

# The study regarding the agrobiological and technological properties of some clonal elites for table grapes, under the conditions of the Murfatlar vineyard

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## ABSTRACT

At the Research and Development Station for Viticulture and Vinification Murfatlar, in the period 2019 – 2022, was carried out clonal selection work on two cultivars for table grapes, respectively: 'Victoria' and 'Coarnă neagră'. The research consisted of the comparative study of five clonal elites of each cultivar, regarding their agrobiological and technological qualities, correlated with the specific climatic conditions of the Murfatlar vineyard. The five elites of each cultivar were studied and analyzed compared to the characters of the initial cultivar (the control). In the case of the 'Victoria' cultivar, out of the five elites under study, the one that stands out is the clonal elite 'Victoria 57/4/7', which has great vigor, good fertility 63-73%, and high productivity. The preservability of grapes on the bush is long, about 30 days. Grape production is high, over 16-18 t/ha, of which 83-85% is commodity production. When are ripe for consumption, the grapes accumulate 140-150 g/l sugars, and the acidity is relatively low 3.8-4 g/l H<sub>2</sub>SO<sub>4</sub>. Regarding the cultivar 'Coarnă neagră', of the five elites under study, the one that stands out is the clonal elite 'Coarnă neagră' 14/5/22', which has great vigor, high fertility, and medium ripening. The grape is large, cylindrical or cylindrical-conical in shape. Grape production is high, 20-25 t/ha, of which 85% is commodity production. The preservability on the bush is high, between 25-30 days. When are ripe for consumption, grapes accumulate 170–180 g/l sugars, and 5 g/l H<sub>2</sub>SO<sub>4</sub> total acidity.

**Keywords:** clonal selection, grapes for consumption, climate, productivity, quality

## INTRODUCTION

On the two hemispheres of the globe, the vine is cultivated between 28° and 50° latitude (Belliturk *et al.*, 2023). The competitiveness of viticulture is, generally, determined by the quality of the vine assortment, the role of this factor becoming decisive, especially depending on the specifics of the cultivation area, as a whole, as well as the geographical peculiarities of the vineyards (Savin and Cornea, 2015).

Due to the attractive external appearance, the particularly pleasant taste and the high energy value, table grapes are among the most valuable fruits that are consumed fresh (Muntean and Ionica, 2006).

## MATERIALS AND METHODS

The research was carried out over a period of four years (2019 – 2022), and consisted in the study of clonal selections coming from 2 cultivars for table grapes, respectively:

'Victoria' and 'Coarnă neagră'. During this period, five clonal elites of each cultivar were comparatively analyzed, regarding their agrobiological and technological qualities, correlated with the specific climatic conditions of the Murfatlar vineyard. The agroproductive behavior of the 10 clonal elites was evaluated compared to the 2 initial cultivars (control), using variance analysis and Tukey's post hoc test.

Observations and determinations were made regarding the biological characteristics of fertility, the development of the phenophases of vegetation, the phytosanitary status, but also some morphological components, production capacity, and the technological characteristics of the grapes were determined and analyzed in the laboratory.

## RESULTS AND DISCUSSION

For most agricultural systems and especially for viticulture, climate is a major factor dividing the spatio-temporal distribution due to the vulnerability of climate inconsistency occurring during the year and climate change (Gouveia *et al.*, 2011).

The climatic conditions specific to the Murfatlar vineyard are favorable for the cultivation of vines, as the climate is continental, with warm summers and moderate winters.

The climatic data presented in Table 1 were analyzed throughout the wine-growing years, with an emphasis on the vegetation period (April - September).

