology
zsofi.zsolt@uni-eszterhazy.hu

DEVELOPMENT OF A NOVEL ELECTROCHEMICAL METHOD FOR THE DETECTION OF INVERTASE ENZYME IN HONEY SAMPLES

Beáta Bóka – Judit Bajzát – Helga Szalontai

Summary

Invertase (α-glucosidase) is one of the most important honey enzymes; it hydrolyses sucrose into fructose and glucose during honey ripening process. Next to the basic honey ingredients (glucose, fructose, water), invertase activity is one of the main characterising parameter of honey: it can be used as indicator of aging and/or overheating, but it also may give information about adulteration.

Our aim was to develop a novel analytical method for the fast determination of invertase activity that can be used during quality control of honey samples. Our assay based on the application of an artificial substrate, namely p-nitrophenyl-α-D-glucopyranoside. p-Nitrophenol produced by the enzyme reaction is detected by amperometric method which is much more sensitive than the traditional spectrophotometric determination.

Screen-printed carbon electrodes and a potentiostat were used for amperometric measurement. Our measuring system worked in flow injection system. The measuring parameters (polarization potential, pH etc.) were optimized. The applicability of the method was tested for detection of α-glucosidase enzyme activity.

Keywords: *honey, enzymes, invertase activity, food analysis, food quality, electroanalytical detection, method development*

JEL: Q10

DOI: 10.33032/acr.2020.spec.39

Introduction

Honey is a natural food product characterised by a complex composition. It composed mainly of carbohydrates (60-85%) and water (12-23%) (Machado De-Melo et al. 2018). Besides these main constituents it also contains about 200 substances in smaller amounts such as organic acids, minerals, vitamins, amino acids, proteins and several other bioactive substances (e.g. phenols and flavonoids) (Escuredo et al. 2013). The composition of honey depends mainly on the botanical and geographical origin of nectar and the honeybee species participated in honey production. It is also affected by weather conditions, honey processing and manipulation (Escuredo et al. 2014). Moreover, many expected changes in honey composition occur during storage due to different chemical reactions, including fermentation, oxidation and thermal processing (da Silva et al. 2016). These changes may have effect on food quality as well. Therefore, amount of certain honey components can be used as identity and quality parameters, and some of them can also indicate possible adulterations motivated by limited availability and high price of honey.

Invertase (α-glucosidase) enzyme - which activity is one of the honey quality indicators (Naila et al. 2018) - hydrolyses sucrose into fructose and glucose during honey ripening process. Invertase is the most sensitive honey enzyme to thermal process, therefore the invertase activity is the best quality parameter that can be used as indicator of aging and/or overheating. Moreover, it may give information about adulteration as well.

Material and methods

Chemicals

As invertase standard α-glucosidase from *Saccharomyces cerevisiae* (EC 3.2.1.20, 125 U mg^{-1} protein, Sigma-Aldrich) was used.

Glucose, fructose, sucrose, maltose, p-nitrophenyl-α-D-glucopiranoside (pnf G, $C_{12}H_{15}NO_8$) and paranitrophenol (pnf, $O_2NC_6H_4OH$) were purchased from VWR International LLC (Radnor, PA, USA).

Water purified with an ELGA Purelab Option DV 25 system (ELGA LabWater, Lane End, UK) was used.

All other chemicals were of analytical grade.

The working electrolyte used for amperometric measurement was 0.1 M phosphate buffer (PBS).

Honey samples were purchased from a local shop, and were diluted to 1 m/V% concentration by the appropriate phosphate buffer solution.

The stock solutions of pnf G (10 mM) and the carbohydrates (25mM) were freshly prepared every working day.

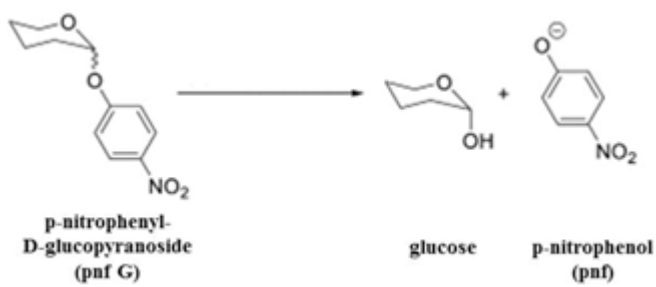
The pnf standard samples (0.1 and 0.01 mM) were diluted from the stock solution (10 mM) with PBS before the measurement.

Apparatus for eletrochemical measurement

Amperometric measurements were carried out in flow injection analysis system (FIA) using QuadStat 164 potentiostat and e-corder A/D converter (eDAQ Pty Ltd, Denistone East, Australia). Screen printed electrodes (Metrohm C110, with graphite working and counter electrodes) were applied in the flow-through cell (DropSens, Spain). Chart software (eDAQ Pty Ltd, Denistone East, Australia) was used for data acquisition and elaboration. The constant buffer flow was maintained by a Minipuls 4 peristaltic pump (Gilson S.A.S., Villiers le Bel, France). The sample was injected with a Rheodyne 7725i type (Rohnert Park, CA, USA) manual injector equipped with 20 µl sample loop.

Results

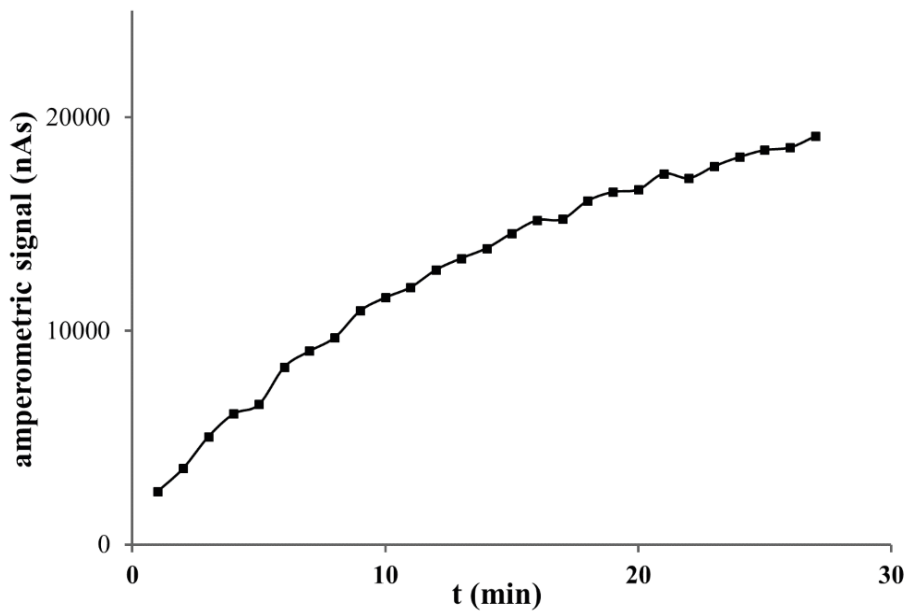
Our novel amperometric method for invertase detection based on the application of an artificial substrate, namely p-nitrophenyl-α-D-glucopyranoside (pnf G). Honey invertase such as α-glucosidase from *Saccharomyces cerevisiae* can hydrolyse the α-glucosidic linkage of pnf G. This enzyme reaction is shown on figure 1. The reaction product p-Nitrophenol (pnf) is a yellow, water-soluble, electroactive compound. It is traditionally measured spectrophotometrically at 405 nm. Its alternative eletrochemical detection was reported more sensitive than the traditional spectrophotometry in case of an alkaline phosphatase assay (Fanjul-Bolado et al. 2006). The limit of detection (calculated as the concentration corresponding to three times the standard deviation of the estimate) was 2×10^{-8} M using amperometric detection in a flow-injection analysis system.



1. figure: The enzyme reaction

The measuring parameters (polarization potential, pH, etc.) were optimized. Flow rate of 1.0 ml/min was applied during the optimization studies. The signals of pnf G, pnf, carbohydrates present in honey (such as glucose, fructose and sucrose) and honey samples were studied as the function of polarization potential in the range from 100 to 1000 mV. The experiments were carried out at different pHs between pH 5.5 and 7.0. The stock solutions of the artificial substrate (pnf G) and sugars studied gave no or neglible signals. In case of honey samples (1m/V%) small, but measurable signals could be detected at 400-1000 mV. While significant increased signal could be observed at 700-1000 mV polarizing potential when pnf standard samples (0.01mM) were measured. Therefore, the enzymatic conversion can cause signal increase at 900 mV potential.

Studies with standard α-glucosidase enzyme were carried out to test the applicability of our detection method. Different amounts of enzyme were added to pnf G solutions (0.001-1mM) and the amperometric signals of the reaction mixtures were measured as the function of reaction time. Figure 2 shows a typical example.



2.figure: Amperometric detection of α-glucosidase enzyme

0.01mM pnf G, 0.05 U/ml enzyme, 900 mV, 1 ml/min phosphate buffer (0.1 M pH 7.0)

We can conclude that the novel method was suitable for the detection of α-glucosidase enzyme activity.

Conclusions

The final aim of our work is to develop a novel amperometric method for invertase (α-glucosidase) activity measurement, that can be used for quality control of honey samples. Our method based on the amperometric detection of the reaction product, pnf produced from an artificial substrate. The main measuring parameters were optimized. The best results could be obtained using phosphate buffer pH 7.0 and 900 mV polarization potential. Studies with standard α-glucosidase enzyme were carried out. Our results demonstrated the suitability of our method for enzyme activity detection, although further development steps are required to achieve practical applicability in honey quality control.

Acknowledgements:

This work was supported by EFOP-3.6.1-16-2016-00001 ("Complex improvement of research capacities and services at Eszterházy Károly University").

References

[1.] Machado De-Melo A. A – de Almeida-Muradian L. B. – Sancho M. T. – Pascual-Mate A. (2018) Composition and properties of Apis mellifera honey: A review, *Journal of Apicultural Research*, 57, 5-37. https://doi.org/10.1080/00218839.2017.1338444

[2.] Escuredo O. – Míguez M. – Fernández-González M. –Seijo M.C. (2013) Nutritional value and antioxidant activity of honeys produced in a European Atlantic area, *Food Chemistry*, 138, 851–856. https://doi.org/10.1016/j.foodchem.2012.11.015

[3.] Escuredo O. – Dobre I. – Fernández-González M. – Seijo M. C. (2014) Contribution of botanical origin and sugar composition of honeys on the crystallization phenomenon, *Food Chemistry*, 149, 84–90. https://doi.org/10.1016/j.foodchem.2013.10.097

[4.] da Silva P.M. – Gauche C. – Gonzaga L. V. – Oliveira Costa A. C. – Fett R. (2016) Honey: Chemical composition, stability and authenticity, *Food Chemistry*, 196, 309–323. https://doi.org/10.1016/j.foodchem.2015.09.051

[5.] Naila A. – Flint S.H. – Sulaiman A.Z. – Ajit A. – Weeds Z. (2018) Classical and novel approaches to the analysis of honey and detection of adulterants, *Food Control,* 90, 152-165.
https://doi.org/10.1016/j.foodcont.2018.02.027

[6.] Fanjul-Bolado P. – González-García M. B. – Costa-García A. (2006) Flow screen-printed amperometric detection of p –nitrophenol in alkaline phosphatase-based assays, *Analytical and Bioanalytical Chemistry*, 385, 1202–1208.
https://doi.org/10.1007/s00216-006-0367-8

Authors:

Beáta Bóka PhD (supervisor)
college associate professor
Eszterházy Károly University
Food Science Institute
boka.beata@uni-eszterhazy.hu

Judit Bajzát (student)
Biology BSc
bajud98@gmail.com

Helga Szalontai PhD
research fellow
Eszterházy Károly University
Centre for Research and Development
Food and Wine Research Institute
szalontai.helga@uni-eszterhazy.hu

ECONOMIC SPATIAL MODELING OF EGER AND MISKOLC ON MAPS WITH DIFFERENT GIS METHODS

Bence Czímer – Balázs Magyar – Csaba Ruszkai

Abstract:

In this study we did the economic spatial modeling of the cities of Eger and Miskolc on maps with different GIS methods. The aim was to produce maps that accurately display the nodes and the operating time interval of companies in different national economic sectors within a given city. The geo-referencing of the available settlement planning maps was necessary for the city of Miskolc. Both GIS and enterprise database building are required to produce the aforementioned results, for which we have used various software and methods.

DOI: 10.33032/acr.2020.spec.45

Introduction

During the research we worked on the economic spatial modeling of Eger and Miskolc in a GIS system. We used several methods to illustrate the spatial distribution of firms within cities: building-based and district-level visualization techniques. This required the creation of a geographic information system and an entrepreneurial database, with the help of these we could create various thematic maps based on the data of the companies. The different methodological structure of the economic map of the two cities was needed due to the availability of data and settlement development plans. By comparing the two databases, it is possible to observe the concentration of the nodes of the companies operating in the selected city, as well as the areas where more companies are established and the period of their operation.

Methods

Creating the map of Miskolc

The inner city of Miskolc consisted of 84 section of settlement organizing map in vector pdf format, which we obtained from the official website of the city. To begin georeferencing, we converted these files to dwg. extensions that is compatible with AutoCad software. The first step is to resize the segment. From the beginning of the project, we had a map of the real estate maps of Miskolc landscapes, with real dimensions and coordinates. Within Arcmap, on this layer, we selected arbitrary plot boundaries or object parts that can be identified on both maps, and then described the exact data in the original scale. Using the "scale" tool, we enlarged the polylines in AutoCad software to the right size, so the base map was scaled to the real city dimension. The next step was to get the correct geographic coordinates by selecting a point on the plot map. In Hungary, the EOV projection system is generally used, so it is important that our map also exists on the basis of this representation, as it can vary or distort the scale of two different projections. We applied the „move" tool to move the base map to its correct location using the measured coordinates.

After transferring the layers to ArcGIS, the layer has to be transformed into an EOV projection system. In order to gain access to any specific changes to the map section, we had to convert the map to the programs own format with the "Feature class to feature class" tool, so the layer would be editable on the interface. It's important not to keep unnecessary elements (points, polygons and annotation) as part of the map, so we only convert the polylines we need with the device to mark buildings, land borders, and roads. After filtering all of this out of the segment, we reduced it further with sorting out one of the twelve „colors" (which attribute came from the original

AutoCAD layout) to get rid of the unnecessary elements. Although we used the correct coordinates in AutoCad software, there were minor discrepancies between maps. Tasks include converting data from one coordinate system to another, correcting geometric distortions, adjusting elements at the edge of a layer to adjacent layers, and comply attributes between layers. Because spatial adjustment works within an editing session, we implemented existing editing functions using the snapping tool. We performed vector georeferencing, which is a procedure for assigning defective points, units to polylines representing building elements that correspond to accurate location data. We sorted out the buildings based on the OBJECT ID in the attribute table: the elements of the cadastral base map have a lower ID number and the added content has a higher number, in the order they were created. Once the 84 sections were completed, we stitched it with the "merge" tool. We transformed the polylines into polygons, then filled in the attribute table of the polygons representing the streets with street names using OpenStreetMap. We generated a unique building ID for each building, and assigned the name of the street closest to the object with the "Spatial Join" tool. We also added the house number to the attribute table for each object manually.

Database of companies in the city (including company name, address, industry, year of registration, annual net sales, last headcount and tax number) was obtained from BISNODE (www.partnerradar.hu), „E-cégjegyzék" (www.e-cegjegyzek.hu) and „céginformáció" (www.ceginformacio.hu) open source websites. The classification of the subsector, sector and national economy was based on the NACE structure.

Eger

In the case of Eger, we already had a cadastral base map which we had to complete. The base map contained the following elements:

- Land Parcels from real estate cadastre
- Buildings from a real estate cadastre
- Roads-line layer
- Borders of the districts-line layer

We also created another database in excel, which contained the ventures of Eger. The elements of this database are the name of the company, the main activity on class/group/sector/section level, the latest data to the headcount of employees (if available), sales returns (if available) the headquarters/branches of the company (at the investigated settlements) and the address of the headquarters and branches. In the case of Eger, we collected the ventures data partly from online open sources, such as https://www.e-cegjegyzek.hu/ and https://www.ceginformacio.hu/, and partly from https://www.bisnode.hu/.

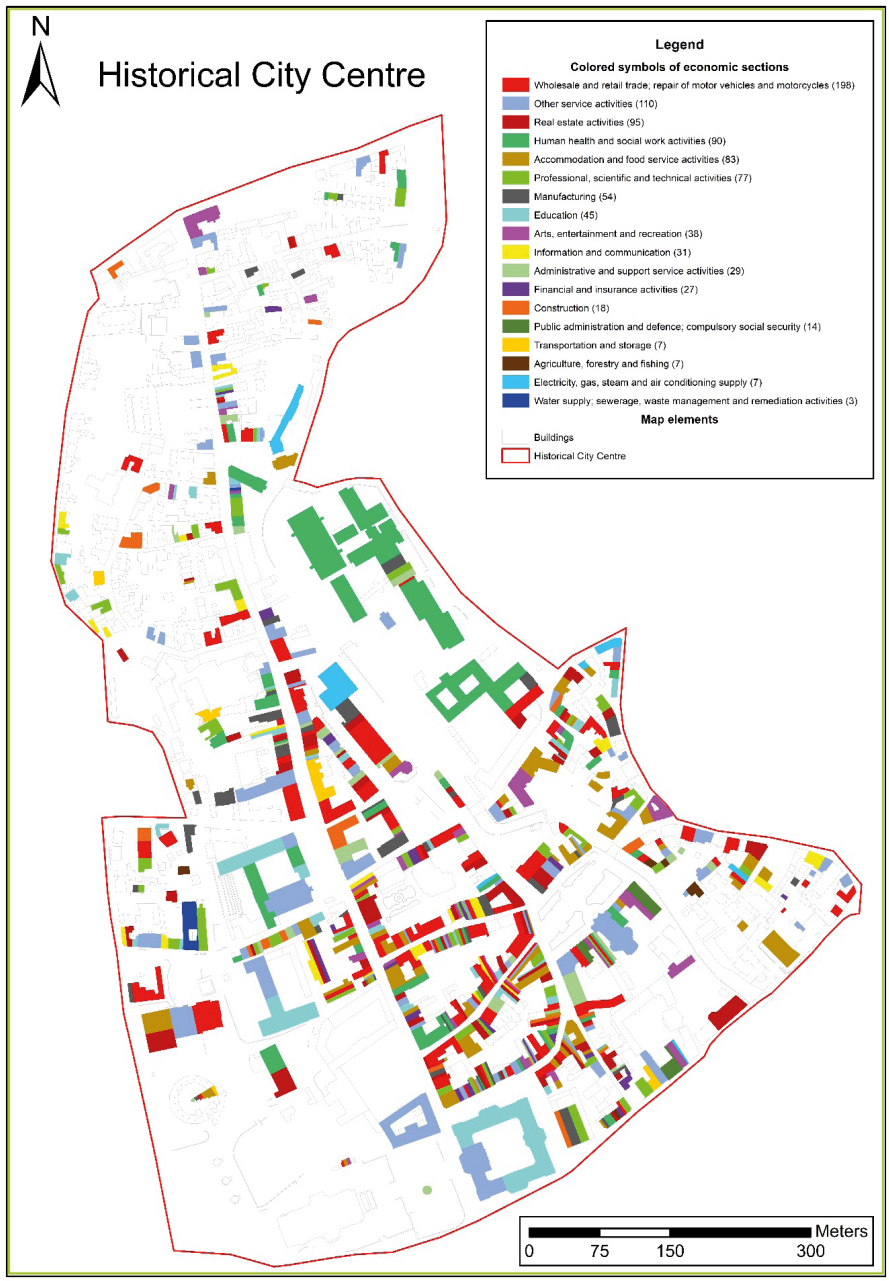
For visualization, when multiple companies were in a building, the polygon representing the building was divided into pieces. In this case we manually cut

of buildings along parallel lines (Cut Polygons Tool, parallel), also dividing the individual building identifier code, for example: Eger_24110//1, Eger_24110//2. In the divided buildings, the companies which are working in the same section, located next to each other. To link buildings, we generated a unique building ID number for each building, so when we had to split the buildings, we also subdivided that ID with a "//" which marks the technical character of the divided polygon. The building ID is a technical number, which we use for the concrete spatial identification of the buildings. The buildings haven't got an official identifier number, like in the case of parcels. Hence buildings on the same parcel don't have individual street numbers. Accordingly, we have generated the building identifier using field calculator in the following method: name of the settlement + underscore + five-digit sequential number (Object_ID). If the O_ID doesn't reach the five-digit length, the first number characters will be "0" characters. For example, in Eger the Object_ID of the first chosen building: Eger_00001. After verifying that every data has a match we joined the excel database to the buildings-polygon layer by matching the addresses with the unique ID's and then we joined of the company database based on unique building ID. We created a color ramp for the economic sections, using the most associative colors for each section.

