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RESEARCH REGARDING THE BEHAVIOR OF CLONAL FETEASCA NEAGRA 10 PT TO LOCAL CLIMATE CHANGES

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Abstract

Throughout numerous research stations and prestigious institutes and wine traditions in our country, owner of germplasm fond, we encounter vineyard center Pietroasa, which quality attributes derive from, on one hand the ecopedoclimatic specific conditions existing here and on the other hand from the scientific activity headed to creating new vine varieties and improving the main soils of the assortment through clonal selection. In the last years, though, as in almost all our country regions, we assist with certain worry to a series of extreme climate events (strong winds, maximum extreme temperatures in summer, minimum extreme temperatures in winter as well as the phenomenon called freezing rain, all with effects on the normal growing cycle of vine plants. In this paper it is observed the influence of the climate changes on the agrobiological and technological potential of the clonal selection Feteasca neagra 10, the newest achievement of S.C.D.V.V. Pietroasa (patented in 2010) between 2010-2012. Climate data has been collected from the research station's own weather station and implied daily observations regarding the evolution of the parameters – temperature, precipitations, insolation – and based on these parameters were calculated the climate indexes that define the favorability degree of an area, as well as the Huglin index. The results obtained after the study prove that they are in direct correlation with these area climate changes, and that on the short run have a positive influence on the precocity of grape maturation, on the sugar accumulation potential, all together giving an extra quality to the final product, the wine.

Key words: *climatical index, grape varietes, favourability, vineyard.*

INTRODUCTION

Although in the vineyard's assortment prevails grape varieties for white wines, the main winery profile is obtaining white, superior quality wines, in the Pietroasa wine area, characterized by a moderate drought microclimate, warm temperate, with cool nights (IS1, IH4, IF3), there are favorable conditions for varieties of quality red wines (Feteasca neagra, Babeasca Neagra, Merlot). In the present study, the evolution of qualitative parameters of the clonal selection Feteasca neagra 10 obtained in 2010 at P.V.R.D.S Pietroasa was observed in the conditions determined by area's climate changes troughout three wine years (2010-2012), which proved to be special under the climate recorded indexes report. At the same time were analyzed the correlations met between the accumulation and increase of the sugar quantities of the grape must and the higher values of the Huglin index (Tonietto and Carbonneau, 2004, Laget et al., 2008). The observations made are of local interest as well as national interest, because it gives undeniable proofs of climate annual changes, of which manifestations have consequences on the annual growing cicle of the vine. (Jones et al., 2005). The necessity of our reasearch derives from the fact that, in present time, the wine assortment is formed of old varieties and the replacement of these ones with new clonal selections is wanted, and have to correspond with the following parameters: to make maximum usage of the climate conditions, to have medium productivity and vigor, constant quality productions according to superior quality wines, and the quality to be expressed in a superior alcohol and acidity potential, and to have a very good pest, environment factors and diseases resistance and so on.

MATERIALS AND METHODS

To accomplish the objective presented above, the research was made between 2010-2012 in an experimental device placed on an sloping land, in the superior third of the slope with southeastern exposition and 12% inclination. The soil is limestone, the mother rock is at low depth, the reaction is low alkaline, with a high level of calcium carbonate which varies between 14% in the A horizon and 20-36% in the B horizon; in the C horizon limestone mother rock predominates. The biological material which is the object of this research is the clonal selection Feteasca Neagra 10Pt (Table 1). The selection was grafted on the Kober 5 BB rootstock, the grapevines were conducted on a semi-stem (Guyot on a semi-stem) at a planting distance of 2,0/1,2m, with a load of 30 buds/vine. The data was collected from the vineyard′s own weather station and regarded daily observations about the evolution of the parameters – temperature, precipitations, insolation and based on these parameters were calculated the climate indexes which define the degree of favorability of an area, the real heliotermic index (IHr), the hidrothermal coefficient (CH), the bioclimatic index of vine (Ibcv), oenoclimatic aptitude index (IAOe), as well as Huglin index calculation. The Huglin index (HI) is calculated from April the 1st to September 30th, in the northic hemisphere and it′s defined as follows:

$$IH = \sum_{01.04}^{30.09} \frac{[(Tm-10)+(Tx-10)]}{2} \times k$$

T*m* = Medium air temperature (ºC)

T*x* = Maximum air temperature (ºC)

k = day length coefficient according to the lattitude, with values between 1,02-1,06 for lattitudes of 40-50^0, and for Romania (44,1^0 – 46,0^0) it has the value of 1,04.

This reference index is used on a large scale in vineyards because it gives information about the heat potential of the area, presenting a high primary importance in choosing the right assortment on one hand and it is positively correlated with the accumulated sugar quantity on the other hand. The values of this index calculated in different wine regions determines this way not only a classifications of the indexes, but the establishment of the minimum temperature required for the progress of the growing cycle of the vines in that area.

