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SAUVIGNON WINE QUALITY AS AFFECTED BY ITS PROCESSING AND STORAGE

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ABSTRACT

The colour and limpidity are the first sensory attributes of wines that are appreciated by consumers, predisposing their acceptance or rejection. The aim of this work was to monitor the effect of harvest, processing (different clarification and treatment of must) and storage on the quality of Sauvignon wine. The wines were stored for two years in the wine cellar at 12°C and 70 % of humidity, in the bottles. The acid content, residual sugar and alcohol content among chemical parameters and sensory profile of wines were observed. Sensory quality of wines was evaluated by the aromatic profile (profile method). Based on acquired results, two years of wine storage significantly affected the total acid content of wines and alcohol content. Different treatments of must affected residual sugars, the variant with the maximum dose of the clarification preparation (highly pure cellulose, polyvinylpolypyrrolidone, gelatin and mineral adsorbents) showed statistically the highest content of residual sugars. From the sensory point of view, sensory profiles of wines were different compared to the first and second harvest of grape, sensory profiles of wines were changed also after two years of storage. The fourth variant appeared to be the best stable, treated with the addition of clarification preparation at the dose of 30 g. 100 L^{-1} must. Because from the same variety Sauvignon were produced wines of different chemical and sensory qualities, some gastronomy recommendations were done as well.

Keywords: wine; quality; sensory evaluation; harvest; clarification

INTRODUCTION

Grapevine phenology and physiology, which affect yield and fruit composition, are largely under the control of climate on a macro (regional), meso (vineyard or site) and microscale **(Šuklje et al., 2014)**. If viticultural variables remain constant, climate differences will have a major effect on fruit maturation and quality **(Mira de Orduña, 2010)**. During grape maturation, the concentration of sugars, amino acids, phenolic compounds and potassium increases, while the content of organic acids, particularly malic acid, decreases **(Adams, 2006)**. Under the term of "wine", can be understood a diversity of quality which is quite unique among the products and determined mainly by interaction among grapes, yeasts and technology. It is a natural product resulting from a number of biochemical reactions, which begin during ripening of the grapes and continue during harvesting, throughout the alcoholic fermentation, clarification and after bottling **(Torija et al., 2001)**.

During winemaking, different oenological products could be used. Generally, clarifying procedures can be achieved by centrifugation, enzymatic treatment or applying clarifying agents such as gelatin bentonite, silica sol, and polyvinyl pyrrolidone **(Chatterjee et al., 2004)**. Fining agents are commonly used to improve the most important characteristics of wine, such as colour and aroma. Clarification of wines is an important process especially from the point of view of wine color and brilliancy **(Sen et al., 2012)**. Fining agents, which are all adsorptive compounds, commonly used in winemaking are grouped according to their general nature; arths (montmorillonite, bentonite, kaolin), animal proteins (gelatin, isinglass, caseins), wood charcoal (carbons) and synthetic polymers (polyvinyl polypyrrolidone – PVPP) **(Sen et al., 2012)**. The storage temperature of must fermentation may affect final viscous behaviour of wine **(Kumbár and Votava, 2015)**.

Quality evaluation of wine is primarily based on wine tasting. Chemical analyses are however performed in order to explain some sensory changes observed. The relationship between sensory evaluation and chemical composition of wine is a critical subject of research in oenology **(Chira, 2011)**. The quality of wines is a complex property of several physico-chemical properties in their mutual synergistic combination. Individual factors affected by the human physiological perception sensitivity are determining overall wine quality perception **(Lapčíková et al., 2017)**. Sensory analysis involves the application of human senses to the description and/or evaluation of a product for consumer use **(Blackman, 2010)**. The colour and limpidity are the first sensory attributes of wines that are appreciated by consumers, predisposing their acceptance or rejection **(González-Nevesa, 2014)**.

Scientific hypothesis

Harvest and processing of grape, storage of wine are important conditions which affect sensory and chemical quality parameters of wines important for their consumption.