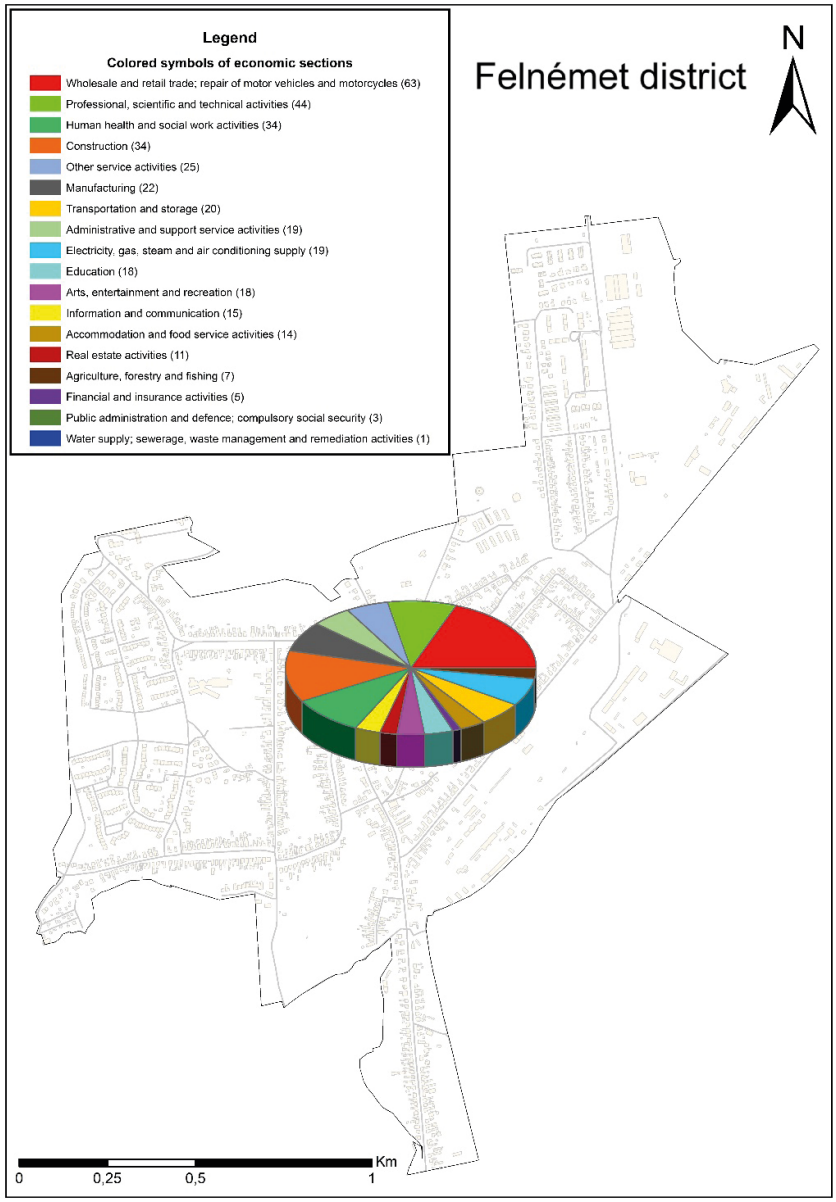
The result was a map where every single venture was displayed with the color of their section. We displayed the number of companies on city district level too because, because the most versatile and best-used method of thematic maps showing statistical data is applying charts to maps.

Results

After completing the databases, we created a building-level economic map for each district as shown on *figure 2*, using the color ramp we made for symbols of economic sections. This map may give accurate spatial data for the location of the companies, but it's less informative according to the overall venture presence and the other qualities of the companies. We displayed the data from a different approach: *figure 3* shows the distribution of the ventures numbers according to their economic activity on district level.



1. figure The economic map of Eger's Historic City Centre according to the activity of the ventures



2. figure The number of ventures in sections of Felnémet district displayed on pie chart

Conclusion:

In the further research, some of the aforementioned methodologies will be neglected due to their time-consuming nature. The visualization created by building-level parallel cutting needs too much manual work, that are more difficult to apply than economic spatial modeling of larger cities. Instead we will create the databases and maps in district level. This kind of presentation is almost equally eloquent, although the way it is illustrated is not as accurate, but the nodes of companies operating in different sectors of the economy are just as easy to identify. In the upcoming period of research, it is more expedient to purchase a complete database of company data in a ready-to-buy form, instead of free interfaces, to save time and obtain a more complete data set.

References

[1.] Lénárt Csaba, Tamás János, Juhász Csaba, Cifer Attila, Szabó Attila (2003): Általános Térinformatikai alapok, Kiadó: Miskolci Egyetem

[2.] Nagyváradi László, Pirkhoffer Ervin (2008): A modern geográfia kihívása: A térinformatika önkormányzati alkalmazásának új lehetőségei Kozármisleny példáján, Kiadó: Földrajzi értesítő

[3.] Sárközy F. (2004): Térinformatikai Oktató Anyag BME Általános- és Felsgeodéziai Tanszék, (elektronikus tankönyv)

[4.] Huiyue Wang, Dongjie Chen, Huabo Duan, Fengfu Yin, Yongning Niu (2019): Characterizing urban building metabolism with a 4D-GIS model: A case study in China, Kiadó: Journal of Cleaner Production
https://doi.org/10.1016/j.jclepro.2019.04.341

[5.] Zoltán Utasi – Balázs Hegyi – Sándor Molják – Csaba Ruszkai (2019): Integrated cadastral and technical databases. In.: Geographia Napocensis 2/2019; Academia Romana – Filiala Cluj Colectivul de Geografie; Cluj Napoca

A COMPARATIVE AROMA AND VOLATILE PROFILE INVESTIGATION OF 2016 AND 2017 VINTAGE BULL'S BLOOD WINE SAMPLES

Gabriella Keresztes – Kitti Bogárdi-Tóth

Összefoglalás

A kísérlet célja az egri Bikavérek aromaprofil felvétele, valamint érzékszervi összevetése volt, ehhez 2016-os és 2017-es Classicus Bikavér mintákat gyűjtöttünk. A vizsgálatok érzékszervi bírálatot, GC-MS készülékkel végzett aromaprofil vizsgálatot, valamint WineScan készülékkel az alapparaméterek vizsgálatát foglalta magában. Az érzékszervi vizsgálatoknál szempont volt a bor megjelenése (szín és tisztaság), az illat (intenzitás, fajta karakter, minőség), zamat (intenzitás, fajta karakter, minőség, hosszúság), valamint az összbenyomás a borról. Az aromaprofil vizsgálatokhoz HS-SPME-GCMS technikát használtunk. Az aromák minőségi kiértékelése után statisztikailag értékeltük az eredményeket, amely során négy aroma és egy alap paraméter, valamint az érzékszervi vizsgálatok szempontjai között összefüggést találtunk. Egy aromavegyület pozitív, a többi negatív irányba befolyásolta az érzékszervi bírálatokon adott pontszámokat, míg az alap paraméter pozitív irányba tolta el a borok megítélését. A kutatási eredményeket későbbiekben fel lehet használni egy adatbázis létrehozására, valamint vizsgálni a vásárlói attitűdöt.

Abstract

In our research, our aim was to examine the volatile compounds of Bull's Blood originated from Eger, and search correlation between them and organoleptic analysis. To reach these goals, we collected 2016 vintage and 2017 vintage Bull's Blood samples from different wineries. The research includes organoleptic analysis, volatile compound profile examined with GC-MS, and studying basic parameters, using WineScan. . Organoleptic analysis' points were givens for the look of the wine (colour and clarity), Fragrance (intensity, character and quality), Flavour (intensity, character and quality) and General impression. For examining volatile compounds, we used HS-SPME-GCMS technique, as it is suitable to study aromas. After qualitation of volatile compounds, we used a statistic programme, and there was correlation between four aroma, one basic parameter and some of organoleptic analysis' part. One aroma had positive effect, three aromas has negative effects, and the basic parameter had positive effect on organoleptic analysis.

DOI: 10.33032/acr.2020.spec.53

Introduction

Bull's Blood is a dry, red wine, which is produced in Eger or Szekszárd (Hungary). Bull's Blood, from Eger, is under the protected designation of origin, and since 2017, it is also one of the Hungaricums[1]. It is a blended wine, whose definition states that none of the base wines' characters can dominate the blended whole. There are three types: Classicus, Superior and Grand Superior; differing, for the most part, in their winemaking technology. The Classicus Bull's Blood carries rich, spicy and also fruity notes without heavy tannin tone, due to the unique climate and region. Thirteen types of grapes can be used in the making of this wine: Bíbor kadarka, Blauburger, Cabernet franc, Cabernet sauvignon, Kadarka, Kékfrankos, Kékoportó, Menoir, Merlot, Pinot noir, Syrah, Turán and Zweigelt. Three of them must be used, none of them can make up more than 50% of the wine and the biggest portion must be Kékfrankos. Classicus also requires half a year of oak aging[2].

The quality of wine depends on the vintage, the technology, the region and the blending ratios. Except blending ratios, all of these factors affect the aromas which originate from the grape[3]. They can be primer, prefermentative, fermentative or aging aromas. Wine aromas has various classes of compounds such as alcohols, terpene alcohols, esters, aldehydes, ketones, acids and ethers[4]. The blended wines are not made with fragrant grape types and they contain mostly the prefermented aromas[5]. These aromas are C6-aldehydes and alcohols and they give a greeny smell and taste to wine[5]. During fermentation, the temperature is essential, as yeast has different esterase activity at lower and higher temperature. At lower temperature (10 °C), fruit esters like isobutyl- isoamyl and hexyl-acetate are produced, however, at higher temperature (15-20°C) yeast produces higher molecular weighted esters like ethyl-octanoate and ethyl-decanoate.[5]

Material and methods

Our aim was to compare volatile components of different vintages of Bull's Blood wines and perform organoleptic analysis, as aromas are key ingredients when costumers choose wine.

Several Bull's Blood samples were collected from different wineries, we concentrated on classicus, 2016 and 2017 vintage Bull's Blood samples. We collected 10 samples of 2016 vintage and 10 samples of 2017 vintage. The samples had to be ready-to-be-bottled and they were in 0,7L bottles. We stored them in room temperature (20°C) and in a dark place until the examinations were performed. We marked each of them with a 2-digit number from 1 to 20 (1-10: 2016 vintage, 11-20: 2017 vintage).

Wine samples were studied with the Headspace-SPME method. A 50/30um DVB/CARV/PDMS, Stableflex SPME fiber is used from Supelco. The bottles were opened just before the examination, 8 mL wine samples were placed into a 20mL Headspace bottles. 3,00 g of NaCl (AnalR Normapur, a.r.) were placed into the Headspace bottles and were heated to 180 °C for 24 hours to eliminate contamination. The samples were held in place for 20 minutes at constant temperature (40°C). The wine samples were stirred with a magnetic stirrer in order to guarantee the even temperature and help the volatile component to transfer into the headspace phase from the sample phase. The SPME fiber was injected to the headspace phase and the volatile components were absorbed for 20 minutes at a constant temperature (40°C). The SPME fiber was conditioned in GC inlet before every usage by a conditioning programme (injector temp.: 250°C, start temp.:100 °C for 1 min, final temp.: 250°C for 25 min) in order to eliminate the contamination. After the absorbing phase, the fiber is inserted to GC injector (injection temp.: 250°C) with a 1 minute sampling time.

The measurement was performed with a Shimadzu GC-2010S gas chromatograph equipped with mass spectrometer. We used a 60m x 25mm VF-WAXms high-performance polyethylene glycol column with a 0,25 µm film thickness, as it is ideal for flavour and fragrance applications. Injection was splitless and we used Helium as a carrier gas. A specific GC-MS programme was used for separation: initial temperature 40°C (4 minutes hold); first ramp 3°C/minute to 70 °C (0 minute hold); second ramp 5°C/minute to 240 °C (hold 27 minutes), total programme time: 75 min).

We carried out an organoleptic analysis by a panel of 5 tasters. They had to give points based on the appearance of the wine (clarity and colour), fragrance (intensity, character and quality), flavour (intensity, character, quality and lengthiness) and general impression. The subtotal of the maximum points possible was 100.

Sample ID: _____ Taster: _____

		Perfect	Very good	Good	Okay	Not okay
Appearance	clarity	5	4	3	2	1
	colour	10	8	6	4	2
Fragrance	intensity	8	7	6	4	2
	character	6	5	4	3	2
	quality	16	14	12	10	8
Flavour	intensity	8	7	6	4	2
	character	6	5	4	3	2
	quality	22	19	16	13	10
	lengthiness	8	7	6	5	4
General impression		11	10	9	8	7

1. Figure: The evaluative sheet of organoleptic analysis

We wanted to know if basic parameters like ethanol, total acid content, volatile acid content, pH, amount of glycerine, the common acids in wine (malic acid, citric acid, lactic acid, sorbic acid, tartaric acid) and sugars (fructose, glucose) are responsible for the different points in an organoleptic analysis, so we measured these parameters with FT-IR (FOSS Winescan).

Results and discussion

One of our aims was to compare the amount of different volatile components to each other, so we identified them manually, in a compound by compound identification by their m/z value using NIST database.

We could find 43 different components, mostly alcohols, esters and acids (2. Table). Methyl decenoate, Furfuryl-alcohol and ethyl-sorbate were only found in 3 separate samples. 1-Octen-3-ol was specific to 2017 vintage, and Only 14 of the components (Ethyl acetate, Isobutyl alcohol, Isoamyl acetate, Isoamyl alcohol, Ethyl caproate, Ethyl lactate, 1-Hexanol, Ethyl octanoate, Ethyl decanoate, Diethyl succinate, Phenethyl alcohol, Octanoic acid) could be found in every single Bull's Blood wine[6,7,8].

After identifying, statistical analysis was made by the IBM SPSS 10.0 statistical programme, where we made normality test and we examined the relationship between the volatile components, the basic parameters and the given points of organoleptic analysis (average of the points where examined with SPSS). Mostly, the volatile components have normal distribution, but there were 18 components, whose distribution was not normal (they were those, that we found only in just 1-3 wine samples). Therefore, we used the Pearson correlation where there was normal distribution and Spearman's where there was no normal distribution. Testing the correlation was successful; there were 5 mild correlations, 4 of them were *from the results of gas chromatography* and one of them was from the basic parameters.

1. Table: Correlations between organoleptic analysis and volatile components found by GC-MS

Correlations

		Fragrance intensity	Fragrance character	Fragrance quality	Flavour intensity	Flavour character	Flavour quality
Pearson Correlation	Tartaric acid	0,182	0,213	0,191	0,468*	0,206	0,175
	Isoamyl alcohol	0,413	0,448*	0,467*	0,343	0,233	0,381
	1-nonanol	-0,226	-0,474*	-0,555*	-0,435	-0,525*	-0,650**
	Isoamyl octanoate	-0,296	-0,480*	-0,376	-0,329	-0,496*	-0,509*
Spearman's rho	Isoamyl lactate	-0,530*	-0,481*	-0,302	-0,363	-0,299	-0,474*

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The first one differs from the last four, as it is a basic parameter of wine. Tartaric acid is common in wine, but if wine contains too much of this acid, it gives the wine a piercing taste[4]. However, the more amount of tartaric acid, the better points given to flavour intensity (p=0,468) (within the limits).

The next parameter was isoamyl alcohol, which is one of the 13 components, that were found in all of the samples. It gives a whiskey like odor to wine[9], and its presence has a positive effect on the fragrance character (p=0,448) and quality . (p=0,467)

1-Nonanol is a straight chain alcohol, that has a characteristic rose–orange odor and a slightly fatty, bitter taste reminiscent of orange[9]. It has a negative effect on fragrance character (p=-0,474) and quality (p=-0,555), flavour character (p=-0,525) and quality (p=-0,650).

Isoamyl octanoate has negative effect on fragrance character (p=-0,480), flavour character (p=-0,496) and quality (p=-0,509), it has a nutty, oily, apricot-like odor and a fruity, winy, cognac-rum flavor[9].

Isoamyl lactate is ester of isoamyl alcohol and lactic acid. It has a fruity, creamy, nutty odor[9] which is an unlikely smell in wines. In this case, we used Spearman's correlation test. Its presence in the wine gave 5 of the samples worse points in fragrance intensity (p=-0,530) and character (p=-0,481), and also has negative effect on flavour quality (p=-474).

Conclusion

This study demonstrates the varieties of volatile compounds found in Bull's Blood wine. Their aromas were examined with GC-MS and it is suitable for qualitative analysis. Results can be used for optimizing wine in order to maximize selling rates.

We want to collect more Bull's Blood samples to make database. This database can be used for spotting adulteration. We also want to carry organoleptic analysis with more people to survey and find correlation between the buyers' attitude and why would they choose that Bull's Blood.

Authors gratefully acknowledge the financial support of the EFOP-3.6.1-16-2016-00001 „Kutatási kapacitások komplex fejlesztése az Eszterházy Károly Egyetemen".

References

[1.] A Magyar Borkönyv előírásai (borászati termékek jelölése és kiszerelése)

[2.] 607/2009/EK bizottsági rendelet

[3.] **Gál Lajos**: Az egri Bikavér minőségfejlesztésének lehetőségei Downloading: 2020. 01. 10., Corvinus PhD dissertation archive: http://phd.lib.uni-corvinus.hu/463/1/de_3501.pdf

[4.] **Gy. Vas, K. Koteleky, M. Farkas, A. Dobo, K. Vékey**: Fast Screening Method for Wine Headspace Compounds Using Solid-Phase Microextraction (SPME) and Capillary GC Technique (Article in American Journal of Enology and Viticulture · January 1999)

[5.] **Eperjesi Imre, Kállay Miklós, Magyar Ildikó**: Borászat (1998, ISBN: 963 286 075 6)

[6.] **V. Ivanova-Petropulos, M. Stefova, T. Stafilov, I. Bíró**: The user Validation of a Method for Analysis of Aroma Compounds in Red Wine using Liquid–Liquid Extraction and GC–MS (Food Analytical Methods 2012. December) https://doi.org/10.1007/s12161-012-9401-y

[7.] **M. Csóka, M. Amtmann, D. Ny. Sárdy, M. Kállay, K. Korány**:GC-MS Description of the primary aroma structure of two Kadarka wines considered indigenous in Hungary (Journal of Applied Botany and Food Quality 86, 104 - 112 (2013))

[8.] **J.Aith Barbará,K. P. Nicollia, É. A. Souza-Silva, A. C. Telles Biasoto,J. E. Welke,C. A. Zinia**: Volatile profile and aroma potential of tropical Syrah wines elaborated in different maturation and maceration times using comprehensive two-dimensional gas chromatography and olfactometry (Food Chemistry Volume 308, 2020 March)
https://doi.org/10.1016/j.foodchem.2019.125552

[9.] **George A. Burdock Ph.D**: Fenaroli's Handbook of Flavor Ingredients (Sixth Edition, ISBN: 978-1-4200-9077-2)

Authors

Keresztes Gabriella
Eszterházy Károly University,
Food and Wine Research Centre
keresztes.gabriella@uni-eszterhazy.hu

Bogárdi-Tóth Kitti Irén
Eszterházy Károly University,
Food and Wine Research Centre
toth.kitti@uni-eszterhazy.hu

THE REGIONAL STRUCTURE OF RETAIL SECTOR IN THE NORTHERN HUNGARY REGION

Gábor Koncz – Konrád Kiss – Dóra Nagyné Demeter

Abstract

The retail sector plays a decisive role in the development of urban-rural relations. As it is not only a narrower segment of the population that participates in it and it is a good measure of the central role of cities on a market basis. Our study is part of a broader research project covering the North Hungarian region, where we investigate market access opportunities for local producers through short supply chains. As a basis for the primary research of a greater project we conducted secondary research based on the databases of the Hungarian Central Statistical Office. In addition to the number of retail stores, we investigated the possible impacts of changes in population and incomes on demand for retail stores and centres in each city and their surrounding rural areas. In terms of the socio-economic sense, the region shows a less favourable picture than the national average, which also manifests itself in the lower number of retail units. However, in the region, significant differences can also be observed in the settlement hierarchy and spatial characteristics. There is some duality in the fact that the population per unit of trade is relatively high, but at the same time, the number of units in the examined chain stores is relatively smaller in the region.

