

INFLUENCE OF NEGATIVE MINIMUM TEMPERATURES AND ABUNDANT PRECIPITATION UPON PRODUCTION AND QUALITY OF SOME VARIETIES OF VINES WITH TABLE GRAPES FROM SANDY SOILS CONDITIONS IN SOUTH-WESTERN OLTENIA

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ABSTRACT

During the 2012-2016 period, only one year (2013), has provided favourable conditions for the cultivation of vines on sandy soils from south-western Oltenia. In this year, all varieties studied were manifested at the genetic potential, consistent with vigour the 1st year of production. It was noted the Otilia variety has realized an output of 27.6 tonnes/hectare.

It was followed up with an output of more than 20 t/ha of varieties: Muscat de Hamburg Cl. 202 (23.1 t/ha), Napoca (21.6 t/ha), Transilvania (21.4 t/ha), Muscat de Hamburg and Coarnă neagră selecționată (21.2 t/ha), Prima Cl. 1022 (20.1 t/ha). At the opposite pole were varieties Tamina (9.9 t/ha) and Sylvania (6.4 t/ha). In 2012, 2015 and 2016 years, there have been less than minimum temperature resistance of the vine, and in 2014, unfavorable factor represented him excessive rainfall (994 mm annual, and 640.7 mm, during the growing season), who this year made the most rainy from 1958-2014 period.

In 2014 year, pesticide treatments applied, the number 9, did not stop the attack of fungal diseases, so that the degree of attack produced by major diseases, Plasmopara viticola and Uncinula necator. In years with negative minimum temperatures, below the limit of vines resistance, between -23,4...-25,1^oC, grape production was affected or compromised in some varieties.

In these conditions noted the ability of varieties to bear the elements bearing short (Prima Cl. 1022, Perla de Zala and Moldova), and the favorable effect of protecting with earth of fruit wood shoots, as happened in 2016.

INTRODUCTION

Sandy soils from south-western part of Romania, although poorly fertile and high permeability due to the low content of humus, nutrients and clay, are part of the very favourable for vines (4; 1).

Although there are a number of varieties of vines, these not satisfy the expectations of winemakers, especially in this time of climatic change or manifestation, expressed in temperatures below -18^oC, during the rest period, and abundant rainfall during the growing season, drought periods and dogdays in July and August, etc. (5; 6; 11; 2; 3; 8; 10; 9). Noting that it was multiplied by the number of years with temperatures below freezing during idle periods of the vine (7). In these circumstances it is necessary to improve the existing assortment with varieties that best meets the current climatic conditions.

MATERIALS AND METHODS

The experience was founded in 2010 year. In 2012 year, these was in the third year of planting, and the 2013 was the first year of production.

Were planted the following varieties: *Silvania*, *Timpuriu de Cluj*, *Muscat de Hamburg*, *Tamina*, *Someșan*, *Splendid*, *Napoca*, *Otilia*, *Victoria*, *Prima Cl. 1022*, *Coarnă neagră selecționată*, *Muscat de Hamburg Cl. 202*, *Transilvania*, *Perla de Zala*, *Moldova*.

The number of plants was 3787/hectare, what emerges from the sett planting distances 2.2/1.2 m.

In years when vines have been affected by frost (2012, 2015, 2016), cutting was effected short, 2-3 eyes, where as existing buds above the snow depth perished in its entirety, and with these wood annual and multiannual. In these circumstances we have not secured the specific shipment of each variety.

Were effectuated experimental observations and determinations for the grapes production and its quality.

During the period 2012-2016, were manifested not just favourable conditions for vines (table 1). From those 5 years, one has been a normal climatic, for vines, 2013 year, the year in which the absolute minimum temperature was -18.1°C , temperature did not affect the viability of main buds.

In three of this years recorded temperatures were below the limit of resistance of the bud and the other organs of the vine, namely in 2012, when the absolute minimum temperature was -24.3°C , 2015, with the absolute minimum temperature was -25.1°C and 2016, when there has been an absolute minimum temperature of -23.4°C . During these three years have resisted only a portion of the buds that were located in the snow layer whose thickness was 25-30 cm.

