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**THE PRODUCTIVE CHARACTERISTICS ON BLACK MAGIC TABLE GRAPE VARIETY, GROWING IN THE TIKVES'S VINEYARD, REPUBLIC OF MACEDONIA**

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**Abstract**

Table grape variety Black Magic was introduced in R. Macedonia in 2000. The variety is grown in the Tikveš vineyard area at 1.0 ha surface, on high cordon with trick system of irrigation. During the period of 2007-2009 Black Magic was studied including the following parameters: amount of harvested grape (total and packed), dimension and shape of cluster and berry, mechanical properties of berry (breaking resistance and resistance of pressure) and chemical content of must (content of sugar and total acids). On the base of obtained results, it was found that Black Magic variety had a high stability with no significant variation during the period of study. Thus, the average yield was 5.6 kg/vine, the cluster had average weight of 369 g and the berry 5.5 g. Furthermore, the berry had a high resistance of pressure (2.715 g) and high breaking resistance (811 g). In the period examined, the average content of sugar in the grape must was 126 g/L and total acids 5.0 g/L.

**Key words:** Black Magic, cluster, berry, mechanical properties, sugar, total acids

**Introduction**

In most of the vineyards in the Republic of Macedonia, particularly the Tikveš vineyard region with continental and partially Mediterranean climates, the agro-ecological conditions are favourable for successful cultivation of table grape varieties of all epochs of maturity. The Tikveš vineyard is characterized by daily mean air temperatures of 12.4 – 14.5°C with annual temperature sum of 4500 – 5300°C and vegetation temperature sum ranging from 3950°C to 4764°C. Total annual precipitation ranges from 440 – 740 mm, and from 250 – 310 mm during the vegetative growth cycle (Table 1).

Regular enrichment of the assortment, mainly with introduced varieties, has increased the offer both on the domestic and foreign markets in the last decade. The Black Magic variety is one of the many varieties that have been introduced so far (Victoria, clones of Italian grapevine varieties, Paglieri, Don Mariano). This variety was first obtained in Moldova by the Institute of Viticulture in Chisinau and was named Codreanca; it was rebranded as Black Magic in Italy, which is the international name as well.

The vine has medium vigour. It is an early variety (maturation period in mid July) with good cluster and berry shape. As the grapes reach its mature stage, berries detach pretty easily thus limiting the transportability (Marjone Bowen 2010). The clusters are medium sized, conical, occasionally winged shaped and loose with an average bunch weight of 450 – 500 g. The berry is medium sized to large with an average weight of 5.5 – 6 g. The berry is ovoid in

shape with dark blue coloration of the skin, neutral taste and 1 – 2 grape seeds per berry (Bozinovic 2010).

**Table 1 Climatic factors in Tikves vineyard**

Vegetative period	in days	229-239
Period of active vegetation	in days	207-229
Average annual air temperature	in C <sup>0</sup>	12.4 – 14.5
Sum of annual temperature	in C <sup>0</sup>	4500-5300
Sum of temperature in the vegetative period	in C <sup>0</sup>	3950-4767
Annual precipitation	in mm	440-740
Precipitation in the vegetative period	in mm	250-310

## Materials and methodes

### Materials

The studies of the Black Magic variety were carried out in the Tikveš vineyard at the production plants of AD Goce Del ev, Tikveš, Kavadarci. The plantation was established in 2002 with the use of certified planting stock produced in the Rauscedo reproduction centre, Italy. The vines is grown on high cordon with 1 m trellis distance and 2.3 m planting distance of the vines in the row. Total of 60 vines were analyzed, i.e., three repetitive analyses of 20 vines. The vines were optimally loaded with 20 buds per vine, distributed in two canes with 8 buds and 2 spurs with 2 buds. Regular agrotechnical and ampelotechnical measures were applied: soil cultivation, fertilization, irrigation, foliar feeding, pest and disease control, lateral shoot thinning, etc.

### Methods

The study was conducted in the period 2007-2009. Internationally recognized methods (O.I.V.) were used.

The yield was obtained by harvesting of the grapes of all the vines involved in the study, and the yield per vine and per unit area (ha) was calculated.

The dimension and shape of the cluster and berries were determined according to the CODE system issued by the International Organisation of Vine and Wine (O.I.V.).

