DOI: 10.46793/SBT30.19MG

YIELD AND QUALITY OF THE GRAPEVINE VARIETY RED TRAMINAC IN THE NIŠ WINE-GROWING REGION

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Abstract: This paper presents the results of a study on some production and technological characteristics of the Red Traminac grapevine variety in the Niš wine-growing region. The study was conducted in the collection vineyard of the "Center for Viticulture and Oenology" in Niš. During the research period, favorable conditions prevailed for the manifestation of production and technological characteristics of the Red Traminac variety. The yield level and its variation over the years indicate high and stable fertility of the examined variety. The sugar content in the grape must was 22.51%, and the total acid content was 7.86 g/L. Chemical analysis of the wine determined that the wine obtained from the Red Traminac variety was of good quality. Alcohol content in the wine ranged from 13.50% to 14.01% by volume. The sensory evaluation of this variety's wine scored 73 points. The research results confirm the justification for growing the Red Traminac grapevine variety in the Niš wine-growing region.

Keywords: phenological observations, yield potential, grape yield, quality of grapes and wine.

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Introduction

The Red Traminac grapevine variety is known under synonyms such as Traminer, Traminer roso, Traminer rozovii, and others. It is a moderately vigorous variety. The tip of the young shoot is semi-open, woolly, and bronze-green. The mature leaf is small to medium-sized, entire, or three-lobed. The flower is morphologically and functionally hermaphroditic. The berry is small, round, and slightly elongated. The skin is reddish, thick, with numerous dots, and abundantly covered with bloom.

Red Traminac is a variety known worldwide. In Serbia, it is cultivated in geographical indication Vojvodina and sporadically in other wine-growing areas.

The aim of our study was to evaluate the yield, as well as the key production and technological characteristics of the Red Traminac grapevine variety under the conditions of the Niš wine-growing region.

Object, Material, and Methods

The research was conducted in the collection vineyard of the "Center for Viticulture and Oenology" in Niš. The examination place belongs to the Niš wine-growing region. The vineyard is situated at an altitude of 210 meters, with a gentle slope and northern exposure. It was established in 1995 in an area of 2 hectares, containing over 200 grapevine genotypes.

The subject of the research was the Red Traminer grapevine variety, planted at a spacing of 3.0 x 1.2 m. The rootstock used for grafting was *Berlandieri* x *Riparia* Kober 5 BB. The training system applied was the "Karlovački" system, with a trunk height of 80 cm, using mixed pruning. The trellis system consisted of wooden stakes, concrete posts, and wires, ensuring the proper distribution of shoots, leaves, and grape clusters in space. During pruning, each vine was left with one spur with two buds and two canes with ten buds each. This ensured that all vines bore the same number of buds, eliminating the influence of different bud loads on yield and grape quality.

The research was conducted during the 2011–2013 period and was divided into field trials and laboratory-chemical analysis of grapes (grape must) and wine. The field trials included 10 vines per treatment. The experiment was set

up following a completely randomized design, where each variant had ten repetitions (10 vines), with each vine serving as a separate experimental unit. Laboratory analyses were carried out in the laboratories of the "Center for Viticulture and Oenology" in Niš, the Agricultural Advisory Service in Niš, and the Faculty of Agriculture in Belgrade.

The study included the following parameters: phenological observations, yield potential, grape yield and quality, mechanical composition of the grape cluster, chemical analysis of the grape must and wine, and sensory evaluation of the wine.

During the research period, climatic conditions were favorable, as shown in Table 1.

Table 1. Values of Basic Climatic Indicators in the Niš Wine-Growing Region

No.	Indicator	Year			
		2011	2012	2013	Average
1	Average annual air temperature (°C)	12.20	13.10	13.30	12.80
2	Average vegetation temperature (°C)	18.60	20.10	18.90	19.20
3	Annual precipitation (mm)	411.10	631.20	581.80	541.30
4	Precipitation during the vegetation period (mm)	273.00	370.20	297.30	313.15

The thermal conditions in this region are favorable for grapevine cultivation and allow for the normal ripening of grapes from all ripening epochs. The average annual air temperature during the study period ranged from 12.2°C to 13.3°C, while the average air temperature during the vegetation period ranged from 18.6°C to 20.1°C. In 2011, drought conditions prevailed during the

vegetation period. In contrast, 2012 experienced frequent and abundant precipitation.

Results and Discussion

Phenological Observations

The timing of individual phenophases in the annual development cycle of the Red Traminer variety can be observed from the data presented in Table 2. Budburst occurred slightly earlier in 2013 (April 15) and slightly later in 2011 (April 18). Flowering began, on average, 42 days after budburst (May 30). The period from budburst to the first harvest lasted an average of 166 days.

Table 2. Phenological Phases of the Red Traminer Grapevine Variety

Year	Phenophase						
	Budburst	Flowering		Berry Development	Veraison	Ripening Time	Number of Days
		Start	End				
2011	18.04.	28.05.	12.06.	17.06.	29.07.	02.10.	167
2012	17.04.	01.06.	15.06.	20.06.	01.08.	27.09.	162
2013	15.04.	30.05.	13.06.	18.06.	29.07.	30.09.	168
Average	18.04.	30.05.	13.06.	18.06.	30.07.	30.09.	166

The first grape harvest took place the earliest on September 27 and the latest on October 2. On average, veraison occurred on July 30, while full grape maturity was reached on September 30. These findings align with the data reported by Zirojević (1974), Burić (1995), Ćirković (2008), Cindrić et al. (2000), and others for the Red Traminer grapevine variety.

