DETERMINATION OF SOME PARAMETERS IN WINE PRODUCED FROM CLONE AND POPULATION OF VRANEC VARIETY VINES

Taseska-Gjorgjijevski Milena*, Nedekovski Dushko, Dzoljevska Milenkovska Roze, Poposka Hristina

Institute of Agriculture, Ss. Cyril and Methodius University, Skopje, North Macedonia
*e-mail: milenataseska2005@yahoo.com

ABSTRACT

Vranec variety is the most planted red grape variety in our country for production of high quality wine. This investigation was carried out on two vineyards, one with clone material and the other with population indigenes for old Macedonian vineyards. Both were located in Gevgelija-Valandovo region with sub-mediterranean clime conditions. The scope of this investigation is to determine some chemical parameters that influence on the quality of wine, as alcohol strength, specific gravity, total extract, total acids, volatile acids, pH, free and total SO_2. Also, the content of total phenols, total anthocyanins, hue, intensity and percent of red, yellow and blue color were analyzed. Five wine experts were involved for the sensory descriptive evaluation of the investigated wines and the results were presented on spider chart.

Key words: Vranec, clone, population, sensory evaluation

INTRODUCTION

Phenolic substances has numerous functions in the plants, thay are responsible for the taste and color of the fruits and vegetables, some play roll in the defense mechanism against predators and pathogens, and some of them has no clear meaning of their function (Macheix et al., 1990; Croft, 1999). The accumulation of anthocyanins in the berries increase from verison to technological ripening. It is evident that the concentration of this substances in late harvest decreases (Kennedy, 2008). Two major factors influence on the accumulation of phenolic and aromatic substances in the grapes. The first one is the group of independent factors: clime conditions (rain; temperature; solar insolation or soil type). The second group include different agrotechnical activities: vine trailing system, defoliation, cluster reduction and some other activities (Arnold & Bledsoe, 1990; Zoecklein et al., 1998). Various autores worked on malolactic fermentation with different bacteria, as Du Toit, et al., 2011; Henick-Kling 1993; Henick-Kling 1994; Martineau & Henick Klining, 1995, who monitor the MLF process with specific malolactic strain and their impact on wine quality. Also, aroma composition of grapevine and their specific content of ester and higher alcohol depends from the yeast and malolactic strains (Sumby 2012; Sumby 2013).

MATERIAL AND METHODS

Material

For this investigation Vranec variety grape from Gevgelija-Valandovo wine region was used. Mature and healthy grapes from this variety were harvested by hand. VP 41, ML Prime, O-Mega and PN4, as the types of commercial available lactic bacterias, produced by Lallemand producer, were used for the malolactic fermentation (MLF) of the wine Vranec. The fermentation of the grapes was followed by Lalvin ICV D-254™ yeast and Fermaid E, yeast

nutrient and Optimalo D, nutrient for MLF, from the same producer. For better color, stability and higher phenolic composition, EX-V for Lallemand producer was used.

Methods

On a small electric crusher the grapes were immediately destemmed and dosage of 30 mg/L SO_2 was added. Then, the grape must was divided into 5 stainless steel tanks, with capacity of 30 kg each. Dosage of 1 g/hL EX-V enzyme was added and each variant was inoculated with selected active yeast Lalvin ICV D-254™ , dosage 25g/hL. 24 hours after yeast addition, four lots were inoculated with different wine bacteria strains, as it is outlined below. The control variant is without bacteria inoculation.

- Control (Lalvin ICV D254™)
- Variant 1 co-inoculation (Lalvin ICV D254™ + Lalvin VP 41™)
- Variant 2 co-inoculation (Lalvin ICV D254™ + O-MEGA™)
- Variant 3 co-inoculation (Lalvin ICV D254™ + ML Prime™)
- Variant 4 co-inoculation (Lalvin ICV D254™ + PN4™)

During the alcoholic fermentation (AF) the cap was plunged 3 times daily. During the fermentation, 15 g/hL nutrient Fermaid E™ was added. The temperature during the alcoholic fermentation was in the range from 24 to 26 °C. The transformation from malic to lactic acid was analyzed every 3 days. After 14 days of fermentation, the wine was separated, than the pomace was gently pressed to extract the remaining juice. After that the wine was left to settle for 2 days. After racking the wine a complete chemical analysis was conducted. At the end of alcoholic fermentation the control wine was divided in 5 equal parts and sequentially inoculated with the same bacteria strains previously used in the co-inoculation trial. Along with the different strains of wine bacteria, a bacteria nutrition addition was also made with Opti'Malo™ 20 g/hL

- Control
- Variant 1 sequent. Lalvin VP 41™ + Opti'Malo™
- Variant 2 sequent. O-MEGA™ + Opti'Malo™
- Variant 3 sequent. ML Prime™ + Opti'Malo™
- Variant 4 sequent. PN4™ + Opti'Malo™

Methods of analysis of the samples

L-malic and L-lactic acid concentrations were determined using Oenolab enzymatic kit on Agilent 8453 UV-vis spectrophotometer.

