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STUDIES ON THE AGROBIOLOGICAL AND TECHNOLOGICAL VALUE OF GRAPE VARIETIES FOR WHITE WINES GROWN IN STEFANESTI WINE CENTRE

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Abstract

The purpose of this work is to study the climatic conditions for three years (2017-2019) and to correlate with the quality of the grapes on varieties, for white wines (Feteasca Regala, Riesling, Sauvignon, Muscat Ottonel and Sarba) from the Stefanesti wine center. Were made determinations to the climatic conditions specific to the years of study and their influence on the production and quality of the grapes (grape mass, 100 grains mass, total acidity, pH). The study helps us to observe the direction of production and quality followed by the white wine grape varieties in the current climatic conditions of the Stefanesti wine center.

Key words*: grapes, climatic conditions, varieties.*

INTRODUCTION

The global warming of the climate has caused many disturbances in the vineyard ecosystems, the vine varieties being forced to modify the annual cycle of vegetation, with consequences most often negative for the quality and quantity of grape production, including on the resulting wines. But this global warming could have a remarkable influence on vineyards producing high quality wines on the verge of vine cultivation. For northern vineyards, this heating will be beneficial, while for southern ones it will be disadvantageous due to the too hot climate. (Popescu, 2011)

Already negative effects of climate change have been observed in some vineyards on the Globe, such as: earlier ripening of grapes, loss of acidity through respiration and a greater accumulation of sugar. Also, if the harvest takes place earlier than usual (August or September instead of October in the northern hemisphere), and the harvest is not irrigated, dehydrated grapes will result. Given that global warming affects the normal development of vine phenophases at both the continental and regional levels, a reassessment of land use in these areas is necessary based on a detailed pedo-climatic study, as well as the application of a strategy viable wineries in the face of future climate change. (Popescu, 2011).

Climate change has led to significant changes in the development and spread of diseases and pests that affect the vineyards, causing the growers to focus on new varieties and treatment schemes (Onache P.A., 2018).

The main criteria that a horticulturist should consider should be the uniformity of the variety, the quality and quantity of the production, the resistance to freezing diseases and pests, as well as to the drought, which is becoming increasingly felt in us in the country. Vines react differently to climate and soil conditions and exhibit specific adaptations to ecosystem conditions. The different mode of reactions and adaptations results from the determination of the production potential and quality of the different genotypes appreciated by phenotype (Onea C.M., 2012).

Grape varieties for wine have a shorter period of ripening of grapes, from the third to the sixth, with a maximum frequency in the fourth and fifth growing stage. In this way, the winemaking campaign runs for about 30 days (September 15 - October 15). In order to determine the quality of wine grapes, priority is given to biochemical criteria, respectively the content of the must in sugar and acidity, to which is added the content in anthocyanic substances for red wines (Stoian M., 2010).

Grape ripening represents the stage in which the grapes synthesize and accumulate oenological value compounds (carbohydrates, organic acids, flavors and phenolic compounds) through specific metabolic processes. Grape ripening is evaluated on the basis of technological maturity and phenolic maturity (Cotea V.D., 1985).

The technological maturity represents that evolutionary moment when the grapes present an optimal composition for the production of a certain type of wine and a quality category. It is defined by the following parameters: weight of 100 grains, volume of 100 grains, sugars, total acidity and pH.

Phenolic maturity is a specific notion of red wine wine-making. It defines the time when grapes for red wines have maximum anthocyanins and soft and slightly astringent tannins (Ţârdea C., 2007).

In order to determine the quality of the wines from the Stefanesti Vineyard, determinations and analyzes were carried out on grapes starting from the ripening stage to full maturity. Thus, the optimal harvesting period could be established, when the grapes accumulated a significant amount of sugars.

MATERIALS AND METHODS

For climate records, an automatic weather station was used in the area of the experimental pilot station Golesca with coordinates data 44°51'N and 24°57' E, 300 m, exposure S. The climate data collected were in the period 2017-2019 using grape varieties grown in this research station.

The soil is of the class Umbrisoils of Eutricambosoil type, brown, typical eumezobasic with clay *in situ*; the texture of the soil is clay-sandy, clay-clay, without skeleton, and the soil tillage is done with plows, the mechanical presses at intervals, the manual hoeing in a row (Radulescu I., 2010).

Sugar content (g/l) was determined with refractive method. Total acidity was determined (g/l tartaric acid) with titrimetric method. For the physico - chemical determinations of grapes and wine, laboratory equipment, equipment and glassware were used. For the statistical interpretation of the results, the data were included in an Excel database and then statistically interpreted with the SPSS 14.0 program, which uses the Duncan test (multiple t test) for a 5% statistical significance.

