ASPECTS CONCERNING THE PREDICTING POSSIBILITY OF ROSE WINES CHROMATIC PARAMETERS ON THE ABSORPTION SPECTRA OF MUSTS

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Abstract

Wine color standardization is a difficult but important problem can be solved by proper quantification of important issues, from the conditions of cultivation of vines and ending with way of selling the wine. In this study we have applied multiple regression analysis to achieve mathematical models to assess the CIE Lab parameters - 76 of wines based on chromatic parameters, total phenolic content and anthocyanins of musts, which are well known and easy to calculate. All these variables were measured at 13 rosé wines obtained by prefermentative maceration technology of two red grape varieties Băbească neagră şi Fetească neagră. We obtained two mathematical models for predicting the CIE Lab - 76 parameters that have small standard errors, first using only the L, a, b, C, H° parameters as independent variables, and the second using the total phenolic and anthocyanin content values determined by spectrophotometry. These models can be useful in wineries, especially in moments during winemaking, specifically to achieve rosé and red wines to determine the optimal timing of closing of the grape prefermentative maceration or maceration-fermentation process, resulting less technology interventions and ensure wines colour constancy from year to year.

Key words: absorption spectra; chromatic parameters; rose wines; wine colour.

Anthocyans are pigments of red, blue and purple colours, mainly occurring in cellular vacuoles of grape skin. Anthocyans are important compounds for characterization of red grape varieties; they are chemical markers in distinguishing varietal red wines (Zamfir C.I. et al, 2008). It is known that the mutual relations of anthocyans (the anthocyans profile) belongs to the vine variety, even though their absolute content in ripe grapes varies a lot and depends on factors that concern the climatic factors, such as intensity of light and temperature (Odăgeriu Gh. et al, 2008). Although the wine anthocyans composition is firstly determined by the genetic factor of the grape sort, the vinification parameters also have an important impact. It was shown that the maceration parameters have a significant influence on extraction of anthocyans from grape skins (Zamfir C.I. et al, 2009). The conditions of maceration, fermentation and maturation of wine influence the anthocyans composition, which is very significant, because the total concentration and composition of total phenolic compounds and anthocyans determine the colour of roze and red wines (Cotea V.V. et al, 2007).

Fetească neagră and Băbească neagră are Romanian local red varieties of *Vitis silvestris*, which acquires his superior quality in the Iaşi vineyard where wines with a protected geographic origin are produced. These grape varieties are very important for production of high-quality roze and red wines.

MATERIAL AND METHOD

The experiments were done during September 2011 – March 2012, at the Oenology Laboratory of the University of Agricultural Studies and Veterinary Medicine “Ion Ionescu de la Brad” Iasi.

We used Băbească neagră and Fetească neagră grapes, harvested on September 29, 2011 from Iaşi vineyard, wine center Bucium. Was harvested about 1200 kg of grapes. Harvesting was performed manually in plastic crates of 18 kg capacity, ensuring intact transport of grapes in the wine center. After conducting qualitative and quantitative reception of the grapes, they were destemming without crushing, then the whole marc was divided, resulting eight experimental variants from Băbească neagră grape variety and five experimental variants from Fetească neagră grape variety, same as all quantitative and qualitative both.

Variant 1: Băbească neagră rose 0 hour. At this variant, the gravity drain must was extracted immediately without pressing the marc. After that, the must was transferred into classic glass vessels of 50L, to complete its alcoholic fermentation, were added fermentation activators Nutristart about 30 g/hL and selected yeasts Saccharomyces

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cerevisiae X16 from Laffort® about 25 g/hL, activated as prescribed by the manufacturer protocols.

Variants 2-8: Băbească neagră rose 3 ½ hours, 7 hours, 10 ½ hours, 14 hours, 17 ½ hours, 21 hours and 24 ½ hours. These variants were executed properly prefermentative maceration process in the periods listed above, then the gravity drain must being subjected wine technological procedures to those applied to variant 1.

