INFLUENCE OF PARTIAL DEFOLIATION AND HARVEST TIME ON AMPELOGRAFIC CHARACTERISTIC OF CABERNET SAUVIGNONE GRAPE

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ABSTRACT

Research carried out in vineyard of King Peter I Karadjordjevic-Royal Winery at Oplenac-Topola municipality. Vineyard is planted in 2006 year and cover area of 3.70 ha, at altitude of 250 m. Geographically positioned at GPS coordinates N 44° 14' 4" and E 20° 41' 15". Training system is single Gijot cordon. Defoliation included control (no defoliation) and treatments with 4 and 8 removed leaves. Grapes is tested at full maturity and at late harvest. For most parameters, greater variations were observed between the two harvesting period whereby the later harvest recorded lower values. Through three treatment experiment (control, 4 and 8 removed leaves) highest values are detected in control. With increased number of removed leaves values of research parameters decresed. By statistical analisys is founded significant impact of variety, harvest time and the treatments.

INTRODUCTION

Cabernet Sauvignon is one of the most widespread red grape cultivar and grown in the 43 world countries with participation with 68.2% of the total assortment (about 250,000 ha). Sauvignon Blanc is grown in 31 world countries with participation with 49.2% in total assortment (60,000 ha). Statistics show that percentage of Cabernet Sauvignon grown areas on in the total cultivated assortment of the world takes the first place and Sauvignon Blanc fourth (Fregoni, 2010).

Defoliation as amphelotechnical technique had multiple benefits: improving brightness in VSP in clusters zone, improving aeration which improves microclimate, grape maturation is better, better berry skin coloration and less degree present of disease. Under the conditions of Serbia is usually done at veraison, 20-30 days to harvest grapes (Nakalamic and Markovic, 2009).

Effect of partial defoliation on yield and grapes quality depends of removed leaf number and growth stages during which is done defoliation. Based on growth stages when is done can be done before flowering or after at fruit set berries (early defoliation) or at veraion (late defoliation). Early defoliation (removing most of leaves) causing photosynthetic shock which stoped transport of quantities asimilatives in formed inflorescences. As a result is forming of smaller berries number, struggly clusters, lower fertility, smaller berries, reduced disease risk and increase percent of berry epidermis (Poni et al., 2006; Sabbatini, 2010).

In order to achieve positive defoliation effects it is necessary to observed time and number of removed leaves. With removing 15-25% leaves at 20-30 days before harvesting positive effects are very evident, especially with oldest leaves removing, which have a

reduced photosynthetic activity, while younger leaves remain on the main shoot, leaves and lateral shots which are photosynthetically most active (Keller, 2010).