RESULTS AND DISCUSSIONS

The values registered in Stefanesti wine centre are influenced by the deficient climatic data of the wine year 2017, and the years 2018-2019 presented a series of particularities whose effects were found both in the unfolding of the vegetative cycle, and especially in the level and the quality of the grape harvest. Of these particularities we mention the most significant ones (Tables 1 and 2):

- In 2017, average temperatures (0°C) between -3.9°C (January) and 23.8°C (July) were presented and with low rainfall in January-February-March (7.0; 26.8; 26.2 mm) and June (38.40 mm). Starting with the months of June - July - August, temperatures of five days were among consecutively (40.1°C/June 29; 43.2°C/ August 28; 41.6°C/ August 4; 42.8°C/August 5; 41.0°C/ August 6). The unfavorable weather conditions of 2017 (April 24 frost and August 08 hail) have contributed to diminishing the qualitative value of the vine varieties. The effect of the prolonged drought during the formation of the berries, the crop and the ripening, alternating with the few precipitations of June-July, favored the appearance of the cryptogamic diseases, and in particular downy mildew (*Plasmopara viticola*).
- At the beginning of 2018 it was thermally balanced with high rainfall in March (108.8 mm) and freezing temperatures in March (-8.8^{0}C/March 01), with high rainfall starting in April until in August (this month it rained almost every day), and from May there were temperatures of 30 degrees until September, which led to the diminution of the qualitative value of the vine varieties. The year 2018 continued with a late autumn (12.4°C November 02), starting with 09th it starts to cool -1.1°C, with difficult winter conditions 2018-2019, low temperatures between December and January 2019 (-7.8^{0}C/ December 01; -12.7^{0}C January 08) and freezing temperatures in January (-12.7^{0}C/08) alternating with periods of warming (13.4^{0}C/January 17).

- In 2019 low temperatures during April - May leading to a delay of the flowering of the vines by one week (3^0C/April 01, 5.9^0C/May 01, 6.1^0C/May 7), June does not exceed the temperature of 35^0C only in 2 days (37^0C/June 26, 35.6^0C/ June 27), also in July there were no very high temperatures (maximum 37.8^0C/21 and 26), but in the two months the temperatures during the night being quite low (14^0C/June between 03 and 10, 8.2^0C/July 11) led to the prolongation of the ripening period of the grapes (Tables 1 and 2).

- Higher temperatures recorded in August but did not exceed 40^0C (39.4°C/22.08, 23.09) (Table 2).

- Low precipitation during the resting period of the vines and high during the harvesting process (193.6 mm in June) of the grapes - high hygroscopicity at the level of the vine trunk in August (Table 1).

Table 1. The viticultural climate from the vegetation period in the years 2017-2019

Year	Month	Air temperature			Air temperature	Index Huglin	Nr. days with precipitation >10 mm	Σ °t global (°C)	Σ °t active (°C)	Σ °tusable (°C)
		T med (°C)	Media T min (°C)	Media T max (°C)						
2017	April	10,7	3,4	19,5	83,6	153,0	3	321,1	244,5	64,7
2018		16,1	-0,4	32,7	4,6	330	-	484,0	484,0	190,0
2019		11,2	5,4	19,1	42,2	171	1	338,1	244,4	53,4
2017	May	16,0	10,0	25,3	155,2	330,1	5	497,2	490,3	196,1
2018		18,6	7,7	33,5	121,6	422	4	577,1	577,1	267,1
2019		16,3	9,8	24,6	93,6	323,95	2	504,1	494,5	194,5
2017	June	22,5	14,5	32,2	38,4	520,5	2	674,6	674,6	375,6
2018		21,6	7,9	35,8	171,2	475	6	649,4	649,4	327,5
2019		22,1	15,5	32,0	193,6	511,5	6	664,6	664,6	364,6
2017	July	22,8	15,4	33,0	96,6	399,9	3	708,3	708,3	394,0
2018		24,7	9,4	35,4	111,8	575	3	765,6	765,6	369,0
2019		22,2	14,5	32,2	70,6	531,95	1	687,1	687,1	377,1
2017	August	23,8	16,0	34,8	83,4	598,3	2	738,7	738,7	428,7
2018		23,6	12,9	37,7	63,0	592	2	732,8	732,8	422,8
2019		24,6	15,7	35,8	6,6	626,2	0	762,1	762,1	452,1
2017	September	18,1	11,2	30,0	74,4	421,5	8	544,4	544,4	382,4
2018		18,9	-1,4	37,8	6,0	550	0	565,8	547,2	267,2
2019		19.3	10.5	30.5	5.2	447	0	578.0	578,0	278.0

Huglin Index =[$(T_{med} - 10)+(T_{max} - 10)$]/2 x no. days of the month
Σ°t global = the sum of positive daily average temperatures
Σ°t active = the sum of daily average temperatures> 10^0C
Σ°tusable = the sum of the differences between the average daily temperature> 10^0C and the biological threshold of starting in the vegetation of the vines (10^0C)

Table 2. The climate of the ripening stage in the year 2017-2019

	Month	Temperature					Hygroscopicity (U%)	Nr. Days with T>30°C	Night coolness index *
		T med (°C)	T min(°C)		T max(°C)				
			average	absolute	average	absolute			
2017	July	22,8	15,4	18,9	33,0	39,8	66	25	-
2018		24,7	15,0	9,4	32,4	35,4	76	25	-
2019		22.2	14.5	8.2	32.1	36.9	68	21	-
2017	August	23,8	16,0	21,3	34,8	43,2	61	26	-
2018		23,6	17,6	12,9	34,8	37,7	66	31	-
2019		24.6	15.7	10.8	35.8	39.9	57	27	-
2017	September	18,1	11,2	4,1	30,0	36,4	63	15	1,5
2018		18,9	10,5	-1,4	30,4	37,8	62	-	2,5
2019		19.3	10.5	1.6	30.5	37.5	60	19	10.5

* it is calculated only for September

These conditions influenced the development of the vegetative cycle as follows: starting in the vegetation, the release of 14-20.04 in 2017, 18.04.

