Impact of cluster thinning on Merlot and Cabernet Sauvignon (Vitis vinifera L.) must quality

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Impact of cluster thinning on Merlot and Cabernet Sauvignon (*Vitis vinifera* L.) must quality

Josip Mesić, Valentina Obradović, Helena Marčetić Brankica Svitlica, Ivan Malčić, Tomislav Soldo

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Abstract

The aim of this study is to present the influence of yield reduction on the chemical composition of must of black grapevine varieties (Merlot and Cabernet Sauvignon). The study was conducted in the vineyard and laboratory of the Polytechnic of Pozega in 2019. The thinning of the clusters was done prior to veraison the on set of the phenophase of the ripening of the grapes. Each shoot was left with one cluster, resulting in a 25% yield reduction in Cabernet Sauvignon and 34% in Merlot. Statistical analysis revealed that the ampelotechnical procedure had a significant effect on the average sugar content, total acids and pH value of Cabernet Sauvignon variety. Although the differences between the average values of the other parameters among the treatment are visible, they are not statistically significant. The analysis of the obtained paramatars shows that in 2019, under the given environmental conditions, the operation of thinning clusters on the cultivars in question was not justified.

Keywords: Merlot, Cabernet Sauvignon, Cluster thinning, chemical composition of must, Kutjevo vineyards

Introducton

Under the environmental conditions of the Slavonia sub-region (ZOI Slavonija), winegrowing zone C1 (Maletić et al. 2003), the operation of thinning grapes on black varieties (*Vitis vinifera* L.) Merlot and Cabernet Sauvignon plays an important role in achieving high quality grapes and wines. Thinning usually leaves one cluster on the shoot so that the cluster is cut with scissors in the upper part of the petiol (Mirošević and Karoglan Kontić 2008). Canopy management is generally viewed as positioning and maintaining bearing (growing) shoots and their fruit in a microclimate optimal for grape quality. Cluster thinning comprises the removal of whole or parts of inflorescence and fruit clusters to improve the microclimate of fruit zone and leaf area and fruit balance (Jackson 2014). Under the environmental conditions of the Slavonia sub-region (ZOI Slavonija), winegrowing zone C1, the operation of thinning grapes on black varieties (Vitis vinifera L.) Merlot and Cabernet Sauvignon plays an important role in achieving high quality grapes and wines. Targeted sugar content is around 100 ˚Oe. The second principal components in most fruits is the acids. Two main acids found in grapes are malic and tartaric, which together constitute over 90% of the acidity of the grapes (Bird 2014; Jackson 2014). For the majority wines, a range of between 5.5 and 8.5 g/L total acidity is desirable. White wines are typically preferred at the higher end of the scale, whereas red wines are preferred at the lower end a pH range of between 3.1 and 3.4 is suitable for most white wines, and between 3.3 and 3.6 for most red wines (Jackson 2014, Beslić 2016). Must acidity, an important element of enological, is essentially constittuted by tree acids: tartaric, malic and citric. They depending on the cultivar, the climate and grape maturity (Ribereau – Gayon 2006).

Clusters removing improve the quality of 'Riesling x Silvaner' berries, retaining 66% of the clusters per plant is recommended, because it generated the highest fruit production per area, mass of clusters and fruits, and total solid soluble content, as well as considerable values of total titratable acids and technical maturity index with a low pH value (Almanza-Merchán et. al 2011). Leaf removal and cluster thinning were carried out prior to veraison to evaluate the effects on berry quality of two *Vitis vinifera* cultivars (Cabernet Sauvignon and Ugni Blanc) in the Weibei Dryland of China in 2013 and 2014, and comprehensive analysis of the chemical and volatile composition in berries was performed. The results showed that content of soluble solids in both varieties was not affected while total acid was generally decreased by leaf removal and cluster thinning. The pH of berry juice was correspondingly higher in most treatment groups (Song et.al. 2018).

