

# BOOK OF PROCEEDINGS



*VII International Scientific Agriculture Symposium  
Jahorina, October 06-09, 2016*



**AGRO** 2016  
**sym**

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“Agrosym 2016”**

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## **Impressum**

VII International Scientific Agriculture Symposium „Agrosym 2016“

### **Book of Proceedings**

#### **Published by**

University of East Sarajevo, Faculty of Agriculture, Republic of Srpska, Bosnia  
University of Belgrade, Faculty of Agriculture, Serbia  
Mediterranean Agronomic Institute of Bari (CIHEAM - IAMB) Italy  
International Society of Environment and Rural Development, Japan  
Balkan Environmental Association, B.EN.A, Greece  
University of Applied Sciences Osnabrück, Germany  
Selçuk University, Turkey  
Perm State Agricultural Academy, Russia  
Voronezh State Agricultural University named after Peter The Great, Russia  
Biotechnical Faculty, University of Montenegro, Montenegro  
Institute for Science Application in Agriculture, Serbia  
Institute of Lowland Forestry and Environment, Serbia  
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Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina  
Maize Research Institute „Zemun Polje“ Serbia  
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#### **Website:**

<http://www.agrosym.rs.ba>

CIP - Каталогизacija у публикацији  
Народна и универзитетска библиотека  
Републике Српске, Бања Лука

631(082)(0.034.2)

INTERNATIONAL Scientific Agricultural Symposium "Agrosym  
2016" (7 ; Jahorina)

Book of Proceedings [Elektronski izvor] / VII International  
Scientific Agriculture Symposium "Agrosym 2016", Jahorina,  
October 06 - 09, 2016 ; [editor in chief Dušan Kovačević]. - East  
Sarajevo =Istočno Sarajevo : Faculty of Agriculture =Poljoprivredni  
fakultet, 2016. - 1 elektronski optički disk (CD-ROM) : tekst, slika ;  
12 cm

CD ROM čitač. - Nasl. sa nasl. ekrana. - Registar.

ISBN 978-99976-632-7-6

COBISS.RS-ID 6216984

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## PREFACE

Dear Colleagues,

In your hands are the *Proceedings* of the 7<sup>th</sup> International Scientific Agricultural Symposium “AGROSYM 2016”, which I hope you will find useful in your research, education and professional activities and endeavors.

AGROSYM 2016 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) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agroforestry.

Keynote papers dealt with organic agriculture from different perspectives as well as international cooperation in agricultural and rural development, climate change and forestry. Organic farming is a holistic production management system of agricultural, food and other products, combining good agricultural practices, a high degree of biodiversity, conservation of natural resources, and application of high standards of animal welfare.

Food production, food security and production of raw materials for other industries determine multiple environmental, economic and social roles of agriculture (including crop production, animal husbandry, forestry and fisheries) in all countries, both developed and developing ones, as well as its multi-functionality; including its contribution to rural development. This is clearly highlighted in the numerous contributions included in these *Proceedings* alongside the challenges that agriculture sector is facing and the negative impacts of industrial agriculture on the environment.

I do believe that the research results reported here will be significant in the dissemination of knowledge to the wider audience about the importance of agriculture as a strategic sector in many countries.

AGROSYM 2016 made an important contribution to the agriculture theory, knowledge and practice in different areas. During the four-day symposium on October 6-9, 2016, over 1100 contributions were presented (either as oral or poster presentations) to more than 1000 participants representing 78 countries.

The *Proceedings* comprise an edited selection of the papers submitted to the symposium. Each paper included in the *Proceedings* was positively reviewed by referees.

AGROSYM 2016 was made possible through the commitment and contributions of a wide range of partners and sponsors. Many thanks to all authors, reviewers, session moderators and colleagues for their help in editing these *Proceedings*. Special thanks go to all co-organizers for their unselfish collaboration and comprehensive support.

East Sarajevo, 05 October 2016

Prof. Dušan Kovačević, Faculty of Agriculture, University of Belgrade

Proceedings Editor in Chief – President of the Scientific committee of AGROSYM 2016



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## **CORRELATION BETWEEN CLIMATIC CONDITION, YIELD AND CHEMICAL COMPOSITION IN MUST ON THREE GRAPES VARIETY**

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### **Abstract**

In this research were examined three different grape varieties Tempranillo, Sangiovese, Petit Verdot a period of 2010-2012 at the locality Lepovo, near Negotino an altitude of 250 m. The main parameters in these research are yield (kg/ha) and chemical characteristics of the must, sugar (g/L) and total acids (g/L) from this three grape varieties.

