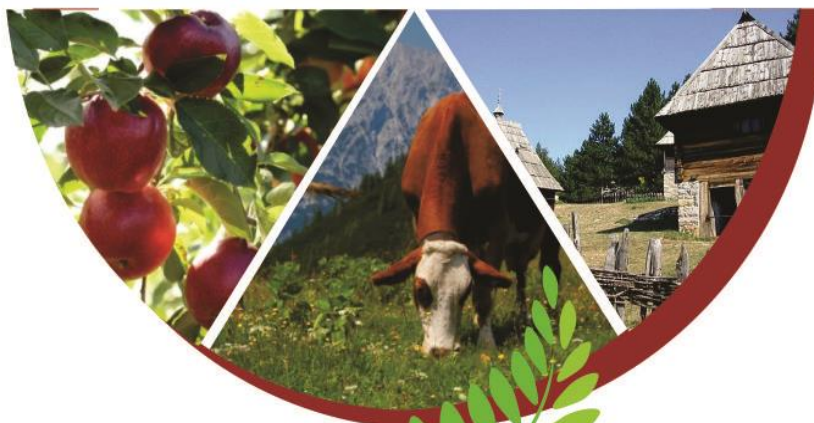


# BOOK OF PROCEEDINGS

AgroSym

*VIII International Scientific Agriculture Symposium  
Jahorina, October 05-08, 2017*



AGRO 2017  
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**VIII International Scientific Agriculture Symposium  
“AGROSYM 2017”**

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## FOREWORD

### A Word from the Editor

The successful implementation of the 2030 Agenda for Sustainable Development and the achievement of the Sustainable Development Goals depend on progress in agriculture. Agriculture has far-reaching implications in terms of poverty eradication, food security, health and wellbeing, biodiversity, climate change and economic development.

The most important goal of the 8<sup>th</sup> International Agriculture Symposium “AGROSYM 2017” – held in Jahorina on 05-08 October, 2017 – was to promote sustainability principles in agriculture. Sustainable agriculture is an important element of the overall effort to make human activities compatible with the demands of the earth's eco-system. Thus, an understanding of the different approaches to ecological agriculture is necessary if we want to utilize wisely the planet's resources. One of the goals of the sustainable agriculture movement is to create farming systems that eliminate, or at least mitigate, environmental harms associated with industrial agriculture. That aim can be realized only with context-specific agro-ecological practices; these depend on regional characteristics, climate conditions, soil types as well as socio-cultural, institutional and political settings.

AGROSYM 2017 made an important contribution to agriculture science and practice. Symposium themes cover all branches of agriculture and are divided into seven sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environment protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agro-forestry.

During the four-day Symposium approximately 250 papers were presented orally and 1030 as posters. The contributions, representing the current research in different countries, were presented to more than 1300 participants from more than 85 countries. We are encouraged by the great success of this year's edition of AGROSYM 2017.

This publication is comprised of an edited selection of over 400 papers submitted to AGROSYM 2017. Each paper included in the present Proceedings was positively reviewed by two referees. Full texts of the submitted communications are also available online (<http://www.agrosym.rs.ba>). Some selected papers will be published in AGROFOR International Journal (<http://www.agrofor.rs.ba/>), International Journal "Agriculture and Forestry" ([www.agricultforest.ac.me](http://www.agricultforest.ac.me)) and EcoPersia ([www.ecopersia.modares.ac.ir](http://www.ecopersia.modares.ac.ir)). Many thanks to all the authors, reviewers, session moderators and colleagues for their help in editing the Proceedings. The results reported here will contribute to the dissemination of knowledge to the wider audience about the importance of agri-food science; one of the most important areas of research strategies in Europe and beyond.

AGROSYM 2017 was made possible through the commitment and contributions of a wide range of partners and sponsors. I take this opportunity to thank all of them and I look forward to a successful joint organization of AGROSYM 2018.

East Sarajevo, 23<sup>rd</sup> October 2017



Prof. Dušan Kovačević, PhD  
Editor in Chief

## CORRELATION BETWEEN INDIGENOUS AND COMMERCIAL STRAINS OF YEAST IN THE PRODUCTION OF WINE FROM THE GRAPE VARIETY VRANEC