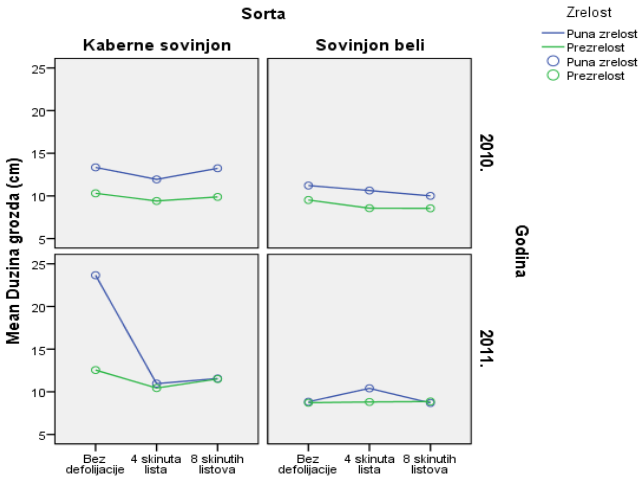
MATERIALS AND METHODS

Vineyard with Sauvignon white planted in 2004 geographically located at the GPS coordinates N 44° 14' 4" and E 20° 41 '15", Cabernet Sauvignon vineyard is planted in 2006 geographically located at the GPS coordinates N 44° 14' 35" and E 20° 41' 22". In both vineyards is presented row spacing of 2.70 m between vines and 1.0 m in row. Training system is characterized with trunk height of 90 cm at which applies pruning by Guyot. All experimental vines are uniformly pruned were allowed one arc with 8 buds and one spur with two buds. Grapes were analyzed in laboratory of Department of Viticulture, Faculty of Agriculture, University of Belgrade. Harvest is done twice, at full maturity and 15 days later. Bunch length is determined by measuring with ruler and cluster mass and average berries mass in cluster are determined by measuring at balance, while the average number of berries was determined by counting. To analyze of data using the triple factorial ANOVA, is doone in software IBM SPSS Statistics 20 (Statistical Package for the Social Sciences), Chicago, IL, USA.

RESULTS

1. Clusterlength (cm)

Clusterlength in bothyearsvariedaccording to differentvarieties and treatments of experiment. In 2010. Cabernet sauvignonindicatedandecreaseclusterslength per treatment. Largervariationswasbetweentwoterms of harvest, where in latervintagerecorded a smallerclusterlength in alltreatments (graph 1). Sauvignonblanc in 2010. wereregisteredreducing of clusterlengthwithnumber of removed leaves and laterharvest. Thesmallerclusterlength has beendetected at laterharvest. In bothharvestterms control hadthehighervalues of clusterlength, thistrendiscontinuing in treatmentwithfour removed leaves and at theend in treatmentwitheight removed leaves in whichisrecordedthelowestvalues.



Graph 1. Clusterlength (cm)

In 2011. the maximum cluster length at Cabernet sauvignon has been detected in control (23.66 cm). Values of Sauvignon blanc had same tendency of variation were the biggest differences found for treatment with four leaf removed in both terms of harvest.

By triple factorial ANOVA was determined for 2010. statistically significant influence of main effects: cultivar and harvest time on bunch length. In 2011. cluster length not affected significantly by one of the major factors (variety, harvest time and treatment) and also there was not interaction between the main effects on bunch length (table 1).

Table 1.

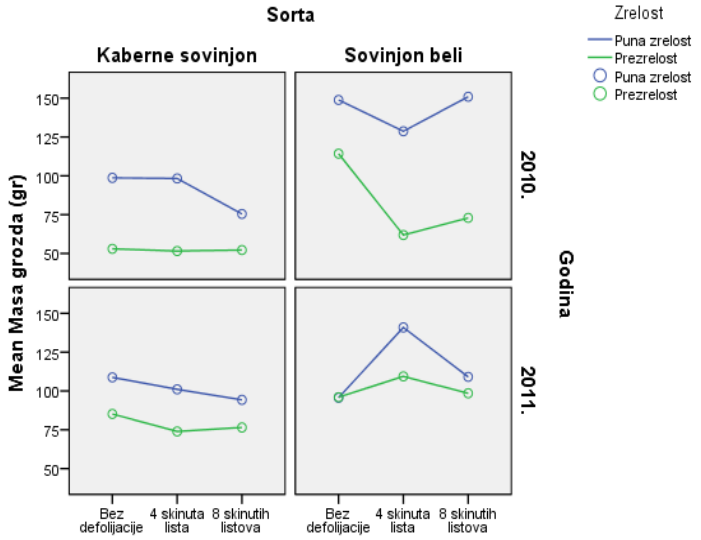
ANOVA forclusterlength

Year	Source of variation	df	Variance	F	p value
2010.	Cultivar	1	77,329	32,483	0,000
	Harvest	1	166,923	70,118	0,000
	Treatment	2	9,780	4,108	0,019
	Cultivar * Harvest	1	11,365	4,774	0,031
	Cultivar * Treatment	2	3,775	1,586	0,210
	Harvest * Treatment	2	0,029	0,012	0,988
	Cultivar*Harvest * Treatment	2	1,304	0,548	0,580
2011.	Cultivar	1	578,778	5,477	0,021
	Harvest	1	145,949	1,381	0,242
	Treatment	2	144,080	1,363	0,260
	Cultivar * Harvest	1	85,920	0,813	0,369
	Cultivar * Treatment	2	189,933	1,797	0,171
	Harvest * Treatment	2	90,131	0,853	0,429
	Cultivar*Harvest * Treatment	2	109,924	1,040	0,357

