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THE PRUNING SYSTEM AS A FACTOR FOR THE QUALITY OF THE GRAPES FROM THE VRANEC VARIETY

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ABSTRACT

Vranec variety is the most important and most represented variety for production of red wines in Republic of Macedonia. It provides raw material for production of quality and excellent red wines. Today, it is present in all warm vineyards, and on smaller areas it is represented in the rest of vineyards. In our research, the impact of the system of pruning on the yield and quality of grapes of this variety in the conditions of Tikvesh winegrowing region was studied. Three variants of pruning were applied: Guyot - Poussard pruning, double Guyot and cordon pruning. The highest yield of 4.368 g/vine and the highest average grape mass of 312 g was obtained by cordon pruning. The lowest yield of 3.709 g/vine was obtained by Guyot - Poussard pruning, while the double Guyot pruning system obtained the lowest average mass of grapes (214,2 g) but this system shows fruity shoots per vine and the largest number of bunches per vine. The theoretical randman ranges from 71.47 % (double Guyot) to 80.0 % (cordon pruning). The sugar content at the time of harvest ranges from 21.0 g/l (cordon pruning) to 22.8 g/l (Guyot - Poussard), while the total acid content is in range of 4.13 g/l (Guyot - Poussard) up to 4.7 g/l (cordon pruning). Based on the obtained results, it can be concluded that the pruning system has a significant impact on the qualitative and quantitative properties of the grapes from Vranec variety.

Key words: Vranec, pruning system, mechanical composition, yield, chemical composition.

INTRODUCTION

The wine production in the Republic of Macedonia dates back to 4,000 years ago, as evidenced by a large number of artifacts in our archaeological sites. As part of those artifacts, it is worth mentioning the drawings of grapes and vines carved on stone, marble or terracotta, which can be seen in the museums in Kavadarci and Negotino today.

The total area under vineyards in the Republic of Macedonia is approximately 24,000 ha (State Statistical Office, 2017), while 20.307 ha are used for wine production, and 45 % of total production is used for production of red wines. Today, Vranec variety is the most common wine variety in the Republic of Macedonia, with total area of 7.616 ha (FARM, Register of MZSV), which makes our country the largest producer of grapes and wine of this variety in the region.

In general, the vineyards are grown on a low or medium-high stem with a double Guyot method of pruning. However, the lack of labor and the ever-higher daily wages necessitate the restricturing of viticulture. Useing of vineyard pruning machines, vineyard vine trimmer and grape

harvesting machines requires a changes in cultivation systems and a grape vine support trellis. Therefore, short pruning systems are increasingly being applied.

Our research was focused on several methods of pruning systems and their impact on the yield and quality of the grapes and wines in the condition of Tikvesh wine growing district. Our main goal was to make a comparative comparison of standard cultivation systems in relation to short pruning and their impact on the production and technological characteristics of the Vranec variety.

MATERIALS AND METHODS

The research was conducted during 2019 on a plantation of the vranec variety in the vincinity of the village of Shivec, Tikvesh vineyard. The plantation was erected in 2003, it is of full fertility and is located at an altitude of 230 m. It is grown on a line system with a height of 2 meters. The distance between the vines in the row is 0.9 m, and between the rows is 2.25 m. During the vegetation, standard agrotechnical and ampelotechnical measures were applied for the production of wine grapes.

The following variants were used in the experiment:

Variant 1: vranec produced with the Guyot - Poussard pruning method (with a load of a total of 11 buds, namely: 2 short spurs (2 buds each) and one bow cut to 7 buds);

Variant 2: vranec produced by cordon pruning with spurs (with a total burden on the vine of 12 buds, that is, 6 spurs per 2 buds);

Variant 3: Vranec produced in a Double Guyot pruning method (with a total burden on the vine of 18 buds, that is, 2 short spurs on 2 buds and 2 arcs on 7 buds).

In all variants of pruning, two variants of maceration of 7 and 15 days each were applied, while all other operations (room temperature, temperature of maceration, pouring, etc. were identical for all variants). Also, the same concentrations of $K_2S_2O_5$ (6 g/100 kg), FCE enzyme (3 g/100 kg), D-80 yeast (30 g/100 kg), Go Ferm Protect (45 g/100 kg), Opti Red (45 g/100 kg) and Fermaid E 10 g/100 kg were used for all variants.

In all variants, the following parameters were examined: yield, mechanical analysis of the cluster, chemical analysis of the grapes and chemical composition of the obtained wine.

A modified method according to Negrul was used to determine the mechanical composition. The following were monitored from the chemical composition of the must: amount of sugar in the must, total acids and pH. The content of sugars was measured with an Exlov must hydrometer, to determine the content of total acids, potentiometric titration was used, by application of the bromothymol indicator, while the pH of the must was determined with a pH meter.