MATERIAL AND METHODOLOGY

The grapes originated from Nitra wine- growing region in Slovakia (Radošinské vineyard) from year 2012. At time of harvest the sugar content 22 °NM was determined, grape was harvested on 04. 09.2012 (1st harvest). At the late harvest 11. 09. 2012 (2nd harvest) the sugar content 24 °NM was detected **(Remeňová, 2015)**.
After harvesting, the grapes were pressed and got rid of stems. Obtained must was divided into four equal homogeneous parts, of which own experimental samples were prepared. Four variants were prepared by different treatments of must:
- *variant 1 :* spontaneous fermentation without the addition of yeast, no clarification;
- *variant 2* : must with static decanting for 12 hours, without adding clarifying preparations, with the addition of active dry wine yeasts *S.cerevisae*;
- *variant 3*: must clarified by the clarification preparation at a dose of 100 g. 100 L^{-1} of must, representing the maximum dose of the clarification preparation. The preparation was applied directly to the must. Yeasts *S. cerevisae* were applied to the clarified must after the must turbidity.
- *variant 4:* must clarified by the clarification preparation at the dose of 30 g. 100 L^{-1} must, with the addition of yeasts *S. cerevisae*.

Clarification consisted of preparation of highly pure cellulose, polyvinylpolypyrrolidone, gelatin and mineral adsorbents.

The process of fermentation was performed at a standard temperature of 15 °C for 14 days. After the fermentation completion, the wine was clarified with bentonite. Then it was coiled up, filtered, and bottled.
The wines were stored for two years (from 2013 till 2015) in the wine cellar at 12°C and 70 % of humidity, in the bottles. The effect of storage on the selected parameters of wines was observed as well. For the determinations five samples of wines were taken and used for the analysis.

Methods

Alcohol content of wines was performed by electronic ebullioscopy (fi. Dujardin-Salleron, France).

Assessments of acid and residual sugar contents were determined according to the International Methods of Analysis of Wines and Musts (2010).
Total acidity of wines was performed at the device HI84502 Total Acidity Mini Titrator for Wine Analysis (Hanna Instruments, Germany) based on neutralization reaction.
Residual sugar content was detected enzymatically (glucose+ fructose) and spectrofotometrically (T80 UV-VIS spectrophotometer).

Produced wines were evaluated also by sensory profile method **(Fic et al., 2015)**. For the evaluation of the profile method were used descriptors of smell and flavour typical for Sauvignon variety. Results of the profile method are the product of intensity scales, which are compiled either for a variety of descriptors or for individual characters.

Statisical analysis

The normality of the data were analysed by the Kolmogorov-Smirnov test. Then One-Way analysis of variance (ANOVA) was used to evaluate effects of treatments on experimental data. For post-hoc tests Tukey's HSD test was applied at $\alpha = 0.05$. All means in charts were presented as vertical columns represent 95% confidence intervals for means. Analysis was conducted using software STATISTICA 10 Cz.

RESULTS AND DISCUSSION

Chemical parameters of wines

Chemical parameters of Sauvignon wines **(Figure 1 – 3)** important for their tasting were firstly observed. The content of acids in wines was statistically affected ($p = 0.000$) by the time of storage **(Figure 1)**, mean acid content determined in the year 2013 was 6. 44 g.L^{-1}while the mean content of acids from the year 2015 (after their storage) was only 5.61 g.L^{-1}.The time of harvest and the treatment of must did not show any statistical influence on the acid content of wines.