In 2018 and later in 2019 between June 27 and 30 starting 10 days later, compared to 2018. It flowering in 2019 (June 14) later with almost 2 weeks compared to 2018 (June 03) and compared to 2017 (June 05), due to the minimum temperatures in the second half of May (5.9^{0}C/May 1 in 2019) and average (9.6^{0}C/ Mai 07 in 2019), but also the abundant rainfall between May 29 - June 24 in 2019 (193.6 mm). The ripening phenophase was achieved later than the year 2019 with approximately 2 weeks (between August 10 and 30), being influenced by the average temperatures (15.7^{0}C/June 4 and 17.2^{0}C/July 15), maximum (35.6^{0}C/June 27 and 37.8^{0}C/July 21), and minimum (11.1^{0}C/ June 30 and 8.2^{0}C/July 11). The high temperatures in July and August of 2019 and rainfall increased in June and low from August, up to the drought threshold, they led to slower grape ripening in the Stefanesti wine-growing center, and this year was a very good one for the vineyards. Of the useful components existing in grapes, sugars, along with acids, are some of the most important quality elements in vines. The two biochemical components are particularly important in terms of sugar/acidity ratio, which decisively influences the taste of grapes (Cotea V., 1985).

In the three years of study 2017-2019 determinations were made on seven white grape varieties: Sauvignon, Muscat Ottonel, Chardonnay, Feteasca Regala, Feteasca Alba, Riesling Italian, Sarba. The dynamics of the ripening of grapes for each year 2017-2019 was made, determining the weight of 100 berries, the sugar content and the total acidity. For the statistical interpretation of the results, the data were included in an Excel data base and then statistically interpreted with the SPSS 14.0 program, which uses the Duncan test (multiple t test) for 5% statistical significance.

Table 3. The indicators of the central tendency of the sample (mean, median and mode), as well as the indicators for spreading the values around the average (maximum amplitude, extreme values, standard deviation and asymmetry coefficient).

Year			Year	Analysis time Factor A	Total sugar content (g/l)	Cultivars	Total acidity	Mean fruit weight-100 grape beans (g)
2017	N	Valid	42	42	42	42	42	42
	Mean		2017	3,50	134,8095	4,00	6,7614	118,5238
	Median		2017	3,50	134,5000	4,00	5,9100	116,0000
	Mode		2017	1(a)	78,00	1(a)	4,79(a)	81,00(a)
	Std. Deviation		,00000	1,729	37,60399	2,024	2,51570	31,57201
	Std. Error of Skewness		,365	,365	,365	,365	,365	,365
	Std. Error of Kurtosis		,717	,717	,717	,717	,717	,717
	Range		,00	5	119,00	6	8,61	106,00
	Skewness			,000	-,085	,000	1,130	,156
	Kurtosis			-1,276	-1,307	-1,255	,051	-1,261
	Minimum		2017	1	72,00	1	3,93	67,00
	Maximum		2017	6	191,00	7	12,54	173,00
2018	N	Valid	42	42	42	42	42	42
	Mean		2018	3,50	134,9524	4,00	5,7752	131,2857
	Median		2018	3,50	136,5000	4,00	5,8750	133,5000
	Mode		2018	1(a)	81,00(a)	1(a)	3,76(a)	83,00(a)
	Std. Deviation		,00000	1,729	37,84819	2,024	1,53741	31,52025
	Std. Error of Skewness		,365	,365	,365	,365	,365	,365
	Std. Error of Kurtosis		,717	,717	,717	,717	,717	,717
	Range		,00	5	119,00	6	5,70	96,00
	Skewness		,00	,000	-,080	,000	,075	-,197
	Kurtosis		,00	-1,276	-1,337	-1,255	-,927	-1,528
	Minimum		2018	1	75,00	1	3,10	80,00
	Maximum		2018	6	194,00	7	8,80	176,00
2019	N	Valid	42	42	42	42	42	42
	Mean		2019	3,50	157,6905	4,00	6,4695	135,2381
	Median		2019	3,50	169,0000	4,00	6,5050	142,0000
	Mode		2019	1(a)	119,00(a)	1(a)	3,66(a)	172,00
	Std. Deviation		,00000	1,729	34,64840	2,024	2,63791	35,72784
	Std. Error of Skewness		,365	,365	,365	,365	,365	,365
	Std. Error of Kurtosis		,717	,717	,717	,717	,717	,717
	Range		,00	5	121,00	6	11,59	117,00
	Skewness			,000	-,456	,000	,726	-,359
	Kurtosis			-1,276	-1,050	-1,255	,279	-1250
	Minimum		2019	1	90,00	1	2,44	71,00
	Maximum		2019	6	211,00	7	14,03	188,00

a Multiple modes exist. The smallest value is shown

In general, a normal distribution is symmetrical when the value of the asymmetry coefficient is equal to zero.

