

# Some possibilities of improving the quality of grape production in Hungary

Szabó, Attila<sup>1</sup> - Botos, Erno<sup>1</sup> - Szenteleki, Károly<sup>2</sup>

1 Research Institute for Viticulture and Enology Kecskemét

2 St. Stephan University Department of Mathematics and Informatics Budapest

## 1. Introduction

On the basis of the methodical researches done with the help of the Hungarian Scientific Research Fund (OTKA) support such a branch informational database could be formed which is new in its quality. Besides directly processing statistically this informational database, possible theoretical models were examined and new procedures were elaborated<sup>[1]</sup>. Within the frames of the research we tried such methods on the test data of the primary and secondary database enlarged on the basis of the theoretical concepts, which can – after the starting and functioning of the informational system – offer such results which can be used on regional and national levels<sup>[2]</sup>. These methodical examinations also meant both the application of the already existing procedures and the elaboration of completely new procedures.

## 2. Method

The test results arrived from 169 wine-growing communities of Hungary. The 3002 records used for the calculations contained the agricultural lands and the averaged crop quantity of many tens of thousands of plantation data as well as degrees of sugar according to wine-growing communities (together with the connected communities) and types. The task aimed at: the clusterization of wine-regions and wine-growing communities, and through this ranging them into different types on the basis of two characteristic quantities (crop-average and average sugar degree), that is:

- ? according to all of the types
- ? according to white grapes (type code 999 < type code < 2000 or 2999 < type code < 4000)
- ? blue grapes (1999 < type code < 3000)
- ? white grape of largest agricultural land in 5 samples, separately (type code = 1020,1200,1270,1320,1080)
- ? blue grape of largest agricultural land in 5 samples, separately (type code = 2060, 2130,

2100, 2030, 2090)

The examination aimed at meant completing altogether 26 partial tasks according to two methods, that is 52 classification tasks. We completed the calculations and analyses with the SPSS for Windows 10.0 software. We based the classification on the standardised variables, with the help of two types of algorithms:

- ? k-means clustering using running means (forming 4 clusters with the initial centres chosen by the software)
- ? hierarchical classification (forming 4, 3 and 2 clusters calculating the distance between the points with Euclidean metric and using the between-groups linkage cluster method)

In the greater parts of the cases there was relatively small difference between the results of the two types of clusterization. The minimal differences arrived this way did not give reason for initiating further examinations in the interest of revealing these differences.

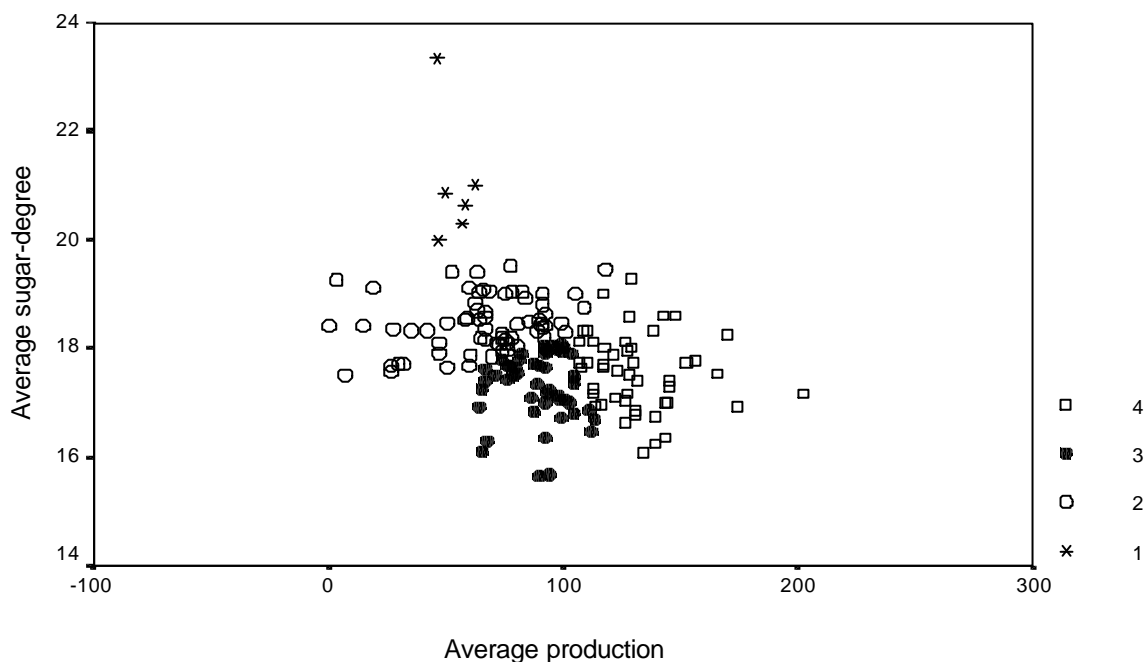


Figure 1.