Variant 9: Fetească neagră rose 0 hour. At this option must was obtained by pressing whole mass of marc immediately after obtaining it, in order to highlight the possible effect of pressing process to the rose wines colour, compared with variants made without pressing from Băbească neagră grape variety. After that, the must was transferred into classic glass vessels of 50L, to complete its alcoholic fermentation, were added fermentation activators Nutristart about 30 g/hL and selected yeasts Saccharomyces cerevisiae X16 from Laffort® about 25 g/hL, activated as prescribed by the manufacturer protocols.

Variants 10 to 13: Fetească neagră rose ½ hour, 1 hour, 1 ½ hours and 2 hours. These variants were executed properly prefermentative maceration process in the periods listed above, then the pressing must being subjected wine technological procedures to those applied to variant 1.

Every marc variant was stirred vigorously for five minutes every hour throughout the prefermentativ process. After alcoholic fermentation the wine was drawn from the storage, were properly conditioned and bottled in glass recipients of 0.75L.

Five samples were taken of each must and wine, which have been subsequently analysed from the point of view of total anthocyanins content (ANTH.), total phenolic compounds content (T.P.C.) and chromatic parameters (L, a, b, C, H°).

Chromatic parameters of the analysed must and wine samples were calculated according to CIE Lab 76 method, taking into consideration the registered absorption spectrum for each variant studied (Odăgeriu Gh. et al., 2008; Zamfir C.I. et al., 2008; Zamfir C.I., 2009). A Specord S200 spectrometer and calculator were used. An automated registration and classification of absorption spectrums was copied in a file. To minimize analysis errors when determining absorbencies, specific vials were used, with an optical characteristic of 1.0 cm. The spectres were processed with a soft realised within the research group, for obtaining the chromatic parameters (L, a, b, C, H°), colour intensity (I) and hue (N).

The colour differences were also calculated with the ΔE 2000 formula.

$$\Delta E = \sqrt{\left(\frac{\Delta L'}{K_L S_L}\right)^2 + \left(\frac{\Delta C'}{K_C S_C}\right)^2 + \left(\frac{\Delta H'}{K_H S_H}\right)^2 + R_T\left(\frac{\Delta C'}{K_C S_C}\right)^2\left(\frac{\Delta H'}{K_H S_H}\right)^2}$$

It was considered that, for values of ΔE smaller that the unity, the colours of two wines are seen as identical, or otherwise said, they cannot be sensorial differentiated.

Statistical analysis was performed using Statgraphics Centurion XVI® software. In this study we have applied multiple regression analysis to achieve mathematical models to assess the CIE Lab parameters - 76 of wines based on chromatic parameters, total phenolic content and anthocyanins of musts, which are well known and easy to calculate. The Multiple Regression procedure is designed to construct a statistical model describing the impact of a two or more quantitative factors X on a dependent variable Y. The procedure includes an option to perform a stepwise regression, in which a subset of the X variables is selected. The fitted model may be used to make predictions, including confidence limits and/or prediction limits.

RESULTS AND DISCUSSION

The mean concentrations of total phenolic compounds and anthocyanins analyzed at musts and wines obtained shows an upward trend due to various prefermentative maceration period used in obtaining experimental variants (*tab. 1*). As can be seen from these tables, appreciable differences between the values of total phenolic content and anthocyanin compounds in musts from wine produced, values downwards (*tab. 1*).

Regarding their chromatic parameters values are listed in the following tables and parameters obtained from the two multiple regression tests and computerized simulation of colour on their musts and wines (*tab. 2, 3, 4, 5*).

In the case of the first test of multiple regression that took into account only the chromatic parameters of musts (L_{MUSTS}, a_{MUSTS}, b_{MUSTS}, C_{MUSTS}, $H°_{MUSTS}$) were generated following mathematical models:

$$L'_{WINE} = -42.9473 + 0.154586*L_{MUSTS} + 6.25866*a_{MUSTS} + 0.709856*b_{MUSTS} - 5.29799*C_{MUSTS} + 3.09732*H°_{MUSTS}$$

Since the P-value = 0,0000 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 97.23% indicates that the model as fitted explains 97.23% of the variability in L'_{WINE}. The adjusted R-squared statistic is 95.24%. The standard error of the estimate shows the standard deviation of the residuals to be 1.78. This value can be used to construct prediction limits for new observations.