Yield Potential

Based on the data presented in Table 3, it can be concluded that the highest values of all yield potential coefficients for the Red Traminer variety were recorded in 2013. The lowest values of the potential and relative fertility coefficients were observed in 2011. The highest absolute fertility coefficient was recorded in 2013, reaching 1.6, while the relative fertility coefficient was slightly lower at 1.2, and the potential fertility coefficient was the lowest at 1.1.

Table 3. Yield Potential Coefficients of the Red Traminer Grapevine Variety

Grapevine Variety	Yaer	Potential Fertility Coefficient	Relative Fertility Coefficient	Absolute Fertility Coefficient
Red Traminer	2011	0.8	1.0	1.4
	2012	0.9	1.1	1.4
	2013	1.1	1.2	1.6
	Average	0.86	1.00	1.33

Grape Yield and Quality

Based on the analysis of the data presented in Table 4, the following conclusions can be drawn. The achieved grape yield per vine depended on the number of clusters per developed and fruitful shoot, as well as on the size and mass of the clusters. The highest grape yield per vine was recorded in 2013 (3.26 kg), while a slightly lower yield was observed in 2011 (2.70 kg). The grape yield per hectare was calculated mathematically and amounted to 8,251 kg/ha. Similar yield values were reported by Zirojević (1974), while Ćirković (2008) noted slightly lower values. The highest cluster mass was recorded in 2013

(156.55 g), whereas the lowest was in 2011 (128.18 g). The average cluster length was 12.83 cm, while the average cluster width was 8.22 cm. Similar values for the Red Traminer variety were reported by Zirojević (1974), Burić (1995), Ćirković (2008), Cindrić et al. (2000), and others.

Table 4. Mean Values and Variability Indicators of Yield, Cluster Characteristics, and Grape Quality of the Red Traminer Grapevine Variety

Characteristic	Year				Variability Indicator	
	2011	2012	2013	$\bar{X}$	S	Cv (%)
Grape yield per vine (kg)	2.70	2.94	3.26	2.97	0.46	15.37
Number of clusters per vine	21.1	22.2	22.0	21.77	2.87	13.20
Cluster mass (g)	128.18	134.93	156.55	139.89	28.23	20.18
Cluster length (cm)	12.0	11.0	14.8	12.83	2.26	17.61
Cluster width (cm)	7.2	7.2	10.2	8.22	1.91	23.25
Number of berries per cluster	80.0	75.2	91.6	82.27	17.31	21.05
Rachis mass (g)	2.27	2.96	6.25	3.83	2.11	55.05
Sugar content in must (%)	22.7	21.2	23.2	22.51	1.44	6.41
Total acid content (g/L)	7.9	7.4	7.4	7.86	0.83	10.56
Alcohol content in wine (% Vol.)	13.96	14.01	13.50	12.92		
Sensory wine rating	70	73	76	73,0		

The number of berries per cluster ranged from 75.2 in 2012 to 91.6 in 2013. The rachis mass varied from 2.27 g to 6.25 g. Additionally, variations were observed in grape yield per vine, number of clusters per vine, and cluster mass for the studied variety (Cv = 15.37, Cv = 13.20, Cv = 20.18). The sugar content in the grape must and total acid content of the Red Traminer grapevine variety were 22.51% and 7.86 g/L, respectively. The variability, expressed by the coefficient of variation, was low for both traits (Cv = 6.41, Cv = 10.56).

The results of the variance analysis, presented in Table 5, show that the effect of the year was not significant for the sugar content in the grape must, nor was it significant for the total acid content in the grape must ($p > 0.05$). However, the combined effect of genotype and year was significant and highly significant for the sugar content in the grape must and significant for the total acid content in the grape must.

Table 5. Statistical Significance of the Effect of Genotype and Year on Sugar and Total Acid Content in the Grape Must of the Red Traminer Grapevine Variety

Source of Variation	Sugar Content in Grapevine Must		Total Acid Content in Grapevine Must	
	ANOVA			
	F-value	*p-value*	*F-value*	*p-value*
Genotype	155,80**	0,00	8,22**	0,00
Year	1,22 nz	0,30	0,74nz	0,48
Genotype × Year	2,56**	0,04	2,75*	0,03
	DUNNETT-*test*			
Red Traminer Grapevine Variety	22.51*		7.86nz	

nz for $p > 0.05$ (not significant); * for $p < 0.05$ (significant); ** for $p < 0.01$ (highly significant)

Conclusion

Based on the results of the study on the yield and quality of the Red Traminer grapevine variety in the Niš wine-growing region, the following conclusions can be drawn:The agroecological conditions of the Niš region are favorable for the normal development of the Red Traminer variety, enabling the production of high-quality grapes and wine.

- The Red Traminer variety had the earliest bud swelling (April 18), flowering onset (May 30), and ripening period (September 30);
- The potential, relative, and absolute fertility coefficients, as indicators of yield potential, exhibited their highest values in the studied variety;
- The highest grape yield per vine (3.26 kg) was achieved in 2013, while the highest number of clusters per vine (22.2) was recorded in 2012;
- The grape quality, assessed based on sugar content, total acids in the grape must, and overall grape health, was evaluated as very good. The sugar content in the grape must varied from 21.20% to 23.20%, while the total acid content ranged from 7.4 to 7.9 g/L;
- The sensory evaluation of the wine for the Red Traminer grapevine variety ranged from 70 to 76 points.

Based on the results of the yield and grape quality study of the Red Traminer grapevine variety under the conditions of the Niš wine-grawing region, it can be concluded that this variety can be successfully cultivated in this region.

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