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### Abstract

This scientific research determined the impact of indigenous and commercial yeast strain on the production of wine from the grape variety Vranec, grown on Crveni bregovi locality, near Negotino, at an altitude of 250 m. The main objective was to display the correlation between indigenous yeast strains F-8 and F-78 with the commercial strain D-80 (Lallemand). The domestic yeast F-8 and F-78 were previously isolated at the Tikves wine region, Republic of Macedonia. The main purpose of this research is to make a comparison between the wine produced from indigenous yeast strains F-8 and F-78 with the commercial strain D-80. The chemical analysis of the wine, monomeric anthocyanins, polyphenolic composition, and the color intensity of the wine produced from the domestic yeast strains, were compared with the wine produced from the commercial yeast strain. The basic parameters, such as alcohol, sugar, total acids, volatile acids, pH, free/total SO<sub>2</sub>, were determined applying international methods of analysis of wines and musts (OIV methods). The correlation value between the main parameters was obtained by using the statistical analysis of the results obtained by applying the software package SPSS 19. The analysis shows that there is a correlation between the analyzed parameters of the wine from the grapevine Vranec, among different strains of yeasts. The Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-8 and D-80 is (.996) which means high correlation value. Also, the Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-78 and D-80 is (.999) which means really high correlation value.

**Keywords:** *indigenous yeasts, wine, Vranec, anthocyanins.*

### Introduction

Vranec is one of the most important red grape varieties in Republic of Macedonia, grown in all vineyards, mostly in the Tikveš wine region. (Ivanova et al.,2014).

In the modern stage of wine production, selected wine yeasts are used, which leads to significant technological progress. The main reasons are: fast and effective controlled alcoholic fermentation of the grape must with a high concentration of sugars, resistance to high concentrations of ethanol and SO<sub>2</sub>, and resistance at higher temperatures during fermentation. The increasing use of these commercial yeasts, leads to a loss of indigenous strains of yeasts. The selection of indigenous strains of yeasts with good characteristics, can be successfully shown through the production of quality wines. It would have improved the biodiversity of a region, would be enriched biological heritage, which is of particular importance in the production of wines of controlled origin. (Ilieva et al.,2016).

Domestication of wine yeast, while inadvertent until recent decades, has generated strains that differ considerably from “wild” *S. cerevisiae* strains. Inoculations of “wild” *S. cerevisiae* yeasts can influence the process of fermentation and greatly affect the quality of the wine. Isolating strains from successful fermentations for inoculation in subsequent vintages was



being practiced during winemaking in order to avoid unwanted malolactic or acetic fermentation. Largely, the specifics and the most important quality characteristics of the wine are due to the natural microflora of the grape of the viticulture region. (Ilieva et al.,2013). Furthermore, *S. cerevisiae* strains selected from the indigenous population of domestic winemaking enable the alcoholic fermentation to proceed more effectively in comparison with commercial yeast strains. (Settanni et al., 2012).

Polyphenols are large and complex group of compounds responsible for the characteristics, quality and colour of the grape and wines. Polyphenolic constituents are classified as flavonoids and non-flavonoids, which contribute to wine sensory characteristics, especially to colour, flavour and astringency. (Ivanova et al.,2015). Anthocyanins are characterized as 3-monoglucosides, 3-acetylglucosides, 3-p-coumaroylglucosides and 3-caffeoylglucosides of cyanidin, delphinidin, peonidin, petunidin and the dominant, malvidin. (Ivanova et al.,2011).

Yeast interact with phenolic compounds and could influence the wine colour. (Mazauric and Salmon, 2005). At the beginning of fermentation, yeast cell wall can absorb anthocyanins and other polyphenolic compounds, influencing the colour. (Morata et al., 2003).

The main purpose of this research is to make a comparison between the wine produced from indigenous yeast strains F-8 and F-78 with the commercial strain D-80.

### **Material and method**

The newly isolated yeast strains were obtained by spontaneous fermentation of grape must from Vranec and Cabernet Sauvignon varieties collected from ten different micro-regions in Macedonia. The grapevines from both varieties grown in “Barovo” micro-region were the richest sources of yeast strains. (Ilieva et al., 2016). The isolation of the yeast was previously executed according to the method of KOH (Bambalov et al., 1996).

From this, were isolated 80 new strains, among F-8 and F-78. (Ilieva et al.,2015). These two strains of yeast F-8 and F-78, and the commercial D-80 (Lallemand) were used for this research.

The wines was produced from the grape variety Vranec, grown on Crveni bregovi locality, near Negotino, at an altitude of 250 m. The grapes were harvested at optimal maturity and transported to the winery. Then, grapes were crushed, followed with addition of SO<sub>2</sub> (20 mg/kg). Vranec grapes from harvest 2016 were equally allocated to the lots, in order to make similar fermentation conditions. The destemmed grape grains were crushed with manual crusher. After crushing, 20 mg/kg free SO<sub>2</sub> was added in the must and it was transferred into 20 L PET bottles. After two hours, the must was inoculated with culture of the selected strain F-8 and F-78. Similar to the other bottles grapes must, were inoculated with the other commercial strain of yeast D-80. The period of maceration of wine was 16 days. During the fermentation, wines were be “pumped-over” four times a day. After the fermentation, the wines were transferred to tanks for stabilization and aging.