Material and methods

The research was conducted on the grapes of the vineyards of the Polytechnic of Pozega. The vineyard is located in the position of Gradina (Podgorje) in the Kutjevo Vineyard, the Slavonia wine-growing sub-region, the Slavonia region and the Croatian Danube region. The altitude is 350 m, it is a plantation of southern exposure and moderate inclinations, suitable for vineyard sites. The rows of the test plantation extend from north to south. The subject of the study are grapevine varieties of the vine Merlot and Cabernet Sauvignon, which were introduced to vineyards in the 1990s. Both cultivars were grafted on Kober 5BB in 2007. The training system is Guyot. The number of shoots per vine is 10, two of which are on the spur and the other eight are located on the cane.

The thinning of the clusters is a summer pruning that is usually done on the black cultivars of the plantation in order to continuously achieve the highest quality of grapes and wine. Although 2019 was ultimately dry and favorable during the ripening phase, heavy rainfall by June and July caused significant damage in many plantations due to the harsh conditions of protecting grapes from disease and pests.

The removal of the clusters was done at stage of fruit development (acording to BBCH scale berries beginning to touch - 77)by leaving one cluster per shoot. The experiment was set up according to a randomised block design for each cultivar with two treatments in four repetitions. The repetition consists of one gap of 8 vines. Between the two pillars in the row. The treatment labels are: MK - Merlot, control; MO - Merlot, cluster thinning; CSK - Cabernet Sauvignon, control and CSO - Cabernet Sauvignon, clusters removed.

During the harvest, on October 2, 2019, data were collected: cluster number per vine and yield per vine, average yield per vine and the average cluster weight. The extracted must was analyzed immediately after harvesting on Gibertini wineflow according to the manufacturers instructions for nitrogen compounds (α-amino and ammonium nitrogen) and total acidity and individual organic acids (tartaric, malic, lactic, citric). The results of the sugar content were measured on a Gibertini superalcomat hydrostatic balance. All data were processed variationally statistically.

Results and discussion

Tables 1 and 2 show the number of clusters and the average yield per vine in the vines undergoing cluster thinning treatment and in the control vines. The average yield of Merlot on vines where part of the clusters were removed was 34 lower, whereas for Cabernet Sauvignon the yield reduction per vine was 25% lower.

The average sugar content of the must of both cultivars is higher in the treatment with the cluster thinning, the total acidity is reduced while the pH is slightly increased in the grapevines with the removed clusters. Similar results are reported by other authors (Almanza Merchán et al. 2011; Jackson 2014; Song et al. 2018). The sugar content of Merlot's must is higher than 4,9% and is 103 ˚Oe, while for Cabernet Sauvignon (CSO) the sugar content is higher by 6,7% Climate conditions had a significant influence on the above-average warm and dry period after the operation in the grape ripening phase.

Table 1: Average number of clusters per vine, average yield per vine (g), average yield per hectare (kg/ha), Merlot 2019

	The number of clusters per vine	Average yield per vine (g/vine)	Average yield (kg/ha)
MK	10	1524	8992
MO	8	1098	6478

MK – Merlot - control = without cluster thinning, MO – Merlot = cluster thinning

Table 2: Average number of clusters per vine, average yield per vine (g), average yield per hectare (kg/ha), Cabernet Sauvignon, 2019.

	Number of clusters per vine	Average yield per vine (g/vine)	Average yield (kg/ha)
CSK	13	1569	9257
CSO	9,5	1170	6903

CSK – Cabernet Sauvignon - control = without cluster thinning, CSO – Cabernet Sauvignon = cluster thinning

Table 3: Average sugar content in must (°Oe), total acidity expressed as tartaric acid (g/L), pH of must, Merlot, 2019.

	Sugar (°Oe)	Total acidity (g/l)	pH
MK	98[a]	6,7[a]	3,50[a]
MO	103[a]	6,2[a]	3,66[a]

MK – Merlot - control = without cluster thinning, MO – Merlot = cluster thinning, [a,b] Values in the same column of the table marked with different letters are statistically different.