Table 1

The climatic dates main from 2012-2016 period

Year	Temperature ($^{\circ}\text{C}$)		Rainfall (mm)			Snow layer (cm)
	Minimum	Maximum	Annual	April-september period	Multiannual	
2012	-24,3	42,6	383,5	230,8	578,5	25
2013	-18,1	38,4	451,5	307,8	588,4	15
2014	-14,1	37,6	994	640,7	546,8	25
2015	-25,1	39,2	748,9	398	554,96	30
2016	-23,4	38	748,9	297,4	554,96	30

In 2014 year, although the vines did not suffer because of the low temperatures, the production of grape was affected by the large amount of rainfall annually, 994 mm and 640.7 mm, during the growing season, well above the multiannual average values.

RESEARCH RESULTS

In 2012 year, the vine was in third year after planting, and although the negative minime temperature (-24.3°C) affected the main buds, placed over snow layer whose thickness was 25 cm, the shoots with grapes were obtained from the buds situated on vine base at all varieties (table 2). It showed precocity and ability of their varieties to beir fruit on short elements (1-3 eye). Were emphasized for the quantity of grape the varieties *Prima Cl. 1022* and *Transilvania* (10.0 t/ha).

2013 year was a favorable for the cultivation of vines, almost, from all points of view, because the negative temperatures did not affected the main buds that the dry pruning was carried out using long wood shoot of 10-12 eyes, without frosts and hoarfrost late spring without abundant rainfall during the growing season. In these circumstances, all varieties studied were manifested at the genetic potential, consistent with vigour the first year of production. It was noted the variety *Otilia*, which achived a grapes quantity of 27.6 t/ha. This was followed, with a grapes quantity over 20 t/ha, of *Muscat de Hamburg Cl. 202* (23.1 Kg/ha), *Napoca* (21.6 t/ha), *Transilvania* (21.4 t/ha), *Muscat de Hamburg* and

Coarnă neagră selecționată (21.2 t/ha), *Prima Cl. 1022* (20.1 t/ha) varieties. At the opposite pole were varieties *Tamina* (9.1 t/ha) and *Silvania* (6.4 t/ha).

Table 2

Production (t/ha) at some varieties of vine with table grapes 2012-2016 period

Variety	Year							Average 2012-2016
	2012	2013	2014			2015	2016	
			Grapes production	*Degree of attack on leaves (%)	* Degree of attack on branches (%)			
Victoria	4.3	18.9	5.7	64	88	9.5	11.7	10.0
Silvania	2.6	6.4	8.4	5	5	5.4	14.0	7.4
Timpuriu de Cluj	1.6	13.2	6.1	15	24	8.2	7.1	7.3
Muscat de Hamburg	5.3	21.2	8.7	42	22	3.5	7.9	9.3
Tamina	2.4	9.1	4.5	38	27	1.2	8.3	5.2
Someșan	2.2	10.1	-	26	100	5.4	8.7	5,2
Splendid	4.5	9.9	6.4	28	95	1.8	15.1	7,6
Napoca	2.3	21.6	6.4	44	96	2.9	10.9	8,8
Otilia	1.5	27.6	7.9	33	87	5.3	7.6	10,0
Prima Cl. 1022	10.0	20.1	6.8	66	72	11.0	10.2	11,6
Coarnă neagră selecționată	2.6	21.2	6.6	72	76	3,0	9.1	8,5
Muscat de Hamburg Cl. 202	5.0	23.1	7.9	45	62	3.4	9.1	9,7
Transilvania	10.0	21.4	-	90	100	-	3.8	7,0
Perla de Zala	4.2	18.2	16.0	10	-	15.0	15.1	13,7
Moldova	5.9	16.6	12.5	12	6	12.5	9.1	11,3

*Degree of attack combined of *Plasmopara viticola* and *Uncinula necator* on leaves and branches.