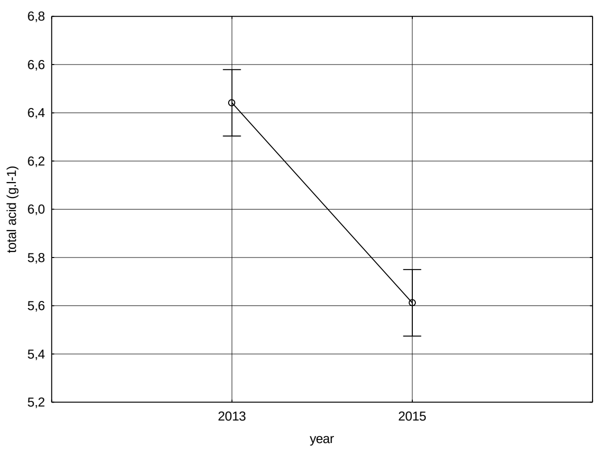


Figure 1 The effect of storage on the total acid content in the wines. Vertical columns represent 95% confidence intervals for mean.

Sugars have the capacity to mask acidity. Residual sugar content in wines important for their sweetness and harmony was significantly affected at parameters of the time of harvest and treatment of must **(Figure 2 a, b)**. It was found to be significantly higher ($p = 0.000$) from the second harvest (33.09 g.L^{-1}) compared to the first harvest (5.14 g.L^{-1}).

At different treatments of must based on Tukey's HSD test at $\alpha = 0.05$, two homogenous groups were formed. The first group consisted of variants 1, 2, 4 and their residual sugar content ranged from 17.03 to 18.57 g.L^{-1}. Statistically differed just variant 3 with the maximum dose of the clarification preparation, its residual sugar content determined was 22.55 g.L^{-1}. Following this variant it seems due to the lack in nutrition of yeasts we found high residual sugar and consequently the lowest content of alcohol in this variant (12.51 %) compared the others. Clarification of must is important operation performed in winemaking, which can have major impact on the future quality of the wine. It removes components that may negatively affect hygienic and sensory quality of the wine **(Vietoris et al., 2014).**

By the **Commission regulation (EC) No 607/2009** wines can be divided into dry, semi-dry, semi-sweet or sweet by the residual sugar content. Following this classification, our wines belong to the category of semi-sweet wines, because of residual sugar content varies from 12 – 45 g.L^{-1}. Just the wines produced from the first harvest (5.14 g.L^{-1}) belong to the semi-dry wines.

Alcohol content of wines **(Figure 3 a, b)** was statistically affected by its storage and the time of harvest. Alcohol content determined in the year 2013 (at the beginning of the storage) was 13.19 %, while the mean content determined in the year 2015 (the end of storage) statistically ($p = 0.000$) decreased (12.08 %). Lower alcohol content ($p = 0.000$) from the second harvest (12.20 %) was detected compared to the first harvest (13.06 %).

Sensory quality of wines

For determination of small differences in sensory parameters of wine, methods of sensory profile evaluation can be used. They are very suitable for research and development work, for determination of similarity and correlation between taste and aroma of samples as well **(Fic et al., 2015)**. Sauvignon blanc has been described as a white wine with its characteristic varietal aroma due to relatively few volatile compounds **(Parr et al., 2013)**.

Nettle with green apple belong to the fresh plant characteristics of Sauvignon from the first harvest. The most intensive neetle flavour was recorded in the third and the first variant. Peach flavor was the most significantly detected in the third variant. Green apple was in all variants almost in balance, but the highest result achieved the second variant. Lemon/lime flavor was found to be the highest at the third variant and the least in the first variant.

