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## THE EFFECT OF PRUNING ON FRUITING CAPACITY OF BLACK MAGIC TABLE GRAPE VARIETY\*

### UTICAJ REZIDBE NA RODNOST STONE SORTE VINOVE LOZE BLACK MAGIC

Mersija Delić<sup>1\*\*</sup>, Fikreta Behmen<sup>1</sup>, Semira Sefo<sup>2</sup>, Pakeza Drkenda<sup>1</sup>,  
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*Original scientific paper*

#### Summary

Black Magic table grape variety is a newly introduced variety in Bosnia and Herzegovina. The aim of this paper was to determine the effect of various types of pruning on fruiting of Black Magic variety in the conditions of Herzegovina, given that no researches have been done so far for this variety. The research lasted three years (2011, 2012 and 2013), and three pruning variants were used (28, 32 and 40 buds/vine). On the basis of obtained results it is evident that the values of the examined parameters were the highest in 2011 (grape yield /vine of 11.06 kg, total number of productive canes/vine was 24.72, number of productive canes/vine 23.79 and number of bunch/vine 44.87), and the lowest in 2013 (grape yield /vine 7.49 kg, total number of productive canes/vine 21.02, number of productive canes/vine 21.11 and number of bunch/vine 23.16). Pruning variant III (40 buds/vine) had the highest levels of these parameters in all three experimental years, and variant I (28 buds/vine) the lowest.

**Key words:** *Black Magic, table grapevine, pruning, yield.*

#### Rezime

Stona sorta grožđa Black Magic je novointrođovana sorta u Bosni i Hercegovini. Cilj ovog rada je bio da se utvrdi uticaj različitih načina rezidbe na rodnost sorte Black Magic u uslovima Hercegovine, obzirom da nisu rađena istraživanja na ovoj sorti. Istraživanja su trajala tri godine (2011, 2012 i 2013), a primijenjene su tri varijante rezidbe (28, 32 i 40 okaca/čokotu). Na osnovu dobijenih rezultata može se vidjeti da

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su vrijednosti ispitivanih parametara bile najveće 2011. godine (prinos grožđa/čokotu 11,06 kg, ukupan broj lastara/čokotu 24,72, broj rodni lastara/čokotu 23,79 i broj grozdova/čokotu 44,87), a najmanje 2013. godine (prinos grožđa/čokotu 7,49 kg, ukupan broj lastara/čokotu 21,02, broj rodni lastara/čokotu 21,11 i broj grozdova/čokotu 23,16). Varijanta rezidbe III (40 okaca/čokotu) imala je najveće vrijednosti navedenih parametara tokom sve tri ogleadne godine, a varijanta I (28 okaca/čokotu) najmanje.

**Ključne riječi:** *Black Magic, stono grožđe, rezidba, prinos*

## INTRODUCTION

Table grapes is one of the most important crops in the world and special attention is paid to improving the yield and quality of fruit (Bruhn *et al.*, 1991). A large number of newly created table varieties of various biological and economic – technological characteristics have been introduced in the area of Herzegovina in recent years. So far, these varieties have not been studied from the standpoint of their adaptation to the environmental conditions of Herzegovina. Therefore, the subject of this paper was to study in detail the effect of pruning on fruiting capacity of Black Magic table grape variety, being one of a large number of newly introduced table grape varieties, in the conditions of Herzegovina.

Black Magic table grape variety was created at the Institute of Viticulture in Chisinau, Moldova, where it was named Codreanca. It was introduced to Italy through Vivai Cooperativi Rauscedo and they have the exclusivity for this variety. The variety was renamed to Black Magic and that is its international name. It was created by crossing Moldova x Marshal (origin *V. labrusca*) varieties (Nicolaescu, 2009; Pizzuto, 2013).

Black Magic is a table variety with seeds. Fruiting capacity is good, fruiting coefficient is 1.19. Its yield is quite high and ranges between 15 to 20 t/ha. Budding period is in the third decade of March, and ripening in the third decade of July which classifies it as a very early variety. Vine is vigorous and five-lobed leaves are of medium size. Bunches are medium to large in size, conical pyramid in shape, with an average weight of 400 – 500 g. The berry is medium-sized, egg-shaped, and its skin is dark purple and covered with abundant bloom. The sugar content in the grape juice is 17.4 %, and total acids is 5.2 g/l. Resistance to transportation is good ([www.vivairauscedo.com](http://www.vivairauscedo.com)).

