

## GRAPE YIELD AND QUALITY OF WHITE WINES VARIETIES IN THE BELGRADE AREA

**Slavica Todić, A. Nakalamić and N. Marković\***

**Abstract:** In the period 1997 - 1999 comparative researches of the white wine varieties were conducted, viz. Smederevka, Italian Riezling, Riezling weisser (clone 239 Gm), Sauvignon white, Pinot blanc and Chardonnay (clone R8). In the first three years of the growing fertility of these varieties, their main biological characteristics and grape quality could be determined. Variety Smederevka reached the highest yield (1.23 kg/m<sup>2</sup>), whereas other tested varieties demonstrated lower rates of yield, but at the same time higher grape quality.

**Key words:** variety, clone, fertility, grape yield, sugar, acids.

### Introduction

In agroecological conditions of the Belgrade Danube Basin grape vine has been grown for ages, as we can conclude from paleontological findings in Vinča and Grocka. The Danube, being a large river offers specific favourable microclimatic conditions for growing a wide range of different varieties. The most common ones are Smederevka, Plovdina and Prokupac, Muscate Hamburg and Afuz Ali. However, for some twenty years other varieties like Italian Riezling, Vranac, Cardinal, Vineyard Queen, Gročanka, Demir Kapija, Muscate Italy, etc. have been grown. On the territory of the School Property "Radmilovac" in Vinča, belonging to the Faculty of Agriculture, in the last fifty years more than three hundred introduced varieties have been studied, of which fifty have been zoned for growing in the vineyards of Serbia. The results of these studies were reported by Avramov

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et al. (1991,1992), Tadijanović et al. (1995), Sivčev (1996), Vujović (1997), Žunić et al. (1998,1999).

After the renovation of the vineyard in 1994 studies on domestic introduced varieties and clones in the young vineyard were continued. The results were published in the studies of Nakalamić and associates (1996, 1997, 1998, 1999, 2000).

This paper will present results of studies on grape fertility and quality of the most important varieties for high quality (Smederevka) and top quality white wines (Italian Riezling, Riezling weiser - clone 239 Gm, Sauvignon white and Chardonnay - clone R8) in the period of their growing fertility, i.e. from the fourth to the sixth year of vineyard's age.

### Material and Method

The experimental seed plot was raised in 1994 at the Experimental School Property "Radmilovac" belonging to the Faculty of Agriculture in Zemun. The distance of sowing was 3 x 1 m, with two rows support, and the training system was "double-branched asymmetrical cordone" (Nakalamić, 1991), the tree being 90 cm high.

In the study period, climatic conditions were favorable for the growth and development of the tested varieties, which can be seen from the following data:

	1951/99	1996	1997	1998	1999
- average annual temperature in °C	10.8	10.9	10.6	11.6	-
- average vegetative temperature in °C	16.5	17.1	16.1	17.6	17.9
- annual precipitation quantity in mm	659	732	769	627	-
- precipitation in vegetative period in mm	428	459	569	441	658

The most severe frost was in December 1996 and it was -16.3 °C. Soil at the experimental parcel is brown forest soil (Cambisol) and it has favorable physical and chemical characteristics. In the study years, standard ampelotechnique was used.

All tested varieties were planted on the same parcel, its surface being around 2 ha. Rootstock was Kober 5BB.

30 experimental grape vines were singled out by random selection. The following indices of grape fertility and quality were tested:

- number of buds left on the grape vine after pruning,
- number of developed and fertile shoots,
- number of grapes per bud left, developed and fertile shoots and grape vine,
- grape mass,
- grape yield per bud, shoot, grape vine and hectare,
- contents of sugar and total acids in the unfermented grape juice.

Standard ampelographic techniques were used. Data were processed by applying the variance analysis and Lsd test for the estimation of the significance of differences shown in the experiment.

