

SUMMARY

of the doctoral thesis entitled:

RESEARCH ON THE SUPERIOR VALORIZATION OF THE WINEMAKING PROCESS BY-PRODUCTS

PhD-student: **MARIN Marian Sorin**

Scientific coordinator: ***Professor, PhD Hab. TEODORESCU Răzvan-Ionuț***

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The research represents the subject of the PhD thesis entitled "**RESEARCH ON THE SUPERIOR VALORIZATION OF THE WINEMAKING PROCESS BY-PRODUCTS**" within USAMVB.

This thesis describes the importance of the winemaking process by-products (the grape marc and biomass obtained with the vinification process of Merlot, Italian Riesling, Large Burgundy and Tămâioasă Românească grape varieties), from the SDCDVP Pietroasa-Istrița, for the production of new compound feed for broilers.

The aim of the present PhD thesis entitled "**Research on the superior valorisation of winemaking process by-products**" has been to find solutions in order to optimise the superior valorisation of the grape marc and yeast biomass resulting from winemaking as feed raw materials, meeting the nutritional requirements for broiler feed.

Within the SDCDVP Pietroasa-Istrița one produces between 400,000 and 600,000 litres of wine per year, including 100-150 tonnes of grape marc and 30,000-60,000 litres of yeast biomass from winemaking. Thanks to the modern presses existing in the SDCDVP Pietroasa -Istrița, the grape marc accounts for 15-25% of the processed grapes. The yeast biomass resulting from vinification represents about 6-10% of the vinification process.

In order to assess the potential for valorisation of the winemaking by-products, the following main lines of research have been addressed:

- The study of raw materials (grapes) out of which winemaking by-products are obtained;
- Testing modern methods for drying wine-making by-products (grape marc and yeast biomass).
- Physical-chemical analysis of by-products: winemaking grape marc and yeasts;
- Obtaining compound feed formulations based on dried grape marc and yeast biomass obtained by the vinification of „Tămâioasa Românească” variety and their characterisation;

- "In vivo" research - used for testing zootechnical performances of some compound feed.

The research in this thesis was carried out from 2017 to 2024 in different places and laboratories across the country, namely:

- SDCDVP Pietroasa-Istrița
- Microbiology - Ecology Laboratory in the Faculty of Land Improvement and Environmental Engineering- USAMV Bucharest
- INCDBNA-IBNA Balotești

Research in recent years has shown that there is still untapped potential for the use of wine by-products as feed ingredients for the development of new high value compound feeds for broilers.

By means of the present doctoral thesis, we aim at analysing in terms of physical-chemical lines the by-products obtained with the vinification process such as grape marc and yeasts biomass in order to show their importance for use as feed ingredients in obtaining new compound feed formulations.

Due to this constant concern, the present thesis contributes to the promotion of the circular economy, to the reduction of the negative impact on the environment and presents clear benefits according to the Green Pact, reducing pollution and creating benefits because of its contribution to the livestock industry by obtaining compound feed. The partial replacement of wheat bran with coarse bran and biomass from wine production helps to reduce the cost price of the compound feed.

THESIS STRUCTURE

The thesis is divided into two main parts, the first part includes the literature review and the second part includes personal research, results, discussion, conclusions, personal contributions and perspectives.

The literature and experimental research was carried out during 2017-2024 and the results are condensed in this thesis, which comprises 150 pages, 59 tables and 20 figures.

The content of the doctoral thesis is divided into two parts: the first part which is bibliographical, comprises two chapters dealing with the current state of research on the evaluation of by-products resulting from winemaking, and the second part, personal research, comprises 4 chapters describing the physical -chemical analysis of by-products, for their use in manufacturing new compound feeds for broilers.

Part I – BIBLIOGRAPHICAL RESEARCH comprises two chapters: 1) By-products obtained by winemaking process and 2) Rules concerning by-products obtained by winemaking process and their superior valorization.