The climatic factors, the vegetative sum of precipitation and the vegetative temperature sum measured at the meteorological station on Winery Bovin, at the locality Lepovo. We made a comparison between the correlation coefficient among the climatic factors and yields for each variety individually and correlation coefficient between climatic factors and chemical characteristics of each grape variety.

The obtained results from this work were statistically processed using the SPSS statistical software package 19, from where it can be measure the frequency, the percentage share of data, measures of central tendency (median, standard deviation, dispersion, arithmetic mean), such as graphic representation of data (a histogram). The analysis indicates that there is a high correlation value between yield and climatic factors, chemical characteristics and climatic factors. Although the correlation between yield, sugar and total acids in the must with the vegetative sum of precipitation is a negative value, still shows a high correlation coefficient.

**Key words:** *Yield, chemical characteristics, climatic condition, correlation coefficient*

### **Introduction**

*Vitis vinifera L.*, includes many varieties of grapevines that are grown in different viticultural areas. Considering the ecological conditions, almost every country has its own grape wine assortment formed over a long time (*Božinovic, 2010*).

Sangiovese is the most planted variety in Italy (about 10 percent of total acreage), especially in Tuscany. Sangiovese has been cultivated in Italy for well over a thousand years, and is presently the most widely planted grape cultivar there, covering some 2,350 hectare or approximately 10% of total vineyard acreage. Although considered indigenous to Tuscany, Sangiovese is grown throughout Italy, indicating its adaptability to different environmental conditions. (*Molon, 1906; Calo et. al., 2001, Giavedoni and Gily, 2005*).

The Tempranillo grape variety, known as Tinto Fino, originated from Spain, the area Rioja. The core of almost every red wine from this area is Tempranillo (*Bettiga, 2003*). The wines are characterized by a good balance of alcohol content, color and acidity, and aging receive smooth structure, specific fruity taste that lasts long. In Spain produce 28 different types of wines with a protected designation of origin (*Dimovska et al. 2015*).

Petit Verdot is a variety used for red wine production. It originates from Bordeaux, France. The highest concentration of vineyards is being in the St. Emilion district. Later, it appears in many

vine-growing regions of southern Europe, America and Australia. The name Petit Verdot derives from the berries characteristics, and indicates the small (petit) size of the grape berries, and it is roughly translated as “green one” and reflects the variety’s propensity to under-ripeness, and it looks like the bunch of grapes is speckled with green. (*Dimovska et al. 2014*). Introduction of varieties is a method that is widely used in the global grape wine science and practice. These three newly introduced varieties Sangiovese, Tempranillo, Petit Verdot, are included in R. Macedonia recently. They are located on collection plantations or on small production areas (*Božinovic, 2010*).

The main purpose of this research is to make a comparison between the correlation coefficient among the climatic factors and yields for each variety individually and correlation coefficient between climatic factors and chemical characteristics of each grape variety.

### **Material and Methods**

In this research as a material for testing were used three different grape varieties Tempranillo, Sangiovese, Petit Verdot a period of 2010-2012 at the locality Lepovo, near Negotino an altitude of 250 m. The grapevines were grown by applying appropriate agro-technical and ampelotechnical measures. The plantations were planted in 2006 with certified planting material at the distance of 2.4 m between the rows and 1 m between the grapevines in a row. The applied farming system is the two legged Guyot system by leaving 7 buds per vine. The plantations are under a drop-by-drop irrigation system (drip irrigation system).

The main parameters in these research are yield (kg/ha) and chemical characteristics of the must, sugar (g/L) and total acids (g/L) from this three grape varieties.

The climatic factors, the vegetative sum of precipitation and the vegetative temperature sum measured at the meteorological station on Winery Bovin, at the locality Lepovo. We made a comparison between the correlation coefficient among the climatic factors and yields for each variety individually and correlation coefficient between climatic factors and chemical characteristics of each grape variety.

The obtained results from this work were statistically processed using the SPSS statistical software package 19 (*Badioze Zaman H. et al. 2013*), from where it can be measure the frequency, the percentage share of data, measures of central tendency (median, standard deviation, dispersion, arithmetic mean), such as graphic representation of data .

For the analyzed properties is calculated the Pearsons’s correlation coefficient. Dependent variables critical in our work are the yield (kg/ha) and chemical characteristics of the must, sugar (g/L) and total acids (g/L) from this three grape varieties. These parameters are dependent variables from climatic factors.

Using the software package SPPS 19 is made table display of correlation between yield and climatic factors, chemical characteristics and climatic factors.

### **Results and discussion**

Beside the characteristics of the variety and their biological potential, yield depends on agroecological conditions where the variety is grown. (*Karoglan J et al. 2000*). In Table 1. is detailed overview of the main climatic parameters measured a period of 2010-2012 at the meteorological station on Winery Bovin, at the locality Lepovo, vegetative temperature sum (° C) and vegetative sum of precipitation (l/m<sup>2</sup> ). The vegetation period lasts on average from 206 to 209 days, enough for the grapes to reach technological and full maturity.