Keywords: *retail amenities, market sizes, regional competition, settlement structure, spatial concentration*

JEL: L81, R12

DOI: 10.33032/acr.2020.spec.61

Introduction

Our secondary study was carried out as part of a complex research project to explore the situation and development opportunities of sales forms that meet the expectations of short supply chains (SSCs) (Examination of value-added chains, determination of its representative spatial data in urban-rural relation). In the framework of the project, in addition to a review of the relevant literature, we collected statistical data and conducted primary research among both producers and consumers. The market is basically not dominated by forms of sales that can be categorized into SSC, also called alternative forms of sale, at the same time, the practical benefits of our research may be to help small producers' goods reach markets more efficiently in the future. Different parts of its regions have differentiated geographical features, which has made it an inevitable task for us to explore the current spatial structure of retail.

Retail is currently a saturated, concentrated market, regardless of the level of development of the regions. In markets, global supply chains have the largest market shares, and small commercial units can easily be pushed out of markets due to increasing concentration (Tömöri, 2015). Despite the fact that the turnover of traditional stores has not decreased, the number of stores and the share of small shops is expected to decrease further in the future, which, however, will not proportionally reduce the total sale space of the stores (Kozák–Neszmélyi, 2018). Based on past experience, economic crises even reinforce this process (Tömöri, 2014,).

Examination of the spatial position of commercial units, peculiarities of visiting shops is one of the most researched topics in economic geography (Golledge–Stimson, 1997). The range and distribution of retailers has changed dramatically in the last two to three decades, constantly posing new challenges to management of international hypermarkets and supermarkets as well as discount chains (Sikos et al., 2019). The performance of elements in commercial networks is continuously evaluated and their distribution is rationalized (Reynolds–Wood, 2010). In Hungary, too, we can find several examples of companies leaving and liquidating stores and the regional networks of store chains. The population development of an area (market) fundamentally influences the quantitative needs of consumers in the area. The information obtained from loyalty card programs allows retail chains to track the composition of consumption based on other aspects as well. Larger retail chains assess in detail the potential location of stores in the region and in town (Birkin et al., 2017).

The development of the service sector in a given territorial unit is fundamentally influenced by its population, the urban-rural relationship system within the area and the competitive situation between the neighbouring regions. (Burger et al., 2013). Research on retail geography prefers to examine the degree of concentration in key centres of the sector (Wrigley, 2009), while the availability of basic retail units in peripheral areas can be a problem. Urban centres are traditional centres of retail

activities, but the benefits of favourable transport hubs are also manifested at lower levels of the network hierarchy (Han et al., 2019).

Of course, the choice of location is a strategic decision not only among the store chains, but also among the smaller actors, which in many cases focuses on the position of the store within the settlement or the district. However, they have much less information about potential consumers and competitors. Smaller stores are often the focus of interest because their legitimacy in the market becomes questionable (Kozák, 2014).

In a market with a small population, the presence of advanced producer and business services is not typical. For markets with less than 2000 inhabitants – which can already include several settlements in a small village area – the literature mentions natural markets characterized by low demand and self-service, and the fact that residents visit other settlements to meet their needs (related to purchases and services). It is not uncommon for villages in the peripheral areas of the Northern Hungary region not to have a grocery store in their administrative units (Kápolnai, 2017; Sikos, 2019).

Material and methods

We carried out our study purposely in the area of the Northern Hungary region. Because this analysis based on secondary data sources is closely related to our research program in the region which examines the role of SSCs. The subject of this is the potential of short supply chains and the factors that influence them. The study area has been the least developed region in Hungary for many years, but since 2012 they have managed to reverse the lagging trend. GDP per capita data increased from 58.9% to 69% of the national average in the five years until 2018. The population that fundamentally influenced the amount of consumption in the region decreased by 5.9% between 2010 and 2018. Youth emigration is a striking phenomenon in the region, but the decline in population due to the difference between live births and deaths has been greater in the average for the last 8 years (-5509 people/year), which was one and a half times the migration loss (-3665 people/year). The demographics of the region are a good reflection of the aging population structure. At the same time, the increase in economic performance has also had a positive effect on incomes, helping some rural areas to catch up. However, this was largely due to commuters - who work mainly in industrial centres (Koncz et al. 2018).

For the study, we used data available at the settlement and district level in the databases of the Hungarian Central Statistical Office to present the regional distribution of retail stores in the period between 2010 and 2018. Because the statistics on the number of stores obscure the size and real role of the stores, we collected information from the own webpage of large chain stores to more accurately

explore the spatial structure of retail. Our analysis was performed for the entire sector of the retail store network. Spatial differences were also illustrated by calculating the Herfindahl-Hirschman index (concentration coefficient).

Results and discussion

Demographic and income trends, which have a major impact on consumption, have been at odds in recent years. The development of the economy of the Northern Hungary region could be measured not only through the GDP data per capita, but also in the income data, which is much more important information for the population. The value of total domestic income on the per capita PIT tax base in the region increased from 83.9% of the national average to 87.7% between 2010 and 2018. Among the counties, Heves county is in the most favourable position in Eastern Hungary, where the income per resident (96.7%) is close to the national average. The indicators of Nógrád (85.5%) and Borsod-Abaúj-Zemplén (84.3%) counties lag significantly behind it. However, according to the data series, the increase in incomes could not significantly contribute to the increase in the number of commercial units.

In parallel with the declining territorial demand caused by the declining population, the number of commercial units also decreased or even exceeded the rate of population decline. While in 2010 there were still 133 retail stores per ten thousand inhabitants in the region, in 2018 this figure was only 116. A lower value was observed only in Pest county, a significant part of which is made up of the dormitory towns around Budapest. These are overshadowed by the capital's outstanding strong service sector. Within the country, 9.8% of retail units will be located within the region in 2018, which is 0.4 percentage points lower than the 2010 regional value.

Among the counties of the Northern Hungary Region, Heves County has the most favourable spatial structure position (M3 motorway, proximity to Budapest) and the least fragmented settlement network (the average population of the settlements was 2435 people in 2018). As a result, the number of retail units per ten thousand inhabitants is also the highest in this county (128), followed by Nógrád County (115), then Borsod-Abaúj-Zemplén County (110) .

The number of retail stores per ten thousand inhabitants was also examined at the district level. In the ranking of 175 districts of the country, the Sátoraljaújhely district occupies the best position with 13th place (the highest value is given to the priority tourist areas next to Lake Balaton). At the same time, six districts in northern Hungary are also among the last ten places in the ranking (Cigánd, Rétság, Edelény, Gönc, Szikszó and Putnok). The regional ranking is led by the districts with a city with a strong secondary central role (above 120). District

centres with a population of less than 10,000, which are also located in peripheral locations, do not provide a suitable location for diversified retail sector.

At the settlement level, the highest values were achieved by villages with a small population and significant tourism. (e.g. Hollókő, Háromhuta, Aggtelek, Mátraszentimre). Among the cities, they appeared at the top of the list, where the size of the attraction area is relatively large in relation to the population, and even the role of tourism is significant (e.g. Gyöngyös, Eger, Tokaj) (*Figure 1*).

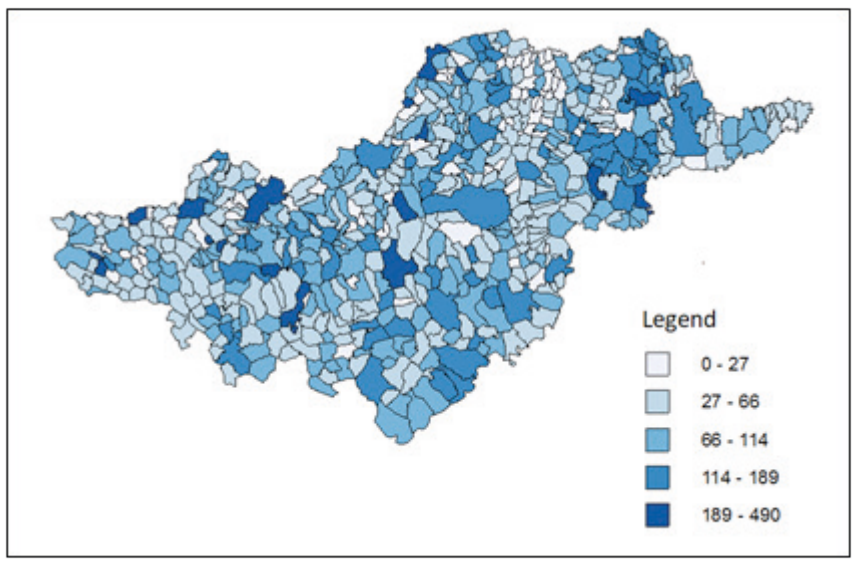


Figure 1: The number of retail stores per ten thousand inhabitants in the settlements of Northern Hungary
Source: Hungarian Central Statistical Office (KSH), 2018.

On the thematic map, of course, not only the dominant attraction centres, the major tourist areas and the main spatial structure lines are outlined, but also the settlements and areas that are in short supply in shops. This is most noticeable in peripherally located, small-village, backward areas (e.g. Cserehát), but it can also be observed that medium-sized villages near some cities also have low indicators due to the shading effect of the stronger towns. It should be noted that among the 610 settlements in the region, there are 48 where no retail units operate. This number increased by 10 compared to 2010, however, the settlements concerned were also replaced partially.

The total number of retail stores and wholesale warehouses in the region decreased from 14,996 to 12,302 between 2010 and 2018. 54.2% of the latter is located in Borsod-Abaúj-Zemplén County, 28.9% in Heves and 16.8% in Nógrád. The store network of Miskolc (the only larger town) within the region (17.2%) alone exceeds the importance of the whole Nógrád County. The regional centre is followed by the

only medium-sized town, Eger (8.6%), then the third county seat, Salgótarján (5.0%) and Gyöngyös (4.9%) – the latter are already considered small-medium towns with a population of 20-50 thousand people. Among cities of similar size, better indicators of more economically prosperous settlements can be clearly observed. A total of 16 cities have a significance above the 1% threshold within the commercial network, which also include small towns with more favourable conditions (e,g. Balassagyarmat, Mezőkövesd, Tiszaújváros)

There are very few towns in the region where the number of commercial units increased in absolute terms between 2010 and 2018 (such as: Hatvan, Füzesabony, Szécsény, Cigánd). The share of major shopping centres decreased, with Miskolc (-2.4 percentage points) accounting for the largest loss. As a result, the degree of commercial concentration decreased in the region. The value of the concentration index changed from 0.0607 to 0.0516 between 2010 and 2018. The decline was smaller in rural areas, but we cannot state that the supply of the population has improved, with the exception of a few settlements that are developing rapidly and implementing tourism developments.

As we cannot get a really accurate picture of the spatial structure of the region's trade based on the number of commercial units, we prepared a separate report on the members of the larger hypermarkets, supermarkets and chains with discount stores in the region based on an online data collection. Virtually all store chains can be said to have fewer stores in Northern Hungary than the average of rural regions (*Table 1*). The location of the stores is strongly in line with the specifics of the settlement hierarchy. For example, Tesco stores are present in 12 of the 13 most important shopping centres in the region, with the exception of Sárospatak, which ranks 12th. However, geographically it is located between two other centres, Sátoraljaújhely and Szerencs

Table 1: Investigation of site selection for large shopping malls in the region based on the number of stores (2019)

Store chains	Hyper- and supermarket profile store chains			Discount profile chain stores		
Location	Tesco (hyper & super)	Spar & Interspar	(CBA) Príma	Lidl	Aldi	Penny
Northern Hungary Region (pieces)	15	29	1	15	6	23
Average of regions (without Budapest) (pieces/region)	18,4	37,9	7,0	19,9	14,1	27,4
The difference between Northern Hungary and the average of regions:	-18.5%	-23.5%	-85.7%	-24.6%	-57.4%	-16.1%

Source: own collection and editing based on the websites of each store chain (2020).

Conclusions

The region of Northern Hungary lags behind the national average based on socio-economic indicators. This is reflected in the declining trend in both population and store numbers. In terms of the number of stores per ten thousand people, the region only surpasses Pest County (excluding Budapest). This can be largely explained by the peculiarities of the settlement network of the region. There are only one large and one medium-sized city in its city network, along with which some small-medium towns have relatively favourable indicators. The shop network of small towns between 10 and 20 thousand people – especially those with a larger agglomeration – is also still differentiated. However, small towns with less than 10,000 inhabitants no longer have adequate spatial organizing power.

Hypermarkets and supermarkets, as well as discount chains, prefer full-fledged secondary catchment areas, where the exclusion of smaller players from the market is spectacular. The increase in the number of shops has been observed in towns whose economic role and relative spatial position have improved in recent years. In several smaller settlements, the development of tourism generated an increase in the number of shops. On the other hand, in the areas characterized by the worst spatial and settlement structure, the number of settlements is increasing where traditional small shops cannot be maintained, only some alternative form of sales.

In light of our research findings, short supply chains have greater development potential in large cities due to the high number of available consumers. However, it can also play an important role in small settlements where traditional forms of retail slowly disappear.

References

[1.] Birkin, M. – Clarke G. – Clarke M. (2017): Retail Location Planning in an Era of Multi-Channel Growth. Routledge, London, 258 p. https://doi.org/10.4324/9781315605937

[2.] Bodor N. – Pénzes J. (2012): Eger komplex vonzáskörzetének dinamikai vizsgálata. = Tér és Társadalom 26(3), pp. 30-47. https://doi.org/10.17649/TET.26.3.1929

[3.] Bujdosó, Z. ; Dávid, L. ; Remenyik, B. ; Tóth, G.(2011) Connection between tourism and regional development on the Hungarian-Croatian border Central European Regional Policy and Human Geography 1 : 2 pp. 27-40. , 14 p.

[4.] Burger, M. J. – Meijers, E. J. – Van Oort, F. G. (2013): Regional Spatial Structure and Retail Amenities in the Netherlands. = Regional Studies 48(12), pp. 1972-1992.
https://doi.org/10.1080/00343404.2013.783693

[5.] Golledge, R. G.–Stimson, R. J. (1997): Spatial Behavior: A Geogrpahic Perspective. The Guilford Press, New York–London, 620 p.

[6.] Han, Z. – Cui, C. – Changhong, M. – Wang, H. – Chen, X. (2019): Identifying Spatial Patterns of Retail Stores in Road Network Structure. = Sustainability 11, 4539, 20 p.
https://doi.org/10.3390/su11174539

[7.] Kápolnai Zs. (2017): A kiskereskedelem és a szolgáltatások térbeli jellemzői Pest és Nógrád megye aprófalvaiban. = A falu 32(1), pp. 59-68.

[8.] Koncz G.–Szűcs A.–Nagyné Demeter D. (2018): A gazdaság térszerkezetének változásai Észak-Magyarországon az ezredforduló után. = Jelenkori társadalmi és gazdasági folyamatok 13(1-2), pp. 139-149.
https://doi.org/10.14232/jtgf.2018.1-2.139-149

[9.] Kozák T. (2014): Kisboltok vonzáskörzetének meghatározása, azaz dohányboltelephely kiválasztása kvantitatív módszerekkel. In: Solt, K. (szerk.) Alkalmazott tudományok I. fóruma (konferenciakötet). Budapest, BGF, pp. 476-489.

[10.] Kozák T. – Neszmélyi Gy. I. (2018): Trendek, trendváltások a kereskedelemben. = JURA 24(2), pp. 468-482.

[11.] Reynolds, J.–Wood, S. (2010): Location Decision Making in Retail Firms: Evolution and Challenge. = International Journal of Retail & Distribution Management 38(11-12), pp. 828-845.
https://doi.org/10.1108/09590551011085939

[12.] Sikos T. T. (2019): Komámasszony, hol az üzlet?: Az Abaúji térség élelmiszer üzlethálózatának elemzése. = Észak-magyarországi Stratégiai Füzetek 16(2), pp. 31-38.

[13.] Sikos T. T.–Kozák T.–Kovács A. (2019): New Retail Models in Online and Offline Space. = DETUROPE 11(3), pp. 9-28.

[14.] Tömöri M. (2014): A gazdasági válság hatása a hazai kiskereskedelem térszerkezetére. = Földrajzi Közlemények 138(3), pp. 197-207.

[15.] Tömöri M. (2015): A kiskereskedelem nagy játékosai, avagy transznacionális vállalatok a kiskereskedelemben. = Modern Geográfia 2015/I., pp. 13-29.

[16.] Wrigley, N. (2009): Retail Geographies. In: Kitchin, R.–Thrift, N. (Eds.): International Encyclopedia of Human Geography. Elsevier Science, pp. 398-405.
https://doi.org/10.1016/B978-0-08-102295-5.10216-1
https://doi.org/10.1016/B978-008044910-4.00226-1

Internet resources:

[1.] www.aldi.hu (January 2020)

[2.] www.cba.hu (January 2020)

[3.] www.ksh.hu (March 2020)

[4.] www.lidl.hu (January 2020)

[5.] www.penny.hu (January 2020)

[6.] www.spar.hu (January 2020)

[7.] www.tesco.hu (January 2020)

Acknowledgments

This work was supported by the project entitled: "EFOP-3.6.2-16-2017-00001 Complex rural economic development and sustainability research, development of the service network in the Carpathian Basin." (In original, Hungarian language: "EFOP-3.6.2-16-2017-00001 Komplex vidékgazdasági és fenntarthatósági fejlesztések kutatása, szolgáltatási hálózatának kidolgozása a Kárpát-medencében.")

Authors

Gábor Koncz (PhD)
Associate professor
Eszterházy Károly University
Institute of Rural Development and Landscape Management
koncz.gabor@uni-eszterhazy.hu

Konrád Kiss
PhD-student
Szent István University
Doctoral School of Management and Business Administration
konrad.kiss@phd.uni-szie.hu

Dóra Nagyné Demeter (PhD)
Associate professor
Eszterházy Károly University
Institute of Rural Development and Landscape Management
demeter.dora@nak.hu

DEVELOPMENT OF A BEE FEEDING PROCEDURE TO SUPPORT BEE HEALTH PROTECTION

Szabolcs Molnár – Ákos Juhász – Helga Szalontai

Summary

This study was conducted to investigate the effect of inulin (a commercial prebiotic) on the gut microbiota of the honeybee (Apis mellifera carnica pannonica). Some colonies of equal strength were fed with sugar syrup or inulin supplemented syrup at different dosages. Bee samples were collected at the beginning of the experiment and then every two weeks until the end of the study. The intestinal tracts of five bees per treatment were isolated, homogenised, diluted and the amount of living microbes (mainly the probiotic microbes) were determined by using differential and semi selective agar plates. Four different experiments were carried out in 2018 and 2019 and we found that the inulin has no detectable effect on the composition of gut microbiome by culture based methods in the case of LAB (lactic acid bacteria), Bifidobacterium spp, Snodgrassella, Gilliamella and Frischella sp.

Keywords: *Honeybee, prebiotics, inulin, intestinal microbiota*

DOI: 10.33032/acr.2020.spec.71

Introduction

The honeybee (*Apis mellifera*), as an important pollinator, contributes significantly to agricultural productions and the human food supply. Nowadays, bees are stressed by a number of biotic and abiotic factors (pathogens, pesticides, climate change, habitat loss, etc.) which affect health and productivity (Porrini et al., 2016; Alberoni et al., 2016) and persistent population decline has been reported several times over the last decade (Lee et al., 2015; Zee et al., 2012; Goulson et al., 2015). The European Union ban of antibiotics as feed additives has stimulated the search for natural alternatives (European Commission, 2005). Animals (as well as humans) have symbiotic microorganisms, which are important for the proper functioning of the gastrointestinal tract (for nutrition and pathogen defence). The intestinal system of the honeybee contains relatively few bacteria in number and variety. Eight major bacterial groups concentrated in the hindgut: two *Alpha-*, one *Beta-* and two *Gammaproteobacteria*, two closely related *Lactobacillus* groups (Firm 4, 5), and one *Bifidobacterium* (Moran, 2015). Some of them are found in all honey bees (*Lactobacilli*, *Beta-* and *Gammaproteobacteria*), but the other groups of bacteria may be completely absent from some animals/individuals (Moran et al., 2012). The most prominent Gram-negative members of the intestinal microbial community *Snodgrassella alvi* and *Gilliamella apicola* are mutualistic symbionts and appear to be unique to *Apis (honeybee)* and *Bombus* spp.*(bumble bee*). *Frischella perrara* and *Bartonella apis* are even more host-specific, occurring only in *Apis* spp (Moran et al., 2012; Kwong et al., 2017).