Analyzing the indicators of dispersion or genetic and experimental diversity in 2017, with regard to the average mass of 100 grapes, the average sample size was 118.5238, the average mass values being between the minimum value 71.0 and the maximum value 188.0. A negative asymmetry is observed (Skewness - 0.359) which means that the values above the average predominate and indicate a normal distribution (Figure 1).

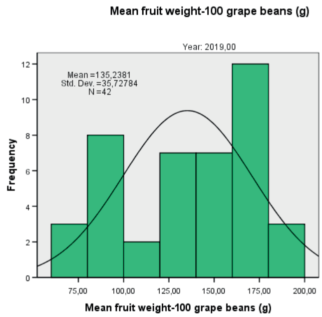


Figure 1. Histogram of the distribution by absolute frequency classes of the average mass of 100 berries

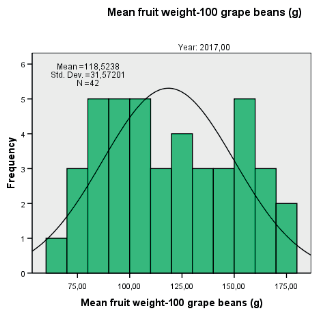


Figure 2. Histogram of the distribution by absolute frequency classes of the average mass of 100 berries in the studied varieties (2018)

In 2018, the average was 131.2857 with a standard deviation of 31.52025. In 2019, the histogram of the mass distribution of the average of 100 berries showed a standard deviation of 35.72784. The overturning coefficient has a negative value (Kurtosis -1.025) which shows the appearance of a large number of values far from the average (Figure 3).

In the case of the content of grapes in sugar in 2017 the average was 134.8095 with a standard deviation of 37.60399, the values being between the minimum value 90.0 and the maximum value 211.0.

In 2019, a negative asymmetry (-1,050) is observed, which means that the values above the average prevail and indicates a normal distribution (Figure 5). Figures 7, 8 and 9 show the histograms of distribution by absolute frequency classes of grape acidity in the 7 varieties studied. In the case of total acidity, in 2017 the average was 5.7752, with a standard deviation of 1.537413, the values being between the minimum value 2.44 and the maximum value 14.03. Analyzing Figure 8 e, we observe a positive asymmetry (Skewness +0.726), which means that the values lower than the average predominate and indicate an abnormal distribution.

In 2019, the average total acidity sample was 157.6905, with a deviation of 37.84819.

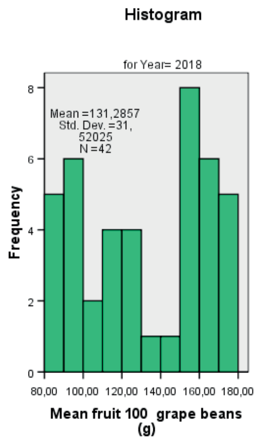


Figure 3. Histogram of the distribution by absolute frequency classes of the average mass of 100 berries (2019)

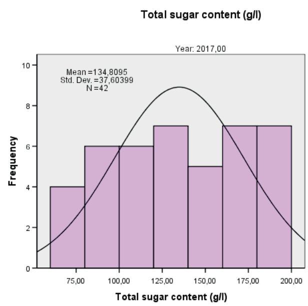


Figure 4. Histogram of distribution by absolute frequency classes of grape content in total sugar, in the studied varieties (2017)

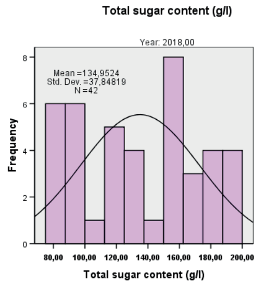


Figure 5. Histogram of distribution by absolute frequency classes of fruit content in total sugar, in the studied varieties (2018)

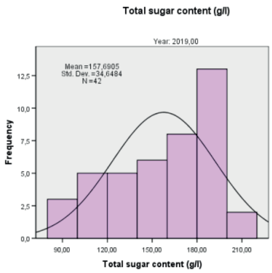


Figure 6. Histogram of distribution by absolute frequency classes of grape content in total sugar, studied varieties (2019)

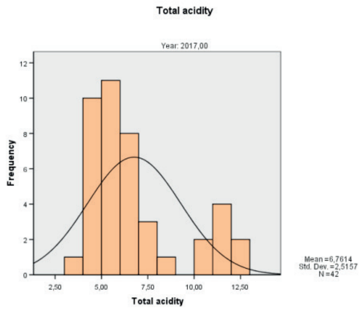


Figure 7. Histogram of distribution by frequency classes absolute of the total acidity, to the 7 varieties (2017)

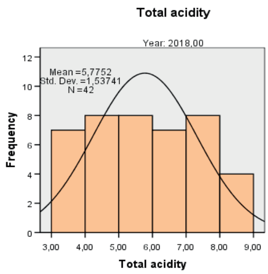


Figure 8. Histogram of the distribution by absolute frequency classes of the total acidity, in the studied varieties (2018)