**Clustering 169 wine-growing communities based on all types**  
(k-means method)

The two evaluations gave characteristically different results in that case, when we based our

examination on the data of the 169 test wine-growing communities in the case of all of the wine types. It could be observed as a tendency that compared two the analysis of the wine-region we arrived at greater differences with the grouping of the wine-growing communities, which gives reason for further examinations.

The analysis of economical processes is realised most commonly along the use of one of the statistical models. In spite of their importance those applications belonging to the topic of operational researches are unreasonably ignored, which not only serve the analysis of the data of the past - together with showing their inner relations -, but which also offer an alternative for changing the existing economical processes and growing-potentials<sup>[3]</sup>.

The process set forth in the following attempts to give an analysis of the wine-producing type-structure and to gradually change its plantation structure. The clusterizational procedure put forth in the earlier part of the lecture listed the wine-growing communities and the wine-regions into different categories by taking into consideration the production-average and the production quality (must-degree) together. On the basis of these data we can grade the individual wine-growing communities and the wine-regions in the case of individual types, but we did not arrive at quantitative suggestions for how, in what proportion it is worthwhile to grow the individual grape types on each wine-region.

We took today's market relations as a starting point for our optimalizational model. It is well known to everybody, that the grape-wine branch struggles with a significant crisis of overproduction at present, especially in the area of cheap table wines<sup>[4]</sup>. Taking this into consideration constructing the following restrictions seems reasonable:

- ? in our optimalizational model we did not allow to exceed the already existing grape-producing regions in the wine-regions;
- ? for reasons of employment policy and social considerations we did not restrict a use of the present grape regions (this is also in synchrony with the EU norms);
- ? we undertook the assessing examinations by starting out from the present type-structure, by gradually modifying it, and also by completely changing it.

The Figure 2. starts out from processing the vintage data of 2001, from which - by processing each wine-producing community data of each wine-type, and by adding it according to wine-growing communities and wine-regions - we arrived at those data, on the basis of which we

could undertake the ranking of the individual types and the assessing of the production potential.

Naturally, an examination becomes the more objective, the more years of data it relies on, but the first year we could truly lean on the effective functioning of the information system which gave usable basis for the decision supporting was the year 2001. In the Figure 2. we give the sugar degree data according to wine-regions calculated from the vintage data of the Chardonnay grape type<sup>[5]</sup>.

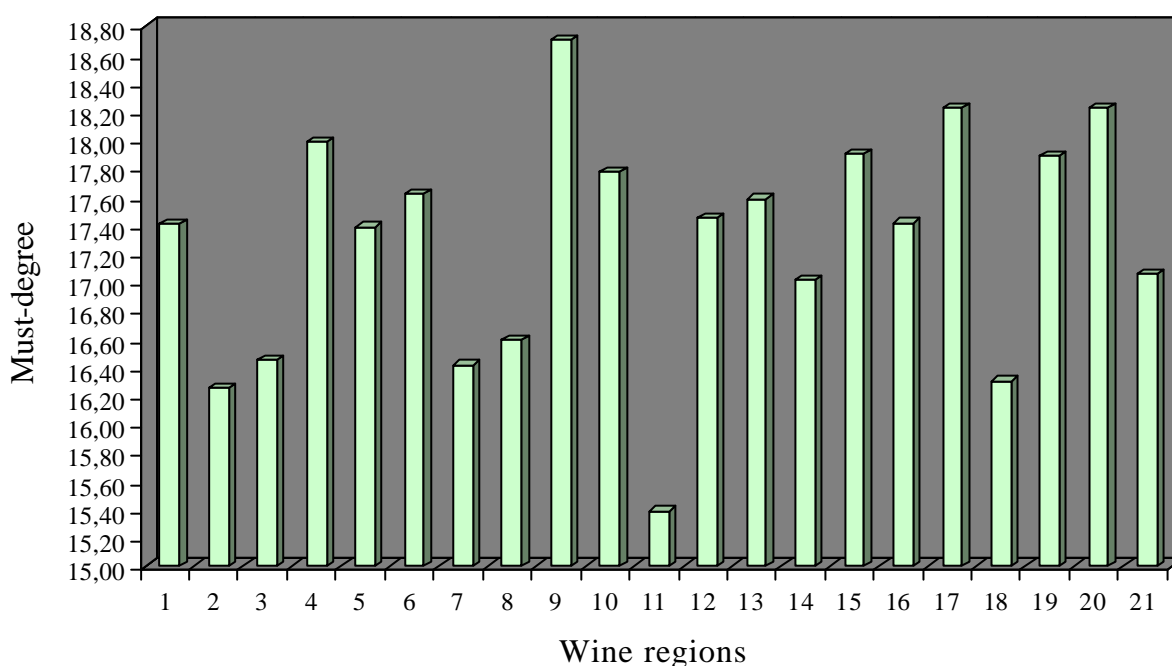


Figure 2.

**Sugar contents of Chardonnay type according to wine-regions**  
(Source: National Council of Wine-growing Communities, 2001)

The same diagrams were at our disposal concerning all of the grape types in Hungary, so there was no obstacle to undertake the wished analyses in whatever depths necessary.