$a'_{WINE} = 302.754 + 0.147657*L_{MUSTS} - 14.6501*a_{MUSTS} + 1.01791*b_{MUSTS} + 11.6375*C_{MUSTS} - 8.46051*H°_{MUSTS}$

Since the P-value = 0.0011 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 91.78% indicates that the model as fitted explains 91.78% of the variability in a'_{WINE}. The adjusted R-squared statistic is 85.91%. The standard error of the estimate shows the standard deviation of the residuals to be 3.88.

$b'_{WINE} = -38.7997 - 0.241112*L_{MUSTS} + 0.412665*a_{MUSTS} - 2.20821*b_{MUSTS} + 0.630434*C_{MUSTS} + 1.91495*H°_{MUSTS}$

Since the P-value = 0.0008 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 92.53% indicates that the model as fitted explains 92.63% of the variability in b'_{WINE}. The adjusted R-squared statistic is 87.36%. The standard error of the estimate shows the standard deviation of the residuals to be 0.92.

$C'_{WINE} = 225.266 + 0.00133472*L_{MUSTS} - 14.2365*a_{MUSTS} - 2.33115*b_{MUSTS} + 13.0808*C_{MUSTS} - 5.90998*H°_{MUSTS}$

Since the P-value = 0.0019 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 90.36% indicates that the model as fitted explains 90.36% of the variability in C'_{WINE}. The adjusted R-squared statistic is 83.48%. The standard error of the estimate shows the standard deviation of the residuals to be 3.56.

$H°'_{WINE} = -396.862 - 0.857994*L_{MUSTS} + 12.6249*a_{MUSTS} - 10.1256*b_{MUSTS} - 6.02412*C_{MUSTS} + 14.5476*H°_{MUSTS}$

Since the P-value = 0.0007 from ANOVA table is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 92.97% indicates that the model as fitted explains 92.97% of the variability in $H°'_{WINE}$. The adjusted R-squared statistic is 87.95%. The standard error of the estimate shows the standard deviation of the residuals to be 6.14.

Generated parameters under these mathematical models, calculating color differences between them and the actual values and the wine color computer simulation are shown in Tables 2 and 4 (*tab. 2, 4*).

It can be seen that for these first mathematical models, the estimates for Băbească neagră variety wines have won 3 of 8 values less than unity when calculating color differences ΔE 2000 formula, which means that the estimated parameters can give senzorial identical wines to those in reality obtained.

The estimates made for Fetească neagră variety wines have won 2 of the 5 values lower than unity when calculating color differences ΔE 2000 formula, the other three being slightly larger than unity.

In the second situation in which was taken account of seven independent variables (L_{MUSTS}, a_{MUSTS}, b_{MUSTS}, C_{MUSTS}, $H°_{MUSTS}$, $T.P.C._{MUSTS}$, $ANTH._{MUSTS}$) were generated following mathematical models:

$L''_{WINE} = -10.0052 + 0.0707419*L_{MUSTS} + 3.58468*a_{MUSTS} - 1.11932*b_{MUSTS} - 2.13823*C_{MUSTS} + 2.52438*H°_{MUSTS} - 0.0023052*T.P.C._{MUSTS} - 0.061813*ANTH._{MUSTS}$

Since the P-value = 0.0008 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 97.78% indicates that the model as fitted explains 97.78% of the variability in L''_{WINE}. The adjusted R-squared statistic is 94.67%. The standard error of the estimate shows the standard deviation of the residuals to be 1.89.