Various OIV-methods were used for determination of chemical composition (alcohol strength, specific gravity, total extract, total acids, volatile acids, pH, free and total SO_2) of the samples.

RESULTS AND DISCUSSION

The climate condition in Macedonia is very suited for cultivation of high quality red wines. The good climatic conditions are the key factor for grapes with good quality. Thus, they are used for the production of high quality premium wines from this variety. The obtained level of malic acid in Vranec grape juice was 1.15 g/L and the sugar content in Vranec grapes was 24.5 Brix.

For this study one yeast and four different strains of wine LAB were used. The co-inoculation treatment was compared with post alcoholic fermentation inoculation of LAB correlated with Abrahamse&Bartowsky, 2012 and Costello et al., 2012. The alcoholic fermentation was completed after a period of approximately 9 days. For higher extraction of phenolic components, the wine was racked after 14 days. The obtained results from chemical analysis of wines after alcoholic and malolactic fermentation are shown in Table 1.

As can be seen in Table 1, the total acidity (TA) in the Control sample is higher than the other treatments because there was no transformation from malic to lactic acid. The level of malic acid in the control sample remains the same 1.15 g/L. All other co-inoculated samples had undergone a complete malic acid transformation. The level of volatile acids is in normal range which indicates that the alcoholic fermentation is normal without unwonted microbiological interactions. The obtained results for alcohol and total extract in all variants, as shown in Table 1. are in the same range with control sample. It indicates that the MLF didn't have influence on these parameters.

The obtained results for co-inoculation of malic acid in Figures 1 & 2 show that in all the treatments, the L-malic acid was metabolized into L-lactic acid except in the control sample, where L-malic acid was unchanged. The MLF kinetics show that ML Prime™ was very effective and able to degrade the L-malic acid faster than the other bacterias, followed by PN4™ strain. The other two strains were slightly slower but still very efficient in degrading L-malic acid. Similar results were obtained for the variety shiraz according to Abrahamse&Bartowsky, 2012.

Following the traditional sequential inoculation technique with selected LAB after alcoholic fermentation, kinetics of malic acid degradation had been almost identical between the four investigated LAB strains. Although not recommended for sequential inoculation in red wines, the ML Prime strain start faster than the others, but all LAB strains degraded malic acid within 3 weeks.

Table 1. Chemical composition of Vranec wine produced with different malolactic bacteria

Variants	Sp. Gravity 20/20	Alcohol vol%	Total extract g/L	Total acids g/L	Volatile acids g/L	pH	Free SO_2 g/L	Total SO_2 g/L
Control	0.9947	14.24	32.3	6.4	0.55	3.45	32.00	55.12
co-VP 41	0.9943	14.29	32.8	5.8	0.51	3.38	28.00	52.32
co-ML Prime	0.9946	14.11	33.6	5.7	0.48	3.40	28.00	48.52
co-OMEGA	0.9947	14.11	33.9	5.5	0.46	3.38	25.60	4852
co-PN 4	0.9942	14.38	32.8	5.6	0.53	3.39	25.60	52.32
post-VP 41	0.9944	14.20	32.8	5.8	0.46	3.40	21.76	45.25
post-ML Prime	0.9947	14.47	33.9	5.8	0.45	3.39	32.00	51.25
post-OMEGA	0.9945	14.38	33.6	5.7	0.49	3.38	21.76	51.25
post-PN 4	0.9944	14.29	32.8	5.6	0.50	3.41	25.60	48.52