To prepare the evaluations we made an independent model-constructing program built on the database available, with the use of Clipper program language. The program could be parameterised in the field of the grape types enclosed in the examination, of the wine-regions and of the regional proportions, so it was possible to run through and try a relatively large number of alternatives extremely fast. The automatically prepared models were built of many

hundreds of conditions, and of variable-system concerning the wine-regions and grape types. We evaluated the table with the Solver and the QSB LP program packages.

### 3. Results

Our first examination involved the analysis of the Hungarian white grapes. The aim of the examination was to build up and evaluate such an optimising model, which aimed at comparing the grape regions according to quality and changing them in structure. We also noted in the Preface that we did not regard the elevating of the production averages as a stressed task, thus we decided not to enclose them in the examination. The results of our examination are contained in the Table 1.

Table 1.

#### Effect of modifying the plantation structure of white grape

	Specification	Average must-degree
1.	Original plantation structure	16.23
2.	Optimalized plantation structure	16.54
3.	20 % land-increase per type	16.74
4.	40 % land-increase per type	16.84
5.	60 % land-increase per type	16.90
6.	80 % land-increase per type	16.92
7.	100 % land-increase per type	16.94
8.	Without type restriction	17.15

Basically, with both the white grape types and the blue grape types we started out from the current type-structure, and took the same type-structure and redistributed it between the wine-regions in optimal way. Such a structure can serve as the starting point for providing for constant/invariable demanding market structure. Following this, by gradually liberating the regional barriers subscribed to the individual types we reoptimalised the white, blue and whole grape region. We put forth the results of these calculations in the Tables 2. and 3.

Table 2.

**Effect of modifying the plantation structure of blue grape**

	<b>Specification</b>	<b>Average must-degree</b>
1.	Original plantation structure	16.30
2.	Optimalized plantation structure	16.76
3.	20 % land-increase per type	16.88
4.	40 % land-increase per type	16.97
5.	60 % land-increase per type	17.06
6.	80 % land-increase per type	17.15
7.	100 % land-increase per type	17.24
8.	Without type restriction	18.92

Table 3.

**Effect of modifying the complete plantation structure**

	<b>Specification</b>	<b>Average must-degree</b>
1.	Original plantation structure	16.25
2.	Optimalized plantation structure	16.73
3.	20 % land-increase per type	16.89
4.	40 % land-increase per type	16.95
5.	60 % land-increase per type	17.01
6.	80 % land-increase per type	17.07
7.	100 % land-increase per type	17.11
8.	50-50 % white grape – blue grape	17.89
9.	Without type restriction	18.04

The results arrived at can be considered as starting points for further examinations, we consider the results reassuring from the point of view that we got results relatively fast which show qualitative improvement. The results arrived at can spare the use of many thousands of hundreds of kilos of sugar on the field of reaching higher quality. The parameters of the task

can be related to type, wine-region, and market demand estimations: after adjusting the desired parameters, the results of the optimization are almost instantly at our disposal.

### 3. Conclusions

We can conclude – even without putting forth the other tables of results – that the newly planned and realised branch informatics system is suitable for creating decision supporting databases which can be the basis of scientific professional and economical questions <sup>[6]</sup>. But the examinations done on the test data raise the importance of further duties in the interest of the relevant establishment of the branch decision tasks, such as:

- ? the range of the established informatics system must be widened to there wine territories of all of the wine-growing communities;
- ? the established theoretical informatics model must be widened to reach the regions not belonging to the wine-regions;
- ? in order to eliminate the anomalies of collected data due to the weather conditions and other circumstances we have to switch from the statically examination of a given year to the dynamical overall examinations of several years;
- ? the consistency examinations of the possible alternative methods have to be done, in order to choose the methods that can be best applied.

### References

- [1] Botos, E. P., Harnos Zs., Horváth, Cs., Szenteleki, K., Urbán, A. (1999): A szolo-bor ágazat szakirányú kérdései (The specialized questions of the grape-wine sector)  
Budapest, Amulett Kiadó
- [2] Botos, E. P., Szabó, A., Horváth, Cs., Urbán, A., Harnos, Zs., Kollányi, L., Szenteleki, K. (2001): A 2001. évi szolokataszteri felmérés stratégiai terve (The strategy plan of the grape cadastral survey of the year 2001)  
Budapest, FVM-SZBKI-HNT-SZIE tanulmány
- [3] Herdon, M. (1995): Mezőgazdasági döntéstámogató rendszerek (Agricultural decision support systems)  
Tessedik Sámuel Tiszántúli Mezőgazdasági Tudományos Napok, Hódmezővásárhely

[4] Szenteleki, K., Lakner, Z. (2001): The Hungarian Wine Sector on Threshold of European Union

ENOMETRICS VIII Conference, St. Helena, California, USA

[5] Kállay, M., Szenteleki, K. (2001): A bor cukortartalom növelésének számítási módszerei (The calculation methods of increasing of the sugar content of wine)

Borászati Füzetek

[6] Pitlik, L. (1996) A döntéstámogatás jövője az agrárinformatikában (The future of decision support in agrarian informatics)

OMÉK Konferencia Gödöllo