# COMPARATIVE STUDY ON THE INFLUENCE OF MACERATION TECHNOLOGIES ON THE FETEASCĂ NEAGRĂ WINES COLOUR

## STUDIU COMPARATIV PRIVIND INFLUENŢA TEHNOLOGIILOR DE MACERAŢIE ASUPRA CULORII VINULUI OBŢINUT DIN SOIUL FETEASCĂ NEAGRĂ

***MOGÎRZAN Petronela Cristina[1], COTEA V. V.[1], CONDORACHI I.[1], NICULAUA M.[2]***

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania
[2]Academia Română, Filiala Iaşi- Centrul de Cercetări pentru Oenologie

***Abstract.*** *The study presents aspects concerning the influence of various types of maceration on the Feteasca Neagră wines colors, color extraction is one of the main concerns of winemakers. Experimental material used was taken from the "V. Adamachi" farm and was applied specific technology for obtaining quality red wines. Then were used different variants of maceration: ultrasonic maceration, microwave maceration compared with classical and thermo maceration. Were obtained five technologic variants and the obtained wine were determined physico-chemical parameters, parameters of color, phenolic compounds: the anthocyans, the phenolic acids, Folin Ciocâlteau and* $D_{280}$ *index. The analyses obtained have found variations of the phenolic compounds and color parameters depending on the type of maceration.*

**Key words**: Feteasca neagră, phenolic compounds, color parameters, microwave, ultrasounds

***Rezumat.*** *În lucrarea de faţă s-au urmărit aspecte privind influenţa diferitelor tipuri de maceraţie asupra culorii vinurilor obţinute din soiul Fetească neagră, extragerea culorii fiind una din principalele preocupări ale tehnologilor. Materialul experimental utilizat a fost preluat din ferma „V. Adamachi" Iaşi şi s-a prelucrat conform tehnologiei specifice de obţinere a vinurilor roşii de calitate. Ulterior, s-a apelat la diferite variante de maceraţie: maceraţia cu ultrasunete, maceraţia prin intermediul microundelor comparativ cu maceraţia clasică şi termomaceraţia. S-au obţinut cinci variante tehnologice, iar la vinul obţinut s-au determinat analizele fizico-chimice, parametrii de culoare, compuşii fenolici: antocianii, acizii fenolici, indicele Folin Ciocâlteau şi* $D_{280}$*. În urma analizelor obţinute s-au constatat variaţii ale conţinutului de compuşi fenolici, ale parametrilor cromatici în funcţie de tipul de maceraţie folosit.*

**Cuvinte cheie**: Fetească neagră, compuşi fenolici, parametri cromatici, microunde, ultrasunete

## INTRODUCTION

Colour is the one of the main issue for obtaining red wine. To extract the color of red wine are used different maceration technologies, like: classical maceration, thermo, microwaves and ultrasound maceration . The main compounds of red wines are phenolic substances. The anthocyanins extraction

during the maceration depends on the oenological potential of grapes. The grapes content in phenolic substances depending on variety and year of the harvest . The main processes determining the anthocyans extraction are diffusion and dissolution (Cotea D.V., 1985, Cotea V.V. et al., 2005). The formation of red wine color involves the phenolic compounds: anthocyanins, tannins and phenolic acids. They are responsible for red wine color, the astringecy and smoothness (Petronela- Cristina Mogîrzan et al., 2009; J. Ribereau-Gayon et al., 1972). The most important specific pigments of red and rosé wines are anthocyanins. The quantities are 200-500 mg/L in red wine and it is reducing by half during the first year of storage and after the content stabilizes of 200 mg/L. The mechanisms which reducing the quantity of anthocyans is the enzymatic hydrolysis with formation of unstable antocianidine and condensation reactions (Pomohaci N. et al. 2000; Ţârdea C et al., 2000).

## MATERIAL AND METHOD

The researches on the influence of microwave, ultrasound compared with conventional maceration, termomaceration, which influence the wine color were made in November 2009 - January 2010, in the Oenology Laboratory of University of Agricultural Sciences and Veterinary Medicine Iaşi and were on obtained dry red wine samples of Fetească neagră grapes, from the wine center Copou harvest in 2009.

The wines were obtained under specific technology for obtaining high quality red wines.

The experiment was carried in three stages: preparation of mark for the 5 variants: 2 variants of irradiation, irradiation at 350 W on 10 and 17 minutes, 1 variant with ultrasound maceration, a variant with termomaceration (90°C) and classical maceration, then inoculation with enzymes Zymoclaire G (Sodinal, 2 g/hl mark) for a high degree of extraction and clarification of musts and selected yeast *Saccharomyces bayanus* Fermactive Rouge (Sodinal; mustuială 20 g/100 kg mark), followed by soaking at 20°C for one day. He followed the pressure mark in a hydraulic press followed by alcoholic fermentation, malo-lactic fermentation, sterile filtration, addition of 30 mg/L SO2 and bottling in dark bottles of 0.75 L. After three months (after which the visual appearance of tartaric precipitation was analysed) the physico-chemical analyses were made. The physico-chemical analyses were made under international and state standards and specific literature (Ţârdea C., 2007; Recueil des méthodes internationales d'analyse des vins et de moûts 2008).