The mechanical properties of the berry were evaluated by 2 elements: breaking resistance and resistance of pressure measured in grams per unit area (g/cm<sup>2</sup>) and the pedicel-berry detachment resistance in grams (g).

The chemical composition of the must is determined by measuring the content of sugar and total acids.

The content of the sugar was determined using the Exlo's device, and the total amount of acids was determined by volumetric method, using 0.025 mol/l solution of NaOH.

## Results and discussion

Table 2 shows the results of the amount of harvested grapes including the yield per vine and hectare (ha), and the amount of packed grapes expressed in percentage (%) and kilograms (kg). The yield ranges from 21400 kg/ha (2008) to 24300 kg/ha (2009). The years of study show insignificant variation of 6.87. The percentage of the packed grapes in the period of study ranges from 85% to 90%, with average of 88% for the same period.

This indicates that the Black Magic variety is characterized with high stability in both the quantity (total yield) and quality (% of packed grapes of extra quality) of the grapes.

**Table 2 Yield of grape**

Year	Total kg/vine	Packed kg/vine	%	Total kg/ha	Packed kg/ha	Refuze kg/ha
2007	5.5	5.0	90	24.009	21.735	2.174
2008	5.5	4.7	85	21.400	18.800	2.600
2009	5.6	5.0	89	24.300	21.692	2.608
<b>07/09</b>	<b>5.6</b>	<b>4.9</b>	<b>88</b>	<b>23.236</b>	<b>20.742</b>	<b>2.461</b>
CV%	1.04	3.63			8.11	

Table 3 shows the results of the weight and dimension of the cluster, and the number of fertilized berries. The cluster weight ranges from 353 g (2007) to 410 g (2009), average of 369 g for the study period. This indicates that the Black Magic variety belongs to large cluster varieties. The cluster length is 20.9 cm. The number of fertilized berries ranges from 62 (2009) to 82 (2008), and the coefficient of variation is 15.

**Table 3 The dimensions and shape of cluster**

Year	Weight (g)	Length (cm)	Width (cm)	L/W	Number of berries
2007	353	22.7	9.8	2.3	81
2008	344	17.6	9.7	1.8	82
2009	410	22.5	8.0	2.8	62
<b>07/09</b>	<b>369</b>	<b>20.9</b>	<b>9.2</b>	<b>2.3</b>	<b>75</b>
CV%	9.7	13.8	11.0	21.7	15.0

L/W: length/width

The values for the weight, dimensions and shape of the grains are shown in Table 4. Berries are with an average mass of 5.46 g, and 23.8 mm in length and 18.8 mm width. The form of the berry is one of the most stable features that distinguishes the varieties. It is determined by the values of the length/width ratio. In our study, the length/width ratio has an average value of 1.3, according to which they belong to the group of varieties with elongated elliptical shape (Bozinovic 2010). After years of testing, the values of the berry shape have been with minor variations (coefficient 4.5), suggesting that it is immutable biological trait of the varieties. The size of the berries of the table varieties is one of the characteristics that define the category of corresponding grape variety. According to the values of average diameter (length + width / 2), the Black Magic variety belongs to the group of varieties with large berries. All these features increase the market value of the variety.

**Table 4 The dimensions and shape of berry**

Year	Weight (g)	Lenth (mm)	Widht (mm)	L/W	Average diameter
2007	5.09	23.7	18.7	1.3	21.2
2008	4.85	21.2	18.6	1.2	19.9
2009	6.43	26.6	19.2	1.3	22.9
07/09	5.46	23.8	18.8	1.3	21.3
CV%	15.6	11.3	1.7	4.5	7.0

L/W: length/width

One of the very important properties of table varieties is the transportability which is determined by the pressure resistance of the berry and the pedicel-berry detachment resistance. The results of these surveys are given in Table 5. The berry pressure resistance ranges from 2414g/cm<sup>2</sup> (2007) to 2870 g/cm<sup>2</sup> (2008) or the average of 2715 g/cm<sup>2</sup> for the test period. The mean test period value of the pedicel-berry detachment resistance is 811g, ranging from 720 g (2009) to 880 g (2008). The results indicate that the Black Magic variety features high transportability which is primarily driven by the high resistance of the berry to pressure, while the pedicel-berry detachment resistance is significantly reduced by the sugar content increase (Figure 1).