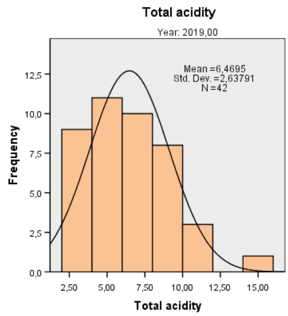
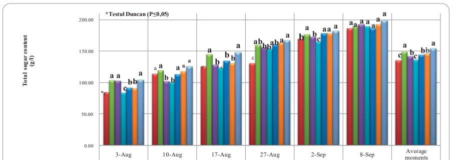


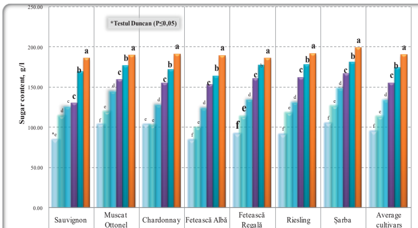
Figure 9. The histogram of the distribution by frequency classes absolute of the total acidity, to the 7 varieties (2019)

The values of sugar content in the 7 varieties studied differ from variety to variety. In the case of varieties Sauvignon (83.66 g/l) and Feteasca Alba presents the lowest values (83.00 g/l), and the variety Sarba the highest value of the sugar content (104 g/l) at the beginning of the dynamics of grape ripening. At the average of the moments, on varieties, the lowest value is observed for the Sauvignon variety (Figure 10). Also, it is important to determine the sugar for each variety, within 40 days, a higher growth is observed in the variety Sarba (198.33 g/l) (Figure 11).



	3-Aug	10-Aug	17-Aug	27-Aug	2-Sep	8-Sep	Average moments
Sauvignon	83.66	113.00	124.66	130.00	168.67	185.67	134.28
Muscat Ottonel	102.66	118.33	144.00	159.00	176.33	189.33	148.28
Chardonnay	102.37	101.33	127.00	155.33	172.00	191.33	141.56
Fetească Albă	83.00	99.00	123.00	152.67	163.67	189.00	135.06
Fetească Regală	90.67	112.33	133.33	160.00	177.33	185.33	143.17
Riesling	90.00	116.67	130.00	161.67	177.67	192.00	144.67
Șarba	104.00	125.00	147.33	166.67	181.00	198.33	153.72

Figure 10. Influence of the variety on the sugar content of grapes, depending on the moment of determination (A to B)



	Sauvignon	Muscat Ottonel	Chardonnay	Fetească Albă	Fetească Regală	Riesling	Șarba	Average cultivars
3-Aug	83.66	102.66	102.37	83.00	90.67	90.00	104.00	93.77
10-Aug	113.00	118.33	101.33	99.00	112.33	116.67	125.00	112.24
17-Aug	124.66	144.00	127.00	123.00	133.33	130.00	147.33	132.76
27-Aug	130.00	159.00	155.33	152.67	160.00	161.67	166.67	155.05
2-Sep	168.67	176.33	172.00	163.67	177.33	177.67	181.00	173.81
8-Sep	185.67	189.33	191.33	189.00	185.33	192.00	198.33	190.14

Fig 11. The influence of the moment of determination on the sugar in the grapes, depending on the variety (B to A)

The variety with the highest sugar content is Sarba with 168,17g/l in 2019 and the lowest variety is Sauvignon with 119,16g/l in 2017 (fig 12). It is observed in all varieties, a much higher total sugar content in 2019, due to favourable conditions.

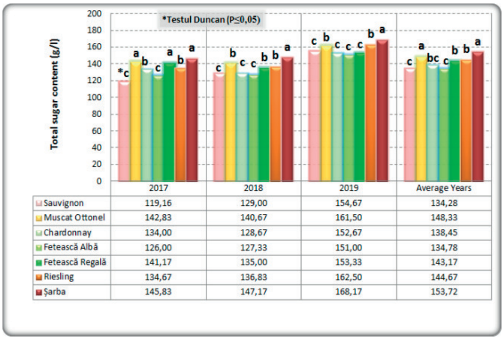


Fig 12. The influence of the variety on the total fruit sugar, according to the year of study (A to C)

And the variety has an impact on the sugar content depending on the climatic conditions of the study year, the lowest sugar content of the Feteasca Alba variety is in 2017 with 126g/l, followed by the one of 2018 with 127,33g/l. Muscat Ottonel variety in 2017 and 2018 has a sugar content of around 140g/l, and in 2019 of 161,5g/l. The average sugar content of varieties per year is 134,8080g/l in 2017, 134,9529g/l in 2018 and in 2019 it is 157,6914g/l. (Figure 13)

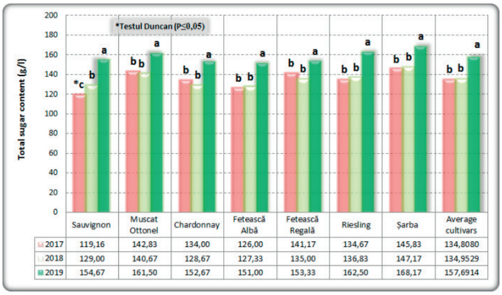


Fig. 13. The influence of the variety on the total sugar from the grapes, according to the year of study (C to A)

In Figure 14 we can trace the influence of the genotype on the average mass of 100 grape berries, depending on the moment of the determinations and we can see in Muscat Ottonel a significant increase of the weight from (89 g) on August 3rd to (176 g) on September 8th. In the case of the average berries weight there is not a very large increase between varieties, the smallest is in Riesling (111.6 g) and the highest in Muscat Ottonel (137.83 g). The influence of the moment on the average mass of 100 berries (Figure 15) it can be observed differences between cultivars, for example Riesling (126.33 g) compared to Muscat Ottonel (176 g).

