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## ABSTRACT

The doctoral thesis has as theme „Studies concerning the influence of some oenological treatments on Cotnari wines' composition” .

The thesis is structured in eight chapters, out of which four compose the main part and the rest the experimental part.

The first four chapters present data regarding the history and ecosystem of Cotnari vineyard, as well as the general technology of quality white wines processing, the studied oenological treatments and last but not least the present state of research concerning the use of oenological treatments and wine composition.

In the next four chapters, within the experimental part, the organisational and institutional frame pf the research is presented as well as the material, method and analyses techniques used, finishing with the obtained results and their discussion. The final part is represented by the general conclusions.

Chapter I, is introductory and represents the present state of research regarding treatments in oenology and wines' composition. The evolution of oenological and curative practices and also practices and oenological treatments allowed by the Vine and Wine Law no. 244/2002, was presented, ensuring a correct conservation and evolution of wines. The compounds that enter the complex wine composition, not only those that are original from grapes but also those that result from fermentation, stabilization and conditioning of wines.

Chapter II presents information regarding the history and natural environment of Cotnari vineyard. Situated at the northern limit of vine culture, the vineyard has a valuable climate, the local grape varieties (Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească) having optimal conditions for obtaining high yields from a quantitative as well as qualitative point of view.

Chapter III is composed of a description of the studied grape varieties' origin, agrobiological and technological value. The general technology of obtaining quality white wines, with their specific technological steps and the four wines of Cotnari (Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească) are described.



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Chapter IV presents the oenological treatments studied: treatment with some oenological products (selected yeasts, nutrients, enzymatic products), gelatine treatment, refrigeration-tartaric salts elimination in wine, wine pasteurisation, treatment with arabic gum, treatment with ascorbic acid, treatment with metatartaric acid, treatment with potassium sorbate, treatment with Riduxhigh® .

Chapter V presents the the institutional and organisational frame for the research.

Chapter VI talks about the main research objectives, the methods and means of analysis, of the most modern admitted by the OIV, with a high fidelity degree. The experimental variants are also presented.

Chapter VII is composed of the obtained results from the main physical-chemical analysis of the obtained wines. The originality aspect is represented by the discussion on the influence of the oenological treatments on the color parameters, total phenolic content and other specific indexes, organic acids and aromatic compounds from the Cotnari wines. The sensorial analyses of the wines is also presented shortly.

The conclusion appear at the end of the thesis (chapter VIII), bringing together the contributions and implications of some oenological treatments on the Cotnari wines' composition.

The study has as main aim the analysis of the influence of some oenological treatments on the composition of wines obtained from four local grape varieties: Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească (Busuioacă de Moldova) from Cotnari vineyard.

The main aims of this research were:

- ▶ two year evaluation of wines obtained from the four grape varieties: Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească from Cotnari vineyard.
- ▶ evaluation at industrial level of the influence of some oenological treatments on the physical-chemical characteristics of Cotnari wines.
- ▶ physical-chemical analysis of the wine samples obtained by using some oenological products at the wine-making stage.
- ▶ comparison and classification of major organic acids in the obtained wines from: Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească.
- ▶ identification of aroma compounds in Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească wines obtained by using some oenological treatments.

The experimental wine samples were obtained within the Pilot Station of the Horticultural faculty from the University of Agricultural Sciences and Veterinary medicine „Ion Ionescu de la Brad” - Iași, and also in the wine-making department of S.C. Cotnari S.A..



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### ***Experimental protocol – within the Pilot Station of the Horticultural Faculty***

Grapes of Frâncușă, Fetească albă, Grasă de Cotnari and Busuioacă de Moldova (Tămâioasă românească) were used, harvested from Cotnari vineyard in September 2009 and 2010.

The harvest was done manually, in plastic buckets. The grapes were transported and processed at the Oenology Laboratory of the Horticultural faculty – Iasi.

The experimental wine-making followed the technological process of obtaining quality white dry wines. The accent was put on the use of some oenological products (selected yeasts, nutrients, limpidity enzymes and extraction enzymes) and their influence on the Cotnari wines.

The studied experimental variants are described below:

#### **Frâncușă grape variety**

**Fr M** - fermentation appeared spontaneously (control sample);

**Fr V<sub>1</sub>** - selected yeasts (IOC Expression<sup>®</sup>) were added to the must (15 g/hL);

**Fr V<sub>2</sub>** - selected yeasts (IOC Expression<sup>®</sup> - 15 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) were added to the must;

**Fr V<sub>3</sub>** - selected yeasts (IOC Expression<sup>®</sup> - 15 g/hL), nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) and limpidity enzymes (Pecvine V<sup>®</sup> - 3 g/100 kg grapes) were added;

**Fr V<sub>4</sub>** - selected yeasts (Zymaflore X 5<sup>®</sup> - 20 g/hL), nutrients (Fermoplus integrateur<sup>®</sup> - 35 g/hL) and limpidity enzymes (Pecvine V<sup>®</sup> - 3 g/100 kg grapes) were added.