The link between intestinal microbiota and health status, have encouraged the researchers to use beneficial gut microorganisms and prebiotics to improve the health of animals (and humans). Probiotics (mainly lactic acid bacteria) and prebiotics (like inulin) help to protect the intestinal microbial health and are recommended to be added into the forage of different vertebrates and invertebrates. There are commercial probiotics and/or prebiotics containing diet supplements in beekeeping management too. The first documented application of probiotics in the case of honeybees occurred in 1997 (Machova et al., 1997). Since then, only a few studies have reported the use of pre/probiotics, and the effect was not always clear. Some data has shown that the use of probiotics and prebiotics has a beneficial effect on the bees and increases honey production (Patruica and Mot 2012; Patruica and Hutu 2013) whereas the others suggest that commercial probiotics increases honeybee mortality because most of them have been developed for humans and the differences between the gut microbiota between honeybees and vertebrates may cause an opposite effect (Andrearczyk et al. 2014; Ptaszynska et al., 2016).

We decided to study the effect of inulin, a well-known commercial prebiotic, on the honeybee and the changes of intestinal microbiome were studied by determining the number of potentially beneficial bacteria.

Material and methods

In our experiment, the so-called "maintenance feeding" used by beekeepers was used as stimulant feeding and this sucrose syrup contains 2 kg sugar in 3 litre water. The selected honeybee colonies were healthy and equal in strength. The control group was fed with one litre sucrose syrup every second day. In the case of the treated group, it was the same but 30 or 60 g l^{-1} was added to the syrup. The treatment was performed on three colonies in both cases and the samples (approximately 20 worker bees each) were collected before the treatment and 2, 4 and 6 weeks later, depending on the duration of the treatment. In later experiments we used an absolute control (without any treatment) to analyse the external, internal and environmental impacts. The intestinal tracts of five bees were isolated, homogenised and diluted in 1% tripton containing saline. Traditional microbiological methods were used to determine the amount of living microbes. Five different media (Nutrient agar, De Man, Rogosa and Sharpe agar, Eosin Methylene Blue agar, Columbia Blood agar, and Bifidobacterium medium) were used to investigate total aerobic bacteria; *Lactobacillus*; coliform bacteria; *Snodgrassella*, *Gilliamella* and *Frischella; Bifidobacterium,* respectively. The inoculated agar plates were incubated at 37±2 °C for 48-72 hours in ambient air or in anaerobic (in the case of *Frischella* and *Bifidobacterium*) and microaerophilic conditions (5% CO_2 in the case of *Lactobacillus, Snodgrassella* and *Gilliamella*). The blood agar was neither selective nor differential to *Snodgrassella*, *Gilliamella* and *Frischella*; further basic biochemical tests and microscopic examinations were applied to confirm the strains identity. The amount of bacteria was calculated per gram of intestine (CFU g^{-1}).

Results

We have compared the repeatability of sample processing in the case of one and five animals. The complete intestinal system was isolated, homogenised and the colony numbers of bacteria was normalised to one gut. In the case of individual isolates, the deviation is very high, especially in the case of coliform bacteria ($2.0x10^2$-$1.3x10^7$). We found that the difference between the parallel samples containing five homogenized gut per sample was smaller than for single intestinal samples and the pooling of five intestines gives a more reproducible result. Apart from the differences in the individual animals, the individual honeybee colonies also differed significantly, so the results obtained for several hives were not comparable. The literature also confirms that there are very large differences between the intestinal microbes of individual animals in the case of the honeybee (Moran et al., 2012).

In later experiments, based on our results, the exact colony count was not compared, but only the tendency of changes due to different treatments was calculated. The bees were treated with sugar syrup and then with increasing inulin concentration. We found that the amount of certain bacteria (total aerobic bacteria and *Lactobacillus*) increased significantly (ten to one hundredfold) as a result of the sugar syrup treatment. The effect of the inulin was not detectable: only the amount of aerobic bacteria changed significantly, the beneficial microbes were not affected. We think that these changes are due not to the treatments but to differences between individual animals.

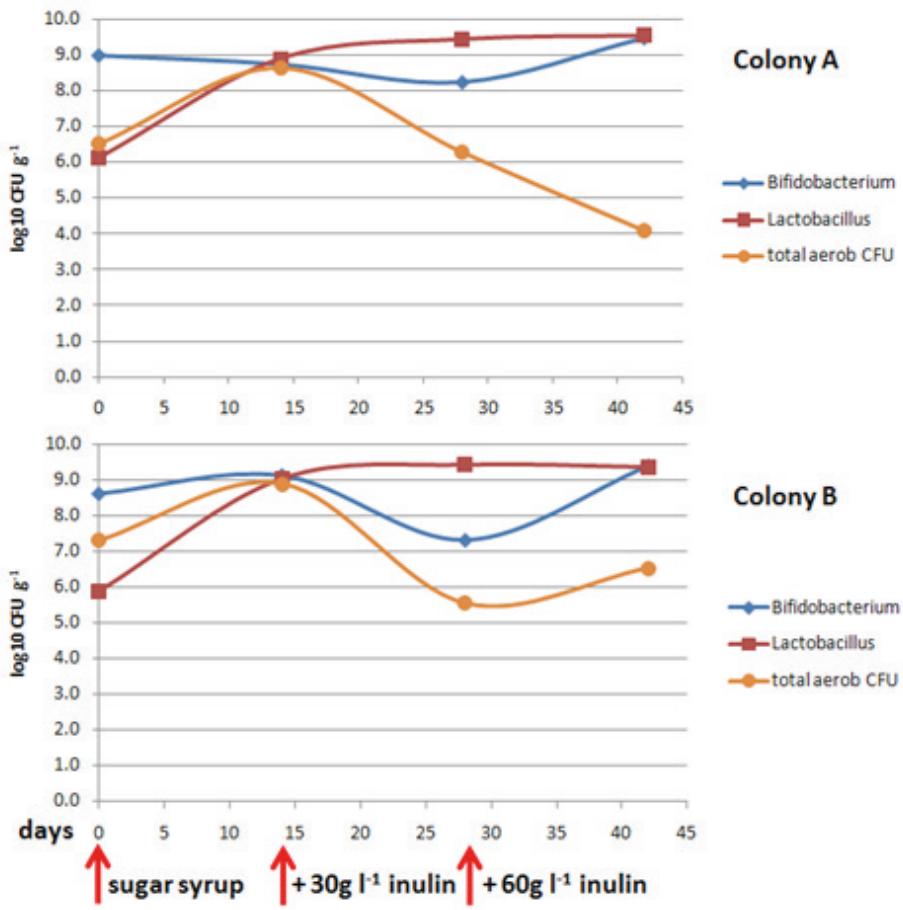


Fig. 1.: The effect of inulin on the intestinal microbiota of two honeybee colonies.

In the following experiment the amount of *Snodgrassella*, *Gilliamella* and *Frischella* were also determined. The treated group received the same treatment as before but the control group was not treated at all, not even with sugar syrup. We found that the inulin treatment did not significantly influence the amount of these bacteria.

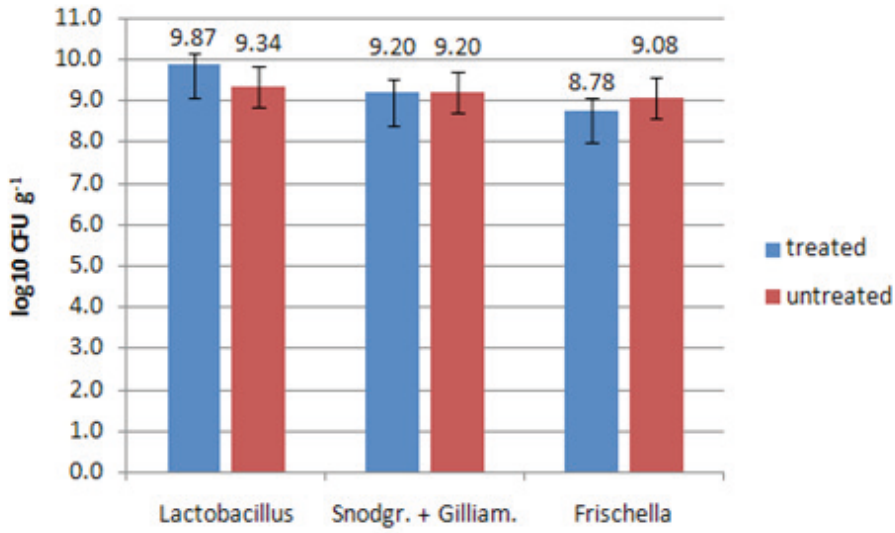


Fig. 2.: The amount of *Lactobacillus, Snodgrassella*, *Gilliamella* and Frischella (log10 CFU g^{-1}) in the end of the experiment. The treated group was fed with inulin supplemented sugar syrup and the untreated group was an absolute control (without any treatment).

Conclusions

We have developed a method that can be used to test the changes of gut microbiota in the case of the honeybee. The prebiotic effect of inulin was not detected by the presently used technique. This result supports the hypothesis that commercially available pre- and probiotics may not be applied uniformly to all groups of animals.

Acknowledgement

This research was supported by the grant EFOP-3.6.1-16-2016-00001 and 2017-1.3.1-VKE-2017-00001.

References

[1.] Porrini, C. - Mutinelli, F. - Bortolotti, L. - Granato, A. - Laurenson, L. - Roberts, K. - Gallina, A. - Silvester, N. - Medrzycki, P. - Renzi, T. - Sgolastra, F. - Lodesani, M. (2016): The status of honey bee health in Italy: results from the nationwide bee monitoring network. *PLoS One* 11: 5. e0155411. doi:10.1371/journal.pone.0155411
https://doi.org/10.1371/journal.pone.0155411

[2.] Alberoni, D. - Gaggia, F. - Baffoni, L. - Di Gioia, D. (2016): Beneficial microorganisms for honey bees: problems and progresses. *Applied Microbiology and Biotechnology*. 100: 9469-9482.
https://doi.org/10.1007/s00253-016-7870-4

[3.] Lee, K.V. – Steinhauer, N. – Rennich, K. – Wilson, M.E. – Tarpy. D.R. – Caron D.M. et al. (2015): A national survey of managed honey bee 2013–2014 annual colony losses in the USA. *Apidologie.* 46: 292–305..
https://doi.org/10.1007/s13592-015-0356-z

[4.] Zee, R. - van der Pisa. L. – Andonov. S. – Brodschneider, R. – Charrière, J.D. – Chlebo, R. et al. (2012): Managed honey bee colony losses in Canada, China, Europe, Israel and Turkey, for the winters of 2008–9 and 2009–10. *J. Apic. Res.* 51: 100–14.
https://doi.org/10.3896/IBRA.1.51.1.12

[5.] Goulson, D. – Nicholls, E. – Botías, C. – Rotheray, E.L. (2015): Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. *Science*. 347: 1255957.
https://doi.org/10.1126/science.1255957

[6.] European Commission. (2005): Ban on antibiotics as growth promoters in animal feed enters into effect. http://europa.eu/rapid/press-release_IP-05-1687_en.htm

[7.] Moran, N.A. (2015): Genomics of the honey bee microbiome. *Current Opinion in Insect Science* 10: 22–28.
https://doi.org/10.1016/j.cois.2015.04.003

[8.] Moran, N.A. - Hansen, A.K. - Powell, J.E. - Sabree, Z.L. (2012): Distinctive gut microbiota of honey bees assessed using deep sampling from individual worker bees. *PLoS ONE* 7: 4. e36393.
https://doi.org/10.1371/journal.pone.0036393

[9.] Kwong, K.W. - Medina, L.A. - Koch, H. - Sing, K-W. - Soh, E.J.Y. - Ascher, J.S. - Jaffe, R. - Moran, N.A. (2017): Dinamic microbiome evolution in social bees. *Sci. Adv.* 3: e1600513.
https://doi.org/10.1126/sciadv.1600513

[10.] Machova, M – Rada, V – Huk, J – Smekal, F. (1997): Entwicklung der bienenprobiotik. *Apiacta* 32: 99–111.

[11.] Patruica, S. – Mot, D. (2012): The effect of using prebiotic and probiotic products on intestinal micro-flora of the honeybee (Apis mellifera carpatica). *Bull. Entomol. Res.* 102: 619–623.
https://doi.org/10.1017/S0007485312000144

[12.] Patruica, S. – Hutu, I. (2013): Economic benefits of using prebiotic and probiotic products as supplements in stimulation feeds administered to bee colonies. *Turk. J. Vet. Anim. Sci.* 37: 259–263.

[13.] Andrearczyk, S. – Kadhim, M.J. – Knaga, S. (2014): Influence of a probiotic on mortality, sugar syrup ingestion and infection of honeybees with Nosema spp. under laboratory assessment. *Med. Weter.* 70: 762–765.

[14.] Ptaszynska, A.A. - Borsuk, G. - Zdybicka-Barabas, A. - Cytrynska, M. - Małek, W. (2016): Are commercial probiotics and prebiotics effective in the treatment and prevention of honeybee nosemosis C? *Parasitology Research* 115: 397–406. doi:10.1007/s00436-015-4761-z
https://doi.org/10.1007/s00436-015-4761-z

Authors:

Juhász Ákos Ph.D.
Szent István University, Institute of Genetics, Microbiology and Biotechnology, Department of Microbiology and Environmental Toxicology
e-mail: ajuhasz11@gmail.com

Molnár Szabolcs
Eszterházy Károly University, Centre for Research and Development, Food and Wine Research Institute
e-mail: molnarszabolcs.hun@gmail.com

Szalontai Helga Ph.D.
Eszterházy Károly University, Centre for Research and Development, Food and Wine Research Institute
e-mail: szalontai.helga@uni-eszterhazy.hu

FRUIT PRODUCTION IN THE SETTLEMENTS OF THE EGER WINE REGION FROM THE MIDDLE OF THE 19TH CENTURY TO THE BEGINNING OF THE 20TH CENTURY

Sándor Rózsa

Abstract

Carrying out a historical statistical analysis of fruit production is a relatively difficult task, as the sector played a complementary role in traditional peasant farming; it appeared only rarely in trade and tax-related resources, and it was not only after its increase in market share that state agricultural statistics paid attention to it. The national agricultural censuses of 1895 and 1935 recorded the fruit tree population of the individual settlements in a distribution by species. Their data, supplemented by other sources (county monographs, contemporary press materials, etc.), are suitable for assessing the significance of the sector and for analyzing changes at the turn of the century. In the settlements of the Eger wine region, traditional varieties of fruit production, characterized by combined cultivation (e.g. fruit trees planted between vine rows) and a high proportion of less demanding species, began to fade into the background only slowly; there was, however, a shift towards market-oriented more intensive production.

Keywords: *agricultural history, Eger wine region, fruit production, agricultural census, agricultural statistics*

CODE: B19

DOI: 10.33032/acr.2020.spec.79

Introduction

In this paper, I present the fruit production of the settlements of the Eger wine region from the mid-19th to the early 20th century, focusing primarily on the importance of the sector, its market orientation, production system, variety composition and changes in the area of these. Fruit production in the area has received little attention in agricultural research so far, and ethnographic (ethnopomological) research, which undoubtedly revealed a great deal of information on the fruit culture of earlier centuries, has usually dispensed with deeper statistical analyzes. Grape and fruit production were closely related to each other in traditional peasant farming, and in this respect it is entirely relevant to examine the settlement group.

Carrying out a quantitative analysis of fruit production in the period prior to the publication of state agricultural statistics censuses is difficult, since peasant fruit production, mainly for self-sufficiency, is hardly mentioned in administrative documents related to taxation and trade. The complementary nature of fruit production was also reflected in the fact that it was not an independent area: fruit trees were usually planted between the vine rows, in gardens belonging to the house or on pastures and meadows, and there was little fruit production in monocultures until the early 20th century. However, many sources testify to the long tradition of selling fruit on the market, and its value was greatly appreciated in some periods of crisis.

Sources

During the investigation, I evaluated the fruit production of the settlement group according to the agricultural census of 1895 and 1935, supplemented by the work of Ferenc Albert of Montedego and Samu Borovszky presenting Heves county, as well as an article on fruit production published in the local press (the daily paper called Eger).

The Department of Statistics, set up in 1868 within the framework of the Ministry of Agriculture, Industry and Commerce, and the independent National Royal Hungarian Statistical Office, established from the former in 1871, paid special attention to exploring the state of agriculture, and due to this the first censuses on certain sub-areas of agriculture were carried out: (1968: first harvest statistics, 1873: viticulture statistics), and later the first comprehensive agricultural census in the history of Hungary. (Laczka, 2000) The agricultural census ordered by statute VIII was intended to be extended to all areas of farming, ranging from property relations through livestock and agricultural equipment to fruit production.

It was important to reconcile the modern statistical approach with local farming practices, which in many cases had unique, archaic elements. As for fruit production,

if only plants grown in modern monocultures had been taken into account, the supplementary sector would have remained almost invisible. To eliminate this problem, fruit trees were recorded by number, regardless of their location. The significance of this becomes clear when we compare the editions of the 1935 census. The main data on the plants of the Hungarian agriculture in the publication entitled in the Year 1935 give only the fruit tree population of the "separated orchards", so the majority of the tens of thousands of fruit tree population of the settlements was left out of the summary work.

During the two large censuses, the number of fruit trees was summarized by species. In 1895, the number of apples, pears, cherries, peaches, apricots, plums, nuts, almonds, chestnuts and mulberries was given, and in 1935 it was supplemented with quince, pineapple and peanuts. In 1935 it was also a novelty to record the number of plums in the categories of free stone, "other kind" and greengage. To facilitate statistical evaluation, I treated prunes and pomaceous ones (apple and quince) together.

Results

About the 19th century fruit production in Heves County in general

In his work of 1868, Ferenc Albert described the fruit production of the county as the average, which played a complementary role in addition to grape production. It had a greater priority only in the lowland areas less suitable for grape production where vineyards were in fact more like orchards. Of the mountain settlements, he picks out Eger, where summer fruit production was very significant, especially that of peaches, which were also delivered in larger quantities to the markets of the settlements along the river Tisza. However, the production of winter fruits was not enough to satisfy the local market needs, either and the market of Eger was supplied with fruits from other regions. According to Albert, the main reason for this was that farmers did not have sufficient storage capacity. (Albert, 1868)

Samu Borovszky wrote about a dynamically growing fruit production sector at the beginning of the 20th century, within which the production of cherries, walnuts and sour cherries, and that of the autumn and summer's peaches were especially significant. Due to the development of the transport infrastructure, the volume of fruit sold continued to increase; only in 1909 there were 420 wagons of cherries transported by rail from Gyöngyös and Eger. He pointed out, however, that fruit production continued to be considered as a secondary activity, with most of the trees scattered among the vines; a significant number of them was not even pruned. (Borovszky, 1909)

The Heves County Economic Association, established in 1858, aimed from the beginning to revive the fruit production of the county. It was considered a priority to domesticate and distribute fruit varieties that are well adapted to the local conditions

of the production site and can be sold well on the market. (Eger, 1868.05.11) To this end, a pilot garden was established in Gyöngyös, where fruit trees were also propagated. By 1864, 87 apple and 80 pear seedlings were available in the pilot garden. (Eger, 13.10.1864) By the end of the decade, however, the members of the association complained about the obsolescence of the gardens and deficiency of maintenance. (Eger, 06.09.1877)

The county economic association, together with other local associations (e.g. the Tiszafüred Fruit Association), besides the operation of the nursery gardens, sought to encourage professional fruit production by organizing various exhibitions and establishing awards. (Eger, 13.10.1864) The National Hungarian Economic Association organized a fruit exhibition in Pest every year and the county association announced their invitation from time to time. (Eger, 28.07.1881) However, we have no information about how many owners of the winegrowing area and with what results took part in them. In 1864, a ministerial prize was announced for fruit and vegetable growers, and an association with an area of operation extended to Jászság at that time proposed a producer in Jászberény and one in Jászárszállás. (Eger, 14.09.1871) In 1881 according to the weekly paper called Eger Béla Kempelen won bronze medals for his potatoes exhibited at the national exhibition; the fruit was, however, not shown by the people of Eger. (Eger, 27.10.1881) From the 1880s, the newly established Tiszafüred Fruit Society organized a fruit and vegetable horticultural exhibition every year, with a gradual increase in the number of participants, but we do not know how many growers from around Eger participated in them. (Eger, 10.02.1884)

Towards the turn of the century, several articles were published that sought to encourage professional fruit production. These articles sadly noted that, despite optimum production conditions and improved sales opportunities, little attention was paid to fruit production in Eger. The poor quality of the fruit produced was identified as the biggest obstacle to exploiting market opportunities. (Eger, 16.12.1886) In the market of Eger a decree was issued concerning the quality of the fruit sold, prohibiting the sale of unripe fruit. After the destruction caused by phylloxera, fruit production became more important, and many saw it as an opportunity to alleviate the problems of making ends meet and emphasized the risk-reducing effect of combined cultivation.