## Results and Discussion

### Growth and development of grape vines

Number of buds left on the grape vine after pruning varied depending on the variety and vegetative potential of the grape vine with the tested varieties each year. Obtaining the training system of "double-branched asymmetrical cordone" lasted from the fifth year of vineyard's age, i.e. from 1994 to 1999. Year after year, the number of buds left increased in order to obtain the wanted form of the tree. In 1997 the number of buds varied from 9.5 (Smederevka) to 21.7 (Pinot Blanc). In 1998 and 1999 the number of buds reached values of normal loading of grape vines with fertile buds, varying from 15 (Smederevka) to 31.2 buds (Sauvignon white). On average, for the period 1997 - 1999, loading of grape vine with fertile buds amounted from 14.23 in Smederevka to 26.13 in Italian Riezling.

The appropriate method of pruning was used for each variety. With Smederevka "short" pruning was used, spurs of 2 and 4 buds. With other varieties mixed pruning was used with arches of 8 to 10 buds and spurs of two buds.

The number of shoots depended on the number of buds left. On average on the grape vines, 13 to 25 shoots developed, i.e. from 88.2% to 97.2% of the number of buds left. With developed shoots from 87.7% to 91.8% were fertile ones. The most favourable percent of fertile shoots was in the variety Smederevka, whereas the least favourable was in the variety Riezling weiser. On the basis of these data, we can conclude that the growth and development of shoots as well as their fertility depended on the biological characteristics of the tested varieties. Weather conditions showed no significant impact, since there were no severe frosts and winter killing of buds.

### Fertility and cluster mass

Buds fertility, expressed through the number of developed clusters per bud, shoot and grape vine (tab.1) varied considerably between the varieties and study years. On average, from 1.23 (Sauvignon white) to 1.45 (Smederevka) clusters per bud were left developed. From 1.32 (Sauvignon white) to 1.54 (Smederevka) clusters per shoot and from 1.46 (Sauvignon white) to 1.68 (Smederevka and Riezling weiser) clusters per fertile shoot developed. On the basis of these results, we can conclude that the variety Smederevka stands out for the fertility of its buds and shoots. However, if we analyze the number of clusters per grape vine, we can see that it depended on the total number of buds left and developed shoots per grape vine. The smallest number of clusters developed on the grape vines Smederevka (20.7), while the greatest number was on the grape vines of the varieties Chardonnay, Riezling weiser and Italian Riezling, these varieties being loaded with the greatest number of buds after pruning (34.4 - 35.4).

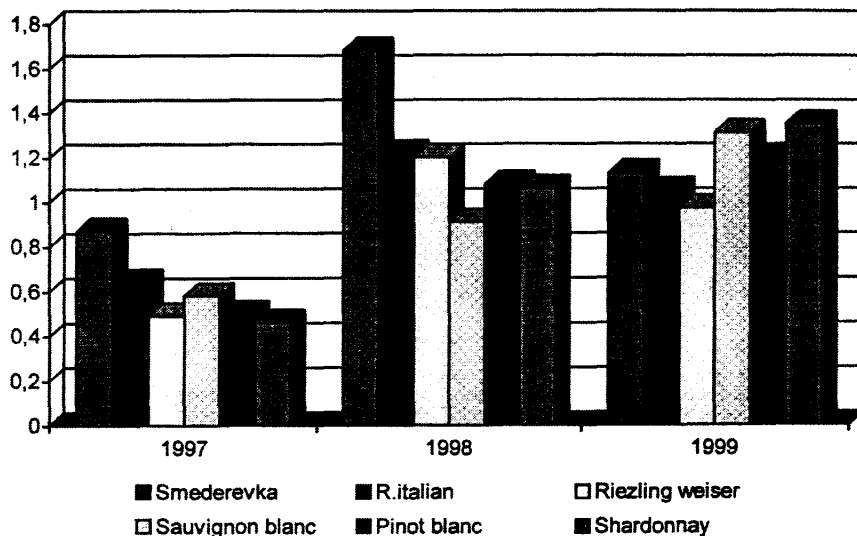
Grape mass varied from 66.85 g (Riezling weiser) to 186.34 g (Smederevka). It can be concluded that the clusters in each year were partly infected by gray decay. As a result, somewhat lower grape mass, approx. 10-20%, with regard to the variety characteristics and growing conditions was obtained, which was especially evident in the variety Riezling weiser (239 Gm).