The determination of the amount of alcohol was performed ebulliometrically with Dujardin - Salleron ebulliometer and for determination of reducing sugars was used Schoorle method.

Determination of titratable and volatile acidity of trial wines was performed by the previous method (Boulton, 1980). The color Intensity (IC) was measured spektrophotometrically at 420 nm (yellow color), 520 nm (red color), 620 nm (blue color) by UV spectrophotometer Shimadzu 1800, Shimadzu Corporation, Kyoto, Japan.

Determination of total polyphenols, anthocyanins, color intensity was performed by applying spectrophotometric methods. Thus, for determination of total phenolics, the Folin-Chiocalteu method was used, measuring the absorbance at wavelength od 765 nm. For anthocyanin analysis, wine was diluted with solution of ethanol/water/HCL=70/30/1 and absorbance was measured on 540.

The monomeric anthocyanins, polyphenolic content, color and other oenochemical characteristics of the wines produced from domestic isolated strains of yeasts were also compared with the wines produced from commercial yeast strain D-80.

The correlation value between the main parameters was obtained by using the statistical analysis of the results obtained by applying the software package SPSS 19. Comparing the Pearson's coefficient of correlation we can see which parameters have higher correlation. If  $\rho = 1$ , it means that there is a perfect linear correlation, i.e. the growth of the one variable means growth of other variables. If  $\rho = 0.5 - 0.9$ , there is close correlation. If  $\rho = 0.2 - 0.5$ , then the correlation is weak, but there is still correlation between variables. Of course, negative values,  $\rho = -1$  means inversely proportional connection.

### Results and Discussion

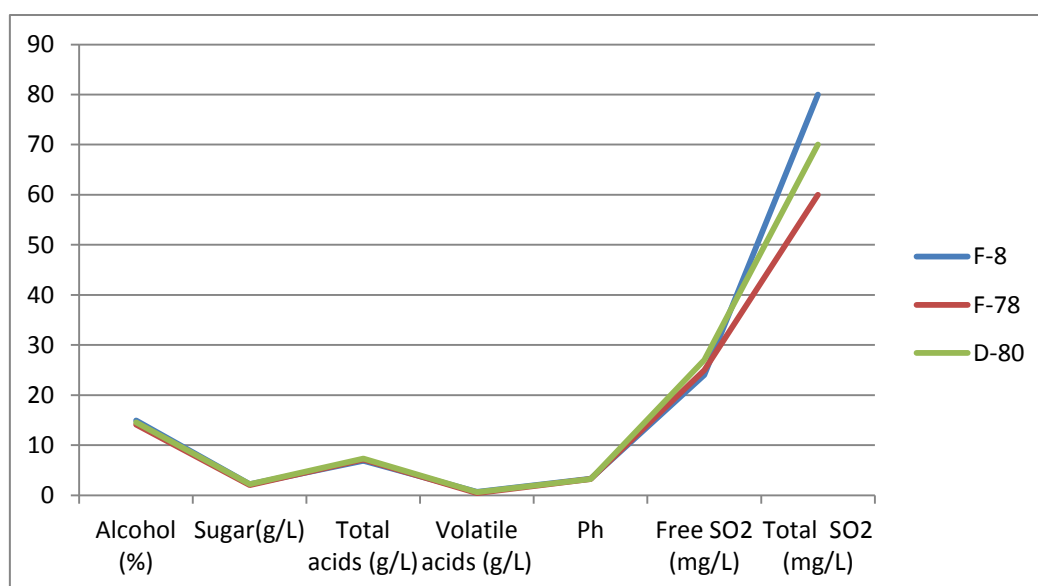
The basic parameters, such as alcohol, sugar, total acids, volatile acids, pH, free/total SO<sub>2</sub>, were determined applying international methods of analysis of wines and musts (OIV methods). Detailed overview of the main chemical parameters measured for wines produced from three different strains of yeasts is shown in Table 1. The wine Vranec produced from the isolated strain of yeast F-8, has the highest % of alcohol (14,96), but the wine produced from the strain of yeast F-78, smallest % of alcohol (14,11). The wines produced from the strains of yeasts F-8 and D-80 have the same concentration of sugar (2,2 g/L). The highest concentration of total acids has the wine produced from commercial strain of yeast D-80 (7,34 g/L) with pH= 3,24, the smallest concentration of total acids the wine from F-8 (6,89 g/L) with pH=3,32. The wines produced from the strains of yeasts F-8 and D-80 have the highest concentration of volatile acids(0,68/0,61).