The average vegetative temperature sum a period of 2010-2012 amount 4179 °C, where the highest was recorded in 2012 and amount 4528 °C. The average vegetative sum of precipitation a period of 2010-2012 amount 232 l/m<sup>2</sup>, where the highest was recorded in 2010 and amount 268 l/m<sup>2</sup>.

Table 1. Climatic factors at the locality Lepovo, vegetative temperature sum (°C) and vegetative sum of precipitation (l/m<sup>2</sup>)

Climatic factors		
Year	Vegetative temperature sum (°C)	Vegetative sum of precipitation ( l/m <sup>2</sup> )
2010	4339	268
2011	4424	238
2012	4528	190
2010/2012	4179	232

The yield of this three different grape varieties Sangiovese, Petit Verdot and Tempranillo by 1ha was mathematically calculated.

In table 2. are presents the results of the main parameter yield (kg/ha), calculated a period of 2010-2012. The average yield, a period of 2010-2012 amount 12.090 kg/ha of the variety Sangiovese, 12.926 kg/ha of the variety Petit Verdot, and the highest value 14.233 kg/ha of the variety Tempranillo. This indicates that the variety Tempranillo has achieved the highest yield in terms of these ecological and climatic factors, any year from research.

Table 2. Yield of the grape (kg/ha), a period of 2010/2012

Yield (kg/ha)			
Year	Sangiovese	Petit Verdot	Tempranillo
2010	8.190	11.401	13.039
2011	12.120	12.600	13.747
2012	15.960	14.777	15.914
2010/2012	12.090	12.926	14.233

The content of sugar in the must was determined by Oechsle Scale, and the composition of total acids was determined by titration method using solution of N/4 NaOH with factor 1.0000.

In table 3. is detailed overview of the main chemical characteristics of the must, from this three different grape varieties Sangiovese, Petit Verdot and Tempranillo sugar (g/L) and total acids (g/L) from this three grape varieties a period of 2010/2012.

The results explained that the variety Petit Verdot and Tempranillo have approximately the same values for measured sugar (g/L) and total acids (g/L) in the must, where Petit Verdot has the average value of sugar 238 g/L, Tempranillo 237 g/L and the average value of total acids in the must are 5.53 g/L for the variety Petit Verdot, 5.6 g/L for variety Tempranillo. The variety Sangiovese has a difference from the two previous varieties, with 226 g/L sugar and 6.8 g/L total acids in the must.

Table 3. Chemical characteristics of the must, sugar (g/L) and total acids (g/L) from this three grape varieties a period of 2010/2012.

Year	Chemical characteristics					
	Sangiovese		Petit Verdot		Tempranillo	
	Sugar (g/L)	Total acids(g/L)	Sugar (g/L)	Total acids(g/L)	Sugar (g/L)	Total acids(g/L)
2010	220	6.8	228	5.5	215	5.4
2011	228	6.7	232	5.0	225	5.5
2012	230	7.1	254	6.1	270	5.8
2010/2012	226	6.8	238	5.53	237	5.6

Using the software package SPSS 19 is made table display of correlation between yield and climatic factors, chemical characteristics and climatic factors. Comparing by the Pearson's coefficient of correlation we can see which parameters have a higher connectivity. If  $\rho = 1$ , it means that there is a perfect linear dependence and the growth of the one variable well the other variable is growing.

Display of Pearson's coefficient of correlation ( $\rho$ ) received from correlation between yield, sugar and total acids with climatic factors (vegetative sum of precipitation and the vegetative temperature sum), from this three grape varieties a period of 2010/2012 is given in Table 4.

The analysis indicates that there is a high correlation value between yield and climatic factors, chemical characteristics and climatic factors. Although the correlation between yield, sugar and total acids in the must with the vegetative sum of precipitation is a negative value, still shows a high correlation coefficient.

Table 4. Display of Pearson's coefficient of correlation ( $\rho$ ) received from correlation between yield, sugar and total acids with climatic factors (vegetative sum of precipitation and the vegetative temperature sum), from this three grape varieties a period of 2010/2012

Variety	Pearson's coefficient of correlation ( $\rho$ )					
	Yield-Rain	Yield-Temp.	Sugar-Rain	Sugar-Temp.	Total acids-Rain	Total acids-Temp.
Sangiovese	-0,99000	0,99800	-0,89300	0,92400	-0,80600	0,76000
Petit Verdot	-0,999	0,994	-0,925	0,895	-0,651	0,592
Tempranillo	-0,988	0,974	-0,976	0,957	-0,989	0,975

On the graph 1. is displayed correlation coefficient between the yield, sugar and total acids with climatic factors for this three grape varieties a period of 2010/2012.