### Grape yield

Grape number and mass varying also influenced grape yield varying of the tested varieties. On average, grape yield per grape vine varied from 2.46 kg (Riezling weiser) to 3.68 kg (Smederevka). Calculated per hectare, average yield was 8.9 to 12.3 t, which may be considered as a fairly satisfactory yield for the first three years of growing fertility of these varieties. Yields varying between years much greater than between varieties, as a result of the number of buds gradual increase after pruning from year to year for the purpose of forming the grape vine training system. The first yield was in the third year of grape vine's age (1996) and it varied from 3.6 to 6.3 t. In the period 1997 - 1999 grape yield increased from year to year together with the increase of the number of buds left after pruning, which is clearly seen in graph. 1. The lowest yield varying between the years was in the variety Italian Riezling (Cv 25.2%), and the greatest was in the variety Chardonnay (Cv 39.4%). Differences between varieties in the obtained yield per hectare had no statistical significance. If we observe the

Tab. 1. - Grape yield and quality (1997-1999)

Index	Smederevka	Riezling Italian	Riezling weiser	Sauvignon white	Pinot blanc	Chardonnay
Number of buds/grape vine	14.23	26.13	25.10	24.93	25.37	25.33
Number of developed shoots/grape vine	13.43	25.40	23.30	23.23	22.33	22.53
% of developed shoots/grape vine	94.4	97.2	92.8	93.2	88.2	88.9
Number of fertile shoots/ grape vine	12.33	23.17	20.43	20.93	20.27	20.63
% of fertile shoots/ grape vine	91.8	91.2	87.7	90.1	90.8	91.6
Number of cluster/bud	1.45	1.35	1.37	1.23	1.24	1.36
Number of cluster/shoot	1.54	1.39	1.48	1.32	1.41	1.52
Number of cluster/fertile shoot	1.68	1.53	1.68	1.46	1.56	1.67
Number of cluster/vine	20.70	35.37	34.4	30.6	31.53	34.37
Average cluster mass	186.34	83.01	66.85	90.66	85.46	81.84
Yield per bud (g)	258.6	113.4	98.0	111.9	109.2	114.9
Yield per vine (kg)	3.68	2.91	2.46	2.79	2.77	2.91
Yield per m <sup>2</sup> (kg)	1.23	0.97	0.89	0.93	0.92	0.95
Cv (%)	27.5	25.2	33.4	32.0	32.8	39.4
Lsd <sub>0.05-0.01</sub>			0.6749 - 0.9462			
Sugar in grape juice (%)	16.0	19.7	20.3	22.0	22.1	21.5
Cv (%)	10.4	16.2	5.6	2.2	8.1	5.8
Lsd <sub>0.05-0.01</sub>			3.9002 - 5.4681			
Acids (g/l)	9.74	5.77	8.48	7.55	7.41	7.90



Graph. 1. - Grape yield per m<sup>2</sup> (kg)