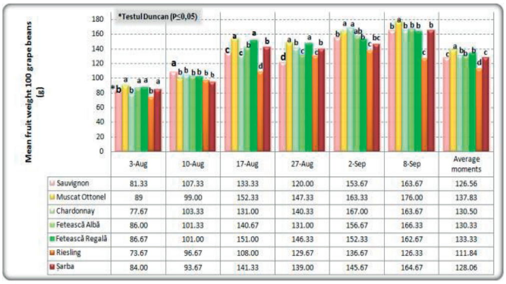


Fig14. The influence of the genotype on the average mass of 100 berries, according to the moment of determination (A to B)

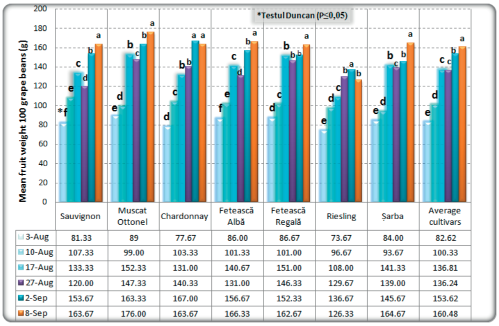
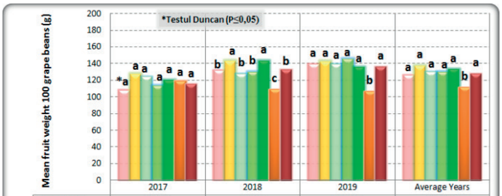


Figure 15. The influence of the moment on the average mass of 100 berries, according to variety (B to A)

Figure 16 shows the influence of varieties per year on the average weight of 100 berries, the lowest average weight was registered by Riesling (111.83 g), followed by Sauvignon (126.56 g) and the largest Muscat Ottonel variety (137.83 g).

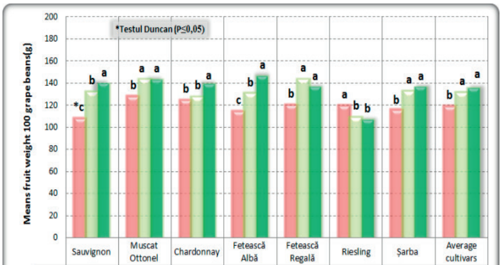
In Figure 17, the mass of 100 berries does not differ much from one variety to another in 2017, as can be seen in Sauvignon (108.17) compared to Feteasca Regala (120.17), or to Sarba (115.33)

Differences from one variety to another are observed in 2018, such as Riesling (109.17), compared to the Royal Feteasca with an increase in weight of 100 berries (143.67).



	2017	2018	2019	Average Years
Sauvignon	108,17	132,17	139,33	126,56
Muscat Ottonel	127,50	143,17	142,83	137,83
Chardonnay	124,67	127,67	139,17	130,50
Fetească Albă	114,33	130,50	146,17	130,33
Fetească Regală	120,17	143,67	136,17	133,34
Riesling	119,50	109,17	106,83	111,83
Șarba	115,33	132,67	136,17	128,06

Figure 16. The influence of the variety on the average mass of 100 berries, according to the year of study (A to C)

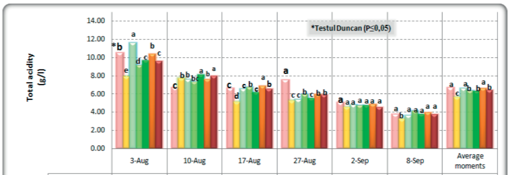


	Sauvignon	Muscat Ottonel	Chardonnay	Fetească Albă	Fetească Regală	Riesling	Șarba	Average cultivars
2017	108,17	127,50	124,67	114,33	120,17	119,50	115,33	118,5243
2018	132,17	143,17	127,67	130,50	143,67	109,17	132,67	131,2886
2019	139,33	142,83	139,17	146,17	136,17	106,83	136,17	135,2386

Figure 17 The influence of the study year on the average mass of 100 berries, according to variety (C to A)

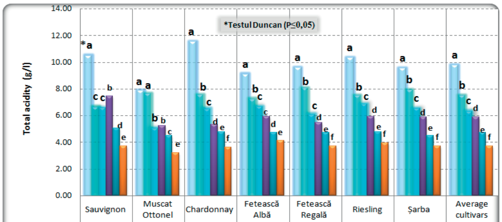
In 2019, the average weight of 100 berries per variety no longer increases with great differences, except Riesling (106.83 g) compared to the other Chardonnay or Sauvignon varieties that have a 139 g increase. Performing an analysis of the content of grapes in total acidity, on varieties and at the moment of determination (Figure 18), the highest value of total titratable acidity was recorded on August 03, at the Chardonnay variety (11.56 g/l sulfuric acid) and lowest in Muscat Ottonel variety (7.9 g/l sulfuric acid)

The total acidity is influenced by the variety and the moment of determination (Figure 18), Muscat Ottonel at the beginning of the dynamics of maturation has the lowest total acidity (7.9 g/l), and the highest is at Chardonnay (11.56 g/l). At the end of the grapes ripening, the highest acidity is Feteasca Alba variety with 4.11 g/l sulfuric acid.