In 2014 year, the factor which has affected the production of grapes were abundant rainfall, so the annual amount, the largest of the 58 years since weather records are made at Dăbuleni, and during the growing season. Excessive moisture conditions increased virulence of the main diseases of the vine, *Plasmopara viticola* and *Uncinula necator*, although there have been a number of 9 phytosanitary treatments, with systemic action and contact.

The degree of the attack produced by the two fungus was high on both leaves, being between 5 and 90%, and bunches, taking values from 5 to 100% (table 2). It was the most resistant variety, *Silvania*, with a degree of attack of 5%, both leaves and bunches, which achieved a yield of grape of 8.4 t/ha, and the most sensitive variety was *Transilvania* with a degree of 90%, on leaves and 100% on bunches, and thus on the production of grapes has been compromised. Diseases also compromise the production of grapes and in the case of the *Someșan* variety. *Perla de Zala* variety, which is classified as resistant varieties, as well as *Moldova* variety, with a degree of attack of 10%, on the leaves and no traces of the attack on the grape, achieved a grape production of 16 t/ha.

Grape production obtained at *Moldova* variety, which the attack diseases manifested in percentage of 12% on leaves and 6%, on bunches, was of 12.5 t/ha. Between noble varieties most productive was *Muscat of Hamburg*, with a yield of grape of 8.7 t/ha.

In 2015 year, was unfavourable for the vines because the negative temperatures, low values up to -25,1⁰C, affected all buds main and wood annual and multiannual situated above snow layer, whose thickness was 30 cm. Load of buds on a vine and positioning shoots at the base of their, decreased production of grapes and even to compromise, as happened at the *Transilvania* variety, a variety very sensitive to negative lows.

In terms of 2015, the most productive varieties were those with „blood” of hybrid manufacturer directly, *Perla de Zala* and *Moldova*, which achieved a production of grapes of 15 t/ha and 12.5 t/ha respectively, and noble variety *Prima Cl. 1022*, which achieved a production of grapes of 11 t/ha. The harmful effect of negative minimum temperatures continued in 2016 year, when the absolute minimum temperature recorded $-23,4^{\circ}\text{C}$, especially because it came as a shock after a few days earlier it had registered temperatures until -18°C . In 2015 year, in autumn, from each vine were protected 2-3 sting, during the winter period through bending and dropping them to the earth, at ground level. In these conditions the dry pruning the vines were used strings of fruits, long 10-12 eye, along with the short elements. Varieties with greater capacity to bear fruit and the short elements grape production was better. Best behaved resistant variety *Perla de Zala* and noble variety *Splendid*, which achieved a production of 15.1 t/ha. Among other noble grape production was achieved greater varieties *Silvania* (14 t/ha), *Victoria* (11.7 t/ha), *Napoca* (10.9 t/ha și *Prima Cl. 1022* (10.2 t/ha).

Analysis of production during 2012-2016 period showed strong the resistant varieties *Perla de Zala* with a average production of 13.7 t/ha, and *Moldova* (11.3 t/ha). Noble varieties were noted *Prima Cl. 1022* (11,6 t/ha), *Victoria* and *Otilia* with a production of 10 t/ha.

The extra harvest was done, especially on account of strings that were protected because their potential fruit is usually done on string between the eyes 4-7.

Accumulated total sugar content in grapes at harvest grapes during the 5 years of determination wavered in large limits, depending in particular genetic potential (early varieties means less sugar content), the climatic conditions of the year, which in turn affects the main buds, which results in a lower production of grapes, disease and pest attack (if the attack is reduced sugar content) ,, and according to the quantity of grape (low throughput means larger amounts of sugar), etc. (table 3).

The lower boundary between falling total sugar content of the grapes at harvest, are 137-154 g/l, at *Victoria* variety, 138-162 g/l at *Napoca* variety, 140-172 g/l at *Prima Cl. 1022* variety and 142-192 g/l at *Timpuriu de Cluj* variety. All these varieties belong to the group of early varieties. *Otilia* variety, variety with grapes without seeds, although characterized by earliness, accumulates the highest total sugars content (168-204 g/l). This grapes, can be used to obtain raisins. A great sugar content accumulated *Perla de Zala* variety (165-172 g/l) and the latest variety *Coarnă neagră selecționată* (162-184 g/l).