## METHODS

Field studies were conducted at the facility "Vinogradi" doo Mostar, and laboratory ones at the Faculty of Agriculture and Food Sciences in Sarajevo. Research lasted three years (2011, 2012, and 2013). In the studied vineyard, experiment was set up by the method of random selection, and health status and uniformity of vegetative

potential of vines were good. This vineyard was planted in 2008, with vine spacing 3m x 1.2 m, with Moser cordon as the training system. Three variants of pruning were studied on Black Magic table grape variety (28, 32, and 40 buds per vine) (table 1). The experiment was set up on 72 vines in four repetitions (6 vines per repetition). Black Magic was grafted on Paulsen 1103 rootstock. In the vineyard there is a system of drip irrigation. On the experimental location, this variety is in intensive production with regular application of agricultural practices.

During the examination, monitored were the beginning, duration and completion of individual phases of the phenological development of vine including: bleeding, beginning of bud swelling and formation of canes, flowering and fertilization, development of green berries to the emergence of veraison, grape ripening and maturation of canes, and leaf-fall. Dates of the beginning of dormancy and vegetation periods as well as individual phases during the vegetation period were recorded for all three experimental years, and mean dates of the beginning of certain periods and phases of the development of vine during the year were determined using the method of arithmetic mean. The phenological development of varieties was monitored by the method of Lazarevski.

The experiment included the following variants of pruning:

Table 1. Pruning variants with the specified number of buds

| Variant     | Pruning | Number of short sprouts | Number of long sprouts | Number of buds per vine |
|-------------|---------|-------------------------|------------------------|-------------------------|
| Variant I   | short   | 4(5)+ 4(2)              | 0                      | 28                      |
| Variant II  | mixed   | 4 (2)                   | 4(6)                   | 32                      |
| Variant III | mixed   | 4 (2)                   | 4 (8)                  | 40                      |

During the research, the following indicators were examined:

1. Phenological development of the variety,
2. Fruiting capacity of canes,
3. Weight of grapes per vine,
4. Number of bunch per vine.

Fruiting capacity of the examined varieties was determined and expressed per vine, per variant and per repetition.

Fruiting capacity of the variety was determined on the basis of the following indicators:

- Number of developed canes,
- Number of fruiting canes,
- Number of bunch per vine,
- Weight of grapes per vine (g).

The parameters obtained during the study were processed in the SPSS software package.

## Environmental conditions

Anticipated changes in the climate of the European winegrowing regions in the following decades can significantly alter both the range and distribution of grape varieties that are currently in use (Chiriac, 2007). Due to the higher temperatures, traditional limitations to winegrowing are changing as well as phenological aspect, production and quality of grapes, as it happened in Western Europe, mainly in France, in the past 15 years (Enache, 2008).

In determining the suitability of conditions for growing vines in an area, climate is the crucial factor. If climatic conditions are not suitable for a certain variety, major changes occur in the duration and passage through phenophases of development which is reflected in the yield and quality of grapes.

Crucial impact on the climate of Mostar vineyard region has its openness towards the sea, along the valley of the river Neretva, and the separation from the northern areas by mountain ranges. To analyze climatic conditions we used data of the meteorological station Mostar obtained through the FBiH Hydro-meteorological Institute.

Table 2. Basic hydro-meteorological factors in Mostar winegrowing region

| Indicator                              | 1961 - 1990 | 2011   | 2012   | 2013   |
|--|-------------|--------|--------|--------|
| Mean annual air temperature (°C)       | 14.1        | 16.2   | 16.1   | 15.9   |
| Mean vegetative air temperature (°C)   | 18.83       | 21.76  | 22.1   | 21.16  |
| Absolute minimum air temperature (°C)  | -14.2       | -1.6   | -7.4   | -2.4   |
| Absolute maximum air temperature (°C)  | 41          | 40.4   | 41.8   | 41.1   |
| Precipitation during vegetation (mm)   | 518         | 396.5  | 744.4  | 931.1  |
| Annual precipitation (mm)              | 1102        | 872.5  | 1394.9 | 2188.3 |
| Length of the vegetation period (days) | 239         | 235    | 236    | 237    |
| Length of insolation (hours)           | 2287        | 2629.9 | 2656.9 | 2464.2 |

Climatic conditions in the years of research deviated from long-term averages according to both the recorded air temperatures and amount of precipitation. During the study years, air temperature was considerably higher compared to a multiannual average. The amount of rainfall was also higher compared to the multiannual average, except in 2011 (table 2).