The chemical analysis of the wine included the following: alcohol content, total extract, dry extract, reducing sugar, total acids, volatile acids, free SO_2 and total SO_2. All analyzes were performed according to the methods of the provisions of the law on wine, recommended by the OIV.

RESULTS AND DISCUSSION

The obtained results are shown in the following chapters: quantity of harvested grape, mechanical composition of the grape cluster and of the grape berry, chemical composition of the must, chemical composition of the wine and sensory properties of the wine.

Amount of harvested grape

The quantity of harvested grape is one of the variable factors that affect the quality of the grapes. By planning the yield, i.e. the quantity of harvested grapes, it is possible to focus on the quality of the raw material (Прцуловски, 2019).

The yield is influenced by several factors that can be divided into variable and non-variable. Invariable yield structures are variety/clone, substrate, spacing, cropping system, etc. Variable yield structures are processing, fertilization, irrigation, climate conditions, buds load etc (Ѓорѓиев, 2020).

Agrotechnical and ampelotechnical measures have a direct impact on the yield and quality of grapes. One of the objectives of our trial was to limit yield through the use of different types of pruning at different vine loads with buds.

Table 1. Influence of the type of pruning on the yield of the vranec variety

Variant	V1- Guyot - Poussard	V2-Cordon pruning	V3-Double Guyot
Number of tiller per grapevine	7.6	8.4	10.8
Number of grape cluster per grapevine	12.8	14.0	17.8
Average cluster mass g	289.8	312.0	214.2
Average grape berry mass g	1.45	1.71	1.09
Grapevine yield in g	3.709	4.368	3.812

The results show a significant influence of the type of pruning and the buds load on the amount of harvested grapes per vine. It ranges from 3.709 g in Guyot - Poussard method to 4.368 g in cordon pruning. By applying the double Guyot method, 3.812g per vine were obtained.

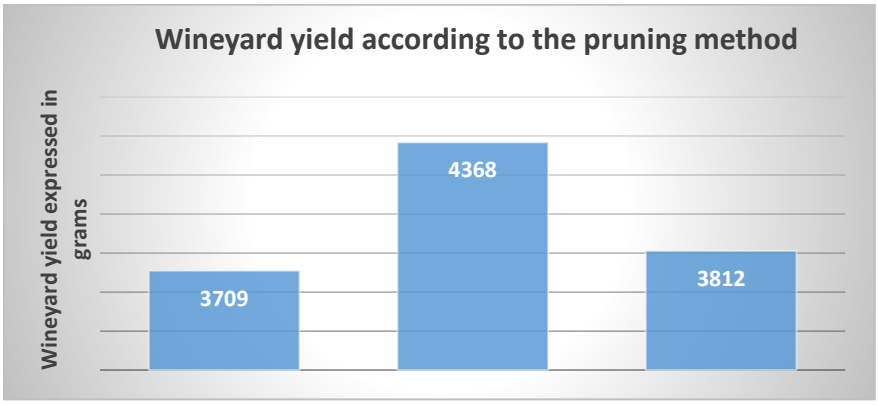

Figure 1. Wineyard yield according to the pruning system

Mechanical composition of the grape cluster and of the grape berry

The mechanical composition of the grape cluster and the grape berry is characteristic for each variety of grapevine and represents its ampelographic and technological feature (Божиновиќ, 2010). The mechanical analysis of the grape cluster includes: composition of the cluster, composition of the grape berries and the structure of the cluster. From the data, it can be established that there is a significant influence of the type of pruning on the mechanical composition of the grape cluster and berry of the vranec variety. Variant 2 has the largest bunch mass of 312 g, and Variant 3 has the smallest mass of 214 g. Variant 1 has the smallest bunch mass (11.33 g), and Variant 3 has the largest mass (12.03 g). The lowest percentage of the bunch was obtained with Variant 2 and it is 3.67%, and Variant 3 with the highest of 5.62%. The largest berry mass (1.71 g) is variant 2, and the smallest (1.09 g) is variant 3. Variant 2 also has the largest mass of meat in the grain of 1.47 g, and the smallest variant 3 with 0.89 g of meat mass in the grain.

Table 2. Mechanical composition of the grape cluster and the grape berry

Elements	Variant		
	V1 - Guyot - Poussard	V2 - Cordon pruning	V3 - Guyot – Poussard
Cluster mass g	289.80	312.00	214.16
Peduncle mass g	11.33	11.45	12.03
Grape berries mass on the cluster g	278.47	300.55	202.13
Percentage of peduncle by mass (%)	3.91	3.67	5.62
Percentage of berries by mass (%)	96.09	96.33	94.38
Number of berries in the cluster	191.95	176.22	184.89
Mass of 200 berries g	290.15	341.10	218.65
Seeds mass in 200 berries g	13.20	14.74	10.28
Skin mass in 200 berries g	31.05	32.75	29.80
Flesh mass in 200 berries g	245.90	293.62	178.57
Average mass in 1 berry g	1.45	1.71	1.09
Average mass of flesh in 1 berry g	1.23	1.47	0.89
Cluster structure			
Peduncle percentage (%)	3.91	3.67	5.62
Skin percentage (%)	10.70	9.60	13.63
Seeds percentage (%)	4.55	4.32	4.70
Flesh percentage (%)	80.84	82.41	76.05
Theoretical yield (%)	77.44	80.00	71.47
Peduncle percentage (%)	3.91	3.67	5.62