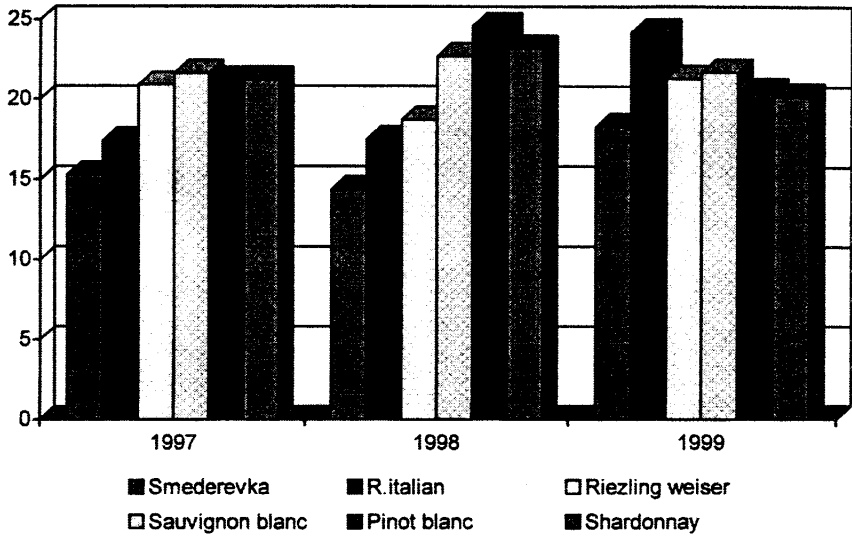
achieved grape yield per bud left, we may conclude that the most productive buds are in the variety Smederevka (258.6 g/bud), whereas in other varieties buds productivity decreases as follows: Chardonnay (114.9 g/bud), Italian Riezzling (113.4 g/bud), Sauvignon white (111.9 g/bud), Pinot blanc (109.2 g/bud) and Riezzling weiser (98.0 g/bud).

### Grape quality

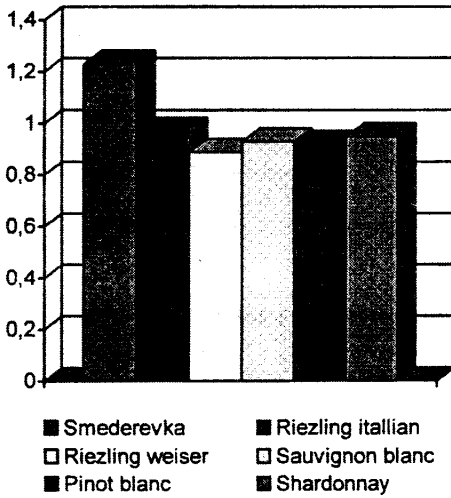
Grape quality will be estimated on the basis of sugar contents and total acids in the unfermented grape juice.

Sugar contents in the unfermented grape juice varied significantly, depending on the variety and conditions each year. The highest sugar contents in the unfermented grape juice was obtained in 1999 (18.3% do 24.2%), and the lowest in 1997 (15.3% to 21.6%). On average, during the experimental period, sugar contents varied from 16.0% in the variety Smederevka to 22.1% in the variety Pinot blanc (Tab. 1, graph. 2). Much higher sugar contents were obtained in the unfermented grape juice of the varieties Riezzling weiser, Chardonnay, Sauvignon white and Pinot blanc than in Smederevka.

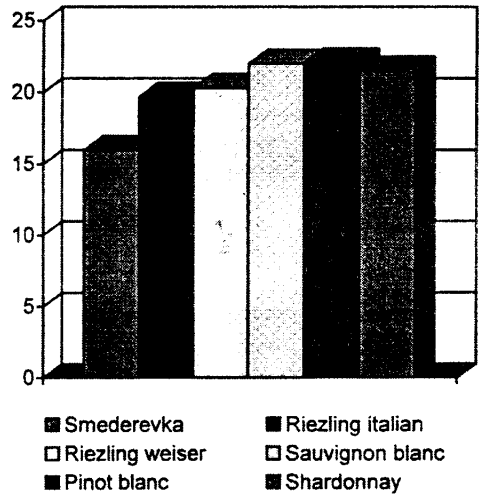
Negative dependence was evident (graph. 3 and 4) between average grape yield and sugar contents in the unfermented grape juice. On average, total acids contents in the unfermented grape juice varied from 5.87 g/l in Italian Riezzling to 9.74 g/l in variety Smederevka. Negative dependence was also shown between sugar contents and total acids in the unfermented grape juice.