	3-Aug	10-Aug	17-Aug	27-Aug	2-Sep	8-Sep	Average moments
Sauvignon	10.50	6.67	6.58	7.48	5.04	3.73	6.67
Muscat Ottonel	7.9	7.65	5.07	5.23	4.51	3.20	5.59
Chardonnay	11.56	7.56	6.52	5.33	4.79	3.61	6.56
Fetească Albă	9.11	7.26	6.69	5.92	4.71	4.11	6.30
Fetească Regală	9.60	8.06	6.11	5.46	4.71	3.73	6.28
Riesling	10.33	7.52	6.87	5.93	4.80	3.95	6.57
Șarba	9.57	7.93	6.54	5.87	4.52	3.72	6.36

Figure 18. The influence of the variety on the total acidity of the grapes, depending on the moment of determination (A to B)



	Sauvignon	Muscat Ottonel	Chardonnay	Fetească Albă	Fetească Regală	Riesling	Șarba	Average cultivars
3-Aug	10.50	7.9	11.56	9.11	9.60	10.33	9.57	9.80
10-Aug	6.67	7.65	7.56	7.26	8.06	7.52	7.93	7.52
17-Aug	6.58	5.07	6.52	6.69	6.11	6.87	6.54	6.34
27-Aug	7.48	5.23	5.33	5.92	5.46	5.93	5.87	5.89
2-Sep	5.04	4.51	4.79	4.71	4.71	4.80	4.52	4.73
8-Sep	3.73	3.20	3.61	4.11	3.73	3.95	3.72	3.72

Figure 19 The momentary influence on the total acidity of grapes, depending on the variety (B to A)

The total acidity at the time of grape maturation stage, at the Sauvignon variety was 10.5 g/l sulfuric acid, and finally 3.73 g/l sulfuric acid, at the Feteasca Regala at the beginning 9.6 g/l sulfuric acid, and the final 3.73 g/l. On average of the varieties at different moment of determination the highest total acidity was recorded on August 3.98 g/l sulfuric acid and at the last moment decrease of 3.72 g/l (Figure 19).

The total acidity is also influenced by the years of study, not only by the variety (Figure 20). In 2017, the grape varieties registered a high acidity Sauvigon (7.94 g/l), Sarba (7.05 g/l), Riesling (6.81 g/l).

In 2018, the total high acidity was registered at Feteasca Regala (6.17 g/l), followed by that of the Sauvignon variety with 6.06 g/l.

In 2019, the highest total acidity was at Chardonnay (7.46 g/l) followed by the Riesling variety (7.04 g/l). The average total acidity per year is 5.6 g/l at Muscat Ottonel, 6.68 g/l Sauvignon, 6.58 g/l Riesling variety.

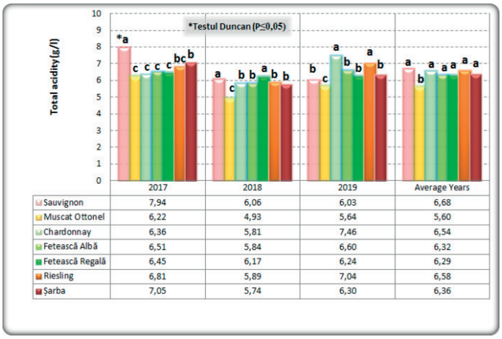


Figure 20. The influence of thevariety on the total acidity of thegrapes, according to the years of study (A la C)

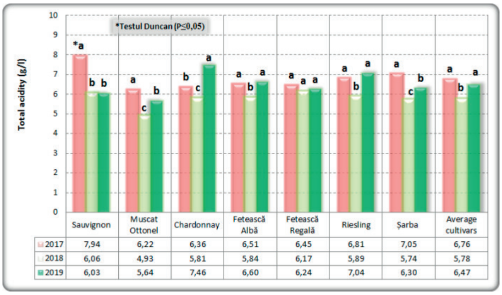


Figure 21. Influence of the study year on the total acidity of grape berries, according to variety (C to A)

Trying to compare the hierarchy between varieties with the situation existing each year in particular, we note that the order of varieties on the average is maintained in terms of total acidity by the Riesling, Feteasca Regala and Feteasca Alba varieties. There is, however, a slight interaction between the 2017 study year and varieties, in the case of Muscat Ottonel, Sauvignon and Sarba varieties, and to a lesser extent in the case of Chardonnay and Riesling varieties, in which the differences between varieties are smaller (Figure 21).

The highest values of total titrable acidity were registered by the Sauvignon variety, for 2017, for the year 2018 is the Feteasca Regala variety (6.28 g/l) and for 2019 it was registered at the Chardonnay variety (7.46 g/l sulfuric acid).

