THE EFFECT OF PRUNING ON FRUITING CAPACITY OF MUSCAT BLEU TABLE GRAPE VARIETY IN THE HERZEGOVINA CONDITIONS

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Summary

The study of the effect of various types of pruning on fruiting of Muscat Bleu grape variety in the conditions of Herzegovina lasted for three years. Three pruning variants (28, 32 and 40 buds/vine) were applied in four repetitions. The yield of grapes per vine and the number of clusters per vine was the highest in 2011 year (10.30 kg and 45.98). The yield of grapes per vine (7.59 kg) was the smallest in 2012, and the number of grapes per vine in 2013 (25.93). The total number of productive canes per vine was the highest in 2012 (26.62), and the lowest in 2013 year (total number of productive canes per vine 22.65, number of productive canes per vine 22.47). Pruning variant III had the highest levels of these parameters in all three experimental years, and variant I the lowest.

Key words: *Muscat Bleu, table grapevine, pruning, yield.*

INTRODUCTION

Table grapes are primarily intended for fresh consumption due to their sensory and commercial characteristics (OIV – 2014). Table grapes represent one of the most important crops in the world, and special attention is paid to improving the fruit yield and quality (Bruhn *et al.*, 1991).

The Muscat Bleu grape variety, as an interspecies hybrid, was created in Switzerland in 1930, on Lake Geneva, with winegrower Charles Garnier. It was created by crossing *Garnier 15/6 x Seyve Villards 20-347*, which are also interspecies hybrids. Initially, it was used as a wine variety. However, it is now used as a table variety as well. It is very popular because of its high resistance to diseases and pests, so it can be grown in organic grape production (Häseli *et al.*, 2008). It is suitable for high altitudes. In addition to Switzerland, it is grown in Belgium, Germany, and other northern countries.

Muscat Bleu is a table variety with seeds. It has a characteristic muscat flavor, a firm skin that protects it from wasps but causes no problem in consumption. Taste is slightly aromatic, with medium to high sugar content and low total acid content. It

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ripens very early, in the Herzegovina conditions as early as late July or early August, while in the northern areas of the B&H ripening occurs somewhat later – in late August to mid-September. The major lack is its sensitivity to unfavorable weather conditions in the flowering phase. When coulure occurs the flowers stay closed due to unfavorable weather conditions, which results in a large number of closed or unfertilized flowers, and ultimately in loose grape bunches.
In recent years, a large number of table varieties with different biological and economic-technological characteristics have been introduced in the Herzegovina region. So far, these varieties have not been studied in terms of their adaptation to the environmental conditions in Herzegovina region. Therefore, the aim of this paper was to study in detail the impact of pruning on yielding of the Muscat Bleu stone grape variety, as one of a number of introduced table grape varieties.

METHODS

Three years of Muscat Bleu table grape variety research (2011 - 2013) were conducted at the facility "Vinogradi" d.o.o Mostar, and laboratory research were at the Faculty of Agriculture and Food Sciences in Sarajevo. Muscat Bleu was grafted on Paulsen 1103 rootstock. Moser cordon is the training system. The experiment was set up by the method of random selection on three variants of pruning (28, 32, and 40 buds per vine). The experiment was set up on 72 vines in four repetitions (6 vines per repetition).

During the examination, monitored were the beginning, duration and completion of individual phases of the phenological development of vine. Dates of the beginning of dormancy and vegetation periods as well as individual phases during the vegetation period were recorded 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 (1946).
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, examined were the following parameter:

a. Phenological development of the variety
b. Fruiting capacity of canes
c. Weight of grapes per vine
d. Number of clusters 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 clusters per vine
- Weight of grapes per vine (g)

The parameters obtained during the study were processed in the SPSS software package version 22.0. (2013).

Environmental conditions

Climate change can affect the growth and physiology of grape varieties, as well as the quality of wine (Jones, 2007; Seguin, 2007). Global climate change has a profound impact on viticulture in terms of growing areas, grape production, product quality and efficiency (Anderson, 2008; Chiriac, 2007).

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 FB&H 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

During the study years, average values of meteorological indicators were considerably higher compared to a multiannual average, except amount of rainfall in 2011.

RESULTS AND DISCUSSION

Phenology refers to changes in the life stages of biological organisms and a more accurate study of the time of biological events, the causes of the timing of their occurrence in relation to biotic and abiotic factors and their mutual relationships. Plant development is defined as a sequence of phenological events controlled by external factors; each event making important changes in morphology and the partitioning of assimilates among different organs during the life cycle of the plant. In this context, the rate of phenological development can be defined as the reciprocal of the time an organism takes to progress from one stage to another (Sivertsen *et al.*, 1999).

Table 3. Dates of occurrence of phenophases in the development of Muscat Bleu variety

Year of observation	Phenophases of development						
	Bleeding	Bud break	Flowering		Veraison	Full ripeness	End of vegetation
			beginning	end			
2011	18.03.	02.04.	17.05.	26.05.	01.07.	27.07.	08.11.
2012	19.03.	03.04.	19.05.	27.05.	05.07.	04.08.	10.11.
2013	22.03.	05.04.	21.05.	31.05.	07.07.	06.08.	13.11.
Average	20.03.	03.04.	19.05.	28.05.	04.07.	02.08.	10.11.