The chemical determination were: alcoholic concentration, reductive sugars, total acidity, volatile acidity, wine density, dry extract, non reductive extract. The other determinations was anthocyans determination by pH variation method, the total content of phenolic compounds determination by Folin Ciocalteau Index, $D_{280}$ Index, phenoloc acids determination by high performance liquid chromatography (HPLC) and determination of the the color parameters.

## RESULTS AND DISCUSSIONS

The main physico-chemical characteristics of the Fetească neagră wines, obtained by different techniques of maceration are presented in table 1.

Regarding the phenolic compounds content, it is remarkable the variation depending on the type of used maceration, the highest quantity, 349,95 mg/L (fig. 1) it is at the microwave maceration samples, at 350 W power, 17 minutes, where the phenolic compounds extraction is highest, due the power and more time maceration, compared with microwave maceration variant for 10 minutes at the same power, where the anthocyans quantity is 309,56 mg/L.

The termomaceration variant, classical variant have lower values than the variants mentioned below and the ultrasound variant, the anthocyans quantity is the lowest, 278,24 mg/L.

The total polyphenols index values at the 5 samples analysed have a minimum of 25, 09 (fig. 2) at ultrasound maceration. The variation of parameters color in wines (varies by maceration technologies used and phenolic maturity of grapes in the moment of harvesting.

The brightness or L parameter values were from 60,13 on ultrasound variant and to 33,41 at the wine produced by microwave treatment for 17 minutes, reverse varying with the intensity color wine. In the case of a parameter (fig. 3) is noted that the wines are red color component, with the values between 34,31 at ultrasound maceration and 59,07 for the variant where was used microwave maceration, 17 minutes. The b parameter indicates the existence of the yellow color component, with a maximum of 31.65 in the microwave variant, 17 minutes and a minimum of 21,08 for the ultrasound variant.

*Table 1*

**Physico-chemical characteristics of wine**

| No. | Alcohol % vol. | Reductive sugar g/L | Total acidity, g/L $C_4H_6O_6$ | Volatile acidity, g/L $C_2H_4O_2$ | Relative density g/mL | R.E g/L | N.R.E g/L |
|---|---|---|---|---|---|---|---|
| 1 | 12,50 | 3,44 | 5,18 | 0,73 | 0.9920 | 21,90 | 18,46 |
| 2 | 11,56 | 3,96 | 4,75 | 0,59 | 0.9924 | 20,10 | 16,14 |
| 3 | 12,27 | 2,94 | 5,44 | 0,54 | 0 .9922 | 21,60 | 18,66 |
| 4 | 11,51 | 3,96 | 6,10 | 0,59 | 0.9922 | 19,30 | 15,34 |
| 5 | 11,38 | 2,26 | 5,96 | 0,54 | 0.9941 | 24,00 | 21,74 |

R.E-reductive extract; N.R.E - non reductive extract;
1 Fetească neagră-ultrasound maceration 37 KHz 10 ', 2 Fetească neagră -microwave maceration 750 W 10 ', 3 Fetească neagră - microwave maceration 750 W 17', 4 Fetească neagră - termomaceration, 5 Fetească neagră - classical maceration;