2. Clustermass (g)

Duringbothinvestigationyearsthehighestvariationswasfound in 2010., comparingharvest time at full maturity and laterharvest. Largerclustermassnoted at full maturitywhilefrom late harvestwerebunchweightwaslower. Cabernet Sauvignon in 2010. at full maturitynotedlessvariationbetween control and treatmentwithfour removed leaf (98.3-98.7 g), in treatmentwitheight removed leafclustermasswas 75.44 g. In laterharvestrecordedlargevariation, clustermassvariedbetween 51.6-53.0 g.

Sauvignonblanc in 2010. hadlargerclusterscompared to Cabernet sauvignon in bothterms of harvest. Alsorecordedlargervariation at harvest and treatmentexperiment. At full maturitylargestclustermasswasobtained in thetreatmentwitheight removed leaves (150.9 g), decreasewasrecorded in the control (148.86 g) and treatmentwithfour removed leaf (128.7 g). In a laterharvestthemaximumweightwasobtained in the control (114.3 g). Clustersmasswassignificantlylower (61.90-71.90 g) in treatmentwithfour and eight removed leaves.



Graph 2. Clustermass (g)

In 2011. Cabernet Sauvignon in bothharvestingtermshadthebiggestcluster in control (108.76-85.18 g), clustermassdecreasedwithtreatmentexperiment. Minimummassclustersrecorded in thetreatmentwitheight removed leaves.

Table 2.

ANOVA forclustermass

Year	Source of variation	df	Variance	F	p value
2010.	Cultivar	1	51387,755	69,986	0,000
	Harvest	1	72518,375	98,765	0,000
	Treatment	2	4029,881	5,488	0,005
	Cultivar * Harvest	1	3384,063	4,609	0,034
	Cultivar * Treatment	2	3465,534	4,720	0,011
	Harvest * Treatment	2	706,366	0,962	0,385
	Cultivar*Harvest * Treatment	2	2717,112	3,701	0,028
2011.	Cultivar	1	10058,599	26,862	0,000
	Harvest	1	10137,489	27,072	0,000
	Treatment	2	1599,864	4,272	0,016
	Cultivar * Harvest	1	593,408	1,585	0,211
	Cultivar * Treatment	2	3768,040	10,063	0,000
	Harvest * Treatment	2	911,296	2,434	0,093
	Cultivar*Harvest * Treatment	2	504,226	1,347	0,264

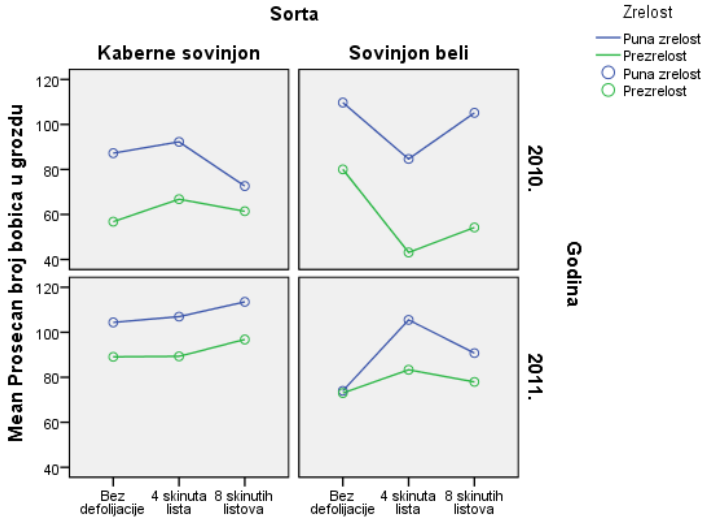
Sauvignonblancnotedsameclusterweight in control at bothharvestterms. Thebiggestvariationswererecorded in treatmentwithfour removed leaf, and at thesame time itwaslargestclustermass (140.92-109.41 g) compared to the control and treatmentwitheight removed leaves. Treatmentwitheight removed leaveshadlargerclusters in control (graph 2).