**Table 1.** The main climatic elements in the Murfatlar vineyard, in the years 2019 – 2022

Elemente climatice analizate	Multiannual average	2019	2020	2021	2022
Global thermal balance, ( $\sum t^{\circ}g$ )	4790,7	5534,4	4999,6	4396,8	5053,3
The active thermal balance, ( $\sum t^{\circ}a$ )	4300,7	5061,8	4500,5	3693,3	4573,8
Useful heat balance, ( $\sum t^{\circ}u$ )	2178,9	2811,8	2270,5	1850,1	2228,8
Average temperature in July, °C	25,5	26,7	26,3	30,3	25,7
Average temperature in August, °C	24,7	27,5	25,8	25,1	26,1
Average temperature in September, °C	19,3	22,8	21,7	17,6	19,56
Temp. min. absolute in air, °C	-22	-10,5	-13,9	-13,1	-10,6
Temp. min. absolute at the ground surface, °C	-15,5	-15	-9,8	-10,8	-12,1
Average annual temperature T°C	13,0	14,8	14,9	13,8	13,9
Maximum air temperature, °C	44	39	33,9	39,5	36,0
$\sum$ annual precipitation, mm	522,6	311,4	267,9	661	383,7
$\sum$ precipitation during the vegetation period, mm	324,2	180,4	161,7	339,3	206,7
$\sum$ hours of insolation per vegetation period, hours	1612,1	2125,5	1574,6	1300,6	1401
Average maximum temperatures in August, °C	30,8	33,8	30,4	31	32
The average temperature in the first and second decades of June	22,9	26,3	22,1	19,5	22,2
No. days with temp. maximum >30°C	51	98	57	44	64
Duration of the bioactive period, no. days	188,4	162	186	213	158
Real heliothermal index (IHR)	3,6	4,5	5,7	3	4,5
Hydrothermal coefficient (CH)	0,8	0,4	0,4	0,9	0,6
Bioclimatic index (Ibcv)	13,2	22,6	20,3	6,4	12,3
Oenoclimatic suitability index (IAOe)	5178,6	5847,5	5457	4700,3	5250,7
Heliothermal Huglin index (IH)	3130,1	4583,7	4584	2856,3	2520

The values for the global, active and useful heat balance, according to Table 1, during the study period (vine years 2019 – 2022), were higher than the multiannual average values, indicating years with high heliothermal availability.

The rainfall regime was deficient (in the years 2019, 2020, and 2022), with precipitation amounts below the multiannual average. Only in the 2021 wine year, the amount of precipitation recorded exceeded the multiannual average.

The values for the Real Heliothermal Index (I<sub>Hr</sub>) (Blanco-Ward *et al.*, 2019), during the study period, exceeded the multi-year average, which indicates that there are sufficient heliothermal resources for the ripening of grapes, including the late cultivars.

The hydrothermal coefficient (CH) had values between 0.4 - 0.9, much lower, compared to normal values (1 - 1.9), this indicates the need to install drip irrigation systems (Table 1).

Regarding the fertility percentage values, during the study period, for each elite, they were higher than those of the control cultivars. The superior clonal elites, in this period, are:

- The elite 'Victoria 57/4/7' (the clone that imposes itself due to its earliness and high productivity), recorded a 92% fertility percentage, compared to the 66% normal fertility values of the original cultivar;
- The elite 'Coarnă neagră 14/5/22' (clone which is imposed by great vigor, large and compact grapes), recorded 86% fertility percentage, compared to the normal fertility of the original cultivar of 56% (Table 2).

