

THESIS OF DOCTORATE

**University of West-Hungary
Faculty of Agricultural and Food Sciences**



Integrated wine production in the Ászár-Neszmély Vine Region

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Introduction

The objective of my research was that out of the nowadays vine producing systems I should examine the principles of the integrated wine production with regards to feasibility. I completed my experiments between 2003-2006 in the Ászár-Neszmély Wine region, in a wine plantation established together with my father in Szomód. I examine the agro-ecological conditions of the region, the effects of the elements of the integrated production on the vegetative and generative productivity of the vine, starting from the establishment of the plantation (selection of the area-, type- and clone) through the sectioning- and phytotechnical works, paying special attention on the plant protection up to the harvesting of grapes. The integrated plant protection also includes the knowledge of the legal regulations in effect as well as beside the positive ecological effect the knowledge of the economical relevancies.

During my research I was looking for reply on the following questions:

How much the clones of the world breeds can be integrated into the integrated vine production?

What vegetative and generative productivity are they capable of in this technology?

How much are they able to adapt to the local agro-ecological conditions?

How do they react to the stress situations caused by the environmental changes?

I. Material and Method

In 2001-2002 we established a core plantation with my father in Szomód, where I carried out my research between 2003-2006.

The plantation was established with the objective of producing excellent quality grape which can easily be sold in the market. We were looking for an area where the environmental conditions are the most optimal for the vine in order to produce the quality and quantity grapes required by us. Mainly we have selected world brands which besides the fact that they meet the nowadays taste and style – which means their grapes would make fresh, reductive style wine – which fit into the local agro-ecological conditions. Beside these both the brands and the area should be suitable for environmental saving vine production.

I.1. Material

Characteristics of the land

The land is situated in the Northern part of Komárom-Esztergom county in the South Western side of Gerecse. Administratively it belongs to the village of Szomód and with regards to the Wine Act it is part of the Ászár-Neszmély Vine Region. The area is facing NE-SW, from South it is directly Csengervölgy, then Tatai-medence (basin); from the North the plateau of Kalácshegy borders this area.

Height above sea level is 252-268 mBf, slope 7-12 %. The wind-chart is NW. This area has been endangered by erosion, even today, therefore the plantation was preceded by melioration.

The plantation was established in 2001/2002 and I monitored its first four years of bearing. The plantation base is virus tested Chardonnay Bb.75/1, Sauvignon blanc Bb. 297/1, Királyleányka 21, Cabernet sauvignon E153, Pinot noir M2, and Kékfrankos Kt 1clones, in total 23 surfaces.

The way of farming of the vine-plants is canopy cultivation, with the clearance 3 m x 0,8 m. The area between the lines is grassy. In the whole plantation we have integrated vine production, within this integrated plant protection. The area is part of the integrated plantation target programme. Apart from this, as registered and controlled base (centre) core plantation by OMMI it also serves production of reproductive materials.

The weather during the years of experiment was rather changeable; therefore it was perfectly suitable for monitoring the reaction obtained by the extreme conditions – stress situations. 2003 and 2004 were droughty, while 2005 was wet

year. In the winter of 2002/2003 I registered serious winter-injuries. The meteorological extremities expressed the need for forecasting the fungicide diseases.

I selected four parcels of each breeds (4 repetitions), each parcel consisting of 10 vine plants. The works on the experimental parcels apart from the machine operations was completed by me. Hereby I give an introduction of these tasks and the related tests and investigations.

1.2. Method

Meteorological measures

- meteorological data measurements with LUFFT OPUSII station
- data input to HP 7500 PC computer, Windows Excel software
- Smart Graph modelling-programme

Soil- and leaf analysis

The examination of soil and the analysis of leaves took place in line with the Hungarian standard. The analysis of soil was carried out one occasion during the experiment on 19th August 2004. The samples were collected by me with the application of sampling stick, from the soil of each type of vine, from the depth of 0-30 and 30-60 cm. I requested a wider range of analysis of the deeper layer of ground partly because this is a regulation in the case of integrated vine production, and also because this is the depth where the plants can take the nutritive. The time of leaf analysis was the time of blooming and burgeoning every year. The leaves were picked without leaf-stalk, walking the whole plantation, 100-100 pieces of each breed.