The clonal selection (Table 1) was observed throughout the whole phenological specter, and in the harvesting moment, on a medium sample of 15 grapes there were made the following determinations: average weight of a grape, average weight of 100 grapes, gluco-acidimetric index, production/vine, sugar (g/l), acidity (g/l sulfuric acid). The results obtained were analyzed with the one-dimensional indexes – arithmethic mean, maximum, and minimum, indexes that can be applied for the majority of the quantitative characters which have the property to variate in time and space.

Table 1. Main characteristics of the clonal selection Feteasca Neagra 10 Pt

	**Ampelographic characteristics** Clonal selection of the Feteasca neagra variety, characterized by a large productivity potential accompanied by a high sugar accumulation potential. The grape is medium-large, cylindrical-conical, compact, with small, black grapes, uniform in size and colour, without manifesting the grape shrinking disease called "small grains" and "very small grains".
	Agrobiological and technological characteristics Fertility: 68% fertile buds Grape weight: 142g Production per bud: 2,8 kg Sugar: 242 gramms per liter Total acidity: 5,5g/l H_2SO_4
	Production direction (clonal selection type) It ensures quality productions and obtaining high quality red wines, intense in colour, smooth and balanced, with controlled name of origin (D.O.C). Important attributes of the selection: good productivity, high sugar content which in favorable years can reach 267 g/l (quality clone).

RESULTS AND DISCUSSIONS

Climate features of the wine years during experimentation period

Wine year 2010. Under the aspect of the thermal regime, January was extremely cold, and between January the 22nd – January the 31st there were registered consecutively minimum temperature values of the air under 25ºC, the absolute value of winter (of the month) was-26,6ºC, on the soil being of-27,9ºC, affecting the biological resistance of the plants. The hydric regime was a little bit over the normal values in spring, accompanied by the thermal regime as well as over the normal for the period, associated with the overheated temperatures, higher than 35ºC from August which favored the installation of hydric stress and the rush of ripening process of the grapes, the dehydration of the grapes and the reducing of their volume. Autumn was not uniform, drought in September and extremely cold in October (-4,4ºC), and in November it was registered a thermal surplus of +73,6ºC, (maximum values of 24ºC).

Wine year 2011. Regarding the temperatures, winter was close to the multi-annual values of the season. Summer was close to the normal thermal regime, with a medium season temperature of 21,5 ºC from the multi-annual average of 21,3ºC. The rain regime was variable during the summer, knowing a growth of 77,8 mm between June-July when hidrometeorological extreme phenomenons were signaled such as torrential rains, wind intensifications with an aspect of storm and severe hail on 24th of August which by intensity and duration produced damages of about 75-90%. Autumn was not uniform under the thermal and hydric aspect, excessively hot, with maximum values over 33-34ºC in the air temperature, in September, and cold with negative values under-5,2ºC in October.

Wine year 2012. The cold season registers severe temperatures (under -23ºC) and snow (February). Extreme negative temperatures, blizzard and glazed frost between January 24th and February 6th brought values of-23,1º C in air temperature, on soil recording -26,7ºC. February registered a record medium temperature value of -5,5ºC which was 4,4º C lower than the average multi-annual temperature of-1,1ºC. The amount of bud losses was due to the large interval in which temperatures maintained critical, but also to the rain phenomenon which froze on the vines strings (freezing rain) signaled between February the 4th-February the 6th. Spring was close to the normal limit, and the summer of 2012 was extremely drought, with a high hydric defficit on the base of a large thermal surplus which marked the progress of the physiological and biochemical processes at normal parameters, but as well as on the quality and quantity of the grape production. The summer of 2012 was remarked by a large number of days with consecutive maximum temperatures over 35ºC (41ºC-August 15th) and consecutive nights (tropical) with minimum temperatures of the air larger than 20ºC. Autumn was extremely hot, with air temperatures of 33ºC (September), poor in precipitations and the rain deficit accentuated in autumn was rebuilt increasingly starting with November.

The analysis of climate conditions in relation to the synthetic indexes

Analyzing the growing active period in accordance with the active balance, we can conclude that the year of 2012 was the only year in this study interval that had a high thermal contribution (3835,5) with multiple influences (positive and negative) in the growth and development of plants. So, the level and the amount of temperature degrees associated with a plus of insolation hour number, but also the soil drought cumulated with the atmosphere drought, determined the maturation phase of the grapes, 7 days earlier than normal (25th of July), determining an advance of the full maturity. Analyzing the values of the four synthetic indexes, it can be observed that the wine station registers high heliothermic resources, which have as a correspondent low water resources and that the most sensitive is the bioclimate index, which′s large specter is situated between 5,38-11,2. Regarding the evolution of the values of Huglin index, the values recorded during the time of the study show that it suffers a growth tendency from one year to another, with some exceptions (2007-2009), reaching a maximum of 2639,7 in the year of 2012, conditions in which the wine areal characterized by a warm temperate

climate (IH4), becomes for this year a hot climate (IH5) – (IS1, IH5, IF3).