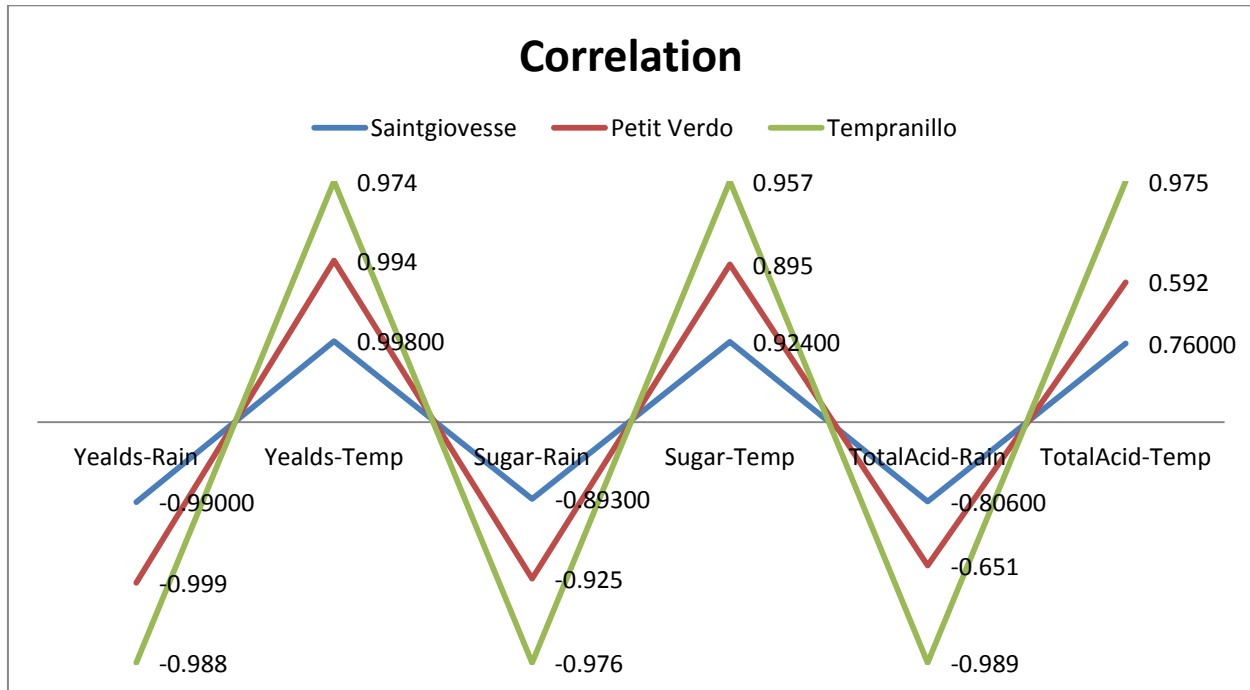
The variety Tempranillo has a highest connectivity, and the variety Sangiovese lowest connectivity for all parameters, although the correlation between yield, sugar and total acids in the must with the vegetative sum of precipitation is a negative value (-).

As indicated above that correlation coefficient ranging between 0.9 and 1 means a very high connectivity, we can conclude that this three varieties Sangiovese, Tempranillo and Petit Verdot, showed high correlation between climatic factors (vegetative sum of precipitation and the

vegetative temperature sum) with yield (kg/ha), and chemical characteristics of the must, sugar (g/L) and total acids (g/L).

The climate conditions has a direct effect on the quantity and quality of the grapes and on the wine production (*Angelov L, Stalev B.,2011*).

This research explain that climatic factors have a significant impact on the yield and quality of grape must and wine from this three newly introduced varieties Sangiovese, Tempranillo and Petit Verdot.



Graph 1. The graph shows correlation coefficient between the yield, sugar and total acids with climatic factors for this three grape varieties

### Conclusion

1. This research explain that climatic factors have a significant impact on the yield and quality of grape must and wine from three introduced varieties.
2. We made a comparison between the correlation coefficient among the climatic factors and yields for each variety individually and correlation coefficient between climatic factors and chemical characteristics of each grape variety. The variety Tempranillo has a highest connectivity, and the variety Sangiovese lowest connectivity for all parametars, although the correlation between yield, sugar and total acids in the must with the vegetative sum of precipitation is a negative value (-).
3. The analysis indicates that there is a high correlation value between yield and climatic factors, chemical characteristics and climatic factors. Although the correlation between yield, sugar and total acids in the must with the vegetative sum of precipitation is a negative value, still shows a high correlation coefficient, which is approximately the value 1, and indicating a very high connectivity.



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