Triple factorial ANOVA showedthat in 2010., variation of clustermasssignificantlyinfluencedbyvariety, harvest time and treatment. Thesefactorshavetakeneffectindividually, interactioneffects of some of mainfactorswasnotstatisticallysignificant. In 2011, isdeterminedeffect of variety and harvest time, whenit comes to interaction of themainfactorsdeterminedeffect of variety * treatment (table 2).

3. Averageberriesnumber in cluster

Averageberriesnumber in 2010, hadoppositevariationtrendforbothcultivars (graph 3). Thehighestaverageberriesnumber in bothharvestterms at Cabernet Sauvignonwasobserved in treatmentwithfour removed leaf (92.28 and 66.78). Control and treatmentswitheight removed leaveshavesmallernumberberries. Independently of reatmentexperiment, harvestterms, can be concludedthat at full maturityfoundedlargerberriesnumbercompared to late harvest.

Sauvignonblancnotedoppositevariationtrendcompared to Cabernet sauvignon. Thelowestaverageberriesnumberwasobserved in treatmentwithfourleaf removed whichis at full maturitystood 84.65 and 43.12 at a laterharvest. Thehighestaverageberriesnumberwasobserved in control in bothterms of harvest (109.72 and 80.02), whilethetreatmentwitheight removed leaves at full maturityrecordedsmallerberriesnumber (105.16), and at a laterharvestevensmallerberriesnumber (54,20).



Graph 3. Averageberriesnumber in cluster

Table 3.

ANOVA analysisforberriesnumber in cluster

Year	Source of variation	df	Variance	F	p value
2010.	Cultivar	1	1317,050	2,718	0,102
	Harvest	1	29869,963	61,636	0,000
	Treatment	2	1612,507	3,327	0,040
	Cultivar * Harvest	1	2525,878	5,212	0,024
	Cultivar * Treatment	2	3980,918	8,215	0,000
	Harvest * Treatment	2	31,374	0,065	0,937
	Cultivar*Harvest * Treatment	2	1035,516	2,137	0,123
2011.	Cultivar	1	7602,118	24,390	0,000
	Harvest	1	6104,992	19,587	0,000
	Treatment	2	1467,762	4,709	0,011
	Cultivar * Harvest	1	157,048	0,504	0,479
	Cultivar * Treatment	2	1132,600	3,634	0,030
	Harvest * Treatment	2	348,329	1,118	0,331
	Cultivar*Harvest * Treatment	2	223,259	0,716	0,491

In 2011. Cabernet Sauvignon noted is in both harvest terms, increasing average berries number with increase of removed leaves. The minimum number of berries was observed in control, and the largest in the treatment with eight removed leaves.

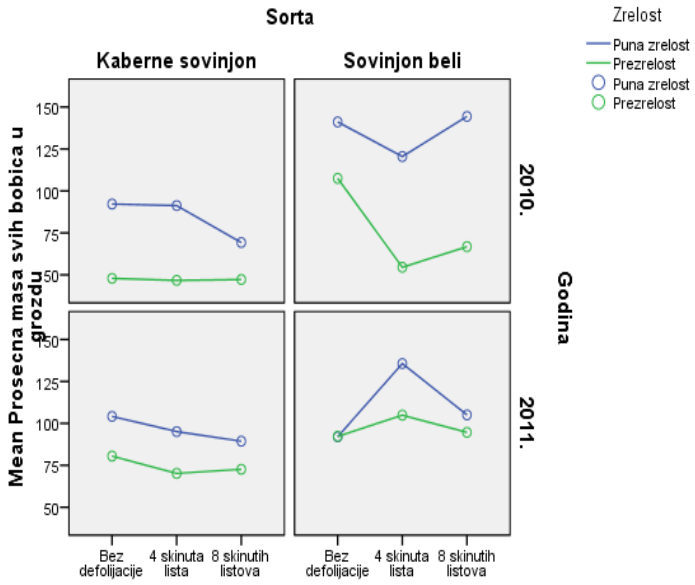
Sauvignon blanc had tendency to vary the average number of berries like Cabernet Sauvignon in the previous year. The largest number of berries was observed in treatment with four removed leaves (105.52 and 83.34) while the control and treatment with four removed leaf were is noted the smallest average number of berries in a cluster.