Table 4. Length of phenophase development in days

Phenophases of development	Year of observation			Average
	2011	2012	2013	11/13
Bleeding	15	15	14	15
Bud break	45	46	46	46
Flowering	9	8	10	9
Green berry development	36	39	37	37
Full ripeness	26	30	30	29
End of vegetation	104	98	99	100
Length of vegetation period	235	236	236	236
Winter hibernation period	130	130	129	130

The length of the period from bud opening to full maturity, i.e. harvesting in Muscat Bleu variety in agro-ecological conditions of Mostar vineyards, averaged 121 days in the study period 2011 – 2013. The Muscat Bleu variety can be classified as a very early variety, based on the classification according to the length of the period from the emergence of nodes to grape harvesting, created by Mattheou *et al.* (1995).

The productivity of a variety is primarily genetically determined, but it is also significantly influenced by internal and external factors, which is why it varies widely. The internal factors include hormones, while the most important and proven impact of

the external factors is attributed to mineral nutrition, light, heat, water, agro and phytotechnics (Srinivasan & Mullins, 1976,1981; Lavee *et al.*, 1981; Ziv *et al.*, 1981; Svanepoel & Archer, 1988; Kuljančić, 1994; Kuljančić *et al.*, 1998).

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).

The total number of developed shoots per grapevine, during the study period, was the highest in 2012, then in 2011, and the lowest in 2013. Variant III expectedly had the biggest number of developed shoots per grapevine, then variant II, while the lowest number was recorded in variant I.

Parameter of the number of productive shoots per grapevine was the highest in 2012, and the lowest in 2013. Pruning variants II and III had a statistically significant higher number of productive shoots compared to variant I.

Table 5. 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	21,14	24,49	22,95	$22,86^{c}$
	II	26,21	25,62	21,50	$24,44^{b}$
	III	27,05	29,75	23,50	$26,77^{a}$
Average for the year		$24,80^{b}$	$26,62^{a}$	$22,65^{c}$	
Number of fruiting canes	I	20,17	22,71	21,08	$21,32^{b}$
	II	24,46	25,75	23,33	$24,51^{a}$
	III	25,96	28,29	23,00	$25,75^{a}$
Average for the year		$23,53^{ab}$	$25,58^{a}$	$22,47^{b}$	
Number of clusters per vine	I	40,13	33,58	24,07	$32,59^{b}$
	II	41,78	30,38	27,62	$33,26^{b}$
	III	56,05	38,59	26,10	$40,24^{a}$
Average for the year		$45,98^{a}$	$34,18^{b}$	$25,93^{c}$	
Yield of grapes per vine	I	9,62	7,26	7,39	$8,09^{b}$
	II	9,26	7,65	8,75	$8,55^{b}$
	III	12,02	7,86	8,04	$9,31^{a}$
Average for the year		$10,30^{a}$	$7,59^{c}$	$8,06^{b}$	

The average grape yield per grapevine was statistically significant the highest in 2011, then in 2013, and the lowest in 2012. Pruning variant III had a statistically significant higher yield compared to the other two variants.

Statistically significant the highest average number of clusters per grapevine was recorded in 2011, then in 2012, and the lowest in 2013. Pruning variant III had a statistically significant higher number of clusters than the other two variants.

The average grape yield of Muscat Bleu variety in Poland was 2.4 kg/grapevine (Lisek, 2014) which is far less than in this study. This difference in grape yield can be explained by the fact that the node load of grapevines in Poland was considerably lower compared to these studies, and the ecological conditions of Herzegovina, where the studies were carried out, are much more favorable compared to the conditions in Poland.

CONCLUSIONS

1. 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 relative to the standard average.
2. Phenophases of development in Muscat Bleu 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. Variety Muscat Bleu had the largest number of developed shoots in 2012, then in 2011, and the smallest in 2013. The total number of developed shoots per grapevine was the highest for pruning variant III, which was to be expected given that variant III also had the largest number of retained nodes per grapevine. In 2012, Muscat Bleu had the largest number of productive shoots compared to the other two experimental years. The number of productive shoots was higher in variants III and II compared to variant I. The grape yield per grapevine in variant III was higher compared to other pruning variants in the examined variety, and in 2011 it was higher compared to 2012 and 2013.

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UTICAJ REZIDBE NA RODNOST SORTE VINOVE LOZE MUSCAT BLEU

Rezime

Ispitivanje uticaja rezidbe na rodnost stone sorte vinove loze Muscat Bleu u uslovima Hercegovine, trajalo je tri godine. Primijenjene su tri varijante rezidbe (28, 32 i 40 okaca / čokotu) u četiri ponavljanja. Na osnovu dobijenih rezultata može se vidjeti da su prinos grožđa po čokotu i broj grozdova po čokotu bili najveći 2011. godine (10,30 kg i 45,98). Prinos grožđa po čokotu (7,59 kg) je bio najmanji 2012., a broj grozdova po čokotu 2013. godine (25,93); ukupan broj lastara bio je najveći 2012. (26,62), kao i broj rodnih lastara (25,58), dok je najmanji bio 2013. godine (ukupan broj lastara/čokot 22,65, broj rodnih lastara/čokot 22,47). Varijanta rezidbe III imala je najveće vrijednosti navedenih parametara tokom sve tri ogledne godine, a varijanta I najmanje.

Ključne riječi: *Muscat Bleu, stono grožđe, rezidba, prinos.*