$a''_{WINE} = 222.429 - 0.115124*L_{MUSTS} - 6.75594*a_{MUSTS} + 2.83362*b_{MUSTS} + 3.58989*C_{MUSTS} - 5.13238*H°_{MUSTS} - 0.0735046*T.P.C._{MUSTS} + 0.115393*ANTH._{MUSTS}$

Since the P-value = 0.0047 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 95.32% indicates that the model as fitted explains 95.32% of the variability in a''_{WINE}. The adjusted R-squared statisticis 88.77%. The standard error of the estimate shows the standard deviation of the residuals to be 3.46.

$b''_{WINE} = -58.932 - 0.066982*L_{MUSTS} + 1.68545*a_{MUSTS} - 0.394774*b_{MUSTS} - 1.2104*C_{MUSTS} + 1.75717*H°_{MUSTS} + 0.0222205*T.P.C._{MUSTS} + 0.0470683*ANTH._{MUSTS}$

Since the P-value = 0.0016 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 97.04% indicates that the model as fitted explains 97.04% of the variability in b''_{WINE}. The adjusted R-squared statistic is 92.90%. The standard error of the estimate shows the standard deviation of the residuals to be 0.69.

C''_{WINE} = 145.952 - 0.218312* L_{MUSTS} - 6.55886* a_{MUSTS} - 0.312852* b_{MUSTS} + 5.16362* C_{MUSTS} - 2.78834* $H°_{MUSTS}$ - 0.0658346* $T.P.C._{MUSTS}$ + 0.116953* $ANTH._{MUSTS}$

Since the P-value = 0.0061 from ANOVA is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic = 94.80% indicates that the model as fitted explains 94.80% of the variability in C''_{WINE}. The adjusted R-squared statistic is 87.52%. The standard error of the estimate shows the standard deviation of the residuals to be 3.09.

$H°''_{WINE}$ = -336.334 - 0.1234* L_{MUSTS} + 5.09838* a_{MUSTS} - 8.45674* b_{MUSTS} + 0.434033* C_{MUSTS} + 9.82196* $H°_{MUSTS}$ + 0.14626* $T.P.C._{MUSTS}$ - 0.0463808* $ANTH._{MUSTS}$

Since the P-value = 0.0044 from ANOVA table is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level. The R-Squared statistic = 95.45% indicates that the model as fitted explains 95.45% of the variability in $H°''_{WINE}$. The adjusted R-squared statistic is 89.086%. The standard error of the estimate shows the standard deviation of the residuals to be 5.85.

Generated parameters under these mathematical models, calculating color differences between them and the actual values and the wine color computer simulation are shown in Tables 3 and 5 (*tab. 3, 5*).

It can be seen that in these last mathematical models, the estimates for Băbească neagră variety wines have won 5 of 8 values less than unity when calculating color differences ΔE 2000 formula, which means that the estimated parameters can give senzorial identical wines to those in reality obtained. The estimates made for Fetească neagră variety wines have won 3 of the 5 values lower than unity when calculating color differences ΔE 2000 formula, the other two being slightly larger than unity.

Table 1

The mean values of total phenolic compounds and anthocyanins content at the must and wines studied from Băbească neagră (B.N.) and Fetească neagră (F.N.) grape varieties