By the end of the century, formerly state-sponsored silkworm rearing and, in connection with this, mulberry planting, were in sharp decline. Economic articles already emphasized the importance of mulberry distillery and foraging, but the population was reduced. (Eger, 22.2.1880)

Fruit production in the settlements of the Eger wine region at the end of the 19th century

According to the data of the 1895 census, stone fruits were produced in the largest proportion in the settlements of the Eger wine region. At the beginning of the study,

I assumed that the less demanding fruit species that produce fruits to be preserved better would form a larger part of the population. This was confirmed by data of the survey, as plum trees accounted for 50% of the total population within the stone fruits. The data of the census did not confirm Ferenc Albert's statement regarding peach production, since the proportion of peach trees in Eger did not exceed 5%. Albert's statement was therefore limited to the greater proportion of peaches in the total marketed fruit.

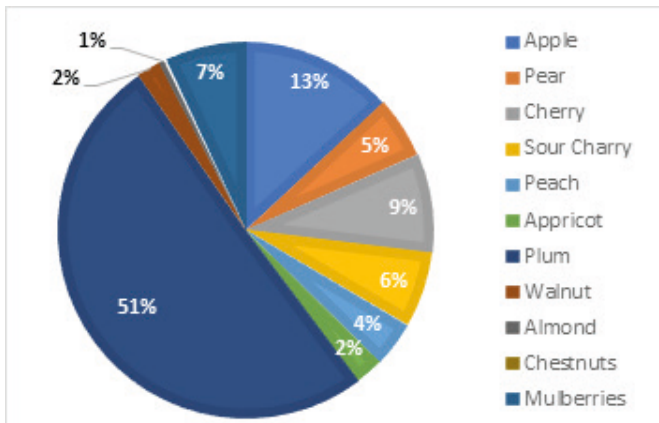


Figure 1: Distribution of fruit tree stock by species in the Eger wine region in 1895
Source: Agricultural Census of 1895 by the Hungarian Royal Central Statistical Office.

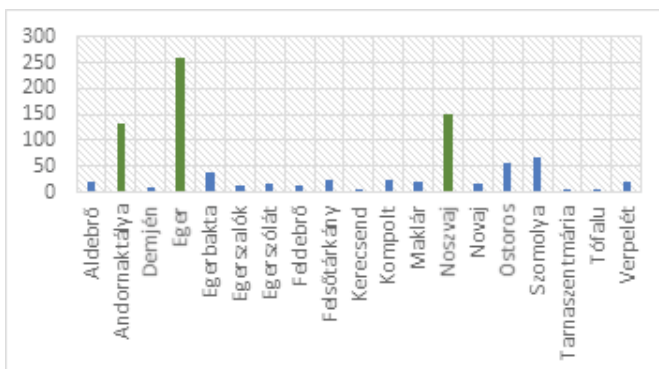


Figure 2: The number of fruit trees per farm in the settlements of the Eger wine region
Source: Agricultural Census of 1895 by the Hungarian Royal Central Statistical Office.

In terms of quantity, the fruit tree population of the settlement group was not outstanding either at county level or state level, and the racial composition did not show any significant difference, either. At county scale, the apple population

(30.81% of the county's population) and the mulberry population (31% of the county's population) were outstanding, while the higher proportion of sour cherries and plums within the stone fruits slightly differed from the county average.

In terms of the number of fruit trees per farmer, five settlements stood out: Eger, Noszvaj, Andornaktálya, Ostoros and Egerbakta. Eger accounted for nearly thirty percent of the total tree population of the settlement group, which is probably due to the better sales opportunities offered by the local market and the greater proportion of wine growing areas. Compared to other settlements in the wine region, the proportion of the apple and sour cherry trees was relatively high. The populations of Noszvaj, Ostoros and Szomolya belong to one group in terms of racial composition, and in their case cherry production is significant compared to other settlements. The population of the Andornaktálya mostly differs from the average in the wine region in terms of the more even proportion of species, while the Egerbakta stood out with the high proportion of the plum tree population.

Fruit production in the settlements of the Eger wine region in the first half of the 20th century

The 1935 census shows only a 5% increase in population compared to the 1895 census, but the composition of the population by species changed significantly. The proportion of plums that used to account for 51% of the population fell to 32%, while that of the peaches increased by nearly 10% and that of apricots by 7%. The proportion of pome fruits and shelled fruits increased slightly compared to that of stone fruits. An increase in the proportion of more demanding and valuable species indicates an increase in market orientation.

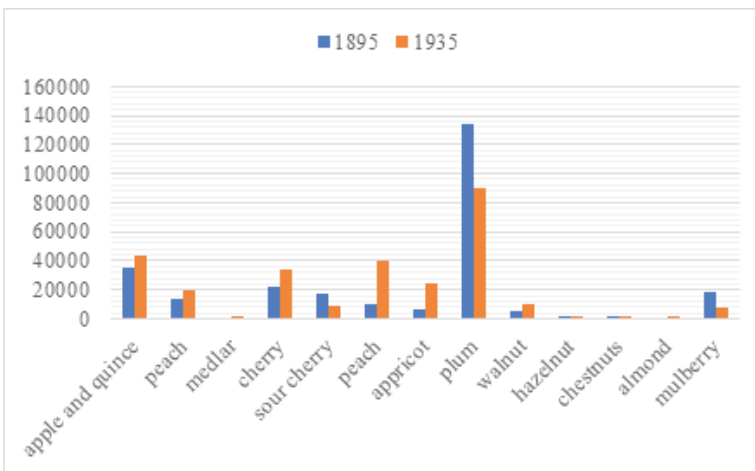


Figure 3: The number of fruit trees per species in the Eger wine region in 1895 and 1935
Source: Agricultural Census of 1895 by the Hungarian Royal Central Statistical Office.

In 1935, Maklár, Verpelét and Aldebrő were among the settlements with the most significant fruit tree population while Egerbakta was one of the settlements with the smallest population. It can be observed that it increased in the southern settlements of the wine region, while in the north – in the more mountainous areas – the number of fruit trees decreased. This is probably due to the fact that the areas with more favorable conditions for fruit production could lend themselves to more intensive fruit production to a greater degree, and thus the decrease in the population resulting from the decline in the use of the traditional methods of fruit production could be more compensated by the advance of market oriented fruit production. For example, the plum tree population of Egerbakta fell significantly compared to 1895, while catching-up Verpelét, where it grew by more than 300%, was already dominated by more marketable species, apples, pears, cherries and peaches.

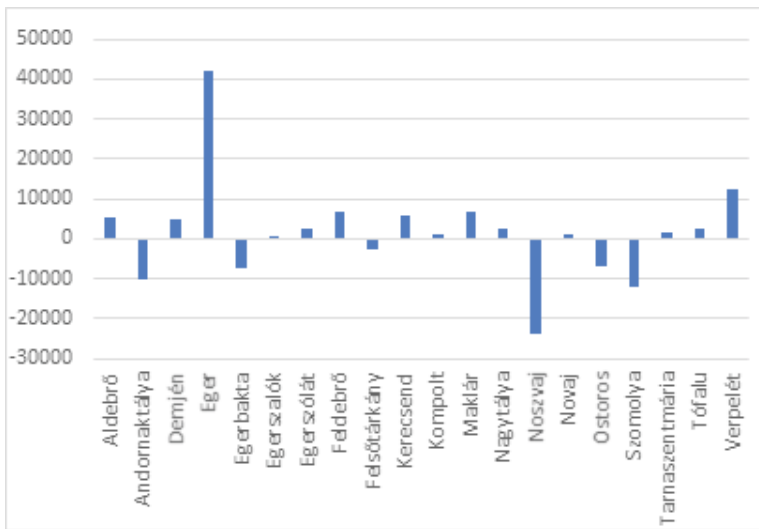


Figure 4: Change in population compared to 1895
Source: Agricultural Census of 1895 by the Hungarian Royal Central Statistical Office.

It is an interesting point, however, that Andornaktálya, Ostoros and Szomolya experienced a significant decline in fruit tree population, although they were settlements traditionally having a more significant fruit production and a higher proportion of production for market. I cannot explain why it decreased in their case; however, it was striking that the increase in the number of farms was the smallest in these cases, i.e. it can be related to the structure of the landed properties of the settlements. Considering that a large proportion of fruit trees were still planted in small gardens and the number of fruit trees planted between vine rows was increasingly scarce on the vine parcels of large estates, the number of farms and the size of fruit tree population could have been closely related.

An important issue is how big the proportion of professionally and intensively cultivated trees planted primarily for market sale was within the total fruit tree population. Trees planted in the backyards of houses, among the vines or in the vegetable gardens, could have formed only a minor part of this category; however, the trees of an area planted with fruit trees in monocultures fall into this category in great number. The census of 1895 and 1935 does not apply an independent orchard category in the cultivation branches, the data of the cadastral survey was taken over, where purely orchards fell into the main category of gardens, including vegetable gardens and ornamental gardens, thus their expanse cannot be determined.

The data of the 1935 census were also published by the Statistical Office in several publications: *Property relationships of Hungary in 1935, Livestock, farm equipment and fruit tree population of Hungary in 1935, The main plant data of Hungarian agriculture in 1935, etc.,* the latter only gives only the tree population of the 'separated orchards' of the settlements. Comparing these data with the data of other publications, which gave the whole population, it can be stated that in 1935 orchards cultivated in monocultures were to be found only in Aldebrő, Andornaktálya, Eger, Egerszólát, Noszvaj and Tófalu. Their fruit tree population accounted for 1.5% of the total population of the wine region. The species ratios of the separated orchards did not significantly differ from the proportion of the total population.

Conclusions

The main objective of agricultural history research is to study the process by which traditional agriculture has become modern market-oriented farm agriculture. An important contribution to this assessment is mapping the changes in the fruit production sector. Fruit production was closely related to wine production; nevertheless, the fruit production of the examined wine region was not more significant than that of other areas of the county. At the end of the 19th century, two processes had an effect time within fruit production at the same. The development of transport infrastructure significantly improved the possibilities of selling fruit, which is well reflected in the transformation of the species structure, i.e. the increase in the proportion of more valuable fruit species. However, a large part of the peasant farm's tree population was fruit trees planted between vine rows, gardens, meadows or just off the roads, and this cultivation system did not match the production of more demanding and marketable fruit species. In this way, we can simultaneously witness a decline in peasant fruit production (in parallel with a decline in the self-sufficiency of the peasant farms) and an increase in the population cultivated more intensively. The small increase in tree population between 1895 and 1935 is presumably due

to the two opposite processes. Farmers of the time called attention to the fact that fruit production could be an alternative to vine production during the time of the phylloxera plague, but it cannot be determined to which extent it was realized. The effect of the phylloxera plague on fruit production may be an interesting area for future research. It is difficult to provide a comprehensive analysis of the fruit production of a settlement or region due to the limited number of sources available. Although the statistical sources used in the study provide an opportunity for a relatively thorough analysis, possible distortions of data are to be expected, it is especially true in the case of the 1935 census. Changes in the fruit tree population of the settlements (e.g. the decrease in the population of Ostoros, Szomolya and Andornaktálya) are difficult to explain in some cases, so further investigation is needed. Thus, the study completed may be the preparation of a larger study that identifies the places where to go deep into the archives.

Reference sources

[1.] Albert Ferenc (1868): Heves és Külső Szolnok törvényesen egyesült vármegyék leírása. [Description of the the legally united Heves County and Outer Szolnok County].

[2.] Borovszky Samu (szerk.) (1909): Magyarország vármegyéi és városai. Heves vármegye. [Counties and cities in Hungary. Heves County]. Budapest.

[3.] Laczka Sándorné (2000): Mezőgazdasági összeírások Magyarországon, 1895-2000. [Agricultural Censuses in Hungary, 1895-2000]. Statisztikai Szemle, 78. évf., 4. sz. 282-289.

[4.] Konkoly-Thege Gyula (szerk.) (1941): Magyarország mezőgazdaságának főbb üzemi adatai az 1935. évben a gazdaságok (üzemek) nagysága szerint. [The main plant data of Hungarian agriculture in 1935 according to the size of the farms (plants)]. Magyar Statisztikai Közlemények 112. Budapest, Magyar Királyi Központi Statisztikai Hivatal, 721. o.

[5.] Szöllősy Zoltán (szerk.) (1937): Magyarország állatállománya, gazdasági gépfelszerelése és gyümölcsfaállománya az 1935. évben törvényhatóságok és községek szerint. [Livestock, farm equipment and fruit tree population of Hungary in 1935 according to municipalities and villages]. Magyar Statisztikai Közlemények 100. Budapest, Magyar Királyi Központi Statisztikai Hivatal, 397. o.

[6.] Sajóhelyi István (szerk.) (1937): Magyarország földbirtokviszonyai az 1935. évben I. Törvényhatóságok és községek (városok) szerint. [Property relationships of Hungary in 1935 I. According to municipalities and villages]. Magyar Statisztikai Közlemények 99. Budapest, Magyar Királyi Központi Statisztikai Hivatal, 1050. o.

[7.] Keleti Károly (szerk.) (1897): A Magyar Korona országainak mezőgazdasági statisztikája. 1. rész. A magyar mezőgazdasági statisztika fejlődése s az 1895. évi VIII. törvényczikk alapján végrehajtott összeírás főbb eredményei községenként. [Agricultural statistics of the countries of the Hungarian Crown. Part 1. The development of Hungarian agricultural statistics and the main results of the census carried out in accordance with the statute VIII from village to village]. Magyar Statisztikai Közlemények Új Folyam. 15., Budapest, 765. o.

[8.] Eger hetilap (1865.05.11): Hevesmegye gazdasági egyesülete igazgatósági választmánya 1865-ik év máj. 1-én Gyöngyösön tartott rendes havi ülés jegyzőkönyve. [The minutes of the regular monthly meeting of the Board of Directors of Heves County Economic Association held in Gyöngyös on May 1, 1865.]. III. évf.,19. sz., 1. o

[9.] Eger hetilap (1877.09.06): Heves Vármegye és a Jászkerület gazdasági egylete folyó évi augusztus 21-én tartott rendes közgyűléséről. [About the Annual General Meeting of the Economic Association of Heves County and Jász District held on August 21st this year]. XVI. évf., 36. sz. 285. o.

[10.] Eger hetilap (1864.10.13): Melléklet az „Eger" 41. számához. [Appendix to „Eger" issue 41]. II. évf., 41. sz.

[11.] Eger hetilap (1864.10.13): Az egri gyümölcstermelőkhöz. [For the fruit growers in Eger]. II. évf., 41. sz., 326. o.

[12.] Eger hetilap (1884.10.02): Tiszafüredi gyümölcs- és konyhakertészeti kiállítás. [Fruit and vegetable gardening exhibition in Tiszafüred]. XXIII. évf., 40. sz., 370. o.

[13.] Eger hetilap (1881.07.28): Gyümölcs- és kertészeti kiállítás Budapesten. [Fruit and horticulture exhibition in Budapest]. XX. évf., 30. sz., 327. o.

[14.] Eger hetilap (1881.10.27): Beszámoló a hírfüzérben a gyümölcs- és kertészeti kiállításokon elért eredményekről. [Report on the results achieved at the fruit and horticultural exhibitions in the news.]. XX. évf., 43. sz., 466. o.

[15.] Eger hetilap (1881.09.14): Heves vármegye és a Jászkerület gazdasági egyesülete részéről Gyöngyösön 1871-ik év augusztus hó 20-án tartott rendes

évi közgyűlésének jegyzőkönyve. [Minutes of the regular annual general meeting of the Economic Association of Heves County and Jász District held on August 20, 1871]. IX. évf., 37. sz., 292. o

[16.] Eger hetilap (1886.11.16): Ültessünk gyümölcs-fákat! [Let's plant fruit trees!]. 25. évf., 46. sz., 366-367. o.

[17.] Eger hetilap (1880.02.12): Néhány szó az eperfa- és selyemtenyésztés érdekében. [A few words for mulberry production and silk worm rearing.]. XIX. évf., 7. sz., 51-52. o.

THE BACKGROUND OF LOCAL FOOD-BASED ECONOMY DEVELOPMENT IN THE EGER WINE REGION

Csaba Ruszkai – Mercédesz Németh – Konrád Kiss – Ilona Pajtók

Abstract

This study reveals the background situation of local food-based economy in the Eger Wine Region. Local food economy is mostly in initial phase in the region because of small scale supply, barely known local food producers and their supply, weak connections between producers and representation of interests, or major labour issues. Despite all these there are advantageous economic environment for development local food-based economy in the area, because the critical mass of producers is still active in the region and consumer's demand is significant. Tourism provides standing demand for local goods as well. A comprehensive development of market infrastructure would increase the existence of these unique economic entities.

Keywords: *local food, rural development, short supply chains, strategic planning*

DOI: 10.33032/acr.2020.spec.91

Introduction

Creating of local food-based supply chains are a very current challenge from an environmental and economic point of view. There are many initiatives, which improve local product based regional capacities in the EU and in Hungary as well (Balázs 2012). The aim of this study is to strengthen local food economies and to identify local obstacles via an example case of an attractive Hungarian town Eger, with its touristic functions, including wine and local food. Even though the wine region and its surrounding area has considerable traditions for producing of local food, it is still in the initial phase in the regional economy nowadays. There are many producers of cheese, meat, fish, fruits or honey, but they have not got enough capacity to manage their markets. Some of them have already built up cooperation with each other for marketing purposes. It would be necessary to establish similar cooperation networks and trade union structures to support their efforts and their market share. However, local food producers are generally active in the processing and trading but with limited raw material producing capacities. (Winter 2003)

Material and methods

This study will reveal the initial situation of the local food economy surrounding Eger. Eger is a small town with 53.000 inhabitants near to the capital city of Hungary (Hungarian Central Statistical Office 2019). Its economy based on tourism and wine with several plants mostly in automotive industry. We used statistical sampling with our own questionnaire (104 examples) as well, and research interviews to collect all relevant data together. We made personal interviews with producers of different local products, like cheese, meat, fish, honey, syrup and jam, herb, bread, wine, etc. According to the opinions of these local producers related mostly to the regional food based economic development, we applied methods from project management to analyze the current situation and to structure the needs and demands of interventions. SWOT analysis, problem-tree, objective-tree and log-frame were the most adequate tools to reveal and to find the potential solutions to reinforce the local food-based economy (Verzuh 2005). Moreover, we established a platform to contribute local food initiatives and cooperation fostering food based rural development and to get to know the most relevant challenges of the local producers and their ventures.

Results

The Eger wine region has a significant local food capacity and there are different kinds of local food producers with lots of product offers. They are in different stages in terms of the evolution of small businesses and they have limited information about the local market and consumption (Churchill-Lewis; 1983). To reach local or regional markets it is important to have a marketing and business strategy as well, but the local producers have scanty capacities to achieve marketing concepts and they have mostly initial business plans. Most of them have other jobs to provide for their living expenses. Moreover, they have limited opportunities to participate in the local gastronomy events because of the high prices and they do not have an adequate representation of interest. They are handled as a marginal part of the whole food industry, which is a very disadvantageous status for them.

According to the opinions of local customers there is a significant demand for local food products especially for wine, cheese, bakery products, fruit, milk, honey, eggs etc. Meat has an average demand, but fish or syrup is less popular, than the others with the local consumers.

The well-known local food producers in most cases are wineries or cheese producers and since the polling was conducted in Eger the most active producers, like Sáfrány Pisztráng (Safrany's trout), Rigó Teák (Rigo's teas), or jam and honey small businesses. Consumers behavior supports the specialized expectations of local food producers, that are commonly known for their quality, special taste of food, reliability, sustainability, circular economy (so that the money stays in the community), etc.

Despite the popularity of local producers, they have limited opportunities to participate in the regional market. First, they have insufficient information and access to the local markets due to marketplace fees or other costs. Some of them are suppliers of local restaurants or they try to sell their products nearby in the shopping malls. Eger does not have dedicated stores to offer local food products for citizens and tourists, and according to the opinion of the producers, they would support a regional shop network, which already exists in the polish tourist city of Zakopane. The local food shops in Zakopane offer many types of local products in unique styles and tastes (see Fig 1.).

Figure 1 Local food shop in Zakopane (Poland) - own picture

To explore the local food-based economy in the Eger wine region, we have created a SWOT analysis, which synthesizes the most adequate cases of the local food market in the wine region. The results of the SWOT analysis call attention to the current situation of the local food economy, which has relatively good fundaments to improve and accomplish a higher level. There are many positive factors in existing food producers in the region, which include their own product ranges, labels, small scale professional and business cooperation, raw materials mostly from the region and a variety of their product supply (wine, cheese, meat, fish, herbs, honey, jams and syrups, etc.).