**Table 2.** The main statistical elements of the studied genotypes in 2019 – 2022

Cultivars	Clonal elite	Total buds/ trunk	Total shoots/ trunk	Fertile shoots	No. of inflorescences /trunk	Fertility percentage %
<b>2019</b>						
'Victoria'	53/5/4	20	14	9	12	86
	57/4/7	27	22	19	20	91
	52/2/5	28	21	15	20	95
	55/4/7	24	20	15	18	90
	50/7/3	22	17	9	14	82
	<b>Control (initial cultivar)</b>	<b>19</b>	<b>16</b>	<b>10</b>	<b>13</b>	<b>81</b>
'Coarnă neagră'	9/7/4	28	21	10	19	90
	17/5/3	20	14	8	12	86
	24/7/8	25	18	10	16	89
	14/5/22	30	22	10	20	91
	32/1/6	27	21	9	18	86
	<b>Control (initial cultivar)</b>	<b>21</b>	<b>17</b>	<b>13</b>	<b>14</b>	<b>82</b>
<b>2020</b>						
'Victoria'	53/5/4	26	17	13	15	88
	57/4/7	32	25	20	23	92
	52/2/5	25	14	5	7	50
	55/4/7	27	14	10	12	85
	50/7/3	25	15	7	12	80
	<b>Control (initial cultivar)</b>	<b>26</b>	<b>20</b>	<b>15</b>	<b>16</b>	<b>80</b>
'Coarnă neagră'	9/7/4	26	19	10	17	89
	17/5/3	20	15	9	13	87
	24/7/8	24	14	10	12	86
	14/5/22	27	21	14	19	90
	32/1/6	23	16	11	13	81

Cultivars	Clonal elite	Total buds/ trunk	Total shoots/ trunk	Fertile shoots	No. of inflorescences /trunk	Fertility percentage %
	<b>Control (initial cultivar)</b>	<b>22</b>	<b>18</b>	<b>10</b>	<b>14</b>	<b>78</b>
<b>2021</b>						
<b>'Victoria'</b>	53/5/4	21	13	10	12	92
	57/4/7	30	17	16	14	82
	52/2/5	23	17	10	15	88
	55/4/7	25	18	11	16	89
	50/7/3	21	15	13	14	93
	<b>Control (initial cultivar)</b>	<b>22</b>	<b>20</b>	<b>13</b>	<b>15</b>	<b>75</b>
<b>'Coarnă neagră'</b>	9/7/4	26	21	13	18	85
	17/5/3	23	17	10	15	88
	24/7/8	25	18	13	16	89
	14/5/22	29	22	12	20	91
	32/1/6	24	19	10	15	79
	<b>Control (initial cultivar)</b>	<b>24</b>	<b>22</b>	<b>16</b>	<b>18</b>	<b>82</b>
<b>2022</b>						
<b>'Victoria'</b>	53/5/4	23	18	15	17	94
	57/4/7	28	21	16	26	93
	52/2/5	26	19	15	17	89
	55/4/7	20	16	12	13	81
	50/7/3	19	15	7	10	67
	<b>Control (initial cultivar)</b>	<b>21</b>	<b>17</b>	<b>13</b>	<b>13</b>	<b>76</b>
<b>'Coarnă neagră'</b>	9/7/4	19	14	10	12	86
	17/5/3	18	15	8	13	87
	24/7/8	22	16	11	14	87
	14/5/22	25	21	18	20	95
	32/1/6	20	13	10	11	84
	<b>Control (initial cultivar)</b>	<b>19</b>	<b>15</b>	<b>11</b>	<b>12</b>	<b>80</b>

According to Table 3, in the years of the study, in the climatic conditions of the Murfatlar vineyard, for the cultivar 'Victoria' (control), and the five studied elites, the budburst occurred between April 15 and April 23, the flowering between May 30 and 07 June, veraison between July 30 and August 28, and full maturity between August 27 and September 26.

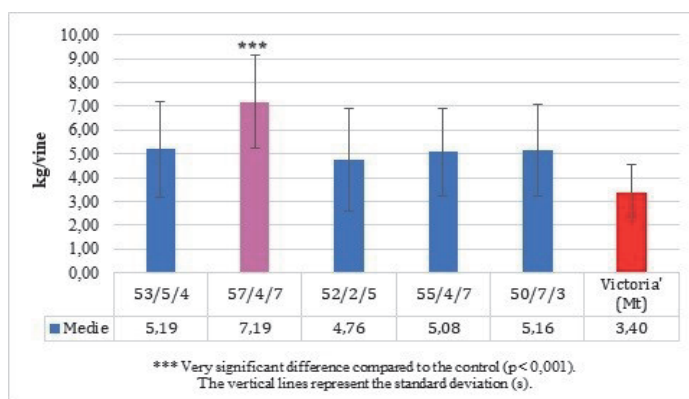
Following the data in table 3, for the cultivar 'Coarnă neagră' (control), and the five elites studied, the budburst occurred between April 25 and 26, the flowering between June 4 and June 10, the ripening between August 28 and September 20, and full maturity between September 24 and October 3.