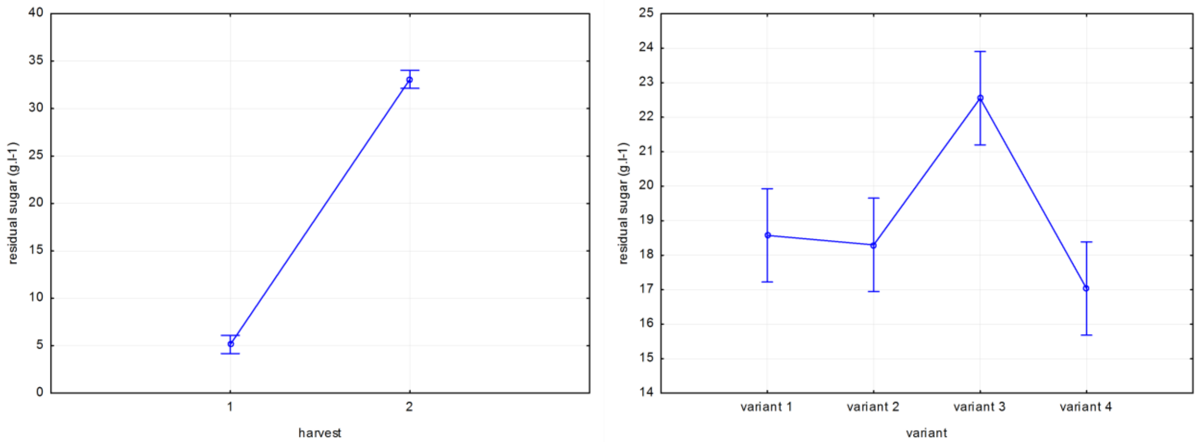


Figure 2 (a, b) The effect of harvest (a) and treatment of must (b) on the residual sugar content in the wines. Vertical columns represent 95% confidence intervals for mean.

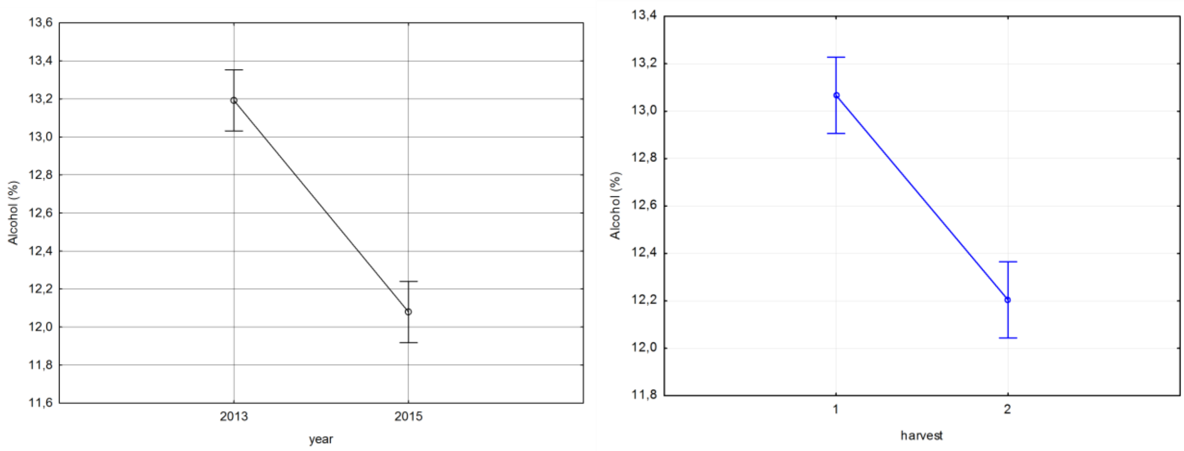
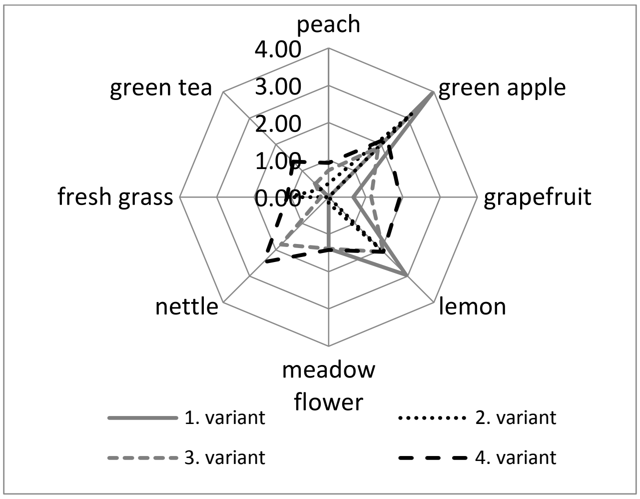
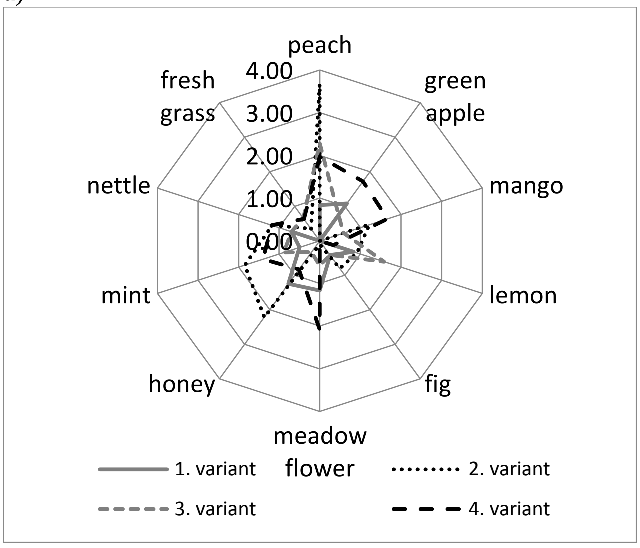