No.	Samples	AVERAGE T.P.C. ± STDEVP MUST (mg/L)	AVERAGE T.P.C. ± STDEVP WINE (mg/L)	Δ T.P.C. MUST-WINE (mg/L)	AVERAGE ANTH. ± STDEVP MUST (mg/L)	AVERAGE ANTH. ± STDEVP WINE (mg/L)	Δ ANTH. MUST-WINE (mg/L)
1	Sample B.N. V1	144.43 ± 0.83	122.59 ± 2.24	21.84	23.14 ± 0.43	8.66 ± 0.20	14.48
2	Sample B.N. V2	157.40 ± 1.05	143.05 ± 0.75	14.35	52.85 ± 0.33	34.33 ± 0.56	18.52
3	Sample B.N. V3	160.95 ± 0.93	158.28 ± 0.57	2.67	92.37 ± 0.20	55.35 ± 1.14	37.02
4	Sample B.N. V4	261.85 ± 4.68	211.04 ± 1.18	50.81	124.34 ± 0.65	66.84 ± 3.63	57.51
5	Sample B.N. V5	296.93 ± 1.49	224.55 ± 1.01	72.39	157.22 ± 0.35	79.64 ± 3.24	77.58
6	Sample B.N. V6	328.20 ± 2.29	236.04 ± 1.84	92.16	179.75 ± 0.66	100.95 ± 5.16	78.80
7	Sample B.N. V7	337.52 ± 2.22	247.55 ± 0.42	89.97	187.75 ± 1.07	117.65 ± 4.91	70.10
8	Sample B.N. V8	345.33 ± 2.28	258.73 ± 0.43	86.60	212.90 ± 0.76	127.57 ± 1.62	85.32
9	Sample F.N. V9	175.83 ± 1.48	97.91 ± 0.58	77.92	20.07 ± 0.03	0.20 ± 0.09	19.86
10	Sample F.N. V10	198.94 ± 1.41	133.07 ± 0.77	65.87	33.64 ± 0.77	6.50 ± 0.10	27.15
11	Sample F.N. V11	228.15 ± 2.12	165.69 ± 0.78	62.46	42.77 ± 0.44	18.21 ± 0.16	24.55
12	Sample F.N. V12	256.11 ± 2.22	176.57 ± 1.11	79.53	65.59 ± 0.24	26.27 ± 0.45	39.33
13	Sample F.N. V13	278.77 ± 2.51	180.60 ± 1.12	98.17	83.08 ± 0.32	27.82 ± 0.72	55.26

Table 2

The mean values of chromatic parameters of the analysed must and wine samples from Băbească neagră grape varieties calculated according to CIE Lab 76 method and chromatic parameters values estimated from the L, a, b, C, H° values of musts using first mathematical model obtained by applying multiple regression

No.	Sample	L	a	b	C	H°	Intensity	Tint	Comput. colour simulation
							ΔE V – V ' est.		
1	Must B.N. V1	71.69	24.50	20.70	32.08	40.19	1.32	1.08	
2	Must B.N. V2	38.78	33.60	29.91	44.98	41.67	3.61	1.13	
3	Must B.N. V3	30.04	36.53	26.86	45.34	36.32	4.41	0.99	
4	Must B.N. V4	24.29	38.30	26.00	46.29	34.17	5.17	0.89	
5	Must B.N. V5	16.79	35.10	22.77	41.83	32.97	6.25	0.89	
6	Must B.N. V6	13.40	33.86	19.29	38.97	29.67	6.91	0.84	
7	Must B.N. V7	13.26	34.62	19.23	39.60	29.05	6.94	0.84	
8	Must B.N. V8	11.71	34.08	17.85	38.47	27.65	7.40	0.84	

9	Roze Wine B.N. V1	90.71	8.41	5.41	10.00	32.72	0.36	0.99	
10	Est. Roze Wine B.N. V1'	90.73	8.69	5.50	10.32	32.84	ΔE V1-V1' est.	0.26	
11	Roze Wine B.N. V2	84.81	18.78	7.45	20.2	21.65	0.59	0.85	
12	Est. Roze Wine B.N. V2'	85.32	17.59	7.83	19.38	26.49	ΔE V2-V2' est.	0.95	
13	Roze Wine B.N. V3	81.49	23.58	7.2	24.66	16.99	0.72	0.79	
14	Est. Roze Wine B.N. V3'	81.68	19.69	7.87	21.05	21.90	ΔE V3-V3' est.	2.38	
15	Roze Wine B.N. V4	79.39	19.24	9.98	21.67	27.42	0.84	1.02	
16	Est. Roze Wine B.N. V4'	79.55	21.33	8.35	23.01	20.79	ΔE V4-V4' est.	1.95	
17	Roze Wine B.N. V5	74.98	25.38	10.7	27.55	22.85	1.03	0.94	
18	Est. Roze Wine B.N. V5'	75.95	22.13	10.87	24.93	28.93	ΔE V5-V5' est.	1.95	
19	Roze Wine B.N. V6	73.11	27.09	10.74	29.15	21.63	1.11	0.93	
20	Est. Roze Wine B.N. V6'	70.18	30.80	10.73	32.67	20.67	ΔE V6-V6' est.	2.83	
21	Roze Wine B.N. V7	67.03	37.13	10.01	38.46	15.09	1.40	0.79	
22	Est. Roze Wine B.N. V7'	69.59	32.19	10.42	33.93	18.16	ΔE V7-V7' est.	2.93	
23	Roze Wine B.N. V8	66.65	35.29	10.65	36.87	16.79	1.41	0.83	
24	Est. Roze Wine B.N. V8'	66.64	37.18	10.22	38.33	13.04	ΔE V8-V8' est.	0.87	