By analyzing the data on the structure of the bunch, data on the quantitative characteristics of the grapes are obtained. Based on the obtained results it can be concluded that there is a significant difference in the structure of the cluster among the tested varieties. Version 2 is characterized by the lowest percentage of peduncle, skins and seeds, and the highest percentage of flash (82.41%). Variant 1 is distinguished by the participation of flash in the structure of the cluster of 80.84%, while Variant 3 is distinguished by the highest percentage of skin and seeds, and the lowest participation of flesh in the structure of the cluster (76.05%).

Chemical composition of the must

From the chemical composition of must, the content of sugars, the content of total acids and pH were tested. Table 3 shows the obtained results.

Table 3. Chemical composition in the tested varieties

Version		V1 - Guyot - Poussard	V2 - Cordon pruning	V3 - Guyot – Poussard
Elements	Indicator			
Sugars	%	22.2	22.4	22.4
Total acids	g/l	6.9	5.23	5.58
pH	/	3.54	3.56	3.59

From the obtained results it can be concluded that the type of pruning does not affect the content of sugars in the must, but a significant difference in the content of total acids was found in variant 1 (6.9 g/l) in relation to the other two variants where they were measured 5.23 g/l (B2), ie 5.58 g/l (B3) acids.

Chemical composition of the wine

For each of the three pruning variants, two types of maceration were carried out, namely 7 days and 15 days. The following parameters were examined in all variants: alcohol, specific mass, extract, total and free SO_2, pH, glucose/fructose, volatile acids, malic acid and lactic acid. The results of the tests obtained are presented in table 4.

Table 4. Chemical composition of the wine in the tested variants

Variant	Alcohol (vol %)	Glucose/Fructose (g/l)	Extract (g/l)	Free SO_2 (mg/l)	Total SO_2 (mg/l)	Total Acids	Volatile Acids	pH
V1/7	13.55	0.13	30.07	18	37	5.79	0.21	3.42
V1/15	13.83	0.1	29.59	17	32	5.5	0.26	3.5
V2/7	13.65	0.15	30.1	15	27	5.95	0.21	3.41
V2/15	13.29	0.07	29.57	17	36	5.77	0.26	3.42
V3/7	13.86	0.16	31.24	21	46	6.45	0.22	3.3
V3/15	13.77	0.09	31.03	22	36	5.64	0.35	3.44

The data in table 4 show that the variant V3/7 gives wine with the lowest amount of alcohol of 13.29 vol % and the highest amount of extract of 31.24 g/l. while the wine of the V2/15 variant gives the lowest alcohol content (13.29 vol%) and the lowest amount of extract (29.57 g/l). The total acids in the wine range from 5.5 g/l in the variant B1/15, to 6.45 g/l in the variant V3/7.

CONCLUSION

The vranec variety is the recommended variety for the production of quality and premium wines in the Tikvesh vineyard. It achieves optimal phenological and technological maturity even on heavier soils. Vranec is a variety that has been successfully grown in this vineyard for over 50 years and is the most widespread of the red varieties in R.N. Macedonia.

The grape cluster mass and grape berries mass decrease with increasing degree of maturity. Variant 1 is characterized by the largest cluster mass, and variant 3 is characterized with the smallest. As the degree of grapes maturity increases, the theoretical yield also decreases.

The sensory evaluation established significant differences in the examined wines in terms of aromatic profile and taste qualities. The wine of variant 2 is distinguished by the most complex and accented fruit aromas, especially of black fruit, the wines are harmonious, have a full flavor that leaves a great impression and are suitable for further finishing and maturation. The wine of variant 3 is distinguished by complex and accented fruit aromas with an emphasis on cherry, with a fruity character, a discreet mineral note, with a harmonious and full taste and are wines suitable for early consumption. The wines from the other varieties have a less accented aroma, medium-expressed varietal aromas of red fruit and soft tannins, wines with a medium body and a well-harmonized taste.

Based on the obtained results, we can establish that it is possible to obtain raw material for the production of high-quality wines from the vranec variety, by monitoring the dynamics of maturing and by applying Guyot - Poussard pruning method we can obtain top-quality wines which are suitable for further processing. By applying the type of cordona pruning with spurs, raw material for the production of quality red wines is provided. With both variants, wines are obtained that are specific in terms of their aromatic characteristics and taste qualities.

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