Statistical analysis of data using triple factorial ANOVA showed that average berries number in 2010. varied under the influence of maturity (table 3). Also, there was a statistically significant effect of interaction variety*treatment. In 2011, the main effects of the studied factors on the average berries number were significantly influenced by cultivar and harvest time (graph 3).

4. Averageberriesmass in cluster (g)

Cabernet Sauvignon in 2010 hade largerberriesmass in cluster at full maturity At full maturityrecordedthelargestmass of berries of 92.20 g, withincreasingnumber of removed leavesdecreasemass to 69.24 g (eight removed leaves). Withsecondharvest, therewas a significantreduction in berriesclusterweight, whichrangedfrom 46.70-47.90 g. In a laterharvestnoticeablylessvariation in berriesclusterweight (graph 4).

Sauvignonwhiteshowedsignificantlylargervariationbetweentwoharvestterms and treatments. At full matureberriesweight in cluster in control and treatmentwith removed eightleaveswasalmostsamewithminorvariations (141.10-144.40 g), to treatmentwithfour removed leavesberriesmass in clustersignificantlydecreased (120,5 g). In a laterharvest has beenevidentthefurther decline of values. The control notedlessvariationcomparingwith control from full maturity (107.50 g), berriesmass in clusterdecreasedwithtreatment (54.50 g four removed leaf and 66.80 g eight removed leaves.



Graph 4. Averageberriesmass in cluster(g)

Table 4.

ANOVA analysisberriesmass in cluster

Year	Source of variation	df	Variance	F	p value
2010.	Cultivar	1	48114,068	69,304	0,000
	Harvest	1	69175,211	99,641	0,000
	Treatment	2	4032,176	5,808	0,004
	Cultivar * Harvest	1	3661,418	5,274	0,024
	Cultivar * Treatment	2	3596,886	5,181	0,007
	Harvest * Treatment	2	691,744	0,996	0,373
	Cultivar*Harvest * Treatment	2	2745,261	3,954	0,022
2011.	Cultivar	1	10545,938	30,297	0,000
	Harvest	1	9406,667	27,024	0,000
	Treatment	2	1401,886	4,027	0,021
	Cultivar * Harvest	1	493,494	1,418	0,236
	Cultivar * Treatment	2	3576,397	10,274	0,000
	Harvest * Treatment	2	775,286	2,227	0,113
	Cultivar*Harvest * Treatment	2	557,480	1,602	0,206

Duringthe 2011. Cabernet Sauvignonhad in thebothtermsdecreaseaverageberriesmass in clusterbyexperimenttreatmentswherebyvariation in a single harvestwasminimal. Sauvignonblanchadthelargestvariation in treatmentwithfour removed leaf. Theleastvariationwasnoted in control, and then in treatmentwitheight removed leaves.

Statisticalanalysis shows that in bothyearsvariation of berriesmass in clusterwasunderinfluence of variety and harvest time. In 2010. inapart to influence of themainfactors (variety and harvest time) determinedeffect of treatmentbutalso trial of variety*harvest time*treatment. In 2011. determinedeffect cultivar*treatment (table 4).

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CONCLUSIONS

Based on results can be make following conclusions:

- Cluster length in later harvest was lower compared to full maturity. With increasing removed leaf number cluster length of both cultivars was lower.
- Bunch weight was higher in full maturity. For Cabernet sauvignon, decrease with increasing removed leaves number and for Sauvignon blanc had large variations in treatment with four removed leaves.
- The average berries number in cluster for both sorts had opposite trend. In 2010. average berries number declined with increasing number of removed leaves at Cabernet Sauvignon, while in 2011. determined opposite variation trend. Sauvignon blanc in 2010. the lowest average berries number cluster had in treatment with four removed leaves, while in 2011. In same treatment determined the highest number of average berries number in a cluster.
- Average berries weight in cluster had a similar trend among treatments as experiment by the average berries number in cluster.

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