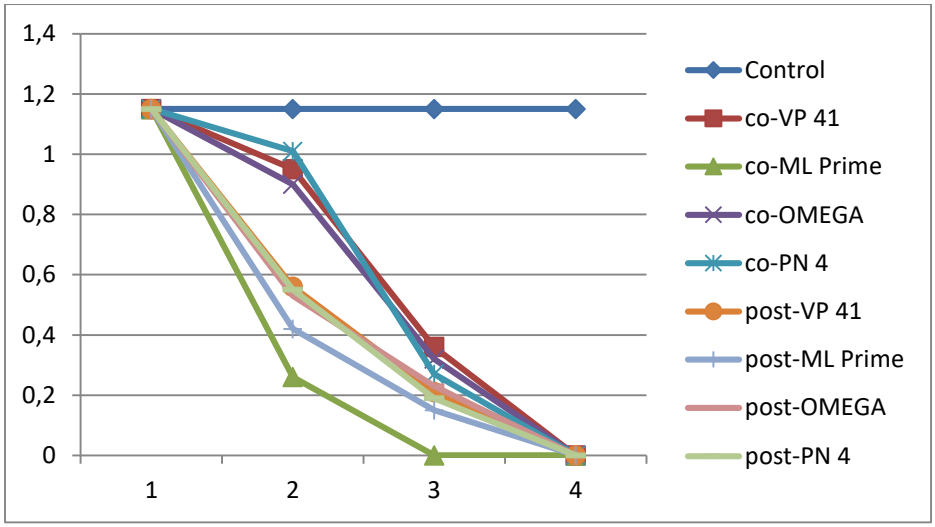

Figure 1. Decrease of L-malic acid with different malolactic strains

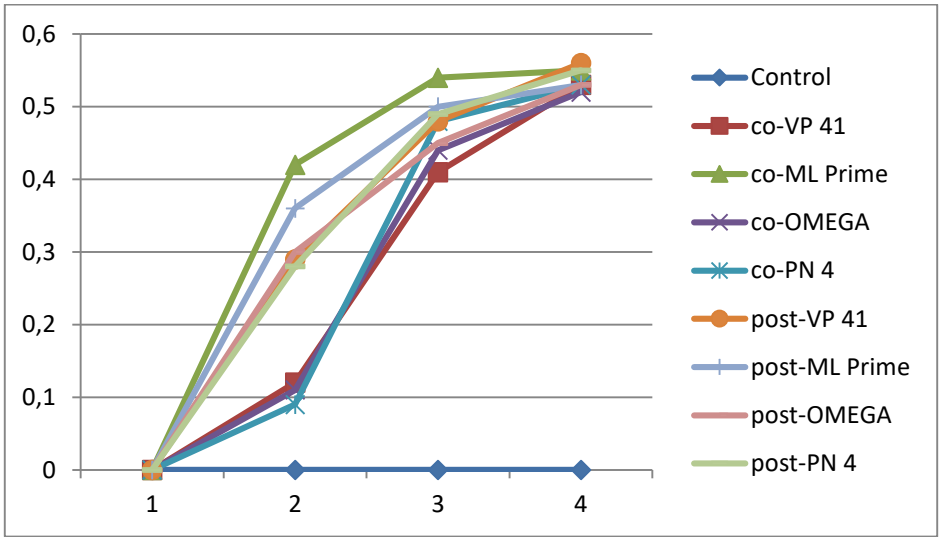

Figure 2. Increase of L-lactic acid with different malolactic strains

Sensory analyses of wine

The sensory descriptive analysis was performed according to the method of Ubigli (2004). Five wine experts were involved for the descriptive evaluation of the investigated wines. The panel proposed 11 descriptors for the final evaluation. All wine samples were evaluated during one tasting session. All the results of the tasting were statistically analyzed.

The 2017 Vranec wine from Gevgelija-Valandovo wine region were analyzed by sensory panelists (Figures 3 & 4) which highlights how these wines have been shaped during MLF driven by different selected wine bacteria strains. Figure 3 shows the results for the wines, which have been co-inoculated with lactic acid bacteria 24 hours after the yeast inoculation in the grape mash. Positive sensorial impact of the wine lactic acid bacteria strain O-MEGA has been noticed at the co-inoculated sample: the obtained wine had higher body and acidity, more red and black fruit balanced aromas compared to the other samples (Figure 3). It shows the potential of O-MEGA™ for keeping varietal aromas and increasing intensity of the same, as well as providing freshness on the Vranec wine made from high maturity grapes. The results were quite different as opposed to the control wine in which astringency and bitterness were

the dominant characteristics. In general, the co-inoculated wines have fruiter sensorial impact on the panelists due to the higher concentrations of fruity esters in the wines, which was observed and from other authors (Abrahamse, C. and Bartowsky, E. 2012; Bartowsky& Henschke, 2004).