#### **Fetească albă grape variety**

**FA M** - fermentation appeared spontaneously (control sample);

**FA V<sub>1</sub>** - selected yeasts (Zymaflore X 16<sup>®</sup> - 20 g/hL) were added to the must;

**FA V<sub>2</sub>** - selected yeasts (Zymaflore X 16<sup>®</sup> - 20 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) were added to the must;

**FA V<sub>3</sub>** - selected yeasts (Zymaflore X 16<sup>®</sup> - 20 g/hL), nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) and limpidity enzymes (Pecvine V<sup>®</sup> - 3 g/100 kg grapes) were added;

**FA V<sub>4</sub>** - selected yeasts (IOC Expression<sup>®</sup> - 15 g/hL), nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) and limpidity enzymes (Pecvine V<sup>®</sup> - 3 g/100 kg grapes) were added.

#### **Grasă de Cotnari grape variety**

**Gr M** - fermentation appeared spontaneously, no extraction enzymes were used, but a maceration-fermentation of 8-12 hours was used (control sample);

The extraction enzyme Vulczyme arome<sup>®</sup> (3 g/hL) was used for the next 4 samples.

**Gr V<sub>1</sub>** - selected yeasts (Cross Evolution<sup>®</sup> - 20 g/hL) were added to the must;



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**Gr V<sub>2</sub>** - selected yeasts (Cross Evolution<sup>®</sup> - 20 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) were added to the must;

**Gr V<sub>3</sub>** - selected yeasts (Cross Evolution<sup>®</sup> - 20 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) and limpidity enzymes (Zymoclaire CG<sup>®</sup> 1,5 g/100 kg grapes) were added;

**Gr V<sub>4</sub>** - selected yeasts (Zymaflore X 16<sup>®</sup> - 20 g/hL), nutrients (Fermoplus integrateur<sup>®</sup> - 35 g/hL) and limpidity enzymes (Zymoclaire CG<sup>®</sup> - 1,5 g/hL) were added.

#### **Tămâioasă românească grape variety**

**TR M** - fermentation appeared spontaneously, no extraction enzymes were used, but a maceration-fermentation of 8-12 hours was used (control sample);

The extraction enzyme Vulcazyme arome<sup>®</sup> (3 g/hL) was used for the next 4 samples.

**TR V<sub>1</sub>** - selected yeasts (Fermol aromatic<sup>®</sup> - 25 g/hL) were added to the must;

**TR V<sub>2</sub>** - selected yeasts (Fermol aromatic<sup>®</sup> - 25 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) were added to the must;

**TR V<sub>3</sub>** - selected yeasts (Fermol aromatic<sup>®</sup> - 25 g/hL) and nutrients (Fermoplus integrateur<sup>®</sup>, 35 g/hL) and limpidity enzymes (Zymoclaire CG<sup>®</sup> 1,5 g/100 kg grapes) were added;

**TR V<sub>4</sub>** - selected yeasts (Zymaflore X 5<sup>®</sup> - 20 g/hL), nutrients (Fermoplus integrateur<sup>®</sup> - 35 g/hL) and limpidity enzymes (Zymoclaire CG<sup>®</sup> 1,5 g/100 kg grapes) were added.

The marc was pressed with a hydraulic press, the must was transferred then in glass vessels for alcoholic fermentation.

After the alcoholic fermentation is over (at a temperature lower than 20 °C), the wines were racked, filtered and SO<sub>2</sub> was added (100 mg/hL SO<sub>2</sub> - for antioxidant protection) and bottled in bottles of 750 mL.

#### ***Experimental protocol – within the wine-making department of S.C. Cotnari S.A.***

The experimental wine samples were harvested during the technological flux: from young wine until its bottling.

The studied wines were: Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească.