Table 4: Average sugar content in must (°Oe), total acidity expressed as tartaric acid (g/L), pH of must, Cabernet Sauvignon, 2019.

	Sugar (°Oe)	Total acidity (g/l)	pH
CSK	96 [a]	7,1 [a]	3,22 [a]
CSO	103 [b]	6,3 [b]	3,24 [b]

CSK – Cabernet Sauvignon - control = without cluster thinning, CSO – Cabernet Sauvignon = cluster thinning, [a,b] Values in the same column of the table marked with different letters are statistically different.

Table 5: Average content of tartaric, malic, lactic and citric acids in must (g/l), Merlot, 2019

	Tartaric acid	Malic acid	Lactic acid	Citric acid
MK	4,9[a]	1,7[a]	0,043[a]	0,018[a]
MO	4,2[a]	1,9[a]	0,045[a]	0,020[a]

MK – Merlot - control = without cluster thinning, MO – Merlot = cluster thinning, [a,b] Values in the same column of the table marked with different letters are statistically different.

Table 6: Average content of tartaric, malic, lactic and citric acids in must (g/l), Cabernet Sauvignon, 2019.

	Tartaric acid	Malic acid	Lactic acid	Citric acid
CSK	5,8[a]	2,4[a]	0,029[a]	0,06 [a]
CSO	4,9[a]	2,6[a]	0,031[a]	0,04 [b]

CSK – Cabernet Sauvignon - control = without cluster thinning, CSO – Cabernet Sauvignon = cluster thinning, [a,b] Values in the same column of the table marked with different letters are statistically different.

Tables 5 and 6 show the average values of the most represented organic acids in must. Although the differences between the average values of tartaric and malic acid are not statistically significant, it can be seen that in the case of vine varieties with reduced yield, the tartaric acid content is smaller and that of males slightly higher compared to the grapevines with full yield. Significant differences caused by the removal of the clusters were found in Cabernet Sauvignon cultivars in the parameters of sugar content, total acidity and pH. The average sugar content is higher with CSO treatment while the content is acidic and pH lower than CSK treatment. is 5 ˚Oe and is 103 ˚Oe, while for Cabernet Sauvignon (CSO) treatments the sugar content is higher by 6,7%. On all parameters were significant influence on the above-average warm and dry period during the grape ripening.

Conclusion

Taking into account the favorable climatic conditions during the grape ripening period in the year of the experiment, differences in the tested parameters do not represent a significant shift in improving the quality of the grapes, although the differences in individual parameters are significant. For a complete picture of the success of the experiment itself, research should be extended to the final product (wine).

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Utjecaj prorjeđivanja grozdova kultivara Merlot i Cabernet Sauvignon (*Vitis vinifera* L.) na kakvoću mošta

Sažetak

Cilj rada je prikazati u utjecaj redukcije uroda na kemijski sastav mošta crnih kultivara vinove loze (Merlot i Cabernet Sauvignon). Istraživanje je provedeno u vinogradu i laboratoriju Veleučilištu u Požegi tijekom 2019. godine. Prorjeđivanje grozdova obavljeno je pred početak fenofaze dozrijevanja grožđa. Na svakoj rodnoj mladici ostavljen je po jedan grozd iz čega proizlazi da je urod reduciran za 25% na kultivaru Cabernet sauvignon odnosno 34% na kultivaru Merlot. Statističkom obradom podataka utvrđeno je da je provedeni ampelotehnički zahvat imao značajan utjecaj na prosječni sadržaj šećera, ukupnih kiselina i pH vrijednost kod kultivara Cabernet Sauvignon. Iako su vidljive razlike među prosječnim vrijednostima ostalih parametara među tretmanima one nisu statistički značajne. Analizom dobivenih paramatara može se reći da u 2019. godini u danim okolinskim uvjetima nije bio opravdan zahvat prorjeđivanja grozdova na predmetnim kultivarima.

Ključne riječi: Merlot, Cabernet Sauvignon, prorjeđivanje grozdova, kemijski sastav mošta, Vinogorje Kutjevo