Figure 3 (a, b) The effect of storage (a) and harvest (b) on the alcohol content in the wines. Vertical columns represent 95% confidence intervals for mean.



a)



b)

Figure 4 (a, b) The sensory profile of wines from the 1.[st] harvest (a) and 2. [nd] harvest (b) after their storage

Meadow flowers were significantat at the second and fourth variant and the least in the third variant as it was published at our previus work **(Vietoris et al., 2014)**.

After the storage of wines from the early harvest several changes in sensory quality of wines were detected. Nettle at the first variant totally disappeared and remained only in the third and the fourth variant. Peach flavor decreased and green apple increased at the first variant. Grapefruit was not significantly affected, lemon increased in the first variant, nettle increased at the fourth variant. During the maturation of wine the individual flavor characteristics were transformed to the others. It can be stated that the most stable were the third and the fourth variants **(Figure 4 a)** with the addition of clarification preparations.

Assessing the sensory profile of the wines from the second harvest with higher sugar content (24 ° NM) of grape, the most intensive was detected peach flavor and generally dominated fine tropical sweet aromas. At the first, second and the third variants honey flavor was found, in high values were observed plant flavors: nettle, green tea and green apple **(Vietoris et al., 2014)**.

The aroma of wine is a unique mixture of volatile compounds originating from grapes (varietal aromas), secondary products formed during the wine fermentation (fermentative aromas) and aging (post-fermentative aromas) **(Callejona et al., 2010)**.

After the storage of wines **(Figure 4 b)** new flavors were observed: fresh grass, fig, mint and meadow flower, but peach flavour still dominated as it was found in the wine before the storage.

Produced wines in enogastronomy

Enogastronomy could be characterised as the art or science of good eating and drinking. There exist two basic principles for merger the wine with food. The first one is in mutual fusion of wine with food resulting in their harmony, and the second one uses contrast between wine and food, there is a competition and diametric difference between wine and food **(Fic et al., 2015)**. Good pairing recommendations may be crucial for the success of beverages, both in the retail and hospitality sector. Food–beverage pairings are often presented by culinary professionals such as chefs or sommeliers, however little focus is given to consumer perception **(Paulsen et al., 2015)**.

Therefore it is important to serve the right food with the right wine, e.g. in terms of actual sweetness and acidity. If the Sauvignon wine is dry, seafood with Tabasco sauce can be prepared or exotic accompaniment can be recommended. **Ailer (2016)** recommended dry Sauvignon blanc wines with combination of fruit, such as apricots, peaches, raisins with steamed fish and potato puree.

Produced semi-dry Sauvignon wines could be recommended to combine with sweet or creamy foods. Ripened cheese with nuts, lichee and pear on mustard sauce with honey and lime is one of the possibilities. Roasted beetroot with goat cheese on wine and honey can be served with parsley puree, grilled zucchini and combined with sweet Sauvignon, produced from the late harvest of grapes.