The wine samples are the following:

#### ***Frâncușă wine***

**Fr M** - young wine, before treatments;

**Fr P<sub>1</sub>** - wine after gelatine and tannin treatment;

**Fr P<sub>2</sub>** - wine after filtration and refrigeration - tartaric salts elimination;

**Fr P<sub>3</sub>** - wine after Arabinol<sup>®</sup> ascorbic acid, metatartaric acid treatment;

**Fr P<sub>4</sub>** - wine after bottling;

**Fr P<sub>5</sub>** - bottled wine in the conditions of supermarket chains.



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### *Fetească albă wine*

**FA M** - young wine, before treatments;

**FA P<sub>1</sub>** - wine after gelatine and tannin treatment;

**FA P<sub>2</sub>** - wine after filtration and refrigeration - tartaric salts elimination;

**FA P<sub>3</sub>** - wine after potassium sorbate and Ridux high<sup>®</sup> treatment;

**FA P<sub>4</sub>** - wine after bottling;

**FA P<sub>5</sub>** - bottled wine in the conditions of supermarket chains.

### *Grasă de Cotnari wine*

**Gr M** - young wine, before treatments;

**Gr P<sub>1</sub>** - wine after gelatine and tannin treatment;

**Gr P<sub>2</sub>** - wine after filtration and refrigeration - tartaric salts elimination;

**Gr P<sub>3</sub>** - wine after potassium sorbate and Ridux high<sup>®</sup> treatment;

**Gr P<sub>4</sub>** - wine after bottling;

**Gr P<sub>5</sub>** - bottled wine in the conditions of supermarket chains.

### *Tămâioasă românească wine*

**TR M** - young wine, before treatments;

**TR P<sub>1</sub>** - wine after gelatine and tannin treatment;

**TR P<sub>2</sub>** - wine after filtration and refrigeration - tartaric salts elimination;

**TR P<sub>3</sub>** - wine after potassium sorbate and Ridux high<sup>®</sup> treatment;

**TR P<sub>4</sub>** - wine after bottling;

**TR P<sub>5</sub>** - bottled wine in the conditions of supermarket chains.

The analysis of compositional characteristics of obtained wines was done during 2009 and 2010 in the oenology laboratory of the Horticultural Faculty - University of Agricultural Sciences and Veterinary medicine „Ion Ionescu de la Brad” - Iași. The following analyses were done: alcoholic concentration, reductive sugars, total and volatile acidity, pH, relative density, non-reductive extract, total phenolic compounds and aromatic substances.

The major organic acids were also analysed by Shimadzu HPLC. At the same time, a sensorial profile analysis was conducted to see the influence of some oenological treatments on the obtained wines, with the help of a gas-chromatographer coupled with mass-spectrophotometry.

By comparing the wines obtained in the two harvest years, one clearly notices that the samples from 2009 have a higher alcoholic concentration and reductive extract than the variants in 2010.



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Wines' total acidity obtained in experimental conditions in 2010 is higher than the one in 2009.

The oenological treatments done during the processing flux did not significantly influence the compositional characteristics of Cotnari wines.

The total polyphenolic index (g/L gallic acid), responsible for expressing the total phenolic index (phenolic acids, color and tannin substances) did not significantly change compared to the control sample in the case of each variant processed within the laboratory.

The Folin-Ciocalteu index (g/L gallic acid), specific only to reductive properties phenolic compounds, had a similar evolution to the total polyphenolic index.

In the case of wines with remanent sugar obtained industrially (Fetească albă, Grasă de Cotnari and Tămâioasă românească), the filtration, pasteurization, refrigeration - tartaric salts elimination, potassium sorbate and Ridux High<sup>®</sup> treatments had no significant influence on the evolution of the total polyphenolic index and Folin-Ciocalteu index.

The analysed organic acids had smaller values in the wines obtained in the laboratory in 2009 compared to those in 2010, as the climatic conditions of 2010 were not as favorable, especially during the grapes' maturation period.

The tartaric acid from the 2009 wines grows directly proportional from Grasă de Cotnari – Tămâioasă românească – Fetească albă – Frâncușă, while in the wines obtained in 2010 in the following order: Fetească albă – Tămâioasă românească – Grasă de Cotnari – Frâncușă.

Terpenic compounds were identified in the samples obtained from Frâncușă, Grasă de Cotnari and Fetească albă grape varieties from the industrial flux, as well as in the variants of Tămâioasă românească, obtained both industrially as well as experimentally.

3-methyl-1-butanol is the superior alcohol determined to be in the highest concentration in all analysed wine samples, followed by phenylethylalcohol.

The fatty acids (octanoic and hexanoic) are identified in highest concentration in all analysed samples, except the Tămâioasă românească variants, where acetic acid is in highest quantity.

Ethyl lactate is an ester identified only in Grasă de Cotnari wines, obtained both at industrial level as well as in experimental variants, the highest concentration being registered in samples processed with selected yeasts.