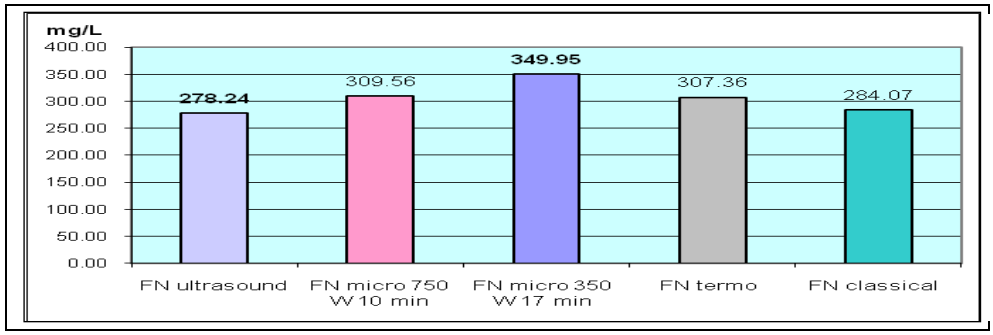


**Fig. 1.** The total quantity of anthocyanins present in wines

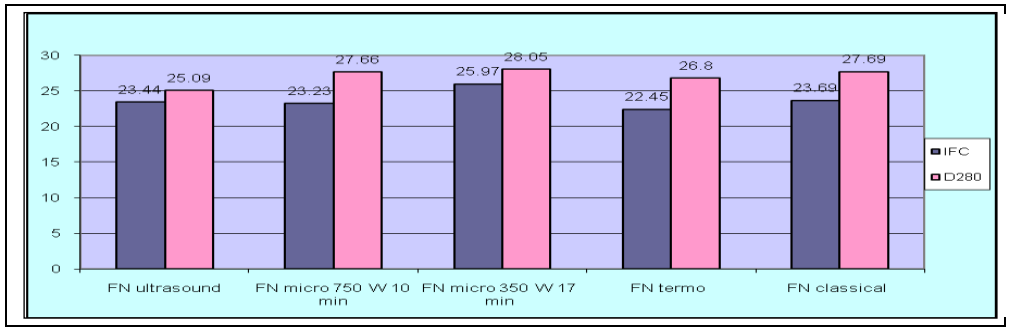


**Fig. 2.** Folin-Ciocâlteau and D280 index

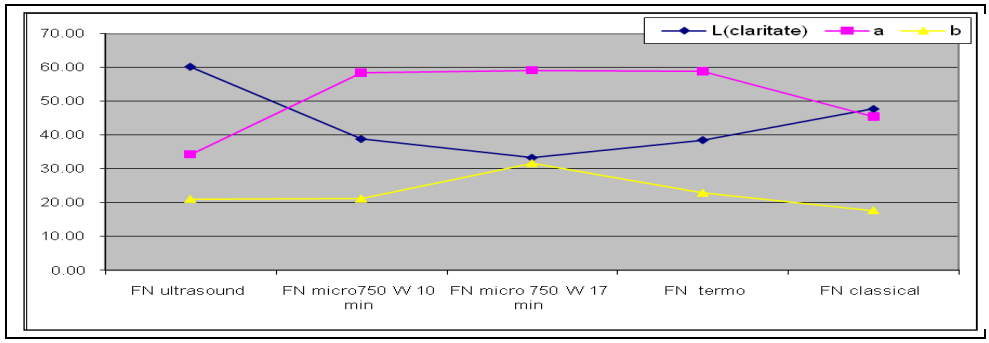


**Fig. 3.** Chromatic parameters CIE Lab 76

The anthocyans profile varies by used maceration technology, finding the highest values on the microwaves variants where were used a higher power and a long time maceration, respectively termomaceration, which can be observed in table 2. The phenolic acids (table 3) were relatively small variations depending on maceration used; the oscillations are not constant depending on the type of phenolic acids.

*Table 2*

**Percentage values (% of amount) of the 9 anthocyanins in wines**

| No. | Dp | Cy | Pt | Po | Mv | Po-a | Mv-a | Po-cm | Mv-cm | ΣAnt.-acet.+Ant.-cum. | ΣAnt.-acet./ΣAnt.-cum. | Mv/ΣMv-COOR | ΣAnt./ΣAnt.-COOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3,91 | 0,34 | 10,08 | 3,50 | 76,75 | 0,42 | 3,40 | 0,10 | 1,51 | 5,42 | 2,38 | 15,64 | 17,44 |
| 2 | 3,42 | 0,55 | 8,72 | 3,58 | 76,69 | 0,45 | 4,58 | 0,12 | 1,90 | 7,05 | 2,50 | 11,83 | 13,18 |
| 3 | 3,48 | 0,67 | 9,03 | 3,23 | 73,82 | 1,00 | 4,43 | 0,49 | 3,86 | 9,78 | 1,25 | 8,90 | 9,23 |
| 4 | 3,37 | 0,01 | 8,44 | 3,45 | 76,08 | 0,80 | 4,34 | 0,35 | 3,16 | 8,65 | 1,46 | 10,14 | 10,56 |
| 5 | 3,28 | 0,30 | 9,11 | 3,01 | 77,23 | 0,38 | 2,96 | 0,36 | 3,38 | 7,08 | 0,89 | 12,18 | 13,12 |

1- Fetească neagră microwave maceration 750 W 17', 2- Fetească neagră microwave maceration 750 W 10', 3- Fetească neagră termomaceration , 4 - Fetească neagră classical maceration, 5 - Fetească neagră ultrasound maceration 37 KHz 15';
Dp - delphinidin ; Cy – cianidin; Pt – petunidin; Po – poenidin; Mv – malvidin; Mv-a, malvidin-acetylated; Po-cm, poedinidin cumarilated; ΣAnt.-acet.+Ant.-cum., the amount of the anthocyans acetylate and cumarilated, ΣAnt.-acet./ΣAnt.-cum, report of the acetylated and cumarilated anthocyans, Mv/ΣMv-COOR, report of the monoglucozid malvidin and the amount of esterified malvidin, ΣAnt./ΣAnt.-COOR-report of the amount of simple and esterified anthocyans.