Table 3

The mean values of chromatic parameters of the analysed wine samples from Băbească neagră grape varieties calculated according to CIE Lab 76 method and chromatic parameters values estimated from the L, a, b, C, H°, Anthocyanins and Total Phenolic Compounds values of musts using second mathematical model obtained by applying multiple regression

No.	Sample	L	a	b	C	H°	Intensity	Tint	Comput. colour simulation
							ΔE V – V '' est.		
1	Roze Wine B.N. V1	90.71	8.41	5.41	10.00	32.72	0.36	0.99	
2	Est. Roze Wine B.N. V1''	90.84	8.22	5.49	9.88	33.42	ΔE V1-V1'' est.	0.23	
3	Roze Wine B.N. V2	84.81	18.78	7.45	20.2	21.65	0.59	0.85	
4	Est. Roze Wine B.N. V2''	85.09	17.84	8.06	19.65	26.67	ΔE V2-V2'' est.	0.85	
5	Roze Wine B.N. V3	81.49	23.58	7.2	24.66	16.99	0.72	0.79	
6	Est. Roze Wine B.N. V3''	81.67	23.45	6.89	24.44	14.78	ΔE V3-V3'' est.	0.24	
7	Roze Wine B.N. V4	79.39	19.24	9.98	21.67	27.42	0.84	1.02	
8	Est. Roze Wine B.N. V4''	78.89	20.46	9.41	22.36	24.30	ΔE V4-V4'' est.	1.02	
9	Roze Wine B.N. V5	74.98	25.38	10.7	27.55	22.85	1.03	0.94	
10	Est. Roze Wine B.N. V5''	74.89	25.18	11.41	27.89	26.13	ΔE V5-V5'' est.	0.53	
11	Roze Wine B.N. V6	73.11	27.09	10.74	29.15	21.63	1.11	0.93	
12	Est. Roze Wine B.N. V6''	70.44	31.02	10.34	32.81	19.51	ΔE V6-V6'' est.	2.80	
13	Roze Wine B.N. V7	67.03	37.13	10.01	38.46	15.09	1.40	0.79	
14	Est. Roze Wine B.N. V7''	69.78	31.43	10.39	33.20	19.09	ΔE V7-V7'' est.	3.26	
15	Roze Wine B.N. V8	66.65	35.29	10.65	36.87	16.79	1.41	0.83	
16	Est. Roze Wine B.N. V8''	66.58	36.82	10.39	38.02	13.90	ΔE V8-V8'' est.	0.68	

Table 4

The mean values of chromatic parameters of the analysed must and wine samples from Fetească neagră grape varieties calculated according to CIE Lab 76 method and chromatic parameters values estimated from the L, a, b, C, H° values of musts using first mathematical model obtained by applying multiple regression