From the sensorial description for sequential inoculation (Figure 4) it can be noticed that the lactic acid bacteria strain PN 4 brings more body, creaminess and more back fruit sensation to the wine. Again the control wine showed more astringency and bitterness than the wine sequentially inoculated with lactic acid bacteria. Overall the LAB strains showed positive sensory impact on the wines body, structure and harmony and lowered the herbal notes, thus improved the overall aroma of the wines.

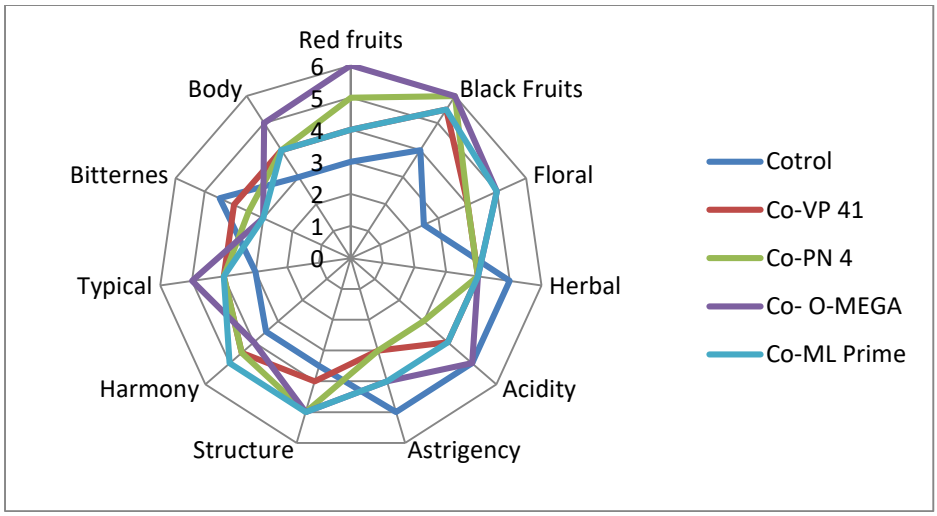

Figure 3. Sensory description of Vranec wine Co-inoculated with 4 selected wine lactic acid bacteria strains compared to a control wine without MLF

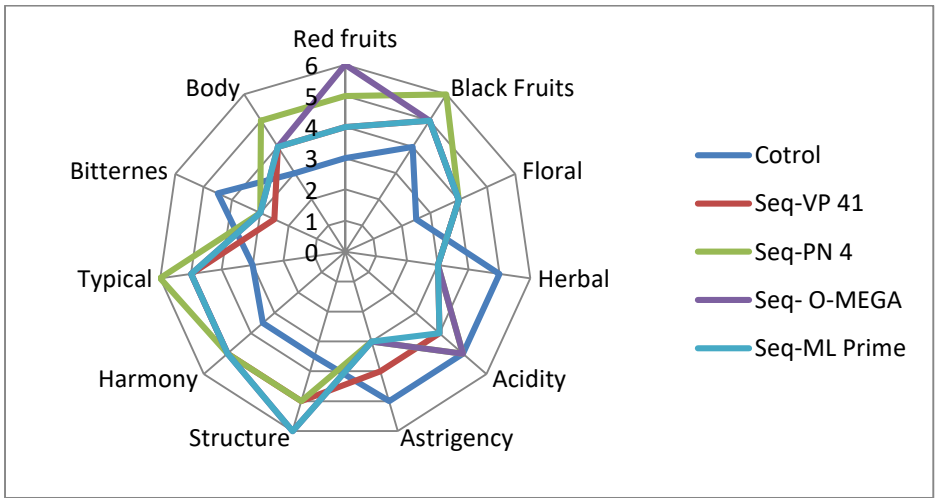

Figure 4. Sensory description of Vranec wine inoculated with 4 selected wine lactic acid bacteria strains after the alcoholic fermentation (sequentional) compared to a control wine without MLF

CONCLUSION

In this investigation the influence of timing of inoculation of four different lactic bacterias by co-inoculation during the fermentation and post-fermentation of Vranec variety was determined. VP 41, ML Prime, O-Mega and PN4 from Lallemand producer are commercially available lactic bacterias, used in malolactic fermentation (MLF) of wine

Vranec. The obtained results for Vranec wine from Gevgelija-Valandovo wine region have shown that the use of selected wine LAB strain can assure a fast and completed malolactic fermentation regardless of both MLF inoculation strategy. Co-inoculation resulted in higher aromatic profile, higher fruit intensity and lower herbal notes.

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