Analyzing the obtained qualitative data

It is observed that, the results of the experiment are directly correlated with the unfavorable evolution of the climate factors during 2010-2012 and that, each year of culture, through the evolution of the weather recorded phenomenon, leaves a mark on the manifestation of one and each variety. Although the clonal selections comes from an old local soil (Feteasca neagra), with a climatic remarkable adaptability, the waves of cold and the absolute minimum temperatures recorded in the air of-26,6 ^{0} C (January 2010), of-23,2^{0}C (January 2012) produced important bud losses during the growing rest period.

In table 3, it is observed that the clonal selection Feteasca neagra 10 Pt, records a medium value of 42% winter buds viability, with a minimum of only 20% in the year 2012, minimum which was due to the large time period in which the temperatures maintained critical, but also to the phenomenon of rain frozen on the vine strings (freezing rain), between February the 4th-February the 6th. Analyzing the recorded production of 6,3 tones per hectar it is also observed that the smallest value is recorded by the clonal selection in 2012, when it obtained the smallest values of a grape medium weight values (175g), as well as a minimum weight value of 100 grapes (140g). It can be mentioned the fact that on this fond of low productivity, the sugar accumulated quantity reached the maximum level of 243 g/l, quantity that offers qualitative constancy and a high alcohol potential because this selection accumulates in the good wine years, around 242 g/l.

Table 2. Evolution of the climate elements in the wine area of Pietroasa (2007-2012)

Specification		Average 2007-2009	Year 2010	Year 2011	Year 2012	Max	Min
Thermic balance	global	4233,4	3920,4	4019,1	4205,7	**4233,4**	**3920,4**
	active	3577.2	3473,1	3388,3	**3835,5**	**3835,5**	**3388,3**
	useful	1677,2	1626,2	1616,2	**1955,6**	**1955,6**	**1616,2**
Absolute minimum temperature°C	Air	-17,13	-26,6	-16,1	-23,1	**-16,1**	**-26,6**
	Soil	-19,5	-27,9	-17,4	-26,7	**-17,4**	**-27,9**
The sum of the hours of real insolation (Sir)		2060,7	2036,4	2049,3	**2125,3**	**2125,3**	**2036,4**
The sum of the annual precipitations (mm)		522,6	**655,2**	601,1	579,6	**655,2**	**522,6**
Number of days of active period		205,6	214	207	**220**	**220**	**205,6**
Indices agroclimatics	The hydrothermic coefficient CH)	0,82	1,17	**1,19**	0,97	**1,19**	**0,82**
	The real heliotermic index (IHr)	**1,37**	1,12	1,05	1,08	**1,37**	**1,05**
	The viticultural bioclimatic index (Ibcv)	9,05	5,96	5,38	**11,2**	**11,2**	**5,38**
	Index of the oenoclimatic aptitude (IAOe).	**5185,7**	4816,4	4373,2	5074,5	**5185,7**	**4373,2**

Table 3. Evolution of quality parametres during 2010-2012

Specification		% viable buds	Yield (kg/vine)	Sugar (g/l)	Acidity g/l H_2SO_4	Gluco-Acidimetric Index	Average weight of a grape (g)	Weight of one hundred grapes (g)	Full maturity
Clonal selection Feteasca neagra 10 Pt									
Wine year	**2010**	**57**	**8,0**	235	**5,5**	4,3	**180**	**210**	16.09
	2011	49	7,0	**231**	5,8	**4,0**	**180**	165	**18.09**
	2012	20	**6,3**	**243**	**5,5**	4,4	**175**	**140**	**10.09**
	average	42	7,1	236,3	5,6	4,2	178,3	171,7	15.09
	min	**20**	**6,3**	**231,0**	**5,5**	**4,0**	**175,0**	**140,0**	**10.09**
	max	**57**	**8**	**243,0**	**5,8**	**4,3**	**180,0**	**210,0**	**18.09**