No.	Sample	L	a	b	C	H°	Intensity	Tint	Comput. colour simulation
							ΔE V – V ' est.		
1	Must F.N. V9	49.65	23.76	31.23	39.24	52.73	2.76	1.33	
2	Must F.N. V10	42.51	28.27	29.93	41.18	46.63	3.29	1.21	
3	Must F.N. V11	31.65	30.76	28.92	41.88	42.99	4.19	1.14	
4	Must F.N. V12	26.11	32.46	28.13	42.95	40.91	4.89	1.08	
5	Must F.N. V13	18.47	38.06	26.24	45.99	34.22	5.49	1.07	
6	Roze Wine F.N. V9	91.01	4.41	15.45	16.2	73.78	0.45	1.25	
7	Est. Roze Wine F.N. V9'	91.04	4.28	15.79	15.90	75.05	ΔE V9-V9' est.	0.29	

8	Roze Wine F.N. V10	89.16	7.81	12.35	13.76	56.76	0.49	1.76	
9	Est. Roze Wine F.N. V10'	88.12	9.92	11.78	16.03	50.88	ΔE V10-V10' est.	2.42	
10	Roze Wine F.N. V11	85.75	10.14	11.98	15.08	49.19	0.63	1.35	
11	Est. Roze Wine F.N. V11'	86.23	9.98	11.11	13.80	44.47	ΔE V11-V11' est.	0.67	
12	Roze Wine F.N. V12	82.5	14.91	11.14	18.11	36.08	0.78	1.12	
13	Est. Roze Wine F.N. V12'	83.37	13.42	11.61	17.67	42.15	ΔE V12-V12' est.	1.47	
14	Roze Wine F.N. V13	80.9	15.39	8.03	16.9	27.13	0.80	1.27	
15	Est. Roze Wine F.N. V13'	79.09	20.26	9.02	21.58	22.85	ΔE V13-V13' est.	3.36	

Table 5

The mean values of chromatic parameters of the analysed wine samples from Fetească neagră grape varieties calculated according to CIE Lab 76 method and chromatic parameters values estimated from the L, a, b, C, H°, Anthocyanins and Total Phenolic Compounds values of musts using second mathematical model obtained by applying multiple regression

No.	Sample	L	a	b	C	H°	Intensity	Tint	Comput. colour simulation
							ΔE V – V ' est.		
1	Roze Wine F.N. V9	91.01	4.41	15.45	16.2	73.78	0.45	1.25	
2	Est. Roze Wine F.N. V9"	91.29	4.29	15.48	15.85	74.34	ΔE V9-V9" est.	0.23	
3	Roze Wine F.N. V10	89.16	7.81	12.35	13.76	56.76	0.49	1.76	
4	Est. Roze Wine F.N. V10"	87.99	9.07	12.17	15.28	52.87	ΔE V10-V10" est.	1.54	
5	Roze Wine F.N. V11	85.75	10.14	11.98	15.08	49.19	0.63	1.35	
6	Est. Roze Wine F.N. V11"	85.91	10.84	11.29	14.64	43.74	ΔE V11-V11" est.	0.97	
7	Roze Wine F.N. V12	82.5	14.91	11.14	18.11	36.08	0.78	1.12	
8	Est. Roze Wine F.N. V12"	83.51	12.79	11.60	17.08	42.96	ΔE V12-V12" est.	1.97	
9	Roze Wine F.N. V13	80.9	15.39	8.03	16.9	27.13	0.8	1.27	
10	Est. Roze Wine F.N. V13"	80.64	16.08	8.19	17.48	26.48	ΔE V13-V13" est.	0.52	

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CONCLUSIONS

Regarding the evolution of phenolic compounds and anthocyanins content from the application of the two types of prefermentative maceration process, can say that the variant that was performed marc pressed gives wines with a higher content in phenolic compounds compared to other technologies.

Of the two models tested proved that the latter is more rigorous, giving chromatic parameter values close to those rosé wines obtained from the study.

From the above it can be said that these mathematical models can be used successfully in industrial oenological practice because the industry currently relies solely on available human resource experience and too little on adequate technology and knowledge that could allow the development of rose wines steadily to maintain their quality in terms of colour.

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