**Table 5 The mechanical function of the berry**

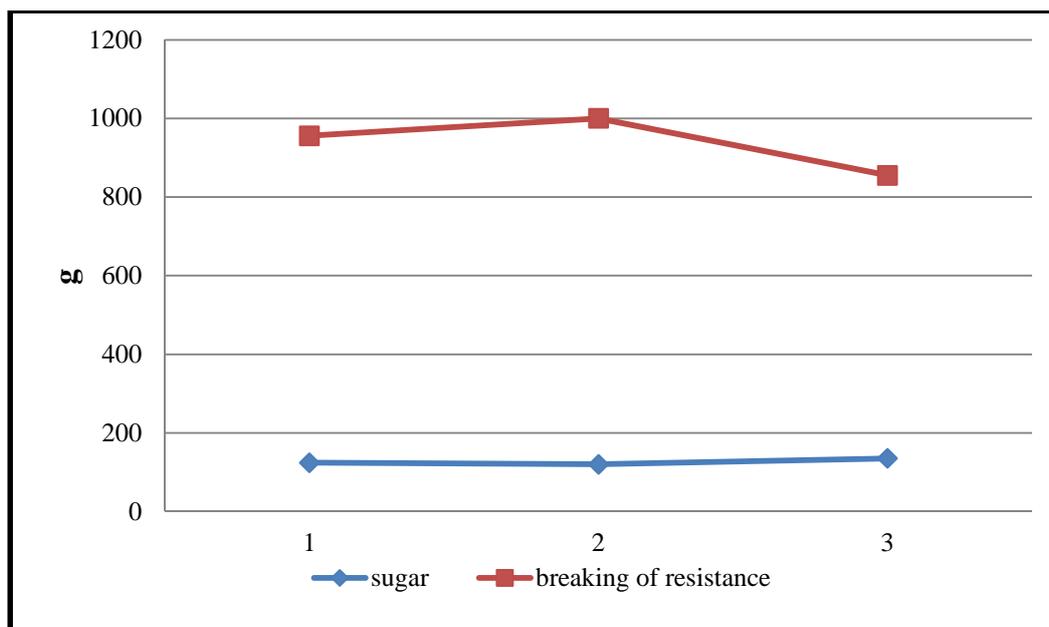
Year	Resistance of pressure (g/cm <sup>2</sup> )	Breaking of resistance (g)
2007	2414	832
2008	2870	880
2009	2860	720
<b>07/09</b>	<b>2715</b>	<b>811</b>
CV%	9.6	10.1

The results for the content of sugar and total acids in the must are shown in Table 6. The average sugar content of the test period is 126 g/l, and after years of testing it has been quite stable with a coefficient of variation of 6.1. The must sugar content ranges from 4.7 g/l (2009) to 5.2 g/l (2008) or 5.0 g/l average for the test period.

The content of sugar and total acid ratio determines the index of the maturity of the berries which primarily depends on the variety and also of the conditions of cultivation and application of agrotechnical and ampelotechnical measures during vegetation. Because of the balanced proportion between the sugar content and total acids, the grapes has pleasant and refreshing taste.

**Table 6. The content of sugar and total acids in the must**

Year	Sugar (g/L)	Total acids (g/L)	Index of maturity
2007	124	5.1	2.48
2008	120	5.2	2.31
2009	135	4.7	2.87
<b>07/09</b>	<b>126</b>	<b>5.0</b>	<b>2.52</b>
CV%	6.1	5.3	



1: 124 g/L, 2: 120 g/L and 3: 135 g/L

**Graph1. Breaking of resistance depending on the degree of maturity (content of sugar)**

### Summary

1. The Black Magic variety belongs to the group of high-yielding varieties. Its cluster is large and beautiful and it ripens early (I stage).
2. The balanced proportion between the sugar and total acid content gives the grapes a pleasant and refreshing taste.
3. Ampelotechnical measures (bunch tipping of the cluster and application of bio-stimulators) and special care during harvesting should be applied due to the low breaking of resistance of the berry.

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