## RESULTS AND DISCUSSION

Phenology is usually described as the art of observing the life cycle phases or the activities of plants and animals in the periodicities of their occurrence throughout the year. Phenology is a scientific field existing on the border between floristics, ecology and meteorology, especially agro meteorology (Lieth, 1970). The length of periods

between phenological phases varies considerably depending on the variety of grape, climate, and geographical location (Jones and Davis, 2000).

Table 3. Dates of occurrence of phenophases in the development of Black Magic variety within the annual cycle of vine development in agro-ecological conditions of the Vrapčići – Mostar site

| Year of observation | Phenophases of development |           |           |        |          |               |                   |
|---------------------|----------------------------|-----------|-----------|--------|----------|---------------|-------------------|
|                     | Bleeding                   | Bud break | Flowering |        | Veraison | Full ripeness | End of vegetation |
|                     |                            |           | beginning | end    |          |               |                   |
| 2011                | 19.03.                     | 01.04.    | 20.05.    | 30.05. | 04.07.   | 25.07.        | 08.11.            |
| 2012                | 20.03.                     | 03.04.    | 26.05.    | 04.06. | 10.07.   | 01.08.        | 11.11.            |
| 2013                | 20.03.                     | 04.04.    | 27.05.    | 06.06. | 11.07.   | 03.08.        | 12.11.            |
| Average             | 20.03.                     | 03.04.    | 24.05.    | 03.06. | 08.07.   | 30.07.        | 10.11.            |

Phenophases of development in Black Magic variety took place in accordance with the temperature conditions in the years of research. The duration of all phenophases of development was within the time lines typical of this region (table 3).

### Fruiting capacity of the variety

Fruiting capacity as economic characteristic is a very important factor in the production cost-effectiveness. It is expressed as grapes yield per square unit, where the yield, in addition to the generative potential as a varietal property, is largely influenced by environmental conditions and applied technology (Maletić *et al.*, 2008). As a rule, in table grape varieties, the first 2 to 3 (or even 4-5) buds on a fruiting cane are very little or not at all fruitful. Therefore, fruiting capacity of the buds or canes in the vegetation begins to manifest from the third or the fourth and fifth bud upward, so it is the basic and sole reason why mixed or long pruning is applied in table grape varieties (Tadijanović, 1993).

Analysis of variance shows that the observed parameters of fruiting capacity of Black Magic variety were statistically significantly influenced by both experimental factors (pruning variant and year), except for the parameter of grapes yield where the pruning variant had no statistically significant effect. There were no interactions between experimental factors (table 4).