Within the innovation of restaurant services, the own production, or local products can be offered. Farm visits and tastings as related with a tour of the vineyards **(Cavicchi, 2015)** can be accompanied. Interesting tasting room at a winery, such as an old cave can be qualified as an example of culinary tourism **(Lušňáková, 2012)**. One of the possibilities and ways of marketing is promotion of "regional gastronomy". Preparing food and drinks is possible to promote as science as an art, as well as a concept comprising the traditions, culture and society.

CONCLUSION

As it can be seen the quality of Sauvignon wines can be affected by different effects. The acidity of wines is significantly (p = 0.000) affected by the time of storage, it decreased during two years of its storage. Significant influence was shown also in residual sugar content at the time of later harvest (p = 0.000) and treatment of must (p = 0.022) by clarification preparation. Alcohol content by storage (p = 0.000) and the time of harvest (p = 0.000) was statistically affected as well.

With using of clarification preparation, flavor precursors formed during the ripening of wines under storage were transformed, and are responsible for the occurrence of other important flavor characteristicof the wine in the archive.

Wine testing can be connected with the farm visits or tours as a unique presentation of local products, marketing and culinary tourism opportunity. It is one of the elements within the trend of authenticity, environmental protection and the need to have a valuable experience.

REFERENCES

Adams, D. O. 2006. Phenolics and ripening in grape berries. *American Journal of Enology and Viticulture*, vol. 57, no. 3, p. 249-256.

Ailer, Š. 2016. *Vinárstvo & somelierstvo (Winery & Sommelier proficiency).* 1. ed. Olomouc, Czech Republic : Agriprint, 2016. 197 s. ISBN 978-80-87091-63-0. (In Czech)

Blackman, J., Rutledge, D. N, Tesic, D., Saliba, A., Geoffrey, R. S. 2010. Examination of the potential for using chemical analysis as a surrogate for sensory analysis, *Analytica Chimica Acta*, vol. 660, no. 1-2, p. 2-7. https://doi.org/10.1016/j.aca.2009.10.062

Callejona, R. M., Clavijo, A., Ortigueira, P., Troncoso, A. M., Paneque, P., Morales, M. L. 2010. Volatile and sensory profile of organic red wines produced by different selected autochthonous and commercial Saccharomyces cerevisiae strains. *Analytica Chimica Acta*, vol. 660, no. 1-2, p. 68-75. https://doi.org/10.1016/j.aca.2009.09.040

Cavicchi, A. 2015. Creativity and Innovation in Food: diversification and innovation paths in food smart specialisation areas. Smart specialisation and food: food, gastronomy and bio-economy as elements of regional innovation strategies. EXPO Milan. Available at: http://s3platform.jrc.ec.europa.eu/expo-2015

Chatterjee, S., Chatterjee, S., Chatterjee, B., P., Guha, A. K., 2004. Clarification of fruit juice with chitosan. *Process Biochemistry*, vol. 39, no. 12, p. 2229-2232. https://doi.org/10.1016/j.procbio.2003.11.024

Chira, K., Pacella, N., Jourdes, M., Teissedre, P. L. 2011. Chemical and sensory evaluation of Bordeaux wines (Cabernet-Sauvignon and Merlot) and correlation with wine age. *Food Chemistry*, vol. 126, no. 4, p. 1971-1977. https://doi.org/10.1016/j.foodchem.2010.12.056

Commission regulation (EC) No 607/2009 of 14 July 2009 laying down certain detailed rules for the implementation of Council Regulation (EC) No 479/2008 as regards protected designations of origin and geographical indications, traditional terms, labelling and presentation of certain wine sector products. OJ L 193 24.7.2009, p. 60.