Part II – PERSONAL RESEARCH comprises four chapters: 3) Physical-chemical characterization of the grape marc obtained from the vinification process of white and red wine grape varieties at SCDVV Pietroasa-Istrița; 4) Physical-chemical characterization of yeast biomass obtained from the vinification process of white and

red wine grape varieties at SCDVV Pietroasa-Istrița; 5) Development of innovative compound feedstuffs, including grape marc or yeast biomass from winemaking („TĂMÂIOASĂ ROMÂNEASCĂ” variety) and analysis of their physical-chemical characteristics; 6) Compound feed testing on broilers.

The first part, the bibliographical research includes:

- In the first chapter it has been demonstrated that the need to develop circularity in viticulture can make a significant contribution to the national and international economy.

- In the second chapter the legislation on the correct management of waste coming from wine industry is presented. General EU waste legislation (Directive 2006/12/EC) requires Member States to take the necessary measures in order to ensure that wastes are disposed of or recycled without endangering human health and without using environmentally harmful processes or methods.

The second part, personal contributions - describes methods, results, discussions and conclusions which present the following aspects;

In chapter III, **Physical-chemical description of grape marc obtained out of the white and red wine grape varieties vinification process in SDCDVP Pietroasa-Istrița**, one observed that the highest protein and amino acid content is presented by the „Tămâioasă Românească” grape marc and for this reason there was established a scaling up of the by-products obtained from the same grape variety, taking into account its compounds for animal husbandry industry.

Chapter IV describes the analysis of some varieties of yeast biomass resulting from winemaking, its physical-chemical characterisation and methods, also the development of a technological drying flow.

Chapter V presents the development of some innovative combined feed based on grape marc and yeast biomass obtained by Tămâioasă Românească indigenous variety winemaking.

Of particular interest in Chapter VI was the testing of these combined diets on broilers and the analysis of thigh, breast and liver. The biotechnological protein component, based on yeast biomass from wine production, had a fatty acid content of Σ saturated fatty acids: max 18.56% of lipids; Σ monosaturated fatty acids: max 19.01% of lipids, Σ polyunsaturated fatty acids: 45.67% of lipids.

The results of the research were aimed at the development of 2 feed ingredients (Tămâioasă Românească grape marc and wine yeast biomass) and 2 combined feed formulations tested on broilers.

The technical issue that was solved out in the present thesis was argued by the importance of the by-products superior valorisation, by-products obtained by means of vinification at SDCDVP Pietroasa-Istrița.

The experiment was carried out for 6 weeks (0-42 days) on 240 Cobb 500 chickens. Broilers were individually weighed, divided into 3 living stocks (M (control), E2 and E4) and housed in an experimental barn for floor rearing on permanent litter. Feed formulations structures were presented in chapter V. The aim of the experiment

was to test wine-grape by-products in broilers feed in order to evaluate their zootechnical performance and to present results on improved nutritional quality of meat.

The experimental living stocks were – control living stock (M); -the stock fed with *Tămâioasa Românească* grape marc (6%); - the stock fed with *Tămâioasa Românească* yeast biomass (6%).

At the end of the PhD thesis conclusions and recommendations are formulated to the livestock sector with a major impact on the promotion of the circular economy and the reduction of the negative impact on environmental pollution. These are: The realization of a technological flow for obtaining dried grape marc resulting from the vinification process of the autochthonous variety *Tămâioasa Românească* (TR); The realization of a technological flow for obtaining yeast biomass in dry form resulting from the vinification process of the autochthonous variety *Tămâioasa Românească* (TR); Selection of a dry grape marc product from the autochthonous variety *Tămâioasa Românească* (TR); Selection of a dry product of yeast biomass from the autochthonous variety *Tămâioasa Românească* (TR); Scale-up of the two selected products: a. grape marc resulting from the vinification of the indigenous variety *Tămâioasa Românească* (TR); b. yeast biomass resulting from the vinification of the indigenous variety *Tămâioasa Românească* (TR); Compound feed recipes for two phases of chick rearing (14-28 days, corresponding to phase II - grower, and 29-42 days, corresponding to phase III - finisher). The product based on dried grape marc is recommended to be used in a proportion of 6% as a feed ingredient for the production of new compound feed recipes; The product based on wine yeast biomass is recommended to be used in a proportion of 6% as a feed ingredient for the production of new compound feed recipes.

These results constitute the basis for a future development of other types of compound feed, which can be adjusted and tested for different animal breeds.