Strengths	Weaknesses
• Several producers in the region • Unique and labeled local products • Relatively broad product lines • Increasing of demand for local food • Good examples of local businesses (Bükk Mountain Cheese, Sáfrány Trout, Soma Meat, Rigó's tea, etc.) • Supporting the local circular economic development • Available subsidies for infrastructure development • Support to the local producers from the Municipality of Eger and Eszterházy University • Increasing demand for local food in restaurants • Advantageous geographical fundaments of raw materials	• Not well-known local producers • Different lifecycles of local food businesses • Limited capacities in production • Not enough opportunities for promotion and sale • The producers have different experiences in marketing • Weak cooperation with each other • Weak circumstances in protection of interests • Weak partnership with the local tourism • Shortage of labour • Young people do not find being a local food producer an attractive job • Relatively high prices • Mostly bad experiences in subsidy application
Opportunities	**Threats**
• Eger as center of international tourism • Following good examples in local food branding • European subsidies for stimulating local markets • Fostering participation of the Hungarian Chamber of Agriculture • The boom in the global economy could improve the demand of local products	• The existing dominance of wholesale trading • Changing policies in subventions • Uncertainty in rural development policies • Changing consumer attitudes • Tightening of local food supply in the region

Some of them have good cooperation with scientific institutions as well, and they have many common projects with such entities (wine clusters, food analytics, taste of Eger initiative, etc.)

Our survey for the needs of local consumers shows, there is an increasing demand in the local market for local food products. We had interviewed 104 respondents

about their shopping habits and 10 food producers or winemakers. 96% of them have bought local products primarily food products and they are convinced that these types of products have a unique quality and a significant value in achieving a healthy life. The consumers know quite well the biggest producers, like wineries and cheese, meat or herb producers. Restaurants are good partners for local producers, but they need a permanent supply, which is not available in all categories of local food offers. (Feldmann-Hamm 2015)

The weaknesses are mostly concerning the gap in the local food economy: there are just a few producers and they are in different lifecycles of business development, which limits their capacities in the local food supply. They are mostly unknown for the local customers, because of limited promotion opportunities. There is a huge lack of marketing knowledge, which is needed for business development. In our opinion, it can be helpful to establish a customized advocacy for local food or product makers, instead of the current situation, that limits their representation to an ordinary way of common agricultural actors. The subsidy system is a restricted opportunity for us, because of rigorous regulations and financial conditions. Training can be an effective way to develop starter venues in this area, but a capable training center is needed to fulfill their demand in business development and marketing. The local university could offer such training events together with the Hungarian Chamber of Agriculture. Tamas Jakab, director of the Chamber in Heves County said, that they are ready to support this formation of local food producers, but it is necessary to separate them from the ordinary food producers. He emphasized, that local producers are mostly interested in producing raw materials, instead of making processed food products. However, there are differences between local processed food and local produced food ingredients. Both are available on local marketplaces, if they require only small scale offers, but there is lack of big producers in the processed local food segment.

Rural areas have considerable issues in the shortage of labour in the Northern Hungarian Region; furthermore, it is not an attractive job for young people to be local product makers. Local products cost slightly more than ordinary food products, because of handmade production, and the small scale of production capacities.

Subsidies would play a very important role in the operation of rural enterprises; however local actors and food producers have disadvantageous experiences in applying rural economic development projects.

The external environment of the local food-based economy in the wine region has a rather positive impact on the food producers. Eger and its region have international role in tourism and can provide an advantageous market for local product producers, although these are yet only possibilities. (Jónás-Berki et. al. 2015) The dominance of wholesale trading, changing development policies and consumer attitudes limit the chances of local products, but the stable economic growth and a technical support of local governmental institutions can strengthen efforts for a local food-based economy.

Conclusion

This paper reveals the potentials and components of the local food economy in the wine region. According to the results of the local food-based research in the Eger wine region it can be stated, that there are multiple fundaments of the local food-based economy in the research area. The question was, how is it possible to make more effort to create a local food-based economy, which is more sophisticated than ever before, with the goal that this sector of the local economy would strengthen regional value chains and environmental solutions. The Eger Wine region has relatively good conditions to develop its own local-food based economy with more GO and NGO advocacy, targeted marketing strategy and a considerable development of market infrastructures.

References

[1.] **Balázs B. (2012):** Local food system development in Hungary. International Journal of Sociology of Agriculture and Food, 19(3): 403–421.

[2.] **Lewis, Virginia L. and Churchill, Neil C., The Five Stages of Small Business Growth (1983)**. Harvard Business Review, Vol. 61, Issue 3, p. 30-50 1983. Available at SSRN: https://ssrn.com/abstract=1504517

[3.] **Winter, M.** (2003) Embeddedness, the new food economy and defensive localism, Journal of Rural Studies, Volume 19, Issue 1, 2003, Pages 23-32, ISSN 0743-0167,
https://doi.org/10.1016/S0743-0167(02)00053-0

[4.] **Verzuh, E. (2006):** Projektmenedzsment. HVG Zrt, Budapest. pp. 424.

[5.] **Jónás-Berki, M., Csapó, J., Pálfi, A., and Aubert, A.** (2015) A Market and Spatial Perspective of Health Tourism Destinations: The Hungarian Experience. Int. J. Tourism Res., 17: 602– 612.
https://doi.org/10.1002/jtr.2027

[6.] **Feldmann, C., Hamm, U. (2015)** Consumers' perceptions and preferences for local food: A review, Food Quality and Preference, Volume 40, Part A, 2015, Pages 152-164, ISSN 0950-3293,
https://doi.org/10.1016/j.foodqual.2014.09.014

[7.] https://www.ksh.hu/docs/hun/hnk/hnk_2019.pdf

THE ROLE OF TRUST IN SHORT FOOD SUPPLY CHAINS

Antónia Szűcs – Gábor Koncz

Abstract

The purpose of this study is to examine the role of trust in Short Food Supply Chains (SFSC) through national and international literary analysis. As local products are usually available at higher prices due to the small volume of production, local producers need to convince consumers in other ways. In addition, it is extremely important to retain the acquired consumer base, as small producers often intervene for survival. First, we write about trust as a general idea, then the concept of SFSC will be briefly defined, to create points of contact between the two topics. Next, we discuss the extent of trust through the presentation of various research findings. In general, the level of trust in Hungary lags behind the European average, which requires active communication on the part of small producers. At the same time, consumers' trust also means positive feedback for producers, strengthening them. Finally, our study summarizes the areas of trust in SFSCs, and in our conclusions we deal with its effects of rural development.

Keywords: *trust, local product, local economic development, Short Food Supply Chains*
JEL: R10

DOI: 10.33032/acr.2020.spec.99

Introduction

The objectives of the study

In our previous research, we examined the rural development and sustainability issues of short food supply chains from several aspects (Koncz–Szűcs, 2018). These studies highlighted the importance of trust in developing and maintaining alternative forms of sales. Therefore, we considered it important to perform a literature review focusing directly on the role of trust in SFSCs. After defining our main concepts, we present literature information on measuring the degree of trust and describing its role in SFSCs.

Definition of trust

There are many definitions in the national and international literature for defining the concept of trust. There was so much interest in this topic that the number of related publications doubled between 1994 and 1999 (Tarnai, 2003). Bencsik–Juhász (2016) focus on willingness, and in their view, trust is the readiness to have a positive attitude towards the actions of others. Sass et al. (2008) emphasize reliability, trust is interpreted as a psychological state, reflects the trust giver's judgment of trust regarding the trust taker's behaviour and intentions. So, emotion is an important basis for trust, positive emotions increase credit, while negative ones reduces it. However, trust is partly a rational phenomenon, that is, based on past experience or reliable information, we have good reason to rely or not to rely someone (Hardin, 2002). Kumar (1996) it also emphasizes reliability, the members of the supply chain trust each other and unconditionally respect their words. A corporate supply chain approach is a business philosophy that requires assurance, commitment, alignment, common goals, senior management support, and understanding and acceptance of interdependence (Németh, 2009).

Short Food Supply Chains

Consumers, as long as food production and consumption were close in space, could be assured of quality. However, consumer confidence has been increasingly shaken by growing food scandals (Beulens et al., 2005). As a result, the need for healthy and reliable food has increased. According to Regulation (EU) No 1305/2013 of the European Parliament Council, the Short Supply Chain is a supply chain made up of a small number of operators committed to cooperation, local economic development and the close geographical and social relationships between producers, processors and consumers. There are several aspects in the literature of grouping short food chains such as: physical distance of sales, territorial attachment of sales, marketing channels, number of participants and form of participation, physical form of sales (Kujáni, 2014). In addition, it is important to distinguish between SSC and SFSC. SSCs are local, regional supply chains that include non-food handicraft products made by producers, while SFSCs are only the food chain. Our study focuses on the latter one.

Material and methods

The research topic areas were summarized, such as the Short Supply Chain and trust and their relationships, based on national and international literature. In addition, we also attempted to briefly summarize previous research results on the topic through secondary information collection.

Results and discussion

Trust and its measure

In general, trust definitions can be categorized into two basic approaches. One is a belief based approach and the other is a risk concept. According to belief-based approaches, the source of trust is the belief in each other. Both parties have an interest in maintaining the prosperity of the other (Nagy–Schubert, 2007), however, cooperation always involves some risk. According to Das–Teng (2004), trust means that we voluntarily take the risk of being vulnerable by the other party.

The difference between cooperation and trust lies in the fact that risk-taking is not necessarily required for two parties to cooperate. From this point of view, trust is relevant in relationships which are characterized by risk. A high level of cooperation is essential to maintain the competitiveness and performance of companies (Benedek–Takácsné, 2016), while long-term business relationships have a positive impact on trust.

Positive cooperation and credence between people is part of the social capital. This capital plays an important role in social reproduction, including the future development of well-being. However, reliance and cooperation can only be truly outstanding in countries where social capital is strong. Economic operators are turning to each other consciously in order to establish economic recovery relationships (Varga, 2013).

According to the survey of Hungarian Central Statistical Office, the level of trust between people in Hungary is moderate on a scale of 10. The value of the indicator decreased between 2013 and 2015, from 5.30 to 4.95. Hungary's trust index is lower than the European Union value (5.8). Mutual trust is strongest in the Scandinavian countries, with Denmark showing a particularly high value. The level of trust is the lowest in Bulgaria, where the average index was 4.2 points. Among our neighbours, the level of trust was lower in Croatia than in Hungary, while in the Czech Republic the average is equal to the Hungarian population (KSH, 2018).

Examining the Hungarian agricultural operators, the cooperation activity of Hungarian farmers is far below that of the developed Western European countries. Research on this topic has identified low levels of trust as one of several reasons for low willingness to cooperate (Takács–Baranyai, 2010). In their study Baranyai–Szabó (2016) examine the factors affecting reliance in Hungarian agriculture.

Their research has shown that the loyalty dimension plays a more important role in building reliance than belief in professional competence. Therefore, continuous bilateral communication between supply chain members is essential to reduce the level of uncertainty (Piricz, 2013).

The role of trust in SFSCs

These forms of cooperation are typically based on social consensus, relying on personal or community trust in producer-consumer cooperation. Their aim is to exchange quality products, guaranteeing the origin of the product, which is typically a priority for the customer (Balázs, 2011).

Trust is therefore a key aspect of the sustainability assessment of SFSCs. The basis of the cooperation between SFSC actors is trust and commitment, and its continuous improvement. It is important for members to accept interdependence and to share the information available to them (Ványi–Varjasi, 2014). In a survey conducted in the Balaton region, the importance of various influencing factors in the sales of local products was assessed on a scale of 1-10. The ranking of factors was clearly driven by trust (average: 9,24). In their opinion, trust is both expectation and compulsion in a good sense which keeps farmers in a good position and a guarantee of quality (Balatoni Integrációs Közhasznú Nonprofit Kft., 2017).

According to Gelei (2002), the primary goal of supply chain members is to meet consumer needs by working together in value-creating processes while sharing both risk and reward.

From a consumer perspective, it has real value to buy food from a producer we know personally. As a result of Byker and co-authors' (2012) consumer attitudes survey, they say that the main reason for the popularity of local products is the quality of the products which has been purchased. According to Hendrickson–Heffernan (2002) consumer trust is not about good product quality, but about safe product production, and this is a guarantee of personal contact.

Benedek–Balázs (2014) discuss the relationship between trust and certification. According to Jarosz (2008) most producers do not have any certification due to more important trust between producers and consumers. The existence of certificates proves for many people just that the product (or method of production) has not been integrated into the local environment (Watts et al., 2005).

Conclusions

The need for trust lies in the fact that cooperation between partners is the only way to meet consumer needs at the highest level and at the lowest cost. What really

distinguishes trust-based business relationships from the rest is the commitment the partners feel to each other.

A local product of a region is a confidential product. Consumer trust or distrust affects the path, success, or failure of a product. In many cases, the production of a reliable, quality local product is based on tradition, and the knowledge and experience of the producers play an important role. It is a real value for the consumers, if the right climate of reliance is created. So they knows exactly where and what the producer has grown for them. In this way, the general effect of SFSC is to improve general reliance and strengthen social cohesion.

The local market is primarily a complex economic development tool. Providing an appropriate relationship of trust among producers and between producers and consumers may trigger the rural development effects of SFSCs. Local food supports the local and regional economy, and well-functioning local markets could be also noteworthy tourist attractions in some areas. They provide basic-level food supply, self-employment and job opportunities.

References

[1.] Balatoni Integrációs Közhasznú Nonprofit Kft. (2017): Rövid Ellátási Láncok kialakítási lehetőségeinek vizsgálata Somogy és Zala megyében. Helyzetelemzés. Keszthely, 67 p.

[2.] Balázs B. (2011): A helyi élelmiszer-hálózatok fejlesztése. In: Kerekes S. et al. (szerk.): A fenntartható fogyasztás környezeti dimenziói. Aula, Budapest, pp. 277-304.

[3.] Baranyai Zs. – Szabó G. G. (2016): A bizalom tényezői a magyar mezőgazdaságban - Egy felmérés tapasztalatai a Sholtes modell alapján. LVIII. Georgikon Napok, Kivonat kötet. ISBN 978-963-9639-84-3, Keszthely, 47. p.

[4.] Bencsik, A. – Juhász T. (2016): Szervezeti bizalom és bizalmatlanság a sharing economy szellemében. In: LIM2016, Zalaegerszeg, pp. 174-183.

[5.] Benedek, A. – Takácsné, Gy. K. (2016): Bizalmon alapuló együttműködés vizsgálata kis és középvállalatok körében.In: Vállakozásfejlesztés a XXI. Században. Budapest, 2016, pp. 379-390.

[6.] Benedek Zs. – Balázs B. (2014): A rövid ellátási láncok szocioökonómiai hatásai. *Külgazdaság* 58 (5-6), pp. 100-120.

[7.] Beulens, A. J. M. – Broens, D. F. – Folstar, P. – Hofstede, G. J. (2005): Food safety and transparency in food chains and networks. Relationships and challenges. *Food Control* 16, pp. 481-486.
https://doi.org/10.1016/j.foodcont.2003.10.010

[8.] Byker, C. – Shanks, J. – Misyak, S. – Serrano, E. (2012): Characterizing Farmers' Market Shoppers: A Literature Review. *Journal of Hunger & Environmental Nutrition* 7 (1), pp. 38–52.
https://doi.org/10.1080/19320248.2012.650074

[9.] Das, T. K. – Teng, B. S. (2004): The risk-based view of trust: a conceptual framework. *Journal of Business and Psychology* 19(1), pp. 85-119.
https://doi.org/10.1023/B:JOBU.0000040274.23551.1b

[10.] Elghannam, A. – Mesias, F. – Escribano, M. – Fouad, L. – Horrillo, A. – Escribano, A. (2020): Consumers' Perspectives on Alternative Short Food Supply Chains Based on Social Media: A Focus Group Study in Spain. *Foods* 9(2), 13 p.
https://doi.org/10.3390/foods9010022

[11.] Hardin, R. (2002): Trust and Trustworthiness. Russell Sage Foundation, New York, 256 p.

[12.] KSH (2018): Magyarország, 2017. Budapest, 214 p.

[13.] Hendrickson, M. K. – Heffernan, W. D. (2002): Opening spaces through relocalization: locating potential resistance in the weaknesses of the global food system. *Sociologia Ruralis* 42 (4), pp. 347–369.
https://doi.org/10.1111/1467-9523.00221

[14.] Jarosz, L. (2008): The city in the country: Growing alternative food networks in Metropolitan areas. *Journal of Rural Studies* 24 (3), pp. 231–244.
https://doi.org/10.1016/j.jrurstud.2007.10.002

[15.] Ji, C. – Chen, Q. – Zhuo, N. (2019): Enhancing consumer trust in short food supply chains: The case evidence from three agricultural e-commerce companies in China. *Journal of Agribusiness in Developing and Emerging Economies* 10(1), pp. 103-116.
https://doi.org/10.1108/JADEE-12-2018-0180

[16.] Koncz G. – Szűcs A. (2018): A rövid ellátási láncok vidékfejlesztési jelentősége. In: Dinya L. – Baranyi A. (szerk.) XVI. Nemzetközi Tudományos Napok : „Fenntarthatósági kihívások és válaszok" - A Tudományos Napok Publikációi. EKE Líceum Kiadó, pp. 997-1004.

[17.] Kujáni K. (2014): Az alternatív élelmiszer-ellátó rendszerek meghatározásának és csoportotsításának tényezői. *Gazdálkodás* 58 (1), pp. 30-40.

[18.] Kumar, N. (1996): The Power of Trust in Manufacturer-Retailer Relationships. *Harvard Business Review* 74(6), pp. 93-107.

[19.] Nagy J . – Schubert A. (2007): A bizalom szerepe az üzleti kapcsolatokban. 77. Sz. Műhelytanulmány, BCE Vállalatgazdaságtan Intézet, 25 p.

[20.] Piricz, N. (2013): A bizalmat befolyásoló tényezők vizsgálata az üzleti kapcsolatokban. *Vezetéstudomány* 44(12), pp. 14-29.

[21.] Sass, J. – Kovács, Z. – Bodnár, É. (2008): „Miben bízhatunk?" – Szervezeti bizalom a szervezeti kultúra tükrében. In: 60 éves a közgáz Jubileumi Tanulmányi Kötet. Budapest, Aula, pp. 49-61.

[22.] Takács, I. – Baranyai, Zs. (2010): Role of trust in cooperation of farmers from the aspect of new institutional economics. *ANNALS of the Polish Association of Agricultural and Agribusiness Economists* 12 (6). pp. 179-184.

[23.] Tarnai M. (2003): A bizalom szerepe a gazdasági kapcsolatokban. In A Gazdaság és az emberi viszonyok c. fejezet része Gazdaságpszichológia (szerk. Hunyady Gy., Székely M.) Budapest, Osiris, pp. 676-715.

[24.] Varga, J. (2013): A nyitott innovációs üzleti modell és az együttműködésen alapuló piacgazdaság: Vezetés és szervezetek Taylor után 102 évvel. *Taylor: Gazdálkodás- és Szervezéstudományi Folyóirat*, No. 14-15., pp. 352-363.

[25.] Watts, D. C. – Ilbery, B. – Maye, D. (2005): Making reconnections in agro-food geography: alternative systems of food provision. *Progress in human geography* 29 (1), pp. 22–40.
https://doi.org/10.1191/0309132505ph526oa

Acknowledgments

This work was supported by the EFOP-3.6.2-16-2017-00001 research grant.

Authors

Antónia Szűcs (PhD)
Assistant professor
Eszterházy Károly University
Institute of Rural Development and Landscape Management
szucs.antonia@uni-eszterhazy.hu

Gábor Koncz (PhD)
Associate professor
Eszterházy Károly University
Institute of Rural Development and Landscape Management
koncz.gabor@uni-eszterhazy.hu

PRECISION CANOPY MANAGEMENT OF THE GRAPEVINE: EARLY DEFOLIATION AND GIRDLING

Adrienn Mária Tóth[1]
[1] Institute of Viticulture and Enology, Eszterházy Károly University, Eger.

Abstract

Although different operations are applied in the cultivation of both wine grape and table grape varieties, the purpose is to produce healthy crop having the desired quality values, with the least possible amount of pesticide applied. Environmental risks and climate change are also becoming increasingly important issues in sustainable agricultural management. Early defoliation and girdling as precision phytotechnical methods can be used to implement the requirements of environmental consciousness and to achieve adequate grape quality parameters in wine making and table grape growing. Early defoliation of the cluster zone increases berry quality and reduces the possibility of rot infection by changing the microclimatic environment around the cluster and improving berry skin resistivity (Poni et al. 2006; Pastore et al. 2013).