The leaf fall phenophase took place between October 25 and November 5, depending on the climatic conditions of each studied year.

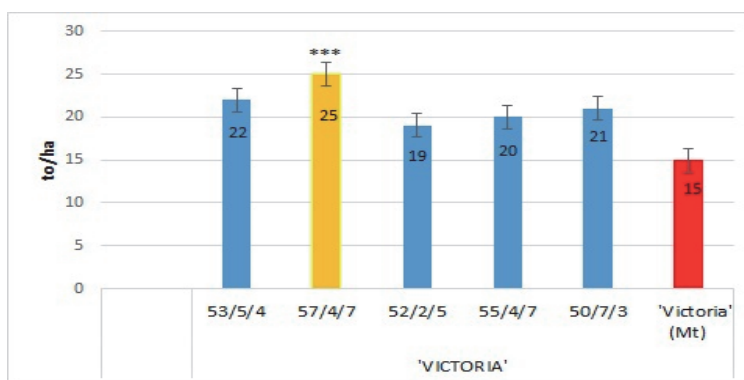
From figure 1, it can be seen that the clonal elite 'Victoria 57/4/7' (characterized by earliness and high productivity), registered a very significant difference (\*\*\*) compared to the control, with an average of 7.19 kg/vine, compared to 3.40 kg/vine, the average for the control. Regarding the to/ha production, according to figure 2, the clonal elite 'Victoria 57/4/7' had an average of 25 to/ha, well above the value of the control (15 to/ha)

**Table 3.** Development of vegetation phenophases during the study period

Cultivars	Budburst (BBCH 08-09)							
	2019		2020		2021		2022	
	Date	T useful °C	Date	T useful °C	Date	T useful °C	Date	T useful °C
'Victoria'	15.IV	27,6	17.IV	25	23.IV	17,2	21.IV	52,7
'Coarnă neagră'	25.IV	28,3	26.IV	53,4	26.IV	17,0	25.IV	75,6
Cultivar	Flowering (BBCH 65-68)							
	2019		2020		2021		2022	
	Date	T useful °C	Date	T useful °C	Date	T useful °C	Date	T useful °C
'Victoria'	30.V	332,9	07.VI	405	04.VI	285,9	02.VI	394,8
'Coarnă neagră'	05.VI	403,5	08.VI	419,1	04.VI	285,9	10.VI	486,9
Cultivar	Ripening (BBCH 85)							
	2019		2020		2021		2022	
	Date	T useful °C	Date	T useful °C	Date	T useful °C	Date	T useful °C
'Victoria'	30.VI I	1342,3	28.VIII	1701,4	22.VIII	1446,7	02.VIII	1270,2
'Coarnă neagră'	03.IX	1410,2	02.IX	1774,6	28.VIII	1526,6	20.IX	1565
Cultivar	Full maturity (for consumption) (BBCH 89)							
	2019		2020		2021		2022	
	Date	T useful °C	Date	T useful °C	Date	T useful °C	Date	T useful °C
'Victoria'	27.VIII	1821,7	26.IX	2061,3	08.IX	1642,5	08.IX	1809,5
'Coarnă neagră'	03.X	2000,4	30.IX	2095,1	29.IX	1825,8	24.IX	1924,1
Cultivar	Falling leaves (BBCH 95-97)							
	2019		2020		2021		2022	
	Date	T useful °C	Date	T useful °C	Date	T useful °C	Date	T useful °C
'Victoria'	25.10	2361,5	11.10	2181,8	30.10	1969,4	05.11	1977,2
'Coarnă neagră'	25.10	2107,3	11.10	2215,6	30.10	1989,4	05.11	2091,8