Graph. 2. - Sugar contents in grape juice



Graph. 3. - Average grape yield in kg/m² (1997 - 1999)



Graph. 4. - Average sugar contents (%) (1997 - 1999)

## Conclusion

Based on the comparative research of grape fertility and quality of the white wines varieties - Smederevka, Italian Riezling, Riezling weiser, Sauvignon blanc, Pinot blanc and Chardonnay, conducted in the period of growing fertility, from the fourth to the sixth year of vineyard's age, the following conclusions may be drawn:

- In the study period (1997-1999) in the area of Radmilovac, climatic and soil conditions were favourable for the growth and development of the tested varieties. There were no severe frosts and winter killing of buds and shoots.

- Fertility of buds and shoots, yield and grape quality varied, depending on the variety and weather conditions in each year. Together with the formation of grape vine training system, the number of buds left per grape vine was increased, which influenced the increase of the number of clusters and grape yield. The variety Smederevka stands out for its fertility shown in this experiment. The lowest fertility was shown by the variety Riezling weiser for its sensitivity to gray decay of grapes. High quality white wines varieties showed greater fertility, while the top quality white wines varieties showed higher grape quality. All the tested varieties showed specific biological variety characteristics in the area of Radmilovac and can be recommended for the cultivation in the conditions of vineyards of Gročani, as well as other vineyards in Serbia where agroecological conditions for their growth and development are favourable.

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## PRINOS I KVALITET GROŽĐA SORTI ZA BELA VINA U PODRUČJU BEOGRADA

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### Rezime

U periodu 1997 - 1999. godine obavljena su uporedna ispitivanja sorti za bela vina - smederevka, rizling italijanski, rizling rajnski (klon 239 Gm), sovinjon beli, burgundac beli i šardone (klon R8) u periodu njihove rastuće rodnosti, odnosno od četvrte do šeste godine starosti vinograda.

Eksperimentalni zasad, na kome su obavljena istraživanja, je podignut 1994. godine na Oglednom školskom dobru "Radmilovac", Poljoprivrednog fakulteta u Zemunu. Razmak sadnje iznosi 3 x 1 m, naslon je špalirski, a uzgojni oblik je "dvokraka asimetrična kordunica" (Nakalamić, 1991), visina stabla 90 cm.

U prve tri godine rastuće rodnosti ovih sorti, ispoljene su njihove osnovne biološke osobenosti i kvalitet grožđa. Najveći prinos ostvarila je sorta smederevka dok su ostale ispitivane sorte ostvarile niži prinos ali bolji kvalitet grožđa.

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Na osnovu uporednih ispitivanja rodnosti i kvaliteta grožđa belih vin-  
skih sorti - smederevka, rizling italijanski, rizling rajnski, sovinjon beli, bur-  
gundac beli i šardone, koja su obavljena u periodu rastuće rodnosti, može se  
istaci sledeće:

- U periodu istraživanja (1997 - 1999. godina) u području Radmilovca  
su vladali povoljni klimatski i zemljišni uslovi za rasteenje i razviće ispitivanih  
sorti. Nije bilo jakih mrazeva i izmrzavanja okaca i lastara.

- Rodnost okaca i lastara, visina prinosa i kvalitet grožđa varirali su u  
zavisnosti od sorte i vremenskih uslova u pojedinim godinama. Uporedo sa  
formiranjem uzgojnog oblika čokota, povećavao se broj ostavljenih okaca  
po čokotu, što je uticalo i na povećanje broja grozdova i prinosa grožđa. Po  
ispoljenoj rodnosti ističe se sorta smederevka (1,23 kg/m<sup>2</sup>). Najslabiju rod-  
nost ispoljila je sorta rizling rajnski (0,89 kg/m<sup>2</sup>), zbog velike osetljivosti na  
sivu trulež grožđa. Sorte za kvalitetna bela vina su u celini ispoljile veću rod-  
nost, a sorte za vrhunska bela vina, su ispoljile bolji kvalitet grožđa. Sve ispi-  
tativane sorte ispoljavaju karakteristične biološke sorte osobenosti u  
području Radmilovca i mogu se preporučiti za gajenje u uslovima  
gročanskog vinogorja, kao i ostalih vinogorja u Srbiji u kojima vladaju  
povoljni agroekološki uslovi za njihovo rasteenje i razviće.

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