Table 3

The content of total sugar at the moment of harvesting grapes at some varieties of vine with table grapes 2012-2016 period

Variety	Year					Multiannual interval
	2012	2013	2014	2015	2016	
Victoria	154	148	137	140	150	137-154
Silvania	174	162	165	158	183	158-183
Timpuriu de Cluj	192	156	142	165	159	142-192
Muscat de Hamburg	214	164	166	151	167	151-214
Tamina	184	156	160	162	153	153-184
Someșan	185	158	-	161	165	158-185
Splendid	174	168	145	148	154	145-174
Napoca	162	152	138	153	140	138-162
Otilia	204	166	186	168	182	168-204
Prima Cl. 1022	152	140	145	142	172	140-172
Coarnă neagră selecționată	184	162	166	168	175	162-184
Muscat de Hamburg Cl. 202	196	178	162	150	174	150-196
Transilvania	241	158	-	-	155	155-241
Perla de Zala	172	165	172	170	154	165-172
Moldova	170	164	152	156	173	152-173

The weight of 100 grape, especially, variety characteristic, differ depending on the level of production of grapes (small production is equivalent to larger grains), (table 4). The variety with the highest weight of 100 grapes was *Victoria*, with a average weight of 690 g. This was followed by *Transilvania* (666 g), *Splendid* (592 g), *Tamina* (588 g) and *Moldova* (563 g).

Table 4

The weight of 100 grape at the moment of harvesting grapes at some varieties of vine with table grapes 2012-2016 period

Variety	Year					Limits	Average
	2012	2013	2014	2015	2016		
Victoria	648	688	570	630	912	570-912	690
Silvania	167	290	346	334	338	167-346	295
Timpuriu de Cluj	261	246	354	381	372	246-381	323
Muscat de Hamburg	305	430	416	366	327	305-430	369
Tamina	661	564	526	535	654	526-661	588
Someșan	237	354	-	385	436	237-436	353
Splendid	399	702	532	542	786	399-786	592
Napoca	265	528	412	448	472	265-528	425
Otilia	250	278	264	330	308	250-330	286
Prima Cl. 1022	372	393	362	430	548	362-548	421
Coarnă neagră selecționată	316	354	323	342	320	316-354	331
Muscat de Hamburg Cl. 202	389	442	422	316	366	316-442	387
Transilvania	616	610	-	-	772	610-772	666
Perla de Zala	236	248	270	308	304	236-308	273
Moldova	480	522	511	542	760	480-760	563

The varieties with the lowest weight of 100 grapes (under 300 g) were *Perla de Zala* (273 g), *Otilia* (286 g), *Silvania* (295 g). *Prima Cl. 1022*, variety wichi emphasized by precocity, shows the grapes size acceptable (421 g/100 grapes).

Total titrable acidity (average 2012-2016), represented by non-volatile organic acids you must, at harvest grapes, falls within 3-6 g/l H₂SO₄, which gives normal taste qualities of each grape variety.

Table 5

The total titrable acidity (g/l H₂SO₄) at the moment of harvesting grapes at some varieties of vine with table grapes 2012-2016 period