DOI: 10.33032/acr.2020.spec.107

Introduction

Apparently, attaining optimal quality parameters of juice and physical quality of berry is the aim of both wine and table grape growing. In practice this means that we want to influence such parameters of wine grapes that will be decisive in the winemaking process, such as sugar content, anthocyanin and phenolic concentration. On the other hand, in the case of table grapes, marketability is the main factor, which is highly influenced by consumer demand. Therefore, the market value of table grapes is mainly influenced by berry size, firmness, color and taste. The desired parameters of both grape types are determined primarily by the variety of the grape, the terroir and the climate and, not least, by the viticulture practices, use of plant chemicals and the agro- and phytotechnical operations applied (Gabura, 2018). The practice of using precision phytotechnical operations has an increasing importance in conscious quality grape-growing worldwide, although they are less known in Hungary and related scientific studies are quite sparse.

Due to the nature of the vine, one of the most important viticultural tasks is to establish vine balance in order to adjust the optimum yield with the adequate. This is a multi-step, labor intensive process that lasts from winter pruning to the harvest of the bunches. Following the appearance of the shoots, canopy management can contribute to obtaining the desired fruit quantity and quality by adjusting the proportion of vegetative and generative organs. These parameters depend on the optimal carbohydrate balance of the leaves and shoots from growing to ripening (Mota et al. 2009, Frioni et al. 2017). A significant number of phytotechnical treatments are generally applied to maintain the optimal proportion of vegetative and generative plant parts (e.g. pruning, shoot thinning) (Bényei et al. 1999). Other lesser known types of phytotechnical treatments include the special or precision procedures that can improve the quality parameters of the grape by modifying the formation and further development of the flowers and fruit clusters through affecting the reproductive activities of the plant (Bényei et al. 1999).

A plant organ can be either source or sink during assimilate partitioning. In simple terms about the relations of the assimilate transport between the sink and source organs are effected by the ratio of leaf to yield ratio (sink-source relations) (Conde et al. 2007). For example, the ratio of the leaf area as assimilate source will become greater by cluster thinning than the bunches. Therefore, excessive crop load can be prevented and enhanced grape quality can be achieved (Mota et al. 2009). Some methods such as cluster thinning or girdling operate by changing the distribution ratio of the assimilates produced by the photosynthesis can enhance maturation and thus their use is quite essential in cool-climate regions (Frioni et al. 2017)

These special canopy management methods can rarely be mechanized and, due to the time consuming nature of manual labor, are only applied in wine grape cultivation

in special cases and for specific production purposes, while some of them can be essential in the case of table grapes (Lőrincz-Barócsi, 2010). These viticulture practices can be manual/mechanical, meaning that certain parts of the plant are removed for a positive result, or chemical, when phytotechnical hormones are used to stimulate the growth and maturation of the bunches (Lőrincz-Barócsi, 2010). The latter method is common practice with seedless grape varieties. Exogenous application of gibberellic acid during flowering reduces the berry set and a repeated application of the hormone increases the berry size during the development (Roper-Williams, 1989).

The role of special canopy management techniques is increasing under extreme environmental conditions due to climate change. It is well known, that water deficit and high air temperature increase phenolic grape maturity, however sugar concentration become also high in the berries (Cohen et al., 2008, 2012; De Orduna et al. 2010; Villangó et al. 2016). Therefore, the optimal use of different viticultural techniques (including canopy management) may help to balance fruit maturity (Poni et al, 2006; Palliotti et al. 2014).

Special phytotechnical practices in cool climate regions

Table grape growing is quite difficult in Hungary – as compared to the Mediterranean countries – because of the cool climate conditions. The annual precipitation and humidity distribution is irregular, the weather during the growing period (from May to October) is warm, but sometimes at the beginning of October the early frosts can stop the ripening process in the case of late maturity varieties (eg. Italia, Afuz Ali). Humidity in late August and September causes several fungal diseases in grapes, and chemical defense not always possible because of the withdrawal period of chemical products used in food production. Some special phytotechnical operations such as defoliating and girdling can be applied as an environmentally friendly method for improving grape quality.

Early defoliation

Early defoliating of the cluster zone increases berry quality and reduces the possibility of rot infection by changing the microclimatic environment around the cluster and by improving berry skin resistivity (Poni et al. 2006; Pastore et al. 2013); however, this method is not commonly used in Hungary. Implementation of this method involves removal of leaves in the cluster zone or defoliating basal leaves, which can produce different results based on the timing of the treatment. Early defoliation (timing before

anthesis or berry set) by removing the basal leaves reduces the carbohydrate supply of the bunches and thereby results in insufficient berry set. The clusters will be less dense, with a smaller number of berries, compared to the control vines (Poni et al. 2006; Diago et al. 2010; Sabbatini-Howell, 2010). In order to achieve such positive effects as yield reduction, loose clusters and higher sugar concentration, defoliation should be applied at least four weeks after blooming (Sabbatini-Howell, 2010)

Changes in yield and cluster structure have been confirmed by several studies (Diago et al. 2010; Tardaguila et al. 2010; Fazekas, 2012; Gabura, 2018). The decline in yields caused by early defoliation is primarily due to lower cluster weight (Pastore et al, 2013). According to a study made in two consecutive year both mechanical and manual pre-bloom defoliation resulted in lower yields, smaller bunches and less berries per cluster compared to the control, whereas only mechanical defoliation produced results when applied at anthesis (Diagoe et al. 2010), and total leaf area was similar to that in the controls as a result of post-leaf regeneration, and greater resistance to botrytis infections was observed (Diagoe et al. 2010).

Comparison of the results of several studies shows that early defoliation does not produce an equable change in the berry weight of different varieties. Tardaguila et al. (2010) found a decrease berry weight on Graciano variety, while the weight of the berries increased as a result of the early defoliation on Carignan variety. Berry weight decreased in the case of defoliated Kékfrankos, while it increased as a result of the treatment in the Turán variety (Fazekas, 2012). However, other studies reported that the experiment did not effect any changes in the berry weight of Pinot noir (Lee-Skinkis, 2013) or Tempranillo (Diago et al. 2010).

Besides yield decrease, positive changes occur in juice quality as a result of the treatment. The sugar content increased and the titratable acidity declined in the examined varieties as the result of early defoliation (Poni et al. 2006; Pastore et al. 2013, Gabura, 2018). According to studies, the decrease of acidity can often be cultivar-specific, as in the case of the Vignoles variety (Sabbatini-Howell, 2010), or in Kékfrankos and Turán there were no significant changes (Fazekas, 2012).

Increased light exposure and better leaf area fruit weight ratio may also affect the polyphenol and anthocyanin content of grapes. Higher light intensity produces more phenolic compounds in the plant through enhancing the enzymatic activity (Zanathy, 2003). Wines will be deeper in color and longer in taste, owing to the defoliation (Lőrincz-Barócsi, 2010). Several studies reported that defoliation increased the amount of phenolic compounds. Total polyphenol and anthocyanin content increased on Graciano variety due to early defoliation in two consecutive years (Tardaguila et al. 2010), and both compounds increased significantly on Turán variety (Fazekas 2012) and also on the Tempranillo variety (Diago et al. 2012) as a result of the treatment. Intrigliolo et al. (2014) came to similar conclusions concerning the Mandó grape variety (Gabura, 2018).

The timing of leaf removal is also decisive in achieving the expected results. Lee and Skinkis's (2013) experiment revealed that the anthocyanin content of the grape crop increased the most if the defoliation was applied during flowering, compared to the control and vines which that defoliated in another phenological phase (e.g. grain-pea size or bunch closure) (Gabura, 2018). Application of leaf removal from pre-bloom vines increased the anthocyanin content, compared with the control (Poni et al. 2006), while treatment at veraison resulted in a reduced amount of anthocyanin on Sangiovese variety (Pastore et al. 2013).

A general inconvenience in cool climate vine growing is that the dry and warm growing season, which provides optimal ripening conditions, is relatively short and the increased precipitation in autumn often results in the rotting of mature or ripening bunches. The frequency and extent of gray rot depends greatly on the microclimate of the cluster zone, temperature, wind velocity, humidity and leaf moisture (Lőrincz-Barócsi, 2010, Gabura, 2018). Early defoliation contributes positively to both the environmental and internal factors, thus reducing the incidence of botrytis infection. This can be explained by a looser cluster structure due to a poor berry set and, on the other hand, by the thickening of the cuticule layer of the berries that initially developed under greater light exposure (Zanathy, 2003; Lőrincz-Barócsi, 2010; Gabura, 2018). These beneficial effects were showed by Diagoe et al. (2012) when high levels of rainfall caused serious infections in control vines, but the early defoliation reduced the botrytis infection in the Tempranillo variety significantly. The degree of infection is also reduced by defoliating at veraison (Pastore et al. 2017).

Girdling at veraison

Girdling means removing a small section of bark (3-6 mm) from the trunk, a bunch or shoot of a woody plant. Usually it is done with a special girdling tool which does not harm the cork of the plant. The wound on the phloem behaves as a physical barrier in the way of assimilates and hormones from leaves to roots, consequently inducing their accumulation; while water and minerals can be transported from roots to leaves without any obstacle. The carbohydrate supply, auxin and ABA quantity increases, and the cytokinine level decreases above the girdled wound.

Different timings of girdling resulted in different positive effects on berries; during anthesis it improves berry set, especially in seedless cultivars; after berry set it improves berry size (Dokoozlian et al. 1995; Brar et al. 2008; Soltekin et al. 2015, 2016). Effects of accelerated maturity and enhanced, balanced colouring of the grape berries can be achieved by girdling at veraison. Girdling causes earlier harvest dates (Keskin et al. 2013; Soltekin et al. 2015 and 2016; Basile et al. 2018) by 6-15 days

(Soltekin et al. 2016) and this can be favourable in cool climate vineyards. Girdling executed at the beginning of veraison on table grapes can accelerate the colouring of the berries (Yamane-Shibayama, 2006; Yamane et al. 2010; Koshita et al. 2011). The finding that girdling caused enhanced maturity in grapes was supported in several studies by lower acidity and higher sugar content values of the treated berries (Yamane and Shibayama, 2006; Keskin et al. 2013; Soltekin et al. 2015 and 2016).

Girdling at veraison may cause accumulation of several components in plants above the ringing of the phloem including clusters, and thus it results in improved maturity (Roper-Williams, 1989; Yamane-Shibayama, 2006; Koshita et al. 2011; Abu-Zahra and Salameh, 2012; Keskin et al. 2013; Ferrara et al. 2014; Soltekin et al. 2015.) The impact of girdling is commonly evaluated by berry or cluster size parameters and changes in total soluble solids (Zabadal, 1992; Abu-Zahra – Salameh, 2012, Ferrara et al. 2014; Soltekin et al 2015, 2016) or increasing Brix values and total extractable polyphenols (Basile et al, 2018). Relatively few studies investigate the effect of girdling on wine grapes. Peduncle girdling in the Shiraz wine grape variety in warm climate did not significantly alter the volatile compounds of the wine (Böttcher et al. 2018).

Girdling causes assimilate accumulation above the ring wound with higher leaf water potential due to stomatal closure. Presumably the ABA concentration induced a decreased stomatal activity (Düring, 1978), similarly to the effect of water deficit (Zsófi et al. 2008). Similar results were found by Ezzahouani and Williams (2001) and a reduced net CO2 assimilation rate was observed above the girdling (Roper and Williams, 1989).

Girdling can be an effective complement to other methods. Combined use with cluster thinning is an effective agronomical technique to enhance berry quality (Basile et al. 2018) and it can also increase the berry weight (Zabadal, 1992). Application of the method during anthesis or berry set with exogenous growth hormones is common in the case of seedless cultivars, because the gibberellin production of the plant is not sufficient to achieve berry size. (Zabadal, 1992; Williams-Ayars, 2005, Zhang et al. 2003; Reynolds-Savigny, 2004; Abu-Zahra, 2010, Abu-Zahra – Salameh, 2012).

Conclusion

In summary, early leaf removal has positive effects on crop quality by limiting yield and increasing phenolic compounds, while looser cluster structure and thicker cuticule layer formation as a result of defoliation reduces the risk of botrytis infection. This method is adequate for producing high quality red wines with increased anthocyanin and phenolic compounds. Girdling applied at veraison can be effective in cool climate

table grape growing, as the method accelerates the ripening process and increases the nutritional values of the grape. However, research on the effect of girdling is still sporadic in the case of wine grapes.

Acknowledgement

This work is supported by EFOP-3.6.2-16-2017-00001.

References

[1.] Abu-Zahra, T. R. (2010). Berry size of Thompson Seedless as influenced by the application of gibberellic acid and cane girdling. *Pakistan Journal of Botany*, 42 (3), 1755-1760.

[2.] Abu-Zahra, T. R., Salameh, N. M. (2012). Influence of Gibberellic Acid and Cane Girdling on Berry Size of Black Magic grape cultivar. *Middle-East Journal of Scientific Research*, 11 (6), 718-722.

[3.] Basile, T., Alba, V., Gentilesco, G., Savino, M., Tarricon, L. (2018). Anthocyanins pattern variation in relation to thinning and girdling in commercial Sugrathirteen ® table grape. *Scientia Hortuculturae*, 227, 202-206 https://doi.org/10.1016/j.scienta.2017.09.045

[4.] Bényei, F., Lőrincz, A., Nagy, Sz. L., (1999). Szőlőtermesztés. Mezőgazda Kiadó, Budapest.

[5.] Böttcher, C.; Boss, P. K.; Harvey, C.A.; Davies, C. (2018). Peduncle-girdling of Shiraz (Vitis vinifera L.) bunches and sugar concentration at the time of girdling affect wine volatile compounds. *Australian Journal of Grape and Wine Research* 24 (2), 206-218. https://doi.org/10.1111/ajgw.12319

[6.] Brar, H. S., Singh, Z., Swinny, E., Cameron, I. (2008). Girdling and grapevine leafroll associated viruses affect berry weight, colour development and accumulation of anthocyanins in 'Crimson Seedless' grapes during maturation and ripening. *Plant Science*, 175, 885-897. https://doi.org/10.1016/j.plantsci.2008.09.005

[7.] Cohen, S. D., Tarara, J. M., & Kennedy, J. A. (2008) Assessing the impact of temperature on grape phenolic metabolism. *Analytica Chimica Acta*, 621(1), 57-67.
https://doi.org/10.1016/j.aca.2007.11.029

[8.] Cohen, S. D., Tarara, J. M., Gambetta, G. A., Matthews, M. A., & Kennedy, J. A. (2012) Impact of diurnal temperature variation on grape berry development, proanthocyanidin accumulation, and the expression of flavonoid pathway genes. *Journal of Experimental Botany*, 63(7), 2655-2665.
https://doi.org/10.1093/jxb/err449

[9.] Conde, C., Silva, P; Fontes, N., Dias, A. C. P., Tavares, R. M., Sousa, M. J., Agasse, A., Delrot, S., Gerós, H. (2007): Biochemical Changes throughout Grape Berry Development and Fruit and Wine Quality. *Food. Global Science Books*: 1-22.

[10.] De Orduna, R. M. (2010) Climate change associated effects on grape and wine quality and production. *Food Research International*, 43(7), 1844-1855.
https://doi.org/10.1016/j.foodres.2010.05.001

[11.] Diago P. M., Vilanova M., Tardaguila J. (2010): Effects of Timing of Manual and Mechanical Early Defolation on the Aroma of Vitis vinifera L. Tempranillo Wine. *American Journal of Enology and Viticulture* 61 (3), 382-391.

[12.] Diago, P. M.; Ayestarán, B; Guadalupe, Z., Poni, S., Tardaguila, J. (2012). Impact of prebloom and fruit set basal leaf removal on the flavonol and anthocyanin composition of Tempranillo grapes. *American Journal of Enology and Viticulture* 63 (3), 367-376.
https://doi.org/10.5344/ajev.2012.11116

[13.] Dokoozlian, N., Luvisi, D., Moriyama, M., Schrader, P. (1995). Cultural practices improve colour, size of 'Crimson Seedless'. *California Agriculture*, 49 (2), 36-40.
https://doi.org/10.3733/ca.v049n02p36

[14.] Düring, H. (1978). Untersuchungen zut Umweltabhängigkeit der stomatären Transpiration bei Reben. II: Ringelungs- und Temperatureffekte. *Vitis*, 17, 1-9.

[15.] Ezzahouani, A., Williams, L. E. (2001). The effects of thinning and girdling on leaf water potential, growth and fruit composition of Ruby seedless grapevines. *J. Int. Sci. Vigne Vin*, 35 (2), 79-85.
https://doi.org/10.20870/oeno-one.2001.35.2.985

[16.] Fazekas, I. (2012): Terméskorlátozó fitotechnikai munkák hatása vörösborszőlő-fajtákra. Budapest. Doktori értekezés.

[17.] Ferrara, G., Mazzei, A., Netti, G., Pacucci, C., Mataresse, A. M. S., Cafagna, I., Mastrorilli, P., Vezzoso, M., Gallo, V. (2014): Girdling, Gibberelic Acid and Forchlorfenuron: Effects on Yield, Quality, and Metabolic Profile of Table Grape cv. Italia. *American Journal of Enology and Viticulture*, 65 (3), 381-387. https://doi.org/10.5344/ajev.2014.13139

[18.] Frioni, T., Zhuang, S., Palliotti, A., Sivilotti, P., Falchi, R., Sabbatini, P. (2017): Leaf removal and cluster thinning efficiencies are highly modulated by environmental conditions in cool climate viticulture. *American Journal of Enology and Viticulture* 68:4, 325-335. https://doi.org/10.5344/ajev.2017.16098

[19.] Gabura, P. (2018): Különböző terhelés és lelevelezés hatása, a Furmint fajta mennyiségi és minőségi paramétereire. Szakdolgozat. Eszterházy Károly Egyetem.

[20.] Intrigliolo, S. D., Llacer, E., Revert, J., Esteve, D. M., Climent, D. M., Palau, D., Gómez, I. (2014): Early defoliation reduces cluster compactness and improves grape composition in Mandó, an autochthonous cultivar of Vitis vinifera from southeastern Spain. *Scientia Horticulturae,* 167, 71-75. https://doi.org/10.1016/j.scienta.2013.12.036

[21.] Keskin, N., İşçi, B., Gökbayrak, Z. (2013). Effects of cane-girdling and cluster and berry thinning on berry organic acids of four *Vitis vinifera* L. table grape cultivars. *Acta Scientiarium Polonorum*, 12 (6), 115-125.

[22.] Koshita, Y., Yamane, T., Yakushiji, H., Azuma, A., Mitani, N. (2011). Regulation of skin colour in 'Aki Queen' grapes: Interactive effects of temperature, girdling, and leaf shading treatments on coloration and total soluble solids. *Scientia Horticulturae*, 129, 98-101. https://doi.org/10.1016/j.scienta.2011.03.014

[23.] Lee, J., Skinkis, A. P. (2013): Oregon 'Pinot noir' grape anthocyanin enhancement by early leaf removal. *Food Chemistry* 139, 893-901. https://doi.org/10.1016/j.foodchem.2013.02.022

[24.] Lőrincz, A., Barócsi, Z. (szerk.) (2010). A szőlő metszése és zöldmunkái. Mezőgazda Kiadó, Budapest.

[25.] Mota, R. V., Souza, C. R., Silva, C. P., Freitas, G. F., Shiga, T. M., Purgatto, E., Lajolo, F. M., Regina, M. A. (2009): Biochemical and agronomical responses of grapevines to alteration of source-sink ratio by cluster thinning and shoot trimming. *Bragantia* 69 (1): 17-25.
https://doi.org/10.1590/S0006-87052010000100004

[26.] Palliotti, A., Tombesi, S., Silvestroni, O., Lanari, V., Gatti, M., & Poni, S. (2014). Changes in vineyard establishment and canopy management urged by earlier climate-related grape ripening: A review. *Scientia Horticulturae*, 178, 43-54.
https://doi.org/10.1016/j.scienta.2014.07.039

[27.] Pastore, C., Allegro, G., Valentini, G., Muzzi, E., Filippetti, I. (2017): Anthocyanin and flavonol composition response to veraison leaf removal on Cabernet Sauvignon, Nero d'Avola, Raboso Piave and Sangiovese Vitis vinifera L. cultivars. *Scientia Horticulturae* 218, 147-155.
https://doi.org/10.1016/j.scienta.2017.01.048

[28.] Pastore, C., Zenoni, S.,Fasoli, M., Pezzotti, M., Tornielli, B. G., Filippetti I (2013): Selective defolation affects plant growth, fruit transcriptional ripening program and flavonoid metabolism in grapevine. *BMC Plant Biology*, 13:30.
https://doi.org/10.1186/1471-2229-13-30

[29.] Poni, S., Casalini, L., Bernizzoni, F., Civardi, S., Intrieri, C. (2006): Effects of Early Defoliation on Shoot Photosynthesis, Yield Components and Grape Composition *American Journal of Enology and Viticulture* 57(4),397-407.