Fic, V. 2015. Víno: analýza, technologie, gastronomie (Wine: analysis, technology, gastronomy). Český Těšín, Czech Republic : Václav Helán-2 Theta. 299 p. ISBN 978-80-8680-77-3 (in Czech)

González-Nevesa, G., Favre, G., Gil, G. 2014. Effect of fining on the colour and pigment composition of young red wines, *Food Chemistry*, vol. 157, p. 385-392. https://doi.org/10.1016/j.foodchem.2014.02.062

Ibeas, V., Correia, A., Jordão, A., M. 2015. Wine tartrate stabilization by different levels of cation exchange resin treatments: impact on chemical composition, phenolic profile and organoleptic properties of red wines. *Food Research International*, vol. 69, p. 364-372. https://doi.org/10.1016/j.foodres.2015.01.003

Kumbár, V., Votava, J. 2015. Influence of storage temperature on the viscous behaviour of partially fermented wine must (*Pinot Gris*). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, vol. 63, no. 3, p. 781-785. https://doi.org/10.11118/actaun201563030781

Lapčíková, B., Lapčík, L., Hupková, J. 2017. Physico-chemical characterisation of Slovak wines. *Potravinarstvo*, vol. 11, no. 1, p. 216-222. https://doi.org/10.5219/727

Lušňáková, Z. 2012. Culinary tourism and Marketing Communication: Theory and the V4 Case Study. In Horská, E et al., Food Sciences &Business Studies, Nitra: SPU, p. 371-389. ISBN 978-80-552-0815-2. (In Slovak)

Mirade Orduña, R. 2010. Climate change associated effects on grape and wine quality and production. *Food Research International*, vol. 43, no. 7, p. 1844-1855. https://doi.org/10.1016/j.foodres.2010.05.001

Parr, W. V., Schlich, P., Theobald, J. C., Harsch, M. J. 2013. Association of selected viniviticultural factors with sensory and chemical characteristics of New Zealand Sauvignon blanc wines. *Food Research International*, vol. 53, no. 1, p. 464-475. https://doi.org/10.1016/j.foodres.2013.05.028

Paulsen, M. T., Rognså, G. H., Hersleth, M. 2015. Consumer perception of food–beverage pairings: the influence of unity in variety and balance. *International Journal of Gastronomy and Food Science*, vol. 2, no. 2, p. 83-92. https://doi.org/10.1016/j.ijgfs.2014.12.003

Remeňová, Z. 2015. Vplyv spracovania vín modernými technológiami na ich kvalitu počas zrenia (The impact of wine processing by modern technologies on their quality during maturation). Nitra: SPU. 92 p. (In Slovak)

Sen, K., Cabaroglub, T., Yilmazc, H. 2012. The influence of fining agents on the removal of some pesticides from white wine of *Vitis vinifera* L. *Food and Chemical Toxicology*, vol. 50, no. 11, p. 3990-3995. https://doi.org/10.1016/j.fct.2012.08.016

StatSoft, Inc. (2011). STATISTICA (data analysis software system), version 10. www.statsoft.com.

Šuklje, K., Antalik, G., Coetzee, Z., Schmidtke, L. M., Česnik, H. B., Brandt, J., du Toit, W. J., Lisjak, K., Deloire, A. 2014. Effect of leaf removal and ultraviolet radiation on the composition and sensory perception of *Vitis vinifera* L. cv. Sauvignon Blanc wine. *Australian Journal of Grape and Wine Research*, 20, 2, p. 223-233. https://doi.org/10.1111/ajgw.12083

Torija, N., Rozèset al. 2001. Yeast population dynamics in spontaneous fermentations: Comparison between two different wine-producing areas over a period of three years. *International Journal of General and Molecular Microbiology*, vol. 79, no. 3-4, p. 345-352.

Vietoris, V., Czako, P., Mendelová, A., Remeňová, Z., Závacký, M. 2014. Relations between must clarification and organoleptic attributes of wine varietes. *Potravinarstvo*, vol. 8, no. 1, p.155-160. https://doi.org/10.5219/359

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