Table 1. Chemical characteristic of wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80.

Wine	Yeast	Alcohol (%)	Sugar(g/L)	Total acids (g/L)	Volatile acids (g/L)	Ph	Free SO <sub>2</sub> (mg/L)	Total SO <sub>2</sub> (mg/L)
Vranec	F-8	14,96	2,2	6,89	0,68	3,32	24	80
Vranec	F-78	14,11	2,0	7,13	0,43	3,26	25	60
Vranec	D-80	14,53	2,2	7,34	0,61	3,24	27	70

On the graph 1. is displayed the chemical characteristic of wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80.

Between three types of wines produced from the different strains of yeasts, we can conclusion high correlation on the chemical characteristic. There is a small difference on the chemical parameters between wine produced from indigenous and commercial strains of yeasts, because the wines were produced from the same grapevariety and locality. The day of maceration was the same (16 days) for the three types of wine. The temperature of fermentation was the same 23-24<sup>0</sup> C .



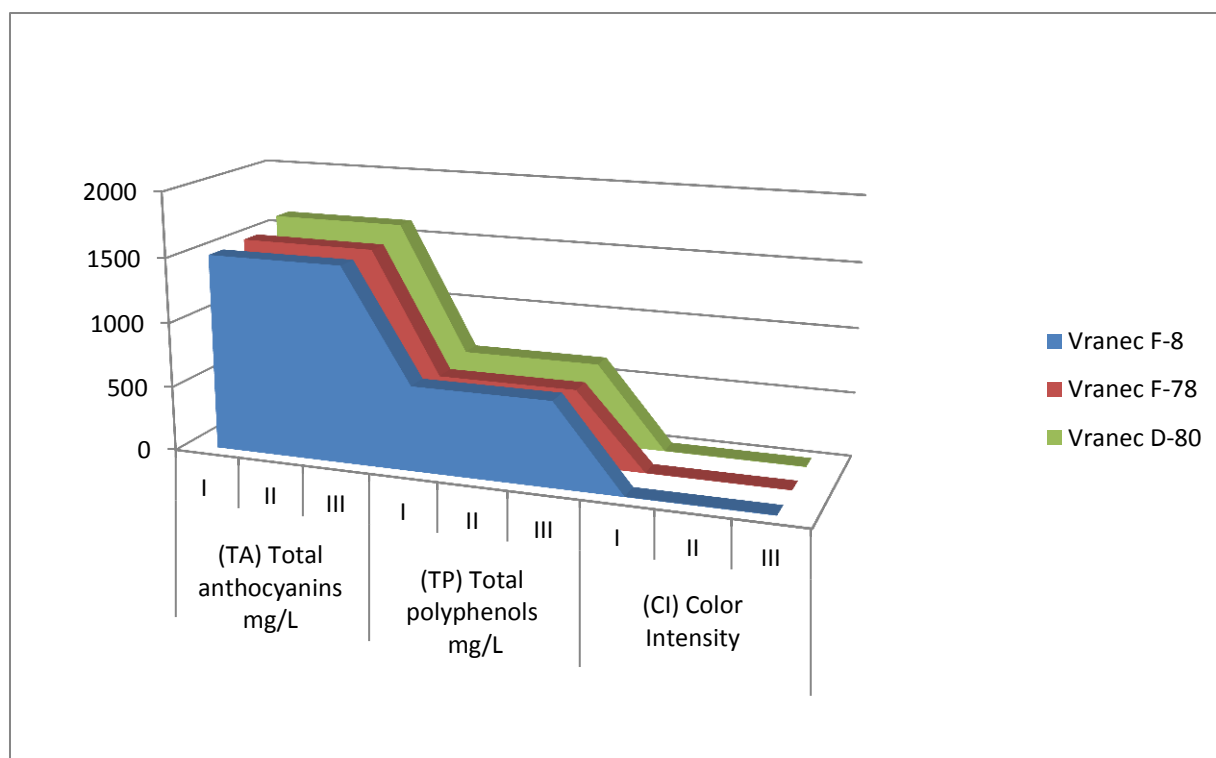
Graph 1. Chemical characteristic of wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80.

Table 2. Content of total phenolics (TP), total anthocyanins (TA), color intensity (CI) in wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80 of three replicates.