The most important component of the determinations made in grape seeds is the maturity index or the acidic-glycemic index, which represents the ratio between the sugar content and the total acidity of the grapes expressed in sulfuric acid. Depending on the variety, at full maturity this index can be between 15 and 50. (Cotea, V.D., 1985).

In 2017, due to the high temperatures in July and August, the ripening stage starts in late July the beginning of August and ends on September 15th. The lowest sugar-acidity index has Chardonnay at the beginning of the ripening stage, and at the end of the ripening of grapes the lowest index had grapes from the Sarba variety and the highest from the Muscat Ottonel variety (Figure 22).

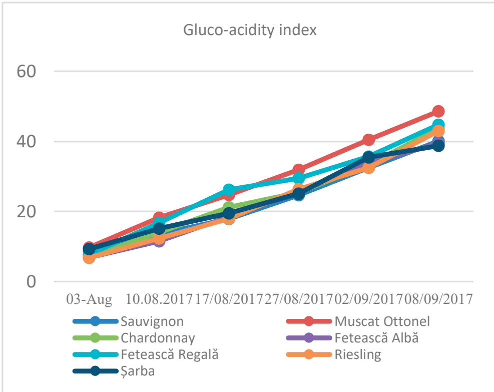


Figure 22. Evolution of grape ripening using the gluco-acidic index in the year 2017

In 2018, the ripening of grapes started later, at the beginning of August, due to the long spring of that year and ended on September 15th. The lowest maturity index is Chardonnay 6.47 and the highest, at the end of maturing, is Sauvignon (49.72) (Figure 23).

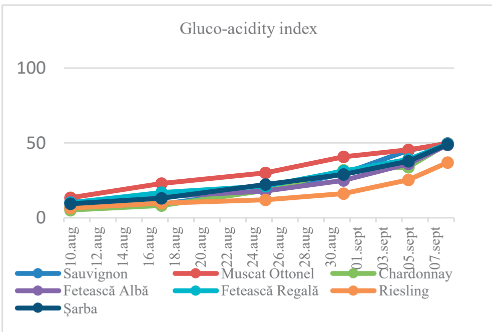


Figure 23. Evolution of grape ripening using the gluco-acidic index in the year 2018

In the year 2019, due to the high spring temperatures, the ripening phenophases started earlier, and due to the low temperatures in July and August, as well as the rains during the ripening stage, it led to a delay in grape ripening and the beginning of the harvest was one week later than 2017- 2018 (Figure 24).

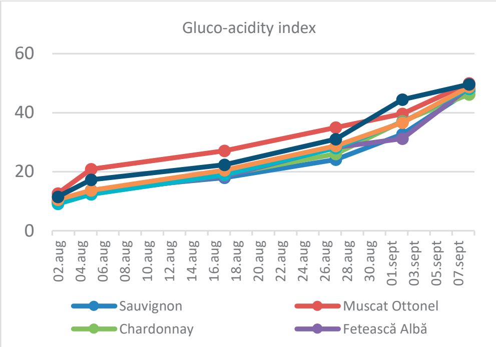


Figure 24. Evolution of grape ripening using the gluco-acidic index in the year 2019

CONCLUSIONS

The unfavorable weather conditions of 2017 (April 24 frost and August 08 hail) have contributed to diminishing the qualitative value of the vine varieties. In 2018 the temperatures were balanced with high rainfall from April to August, leading to a year similar to 2017 in terms of heat and the harvesting period.

The high temperatures in July and August of 2019 and the high precipitations in June and low from August, to the drought threshold, led to the slower maturation of grapes in the Stefanesti wine-growing center, delaying harvesting for a week, but having qualitative values and quantities higher than previous years.

In order to evaluate the dynamics of the ripening of grapes in each year of the study were determinate the fallowing indicators: the weight of 100 berries the sugar content and the total acidity. In order to evaluate the dynamics of the ripening of grapes for in each year of the study were determinate the following indicators: the weight of 100 berries, the sugar content and the total acidity.

The average sugar content, at the time of determination depends on the grape variety, the highest is in Sarba (153.72 g/l) and the lowest in Sauvignon (134.28 g/l). The average sugar content per variety at the time of harvest is 190.14 g/l. The average of the sugar content per variety in the three years is the highest in Sarba (153.72 g/l) and the lowest in Sauvignon (134.28 g/l).

The average weight of 100 berries of grapes per variety according to the moment of determination was between the values 126.56 g -137.83 g. The average mass of 100 berries of grapes per year and varieties, was quite different, at Riesling the average was of 111.83 g, while at Feteasca Regala it is 133.34 g.

The average total acidity per year according to each variety is close to the total acidity for the years 2018 and 2019, but for 2017 it is non-specific for each variety.

The most important component for determining the ripening of grapes is the sugar-acidity index. The lowest sugar-acidity index are in 2017, Sarba having 38.77 and the highest Muscat Ottonel with 48.6. In 2018, the lowest sugar - acidity index was Riesling (36.88) and the highest was Sauvignon variety (49.72). For the year 2019, the values of the sugar-acidity index have been balanced falling in 46.23 and 49.96.

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