[30.] Reynolds, A. G., Savigny, C. de. (2004). Influence of girdling and gibberellic acid on yield components, fruit composition and vestigial seed formation of 'Sovereign Coronation' table grapes. *Hort. Science*, 39 (3), 541-544.
https://doi.org/10.21273/HORTSCI.39.3.541

[31.] Roper, T. R., Williams, L. E. (1989): Net CO2 Assimilation and Carbohydrate Partitioning of Grapewine Leaves in Response to Trunk Girdling and Gibberellic Acid Application. *Plant Physiology* 89: 1136-1140.
https://doi.org/10.1104/pp.89.4.1136

[32.] Sabbatini, P., Howell, G. S. (2010): Effects of early defoliation on yield, fruit composition, and harvest season cluster rot complex of grapevines. *Hort. Science* 45 (12), 1804-1808.
https://doi.org/10.21273/HORTSCI.45.12.1804

[33.] Soltekin, O., Candemir, A., Altindisli, A. (2016): Effects of cane girdling on yield, fruit quality and maturation of (*Vitis vinifera* L.) cv. Flame Seedless. *BIO Web of Conferences* 7 (01032): 1-5.
https://doi.org/10.1051/bioconf/20160701032

[34.] Soltekin, O., Teker, T., Erdem, A., Kacar, E., Altindisli, A. (2015): Response of "Red Globe" (*Vitis vinifera* L.) to cane girdling. *BIO Web of Conferences* 5: (01019)
https://doi.org/10.1051/bioconf/20150501019

[35.] Tardaguila, J., Toda, F. M., Poni, S., Diago, M. P. (2010): Impact of Early Leaf Removal on Yield and Fruit and Wine Composition of Vitis vinifera L. Graciano and Carignan. *American Journal of Enology and Viticulture*, 61, 372-381.

[36.] Villangó, S., Szekeres, A., Bencsik, O., Láposi, R., Pálfi, Z., & Zsófi, Z. (2016). The effect of postveraison water deficit on the phenolic composition and concentration of the Kékfrankos (Vitis vinifera L.) berry. *Scientia Horticulturae*, 209, 113-116.
https://doi.org/10.1016/j.scienta.2016.06.010

[37.] Williams, L. E., Ayars, J. E. (2005). Water use of Thompson Seedless grapevines as affected by the application of gibberelic acid (GA3) and trunk girdling - practices to increase berry size. *Agricultural and Forest Meteorology,* 129 (1-2), 85-94.
https://doi.org/10.1016/j.agrformet.2004.11.007

[38.] Yamane, T., Miyake, S., Hamana, Y., Sugiyama, N. (2010): Effects of tape covering and vine vigor on developement of surface callus in girdle of grapevine. *Vitis* 49 (3), 107-111.

[39.] Yamane, T., Shibayama, K. (2006). Effects of Trunk Girdling and Crop Load Levels on Fruit Quality and Root Elongation in 'Aki Queen' Grapevines. *Journal of the Japanese Society for Horticultural Science*, 75 (6), 439-444.
https://doi.org/10.2503/jjshs.75.439

[40.] Zabadal, T. J. (1992). Response of 'Himrod' Grapevines to Cane Girdling. *HortScience – American Society for Horticultural Science*. 27 (9), 975-976.
https://doi.org/10.21273/HORTSCI.27.9.975

[41.] Zanathy, G. (2003): A szőlőfürtök körüli levelek ritkítása. *Növénytermesztés*, 2003 (7). Digitalized: https://www.agronaplo.hu/szakfolyoirat/2003/7/novenytermesztes/a-szolofurtok-koruli-levelek-ritkitasa

[42.] Zhang, X., Luo, G., Wang, R.,Wang, J., Himmelrick, D. G.(2003). Growth and developmental Responses of seeded and Seedless Grape Berries to Shoot Girdling. *Journal of the American Society for Horticultural Science*, 128 (3): 316-323.
https://doi.org/10.21273/JASHS.128.3.0316

[43.] Zsófi, Zs. Tóth E., Váradi Gy., Rusjan D. and Bálo, B. (2008). The effect of progressive drought on water relations and photosynthetic performance of two grapevine cultivars (Vitis vinifera L.). *Acta Biologica Szegediensis*, 52(2), 321-322.

EGER TÖRTÉNELMI VÁROSRÉSZEINEK DEMOGRÁFIAI JELLEMZŐI, KIVÁLASZTOTT MUTATÓK ALAPJÁN

Antal Tóth – Csaba Patkós

Összefoglalás

Eger az Észak-Magyarország régió második legnépesebb települése; központi funkciókkal rendelkező igazgatási, gazdasági, oktatási, egészségügyi, kulturális és egyházi központ. Jól elkülöníthető, jellegzetes településrészekből áll, amelyek demográfiai jellemzői is igen eltérőek. Legnépesebb lakófunkciójú területeinek népességszáma több tízszeresen múlja felül az egyéb funkciójú városrészekét. Az elöregedő városok közé tartozik, fiatalosabb korösszetételű északi területei társadalmi szempontból nem homogének, sőt jelentősen különböznek egymástól: magas, illetve alacsony státuszú lakosságot magas arányban koncentráló részeket egyaránt találunk itt. Egerben az országos átlagnál magasabb az iskolázottsági szint, viszont ebből a szempontból is nagymértékű területi differenciák figyelhetők meg (Rác Hóstya, Felnémet, Felsőváros versus Almagyardomb, belváros).

Kulcsszavak: *Eger, városrészek, demográfia, népességszám, korösszetétel, iskolai végzettség*

THE DEMOGRAPHIC CHARACTERISTICS OF THE HISTORIC DISTRICTS OF EGER ACCORDING TO SELECTED INDEXES

Abstract

Eger is the second largest settlement of the North Hungarian Region, it has central functions in administration, economy, education healthcare, culture and religion. It consists of well-separable, typical districts having special demographic functions as well. The number of inhabitants in its most populous residential quaters outperforms ten times that of the districts with other functions. Eger is an ageing town. Its Northern district has the youngest age structure, but its society is not homogenous as there are poeple of the higher and the lower social strata as well. Although the level of education in the town is higher than that of the national average, there are huge spatial differences in it. (Rác Hóstya, Felnémet, Felsőváros v.s. Almagyardomb, Belváros).

Keywords: *Eger, districts, demography, population number, age structure, highest education*

DOI: 10.33032/acr.2020.spec.119

Introduction

Eger is a county town with 53 thousand inhabitants in the North Hungarian Region, Heves County and the District of Eger. It is the seat of the county and the district, the second biggest settlement of the region with a branch of central functions in administration, economy, education healthcare, culture and religion.

The town has deep historic roots as it is inhabited since the Neolith Ages. It became an archbishop seat in 1009, in the first period of the reign of St. Stephen (Csapó et al. 2019, [3, 90. p.]). One of the most urbanized settlements, based on the medieval town structure its typical districts were evolved from the 17th century till now [3, pp. 43-44.]. The main objective of our study is to research the demographic characters based on the data of the National Census of 2011. A special emphasis was put on the differences in the number of inhabitants, age structure and education.

Material and methods

At the first stage of our research the main challenge was to fix the borders of the historic districts. A digital map containing the borders of the districts was acquired from the Municipality of Eger ([2, 10. p.]). Small corrections were made according to settlement morphology point of view. The next step was the spatial adjustment of the historical districts and the regions of census with the assistance of Hungarian Central Statistical Office (HCSO). Finally 20 districts were determined (*Figure 1*).

During the project 16 data of the 2011 national census were bought from HCSO. In our recent study the processing of some relevant indexes (population number, the ratio of 0-14 years old and 60-x years old people, the ratio of people with elementary education in the active population (15-59 years old) additionally the ratio of graduated people in the 25+ years old population) was done in order to reveal and analyse the basic demographic trends of the districts.

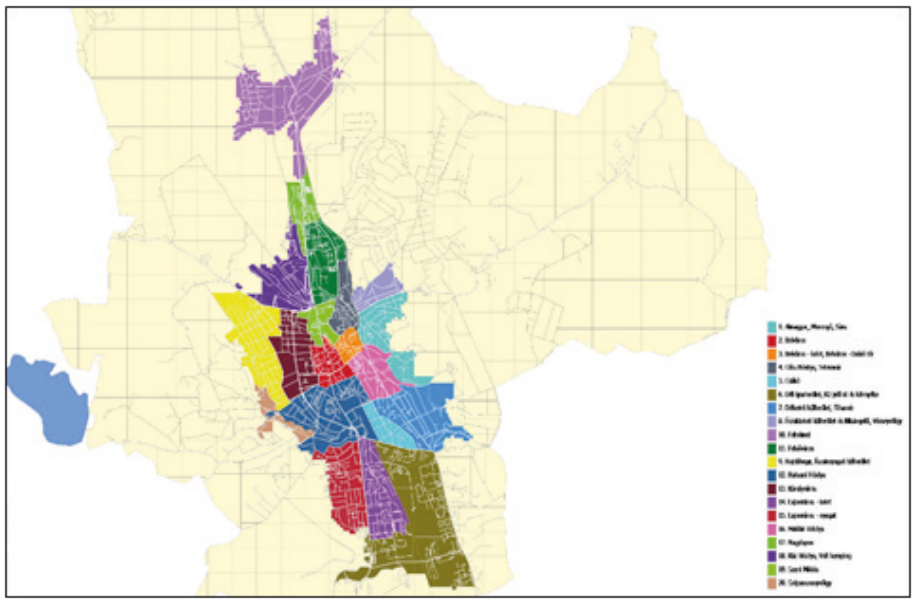


Figure 1: The 20 districts of Eger
Source: Eszterházy Károly University INNOREGIO Knowledge Centre – Hungarian Central Statistical Office – Municipality of Eger
(Authors' edition, technical editor: Balázs Magyar)

Results

The population number of Eger has reached its peak since 1990 in 1994 with almost 64 thousand inhabitants. In the following decades the decline was almost continuous, consequently there were 52898 inhabitants in 2019. The shrinking tendency is similar to that of the country, but the ratio of decline is bigger than the national average: between 1990-2019 the ratio is -14.5% that is 8.7% bigger than the national average.

The distribution of population among the 20 districts is quite uneven (*Figure 2*). According to the data of the 2011 census there were 1500-4500 inhabitants in half of the districts. At the same time in the biggest housing estate of Eger – built in the 1970s-1980s – the Felsőváros (the former „Csebokszári" Housing Estate) the number of inhabitants exceeds 10 thousand (almost one fifth of the population (17.7%) lives here), in the Hatvani „hóstya" (district) and Felnémet area 5-5 thousand people were living. (In certain areas of Eger founded in the 18th centry the „hóstya" phrase of German origin is used meaning an uptown zone (Csapó et al. 2019, [4]).

In the Szépasszonyvölgy zone there are only 146, in the Souther Industrial Zone and around the K2 road 266 and in the Eastern Belváros (City Zone) and Dobó Square 454 inhabitants. In case of the last three areas the dwelling function is of secondary importance beyond wine making, wine touristic, industrial and administrative, cultural, education and other touristic featuris.

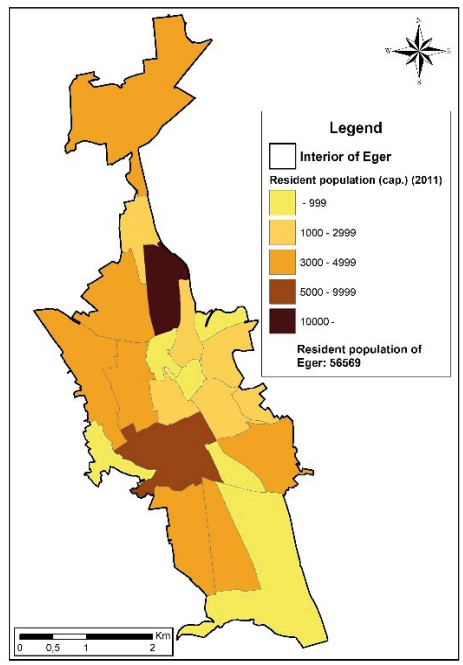


Figure 2: The number of inhabitants in the 20 districts of Eger (2011) (capita)
Source: HCSO (own edition, technical editor: Balázs Magyar)

Eger at the beginning of the 21st century belongs to the ageing towns because of the lower birth rates and the growth of the life expectancies. The ration of children and te youth is decreasing. The disadvantageous situation of Eger in case of ageing is shown by the ratio of the age group 0-14. It was 13.2% during the last census which is less than the data of the District of Eger (14.1), Heves County (14.7), the North Hungarian Region (15.6%) and the national average (14.6%).

There are huge differences between the districts of Eger concerning this index too (*Figure 3*). In 14 districts the ratio of the 0-14 years population was between 10.3-13.7% with a smaller deviation in 2011. In the Southern Industrial Zone and the surrounding of the K2 road (4.1), in the Eastern side of the a Belváros (City Zone) and Dobó Square (7.9), and in the Maklár Hóstya (9.3) it did not reach 10%. At the same time in the area of the Rác Hóstya and the ex-camping zone (21.6%), in Felnémet (17.5) and in the North Eastern Periphery and Bikalegelő additionally

in the Vécsey Valley (14.4) the value is much higher than the the average of the town. The zones with younger age structure are different from each other from a social point of view: beyond the zones of self-contained, terraced houses (e.g. Vécsey-völgy, Felnémet-Pásztorvölgy) and subdivisions segregated areas with disadvantaged, mainly Roma population can be found here (mainly in the Rác Hóstya District, the so-called Szala-shore and the Béke Yard in Felnémet) ([2, pp. 55-56.], [3, 105. p.]).

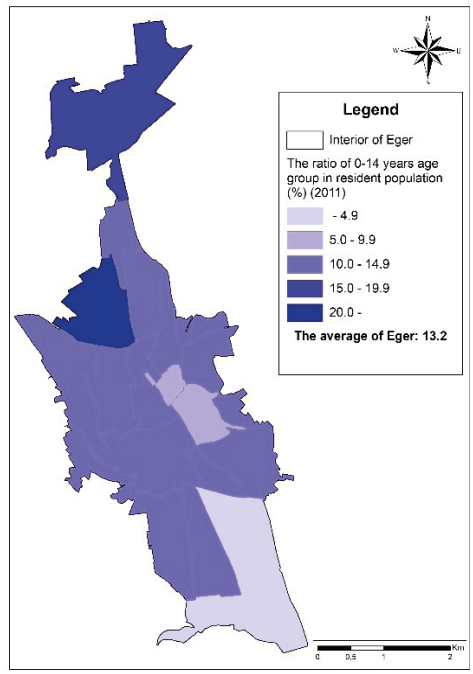


Figure 3: The ratio of the 0-14 years old population in the 20 districts of Eger (2011) (%)
Source: HCSO (own edition, technical editor: Balázs Magyar)

Concerning the spatial distribution of 60+ population the situation is reverse: in the Almagyar, Merengő, Sánc (13.0) and the Rác Hóstya, former camping (13.8) district their ratio is less than half of the average of th town (23.7%). Among these districts, moreover inside these areas population with diverging social strata can be found. The population of four historic districts (Belváros, Hajdúhegy és Northwestern Periphery, Maklár Hóstya, Csákó) is the oldest, the ratio of 60+ people was almost one third of the inhabitants.

In the age of knowledge-based society and economy the learning capacities, competences, skills and talents of the potential workforce is of high importance. One relevant element of this is the level of education as its low level decreases the chances to find proper job (because of the lack of expertise and needed practice too).

In the active age generation (15-59 years) the ratio of people with only elementary school qualification is 8.4%. In the Southern Industrial Zone and the surrounding of the K2 road, the Almagyar, Merengő, Sánc Districts their ratio is under 2%, in Felnémet (14.2) and specifically in the Rác Hóstya and the ex-camping area (22.4) is well above the average of the town.

As a consequence of the appreciation of human capital it is even more important to examine the territorial differences of the population with higher graduation. Eger is a center of schools and education with two universities. It may explain the fact that the ratio of graduated people among the 25+ population is 10 percent higher (28.9) than the national average (19%). Spatial differences area high in case of this index: in the Belváros, the Eastern side of the a Belváros (City Zone) and Dobó Square and in the Almagyar, Merengő, Sánc districts (45.5) the ratio of graduated people was above 40% in the 25+ age population (*Figure 4*). At the same time in the Felsőváros – the most populated district – it was 18.1 and in the Rác Hóstya ex-camping zone it was only similar to the national average (20.3).

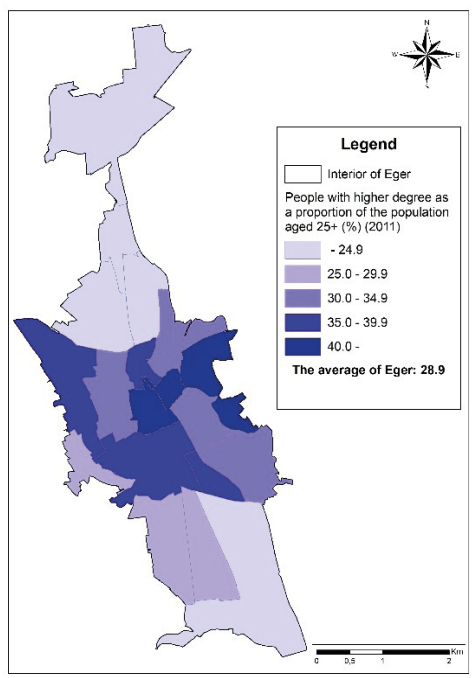


Figure 4: The ratio of people with higher grade in the 25+ population in the 20 districts of Eger (2011) (%)
Source: HCSO (own edition, technical editor: Balázs Magyar)

Conclusions

As for demographics Eger can be stated a disadvantageous (but not yet critical) town because of population decline and ageing. According to the trends and the empirical researches of the last years the continuation (in some cases the strengthening) of the negative tendencies can be forecasted.

The town consists of clearly demarked districts, being quite different from a demographic (population number, age structure, education) point of view.

Our socio-geographic research results can be used in practice too during decision making in: city development, site selection or choice of residence.

Acknowledgements

This work was supported by the grant EFOP-3.6.1-16-2016-00001 ("Complex improvement of research capacities and services at Eszterházy Károly University").

References

[1.] Csapó T. - Lenner T. - Kovács G. (2019): Eger történeti földrajza és településmorfológiája. Településföldrajzi Tanulmányok, VIII(2), pp. 16-34.

[2.] Eger Megyei Jogú Város Integrált Településfejlesztési Stratégia 2014-2020 (2014). Available at: https://eger.hu/public/uploads/integralt-telepulesfejlesztesi-strategia-2014-2020_592fcc35869b2.pdf (Accessed: 19 September 2019)

[3.] Eger Megyei Jogú Város Integrált Városfejlesztési Stratégiája (2010). (Accessed: 19 September 2019) Available at:

[4.] https://www.eger.hu/public/uploads/II_fejezet.pdf https://www.eger.hu/public/uploads/III_1_Belvaros.pdf

[5.] https://www.eger.hu/public/uploads/III_2_Eszak.pdf

[6.] Mi az a hóstya? Available at: https://m.nyest.hu/hirek/mi-az-a-hostya (Accessed: 23 September 2019)

Authors

Antal Tóth PhD
Associate professor, vice dean
Eszterházy Károly University
Faculty of Natural Sciences
Institute of Geographical and Environmental Science
toth.antal@uni-eszterhazy.hu

Csaba Patkós PhD
Associate professor, director of institute
Eszterházy Károly University
Faculty of Natural Sciences
Institute of Geographical and Environmental Science
patkos.csaba@uni-eszterhazy.hu

LEKTOROK JEGYZÉKE

Bartók Béla

Bori Zsuzsanna

Csáki Tamás

Gomba-Tóth Adrienn

Göblyös Judit

Hegedűs Szilárd

Horváth Zoltán

Kajati György

Lakatos László

Lovas Miklós

Lukácsy György

Murányi Zoltán

Ősz Katalin

Patkós Csaba

Radics Zsolt

Szabó Jolán

Szalontai Helga

Tömöri Mihály

Utasi Zoltán

Vincze Judit