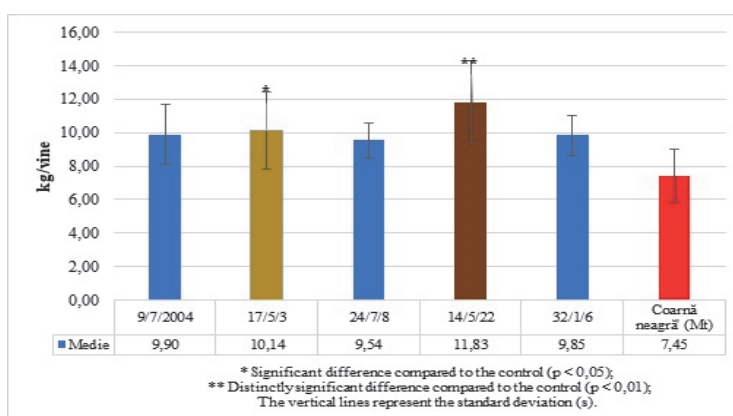


**Figure. 1** Production (kg/vine) of clonal elites in the period 2019-2022 compared to the control cultivar 'Victoria'

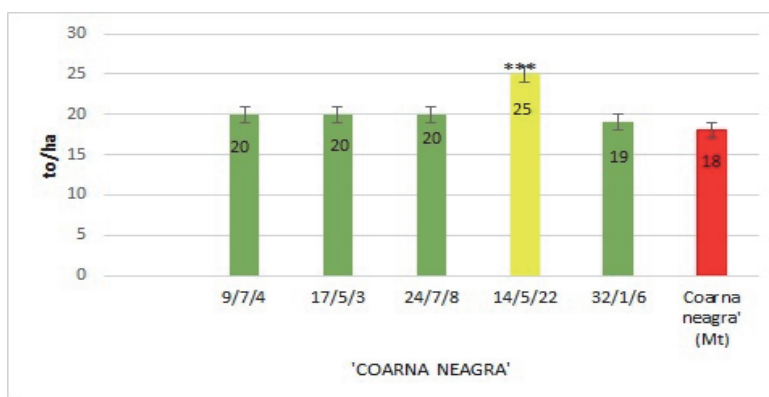


**Figure. 2** Production (to/hectare) of clonal elites in the period 2019-2022 compared to the control cultivar 'Victoria'

Analyzing figure 3, the clonal elite 'Coarnă neagră 17/5/3' had a significant difference (\*) compared to the control, but the elite 'Coarnă neagră 14/5/22' (characterized by high vigor, large and compact grapes) registered a distinctly significant difference (\*\*) compared to the control, having an average of 11.83 kg/vine compared to 7.45 kg/vine average for the control. Analyzing figure 4, where the production to/ha is presented, the clonal elite 'Coarnă neagră 17/5/3', had on average in the years of study, 25 to/ha, exceeding the production of the control (18 to/ha).



**Figure. 3** Production (kg/vine) of clonal elites in the period 2019-2022 compared to the control cultivar 'Coarnă neagră'



**Figure. 4.** Production (to/hectare) of clonal elites in the period 2019-2022 compared to the control cultivar 'Coarnă neagră'

In the years 2019 - 2022, for the ten clonal elites and for the control, their sugar and acidity were monitored.

Analyzing the data in table 3, regarding the amounts of accumulated sugars, the differences between the elites and the control are on average positive, the grapes of the clonal elites accumulated significant amounts of sugars and implicitly the acidity was lower, the superior elites of the two control cultivars being: 'Victoria 57/4/7' and 'Coarnă neagră 14/5/22'.

Overall, under the conditions of these years, the elites studied developed normally and accumulated large amounts of sugars, which demonstrates their readiness for good cultivation in Dobrogea and other areas with a similar climate.