Forwarding

It took place in line with the klosterneuburg method. From the result of this I received information with regards to the effect of winter frost and the fertility of the buds.

- 2003. February 12.
- 2004. February 25.
- 2005. January 18. and February 28.
- 2006. February 28.

Diameter of body and the volume of the cut layers

Applied tools and method:

- Digital calliper gauge, Digital Caliper
- KERN DE 15K5N type digital scale
- FELKO 11 seateurs

Time:

- 2003. March 02-05.
- 2004. February 25-27.
- 2005. March 10-13.
- 2006. March 3-6.
- 2006. December 25-29.

Every year started with the measure of the diameter of the bodies of the plants. This was completed always from 50 cms from the ground, always at the same direction with every selected plant. (240 measures x 4 year).

This was followed by the cutting of the vine plants. I cut every year 240 plants and I measured the weight of the cut layers for each plant (between 2004-2007). During the recording of the plants I also took note of the sprits from light buds as well as from the side buds, and also the number of clusters (between 2003-2005).

Record of plants

The recording was completed by me in line with CSEPREGI (1982) method. The examination was completed by the rods and sticks left on the plants and on these – in the order of the buds – I calculated the grown sprits and I used the following signals for these:

Ø (*) = left, but not opened bud
 0 = sprit without cluster
 1 = 1 cluster sprit
 2 = 2 cluster sprit (etc.)

The recording was taken in the following period of times:

- 2003. May 8-10.
- 2004. May 20-25.
- 2005. May 29-June 4.

When recording the sprits developed from the buds of the spears I marked as above and the relevant data of the rods and sticks were written in one line, one after the other in sequence.

The processing of data gives possibility:

- To get accurate knowledge on the loading on buds and the distribution of buds,
- To define the ratio of buds staying quiet,

- To get accurate information on the sprits developed on the plants and the number of clusters,
- To define the productivity coefficient,
- To study to sequence of the buds sprit and their productivity,
- To calculate the volume of produce by bud and by sprit with the knowledge of average cluster weight.

Integrated plant protection

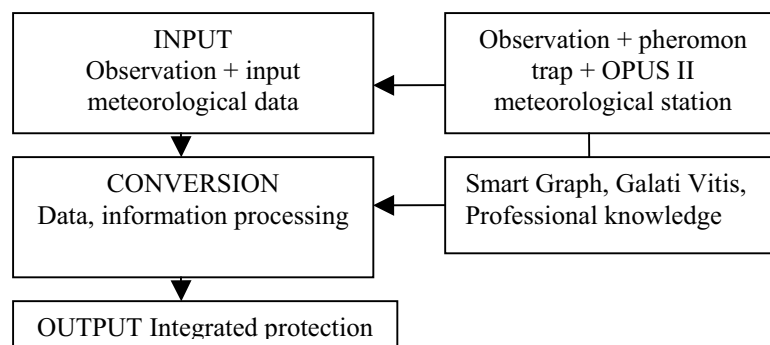
The methods and tools applied by the plant protection centered weather forecasts:

- LUFFT OPUSII meteorological station
- Own observations
- HP7500 PC
- Smart Graph Agro fungi forecasting software
- GALATI Vitis integrated vine protection managing software
- Stereomicroscope
- „Csalomon” pheromone trap
- Chafer-grub survey with volume quadrature method

The base of the integrated plant protection is the forecast (prognostics). My studies were rendered to this approach mainly.

The forecast of pestiferous there is the need of population-dynamics test required. This takes place in the case of *Lobesia botrana*, *Eupoecilis ambiguella*, *Sparaganothis pilleriana* with pheromone traps; in the case of *Panonychus ulmi*, *Tetranychus urticae* and *Calepitrimerus vitis*, *Colomerus vitis* with winter examination of buds. The appearance of *Byctiscus betulae* was with the occurrence of convolute cigar test (their number and the number of eggs inside), and the soil pestiferous observation took place with the application of the volume quadrature method.

The plant protective activity was built up as the following:



Harvest

Harvest was every case preceded by must tests, which I always repeated on the day of harvest (MM°, acid content, and pH). The laboratory background was provided by Hilltop-Neszmély ZRt. In 2003-2004, and in 2005-2006 my workplace Tokaj-Oremus Kft.