Table 4. Average values of grape fruiting parameters in the years of research

| Parameter                      |                      | Pruning variant | Year of research   |                    |                    | Average for the pruning variant |
|--------------------------------|----------------------|-----------------|--------------------|--------------------|--------------------|---------------------------------|
|                                |                      |                 | 2011               | 2012               | 2013               |                                 |
| Total number of canes per vine |                      | I               | 23.46              | 18.92              | 20.53              | 20.97 <sup>b</sup>              |
|                                |                      | II              | 24.08              | 20.92              | 19.86              | 21.62 <sup>b</sup>              |
|                                |                      | III             | 26.63              | 24.71              | 22.67              | 24.67 <sup>a</sup>              |
|                                | Average for the year |                 | 24.72 <sup>a</sup> | 21.52 <sup>b</sup> | 21.02 <sup>b</sup> |                                 |
| Number of fruiting canes       |                      | I               | 22.42              | 18.75              | 20.00              | 20.39 <sup>b</sup>              |
|                                |                      | II              | 23.25              | 20.75              | 19.79              | 21.27 <sup>b</sup>              |
|                                |                      | III             | 25.71              | 24.42              | 23.54              | 24.56 <sup>a</sup>              |
|                                | Average for the year |                 | 23.79 <sup>a</sup> | 21.31 <sup>b</sup> | 21.11 <sup>b</sup> |                                 |
| Grape yield per vine           |                      | I               | 10.20              | 10.14              | 7.36               | 9.23 <sup>ns</sup>              |
|                                |                      | II              | 10.58              | 10.38              | 7.39               | 9.45 <sup>ns</sup>              |
|                                |                      | III             | 12.38              | 11.14              | 7.73               | 10.42 <sup>ns</sup>             |
|                                | Average for the year |                 | 11.06 <sup>a</sup> | 10.55 <sup>a</sup> | 7.49 <sup>b</sup>  |                                 |
| Number of bunch per vine       |                      | I               | 39.96              | 29.34              | 22.84              | 30.71 <sup>ab</sup>             |
|                                |                      | II              | 42.68              | 25.18              | 22.50              | 30.12 <sup>b</sup>              |
|                                |                      | III             | 51.96              | 29.83              | 24.15              | 35.31 <sup>a</sup>              |
|                                | Average for the year |                 | 44.87 <sup>a</sup> | 28.12 <sup>b</sup> | 23.16 <sup>c</sup> |                                 |

In total number of canes per vine there was a statistically significant difference in 2011 (24.72) compared to 2012 (21.52) and 2013 (21.02). Also, there was a statistically significant difference between the pruning variants, so the Variant III (24.67) had a statistically significantly higher number of total canes compared to the other two pruning variants.

Number of fruiting canes per vine was in line with the relations identified in the analysis of the total number of canes per vine.

The yield of grapes per vine was statistically significantly higher in 2011 (11.06 kg) and 2012 (10.55 kg) compared to 2013 (7.49 kg).

The number of clusters per vine was statistically significantly different during all three years of research. Statistically significantly highest average values of the observed parameter were recorded in 2011 (44.87), then in 2012 (28.12), and the lowest in 2013 (23.16). When it comes to the variants of pruning, it can be stated that there is a statistically significant difference in the number of clusters per vine as well as the variant of pruning. Variant III (35.31) had a statistically significantly larger number of clusters compared to the variant II (30.12), but there was no statistically significant difference in the value of the observed parameter for the variant I (30.71) compared to the variants II and III.

The yield of grapes per vine in Black Magic variety amounted to 5.6 kg in the Tikveš winegrowing area (Dimovska *et al.*, 2013), and to 5.67 kg in conditions of Moldova



(Nicolaescu *et al.*, 2009). In this study, the yield of grapes per vine was significantly higher compared to the studies of the aforementioned authors. This difference in the yield of grapes can be explained by the fact that the fruiting bud load of a vine in these authors was significantly lower (20 buds/vine), while in this experiment it was far higher (28.32 and 40).

## CONCLUSIONS

1. Agro-ecological conditions of the site were presented using climate parameters for a multi-year sequence from 1961 to 1990, as well as the three experimental years (air temperature, precipitation, cloudiness) and soil parameters. Climatic conditions in the years of research deviated from the standard average in terms of both air temperature and amount of precipitation. The mean annual air temperature in the years of research was higher compared to the standard average by approximately 2°C and the average vegetation temperature by approximately 3°C. All three experimental years had extremely hot summers. Distribution of precipitation in the researched period was uneven, so during three years we had a number of months with extremely low or high levels of precipitation compared to multi – year average.
2. Phenophases of development in Black Magic variety took place in accordance with temperature conditions in the years of research. The duration of all phases of development was within the timelines typical of this region.
3. Fruiting capacity of the examined variety was shown using the following indicators:
  - a. The total number of developed canes per vine was the largest in pruning variant III, which was to be expected given that the variant III had the highest number of remaining buds per vine.
  - b. The number of fruiting canes was also the largest in the variant III, and the value of this parameter was statistically significantly influenced by both experimental factors (pruning variant and year).
  - c. The yield of grapes per vine in the variant III was higher compared to other variants of pruning in the examined variety, where the yield of grapes per vine in 2011 and 2012 was higher compared to 2013.
  - d. The number of bunch per vine in the variant III was the highest relative to other pruning variants, while the number of clusters per vine was the largest in 2011.

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