Variety	Year					Limits	Multiannual interval
	2012	2013	2014	2015	2016		
Victoria	2,8	3,7	4,5	4,1	4,5	2,8-4,5	3,9
Silvania	2,1	4,8	4,7	5,0	4,7	2,1-5,0	4,3
Timpuriu de Cluj	2,1	4,0	4,0	5,6	2,9	2,1-5,6	3,7
Muscat de Hamburg	3,8	4,1	3,9	4,6	4,7	3,8-4,7	4,2
Tamina	4,0	3,3	3,4	3,6	5,5	3,3-5,5	3,9
Someșan	3,7	3,7	-	5,2	3,0	3,0-5,2	3,9
Splendid	3,1	4,2	4,7	4,5	4,7	3,1-4,7	4,2
Napoca	2,2	3,4	3,5	3,8	3,6	2,2-3,8	3,3
Otilia	3,5	4,2	5,7	4,2	5,0	3,5-5,7	4,5
Prima Cl. 1022	3,8	4	4,2	4,8	4,2	3,8-4,8	3,9
Coarnă neagră selecționată	3,7	4,2	4,3	4,4	3,2	3,2-4,4	3,7
Muscat de Hamburg Cl. 202	3,5	4,6	4,4	4,5	5,5	3,5-5,5	4,5
Transilvania	4,2	4,7	-	-	3,8	3,8-4,7	4,2
Perla de Zala	3,7	4,8	5,0	4,6	5,4	3,7-5,4	4,7
Moldova	4,2	4,5	4,7	4,4	3,4	3,4-4,7	4,2

Data obtained different from one variety to another and from year to year, shows that this is characteristic of the variety, but depend much on climatic conditions of the year (table 5). On sandy soils total titratable acidity of the grapes values are lower than the

same varieties obtained on other types of soil, which are closer to the bottom than the upper limit of the optimum range. The lowest average was recorded in variety *Napoca* (3,3 g/l H₂SO₄). The largest total titrable acidity content found in grapes varieties *Perla de Zala* (4.7 g/l H₂SO₄), *Otilia* (4.5 g/l H₂SO₄) și *Silvania* (4.3 g/l H₂SO₄). The value of 3.9 g/l H₂SO₄, achieved of *Prima Cl. 1022*, with the earliest production of grapes with sugar content accumulated (140-172 g / l), manages to give this variety beans taste balanced.

CONCLUSIONS

1. Of the five years, in which those varieties were studied, only one (2013), has provided favorable conditions for vines in the sandy soils in southwest Oltenia. In the years 2012, 2015 and 2016 were recorded minimum temperatures below the resistance of the vine and in 2014 year it accounted unfavorable factor excessive rainfall (994 mm annually and 640.7 mm in the vegetative period), which make this year the rainy period 1958-2014.

2. In 2013 year, all varieties studied occurred in the genetic potential, consistent with vigor first year of entry into the fruit. It noted the variety *Otilia*, who conducted a production of 27.6 t / ha. This was followed with a production of over 20 t/ha, by *Muscat de Hamburg Cl. 202* (23.1 Kg/ha), *Napoca* (21.6 t/ha), *Transilvania* (21.4 t/ha), *Muscat de Hamburg* and *Coarnă neagră selecționată* (21.2 t/ha), *Prima Cl. 1022* (20.1 t/ha). On the opposite side stood varieties *Tamina* (9.9 t/ha) and *Silvania* (6.4 t/ha).

3. In 2014, pesticide treatments applied, the number 9 did not stop the attack of fungal diseases, so that the degree of attack produced by major diseases, *Plasmopara viticola* and *Uncinula necator*, was raised both in the leaves being between 5 and 90% and as well as clusters, with values of from 5 to 100%. The most resistant was *Silvania* variety with a degree of attack by 5%, both on the leaves and the bunches, which conducted a production of grapes of 8.4 t/ha, and the most sensitive was the *Transilvania* variety, with a 90% degree of attack on leaves and 100%, in bunches, and thus grape production was compromised.

4. In years with minimum temperatures negative below the resistance vines organs, between -23.4 ... -25,1°C, grape production was affected or compromised in some varieties (*Transilvania*). In these conditions it noted the ability of some varieties to bear fruit on short elements, (*Prima Cl. 1022*, *Perla de Zala* și *Moldova*), but the favorable effect of protecting the land of fruit strings as happened in 2016 year.

5. Weight of 100 grapes, the total sugar content and total titratable acidity is characteristic of the variety, but it depends on the climatic conditions affecting main buds and creates favorable conditions for fungal diseases attack.

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