Tools:

- FALKO 2 Hand Refraktometer; suitable for 0-55 % dry content measure
- KERN DE 15K5N type digital scale
- FELKO 11 averruncator
- Certified Hungarian must degree measure
- pH- measure
- laboratory tools (test-tubes, Erlenmeyer flasks, indicators)

Times of harvest:

- 2003. August 25-28.
- 2004. October 3., October 16-17.
- 2005. September 17., 24.
- 2006. October 01-02.

During the harvest I examined the volume of the product as well as its quality. The grapes of each marked plant were harvested separate by me. The number of clusters was recorded by me and their total weight by plants. At the end of the harvest I picked the grapes of one selected plant then I measures and took off the acinus. The number of acinus by grapes was recorded and I measured the weight of acinus and the clusters. Representative samples were used to measure must, acid and pH measures in laboratory.

Analysis of problems

During the four years of the experiment I was dealing with the following problems:

- Effect of the low temperature – winter-injury (in the case of all types)
- Effect of the low volume of rainwater – drought damage (in the case of all types)
- Effect of cluster thinning

Data Processing

Data were processed and the statistical analysis was completed with the use of the following softwares:

- SPSS V 12.0
- APPLIX TM1 OLAP database management system
- M STAT C software

II. Results and their analysis

Meteorology

The meteorological data measured confirmed the extreme conditions. The annual thermo- amount in 2003 was 3705 C°, while in 2006 it was 4080 C° (slow, but continuous increase). The volume of rainwater in 2003 was 278 mm, while in 2005 it was 745 mm (the 50 years average in the region is 594 mm). Due to this the phenological phases showed a few days of differences from the „usual”.

Soil- and leaf analysis

The main element of the vegetative growth, the nitrogen, was more every year and considering its ratio it was more in comparison to the other elements. Opposed to phosphor, which is the leader of the generative phase, and both the soil and the leaves show slight lack of this element. Potassium ensures the vegetative and generative energy needs, and the area is to receive supplements of this (it will take place in the spring of 2007). Calcium is suitable in all the four years, Magnesium and Zink due to nutritive supplementation and it reached the optimal level by 2005.

The values of leaf analysis were broken down to brands and also examining the quality of production the „leader” is the Chardonnay, which is the best considering the Magnesium, Zink and Calcium supply. The following is the Pinot noir – almost in every parameter. Since they are relative brands. It is general characteristic of the blue brands that their Iron content is low. The supplementation of the nutrients should be completed targeted, broken down to brands

Forwarding

Based on the forwarding we could foresee significant winter injuries in 2003 and 2004. This was proving true during the vegetation. The brands that suffered winter injuries the most were Cabernet sauvignon and Királyleányka; the former with 42 %, the latter with 52%, which by the Cabernet sauvignon brand meant the cutback of the plants. The examination of the aestivation fertility coefficient helped every year to define the length of the cutting element. The order of the brands is the following from the point of view of the aestivation fertility coefficient measured during the forwarding: Királyleányka – 1,69; Pinot noir – 1,47; Sauvignon blanc – 1,36; Cabernet sauvignon – 1,35; Kékfrankos – 1,29; Chardonnay – 1,25.

Diameter of body and the volume of the cut layers

There was the most intense growth of the body of the Sauvignon blanc (in 2006 it was 32 mm), the following was the Cabernet sauvignon and Pinot noir. The volume of the cut layers was also the highest by the Sauvignon blanc (in 2007 it was 0,96 kg/plant, but this year with the exception of the Kékfrankos the average volume of the other brands was also 0,7 kg).

I have hereby analysed the y/n values as well, which indicates the vegetative and generative balance of the plants. The values are between 4 and 8, which mean that the plantation is in excellent condition and balance.

It can be statistically proved by every brand and I showed strong correlation between the diameter of the body and the volume of the cut layers. The stronger the body of the plant, the better is the plant's vegetative production. There is the exception of the brand Cabernet sauvignon, where the diameter of the body and the production of the grape are proved true to correlate. By the Királyleányka, above this there is a positive correlation by the volume of the layers and the volume of the grapes. The y/n value and the correlation of degree of grape-juice are proved by the Sauvignon blanc and Királyleányka brands.