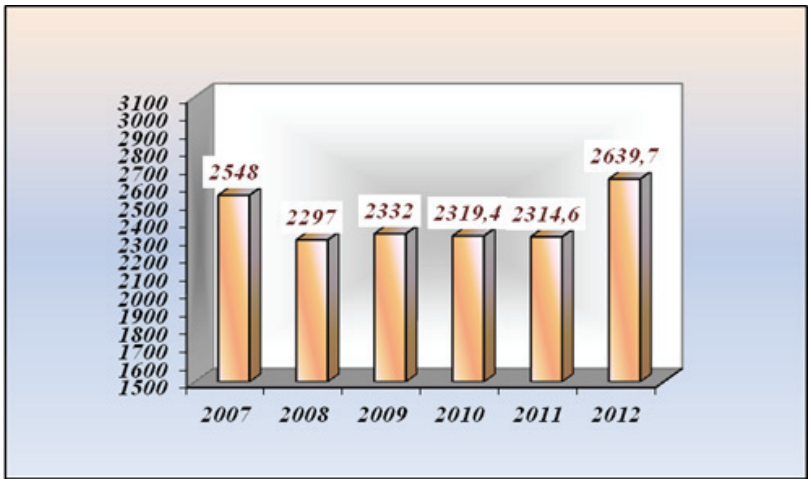

Figure 1. Evolution of Huglin Index between 2007-2012 in the wine area of Pietroasa

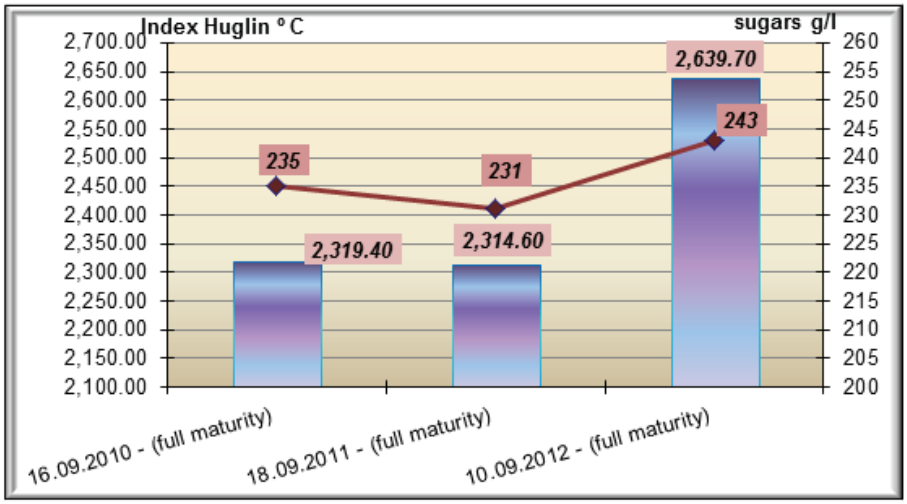

Figure 2. Evolution of Huglin Index and content sugars (g/l) for clonal selection Feteasca neagra 10 Pt

A partial conclusion that can be made is that the particularities of these wine years left a mark on the agrobiological and tehnological behavior of the clonal selection Feteasca neagra 10 Pt, and that particularly, the productions obtained in this years are much under the selection limits, practically hierarchial descending, as follows: 2010, 2011, 2012 without being majorly affected by those parameters that define and insure the quality of a wine (sugar, acidity).

It is worth mentioning the fact that, low productions of the year 2011 were due to the hydrometeorological extreme phenomenons under the form of torrential rains, wind intensifications with storm aspect and extreme hail on the 24th of August, which by intensification and duration produced damages in the Pietroasa area of 75-90%, and in the year of 2012, due to the extreme air temperatures limits (-23,1ºC) and (-26,7ºC – record value) at soil, which lead to bud losses of approximately 80% for all cultivated varieties in this wine area.

After the study, following the evolution of Huglin Index values in the wine area of Pietroasa (index that offers relations regarding the thermal potential of the wine area) and the

quantities of sugar accumulated in the maturation process, it can be observed a direct correlation in general (figure 2) and only in the conditions of the year 2012 the recorded values overcome the potential of the clonal selection (242 g/l). These accumulations (235 g/l, 231 g/l) reach a level which insures obtaining a good alcoholic potential for superior quality wines. Based on the same data, it can be observed a precocity of grape maturation (6-8 days in advance) undependable of the production year.

Figure 3. Clonal selection Feteasca neagra 10 Pt, 2010

CONCLUSIONS

It is observed that, special climate features of the last years, defined by the climate unspecific changes to Pietroasa station, determines a faster process of the phenophases and have an effect on the precocity of grape maturation and sugar accumulation which finally bring a plus of quality to the wines that are obtained.

Clonal selection newly obtained Feteasca neagra 10 Pt present promising perspectives due to the high degree of adaptation, and the success of integrating and expanding it in the culture depends on finding adaptation and long-lasting solutions to the climate changes in culture technologies, oenological practices and so on.

These information represent the basic elements taken into consideration for a better, deeper reflection on what it means choosing the assortment, on introducing into culture some varieties and clonal selections more appropriate for the culture technologies, on finding some long-lasting adaptation solutions to the climate changes of the technologies, oenological practices and so on.

In conclusion, the biological value of the new clones obtained by applying the clonal selection is sustained by the hereditary analyzed specific of each variety, biotype, or assortment group.

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