**Table 4.** Sugar and acidity of the elites compared to the control cultivars

Cultivar	Clonal elite	Sugars g/l				Acidity g/l			
		2019	2020	2021	2022	2019	2020	2021	2022
'Victoria'	53/5/4	177,3	172,3	136,2	144,7	4,6	3,40	2,8	1,42
	57/4/7	206,5	204,1	137,3	178,2	3,4	3,50	2,6	1,75
	52/2/5	180,1	165,4	136,4	152,5	4,2	3,25	2,7	1,50
	55/4/7	183,2	173,7	136,2	160,3	3,6	3,36	2,7	1,57
	50/7/3	161,4	152,4	135,9	167,2	4,7	3,49	2,8	1,64
	<b>Control (initial cultivar)</b>	<b>142</b>	<b>146,3</b>	<b>112,4</b>	<b>149,5</b>	<b>4,3</b>	<b>4,23</b>	<b>3,84</b>	<b>4,52</b>
'Coarnă neagră'	9/7/4	163,0	158,4	191,7	158,4	4,6	5,1	5,4	2,31
	17/5/3	160,1	160,1	198,4	150,6	6,8	4,6	3,8	2,16
	24/7/8	150,2	164,2	194,5	160,7	7,2	6,2	3,9	2,30
	14/5/22	187,2	186,4	203,2	162,2	5,4	4,8	2,7	2,33
	32/1/6	149,5	160,9	194,2	156,8	6,5	5,3	3,7	2,25
	<b>Control (initial cultivar)</b>	<b>140,4</b>	<b>139,8</b>	<b>152,4</b>	<b>121,6</b>	<b>6,0</b>	<b>5,5</b>	<b>4,0</b>	<b>3,80</b>

The clonal elites 'Victoria 57/4/7' and 'Coarnă neagră 14/5/22' have a special commercial value, they are significantly different from the control but also the other elites, due to the size of the grapes, the compactness and consistency of the core (Table 4).

**Table 5.** Technological characteristics of clonal selections with an emphasis on commercial value

Cultivar/ Clonal selection	Grape size	Bunch weight	Berry size and uniformity	Compactness	Form and color	Epicuticular wax layer	Adhesion and elasticity of the skin	Consistency	Seeds presence	Taste	Flavor
'Victoria' 57/4/7	Very large	400-600g	Large and non-uniform	Loose	Oval, greenish yellow	Medium	Very firm	Medium crisp	Fully formed	Other taste	No flavour
'Coarnă neagră' 14/5/22	Large	180-350g	Large and uniform	Medium	Ovoid, bluish black	Medium	Medium firm	Crisp	Fully formed	Other taste	No flavour



**Figure 5.** Clonale elite 'Victoria 57/4/7' and cultivar 'Victoria' (martor)



**Figure 6.** Clonale elite 'Coarnă neagră 14/5/22' and cultivar 'Coarnă neagră' (martor)

## CONCLUSIONS

During the studied period, the clonal elite 'Victoria 57/4/7' was constantly maintained at a higher level than the other elites and the control. It has great vigor, good fertility (63-73% fertility percentage) and high productivity. The preservability of grapes on the trunk is long, about 30 days. Grape production is high, over 16-18 t/ha, of which 83-85% is commodity production. When are ripe for consumption, the grapes accumulate 140-150 g/l sugars, and the acidity is relatively low 3.8-4 g/l H<sub>2</sub>SO<sub>4</sub>.

In the wine years 2019 - 2022, the clonal elite 'Coarnă neagră 14/5/22', constantly had higher values than the other elites and the control. This elite has high vigor, high fertility, and medium ripeness. The grape is large, cylindrical or cylindrical-conical in shape. Grape production is high, 20-25 t/ha, of which 85% is commodity production. The preservability on the trunk is high, between 25-30 days. When are ripe for consumption, the grapes accumulate 170-180 g/l sugars, and 5 g/l H<sub>2</sub>SO<sub>4</sub> total acidity.

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