Record of plants

During the records of plants the aestivation fertility coefficient was also calculated. It is interesting that the values slowly, but continuously were decreasing. Furthermore it is also worth noticing that the absolute-, the relative- and the aestivation fertility coefficient values were really close to each other. The cause of the previous one is that the plantation is very young, and in the first year it has very breezy and weak leafage, practically the light could get into inside the leafage and this was the fertilization of the bud was undisturbed. As the plant got stronger, the inside of the leafage became more and more closed. At the same time the fertility coefficient values close to each other allow us to come to the conclusion that the ways of farming, the correct fitotechniques there are only a few infertile shoots, so „unnecessary” infertile shoots do not compress the canopy.

The statistic tests proved that the aestivation fertility and the volume of the cut layers are correlated.

The temperature values existing at the time of the bud differentiation and when completing the aestivation fertility coefficient examination I found correlation of the Chardonnay, Sauvignon blanc, Királyleányka and Pinot noir brands that are statistically proved.

Plant protection

Plant protection was based on forecast both in the case of the pests and in the case of germs. During the four year, there was only once an akaricides treatment and two protections against bell-moth. The timing of the latter was based on the catch of pheromone-traps. The meteorological data required for the forecast of the fungus diseases in the plantation was given by the station in the plantation. The data entered the computer with GSM-transfer and the data processing took place by Smart Graph and Galati Vitis data processing software which I used for analysing those. In line with this the year 2003 was „vine-mildew”, while 2004 in the first part of the vegetation there was a danger of mildew and vine-mildew, from July however due to the warm and dry weather the mildew danger passed but the vine-mildew danger increased. In 2005 the vine-mildew had a strong infection in the whole year and in the meantime the software signalled for mildew danger as well every second week, while from the week 28 the danger of botrytis increased. In 2006 in week 18 there was already a vine-mildew infection and the mildew appeared at week 23 and showed slight signs of infection during the whole year on. The botrytis appeared in the 33rd week of the vegetation.

However strong the infection pressure was, in the integrated farming the yellow and green signed insecticides were able to protect the plantation from the damage.

Harvest

Taking into consideration the volume of production the most chargeable brand is the Királyleányka – 4,41 kg/plant in 2005 – without causing any decline in the condition. It is also true that considering the degree of grape juice it is behind than the other brands, however it is in the second place in the sugar production par acres (2945 kg/ha), preceding by Pinot noir brand (3056 kg/ha) and followed by Chardonnay (2766 kg/ha). The weight of cluster of grapes is usually above the clone average by every brand, except for the Cabernet sauvignon.

Taking into consideration the correlation of the meteorological data and that of the production volume I found the following correlations:

By the Sauvignon blanc brand the volume of rainwater in September and the volume of grapes has strong correlation, while the Királyleányka, Pinto noir and Kékfrankos brands it is the August volume of rainwater that correlates the volume of production. The strongest is the connection in the case if Kékfrankos and Királyleányka. (R^2 (determination coefficient) values are above 0,9.). By the Chardonnay and Cabernet sauvignon brands I could not find this type of connection.

In the Ászár-Neszmély Vine region all the six brands reached better results than expected and they are suitable for the integrated vine production.

III. New scientific results

- The diameter of the body of the plants and the volume of cut layers showed strong positive correlation in the cases of 'Chardonnay', 'Sauvignon blanc', 'Királyleányka', 'Pinot noir' and 'Kékfrankos'. With the 'Cabernet sauvignon' brand this statement is not proved, here the diameter of body and the volume of production showed strong connections.
- The y/n value and the must degree have strong correlation with each other by the 'Királyleányka' and 'Sauvignon blanc' types.
- During the bud differentiation the measured total volume of heat has a significant effect on the productivity of buds.
- 'Cabernet sauvignon' and 'Királyleányka' are explicitly sensitive to winter frost.
- 'Kékfrankos' and 'Királyleányka' types suffer from the below 30 % water capacity value with significant production volume and decrease in quality. (the volume of loss of production reaches the 70 %.)
- The volumes of clusters are strongly influenced by the volume of rainwater during the month of September. I experienced the strongest correlation by 'Királyleányka' and 'Kékfrankos'.

IV. Publication with regards to this topic

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