Wine	Yeast	(TA) Total anthocyanins mg/L			(TP) Total polyphenols mg/L			(CI) Color Intensity		
		I	II	III	I	II	III	I	II	III
Vranec	F-8	1513,0	1512,2	1511,8	652,7	653,1	653,9	3,1289	3,1253	3,1213
Vranec	F-78	1528,3	1525,4	1523,1	583,2	583,5	584,1	2,1058	2,1026	2,1013
Vranec	D-80	1618,6	1617,0	1615,4	636,2	636,8	637,2	2,3798	2,3657	2,3614

In Table 2, is detailed overview the content of total phenolics (TP), total anthocyanins (TA), color intensity (CI) in wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80 of three replicates. The total anthocyanins (TA) have the highest concentration in wine produced from commercial strain of yeast D-80, and the smallest from indigenous strain of yeast F-8. The content of total phenolics (TP) have the highest concentration in wine produced from indigenous strain of yeast F-8, and the smallest from indigenous strain of yeast F-78. The intensity of color was the highest in wine produced from indigenous strain of yeast F-8, and the smallest from indigenous strain of yeast F-78.

There exist a difference on chemical parameters (TA/TP/IC) between three types of wine, but the differences between the three replicates of wines is a small.



Graph 2. The graph shows the content of total phenolics (TP), total anthocyanins (TA), color intensity (CI) in wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80 of three replicates.

On the graph 2. is displayed the the content of total phenolics (TP), total anthocyanins (TA), color intensity (CI) in wine Vranec produced by indigenous strains of yeasts F-8, F-78 and commercial D-80 of three replicates.

Between three replicates of wines produced from the same strains of yeasts, we can conclusion a small difference at all parameters. There exist a difference on chemical parameters (TA/TP/IC) between three types of wine.

Table 3. Display of Pearson's coefficient of correlation ( $\rho$ ) received from corelation between wines Vranec produced from indigenous (F-8/F-78) and commercial (D-80) strains of yeasts.

		<b>Correlations</b>		
		<b>D80</b>	<b>F78</b>	<b>F8</b>
<b>D80</b>	Pearson Correlation	1	,999**	,996**
	Sig. (2-tailed)		,000	,000
	N	7	7	7
<b>F78</b>	Pearson Correlation	,999**	1	,993**
	Sig. (2-tailed)	,000		,000
	N	7	7	7
<b>F8</b>	Pearson Correlation	,996**	,993**	1
	Sig. (2-tailed)	,000	,000	
	N	7	7	7

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

The correlation value between the main parameters was obtained by using the statistical analysis of the results obtained by applying the software package SPSS 19. The analysis

shows that there is a correlation between the analyzed chemical parameters of the wine from the grapevine Vranec, among different strains of yeasts.

Display of Pearson's coefficient of correlation ( $\rho$ ) received from correlation between chemical parameters from all three types of wines produced from indigenous and commercial strains of yeasts is given in Table 3. The analysis indicates that there is a high correlation value between three types of wine (from F-8/F-78/D-80). Because the main objective to this research is to make a correlation between Vranec produced from indigenous strains of yeasts F-8/F-78 and Vranec produced from commercial D-80, we showed that there is a close correlation. The Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-8 and D-80 is (.996) which means high correlation value. Also, the Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-78 and D-80 is (.999) which means really high correlation value.

### **Conclusion**

This scientific research determined the impact of indigenous and commercial yeast strain on the production of wine from the grape variety Vranec, grown on Crveni bregovi locality, near Negotino, at an altitude of 250 m. The main objective was to display the correlation between indigenous yeast strains F-8 and F-78 with the commercial strain D-80 (Lallemand).

A comparison was made between the domestic yeasts F-8 and F-78, previously isolated at the Tikves wine region, Republic of Macedonia and commercial strain D-80. There is a small difference on the chemical parameters between wines, because the wines were produced from the same grapevariety and locality, also the same days of maceration (16 days) and temperature of fermentation 23-24 °C

The analysis shows that there is a correlation between the analyzed parameters of the wine from the grapevine Vranec, among different strains of yeasts. The main purpose of this research is to make a comparison between the wine produced from indigenous yeast strains F-8 and F-78 with the commercial strain D-80. The Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-8 and D-80 is (.996) which means high correlation value. Also, the Pearson's coefficient of correlation ( $\rho$ ), between wine Vranec from F-78 and D-80 is (.999) which means really high correlation value.

With this scientific research we concluded a very high connectivity between wine Vranec produced from indigenous yeast strains F-8 and F-78 with the commercial strain D-80 (Lallemand).

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