*Table 3*

**Quantitative value of phenolic acids in wine (mg/L)**

| No. | gallic acid | protocatechic acid | p - hydroxybenzoic acid | gentisic acid | vanillic acid | caffeic acid | clorogenic acid | syringic acid | p-cumaric acid | ferulic acid |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8,063 | 0,593 | 0,012 | 13.0387 | 20,616 | 4,065 | 1,514 | 4,647 | 3,767 | 0.3886 |
| 2 | 5,007 | 0,899 | 0,008 | 12,038 | 19,441 | 3,267 | 1,034 | 4,571 | 3,002 | 0,494 |
| 3 | 12,508 | 0,803 | 0,032 | 6.9221 | 13,810 | 0,496 | 0,919 | 6,213 | 0,374 | 0,413 |
| 4 | 9,010 | 0,779 | 0,016 | 8,068 | 10,092 | 0,492 | 1,180 | 5,409 | 0,392 | 0,353 |
| 5 | 3,983 | 0,704 | 0,026 | 3,020 | 22,808 | 3,265 | 1,329 | 3,590 | 3,168 | 0,205 |

1- Fetească neagră microwave maceration 750 W 17', 2- Fetească neagră microwave maceration 750 W 10', 3- Fetească neagră termomaceration, 4 - Fetească neagră classical maceration, 5 - Fetească neagră ultrasound maceration 37 KHz 15'

## CONCLUSIONS

The study demonstrates that microwave treatment favors the color components extraction, the total quantity of anthocyanins increased in microwave the sample,750 W 17 minutes.

The color parameters varies by used maceration technology, the brightness increased on the ultrasonic maceration variant varying inversely with intensity. The a and b parameters showed a maximum value on the microwave variant, power of 750 W, 17 minutes, which shows that microwaves have influence on the tannins and anthocyans extraction.

The monoglucosid anthocyans is higher on the microwave maceration at 750 W 17 minutes and the amount of acetylated and cumarilated anthocyans has the highest value for the microwave treatment at a lower intensity and for the ultrasound variant.

The phenolic acids quantity varies depending on the used treatment, the microwave and the ultrasound treatment favors phenolic acids extraction.

The classical variant and the other new type of variants are not large differences, but we may say that the color varies quite high comparative with the conventional maceration and termomaceration, so can be obtained a new type of wine.

### REFERENCES


**1. Cotea D. V., 1985** - *Tratat de Oenologie, vol. 1*. Ed. Ceres, Bucuresti, p. 533-546.

**2. Cotea V. V., Odăgeriu G., Nechita B., I., Niculaua M., Zamfir C., Coşofreţ S., 2005** - *Studiul variaţiei caracteristicilor cromatice ale vinului Fetească neagră ca urmare a tratamentelor de limpezire.* Lucrări ştiinţifice, seria Horticultură, U.Ş.A.M.V. vol. 48, Iaşi, 2005, format electronic (CD), p. 359 – 364.

**3. Mogîrzan Petronela-Cristina, V.V. Cotea, G. Odăgeriu, Otilia Chiriţă, M. Niculaua, I. Condorachi**, 2009 - *Aspecte privind variaţia caracteristicilor cromatice în timpul fermentaţiei malolactice a unor vinuri roşii.* Lucrări ştiinţifice, seria Horticultură, U.A.M.V. Iaşi, vol. 52, 2009, p. 787-792.

**4. Pomohaci N., Sîrghi C., Stoian V., Cotea V.V., Gheorghiţă M., Năməloşanu I.,** 2000 - *Oenologie, vol. 1 Prelucrarea strugurilor şi producerea vinurilor*. Editura Ceres, Bucureşti.

**5. Ribereau-Gayon J., Peynaud E., Sudraud P., Ribereau-Gayon P., 1972** - *Traité d'oenologie. Sciences et techniques du vin, vol 1. Analyse et contrôle des vins.* Dunod-Paris, France.

**6. Ţârdea C., Sârbu Gh., Ţârdea Angela, 2000 -** *Tratat de vinificaţie.* Edit. "Ion Ionescu de la Brad Iaşi", p. 337-348.

**7. Ţârdea C., 2007 -** *Chimia şi analiza vinurilor*. Editura "Ion Ionescu de la Brad", Iaşi.

8. *** **2008** - *Recueil des méthodes internationales d'analyse des vins et de moûts*. Office International de la Vigne et du Vin, Édition Officielle, juin, Paris.