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WINE PRODUCTION FROM LOCAL VARIETIES OF GRAPES IN MICROWINERY CONDITIONS

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Abstract In the paper there has been studied the process of wine making from local grape varieties: Feteasca White, Feteasca, Regala, Feteasca Neagra, Rara Neagra, in conditions of microvinification. Wine raw materials were obtained with the involvement of a dynamic process of alcoholic fermentation from the varieties harvested in different regions of the Republic of Moldova. It has been established that the obtained wine material meets the requirements of the normative documents. The organoleptic characteristics of the red and white wines produced from the local varieties in the micro winery of the Technical University of Moldova are specific to each grape variety and they are of the highest quality.

Keywords: *variety, must, white and red wines, physical-chemical indices, alcoholic fermentation, control, temperature, sugar content.*

Introduction

All local varieties are of particular importance for the development of Moldovan winemaking industry, and the wines produced from these varieties represent a niche for promotion on the international market because producers are looking for an original taste that would represent the country.

Local varieties are also called aboriginal varieties and are the ones that have appeared on Moldovan land since ancient times, have adapted to the pedo-climatic conditions of the respective areas and have been preserved until the present. Among the most important white grape varieties in this category the following are mentioned: Feteasca albă, Feteasca Regală, Zghihara, Plăvaie, Galbena, Crâmpoşie. But the main red grape varieties are: Feteasca Neagră, Rara Neagră, Negru de Ialoveni, Francuş [1, 2].

Feteasca Albă literally means "white young girl". It is an old variety with probable origins in the historic region of Moldova (including today's Republic of Moldova and Romania's eastern region of Moldova), where it has been cultivated traditionally. The short vegetation period, of about 150-160 days and the high capacity to accumulate sugars are the main characteristics of the variety. The wine from this variety develops a very pleasant secondary flavor of fermentation, which reminds of the vine flower perfume. Usually the Feteasca Albă wines are dry, acid and full of freshness, but they can also be off-

dry or medium sweet, the latter having a characteristic aroma, resembling the taste of honey comb [3 - 5].

Fetească Regală is a famous variety of [white wine](#) grape the origin of which is not very ancient. This grape variety is the result of a natural crossing performed between two different varieties of grape namely Grasa and Feteasca Alba. Feteasca is considered as one of the three different varieties of the Feteasca which means maiden in Europe. The two other grape varieties with the same name include Feteasca Alba and Feteasca Neagara [6, 7].



Figure 1. Feteasca Alba grapes.



Figure 2. Feteasca Regală grapes.

Feteasca Neagra is an attractive prospect to winegrowers, as it is resistant to both cold temperatures and drought conditions. It ripens late and has thick skins, leading to wines with an excellent concentration of [anthocyanins](#), giving good pigment to the wines. Nowadays, Feteasca Neagra is usually produced as a [varietal](#) wine, although in the past it was often blended with [Cabernet Sauvignon](#) and [Merlot](#) to give it more body and weight [8, 9].

Rară Neagră or Babeasca Neagra is a grape variety which ripens late and it is also a wine which buds from the mid-to-late season, contributing to the resistance to the early spring frost like viticulture hazards and winter hardiness of grape. Rară Neagra is capable of tolerating temperatures as less than -18°C during the cold winters of Eastern Europe [10, 11].



Figure 3. Feteasca Neagră grapes.



Figure 4. Rară Neagră grapes.

It is known that the cultivation of vine is a traditional occupation of Moldovans, known for centuries in these lands. In the past, the produced and kept in the wine cellars wines were demanded and much appreciated in the salons of the aristocrats of the European capitals (including Vienna), where large quantities of wine were exported from the grapes of the Rara Neagră (or Bănească) Black), Fetească Albă, Fetească Regală, Fetească Neagră (also called Păsarească) [12]. These varieties, created by the scholars of the Wine and Wine Research Institute (Feteasca albă, Feteasca, Regală, Feteasca Neagră, Rară Neagră, Viorica, Legenda, Floricica), serve as the foundation for the creation of the

modern winery industry, based on the latest achievements of modern science and practice [13]. At the same time, the potential of local varieties is enormous. Efforts are made to find a relation between the variety and the specific climate of this microregion. This fact will help to create more wines with their own personality. In this way, we can create personalized wines, taking into account the soil, climate, variety and technology, in order to occupy our own niche on the international wine market [14, 15].

Materials and methods

Local grapes, cultivated in different regions of the Republic of Moldova, have been used for research. As autochthonous varieties, grapes from Feteasca Albă, Feteasca Regală, Rara Neagră and Feteasca Neagră were harvested. Wine raw materials were obtained from the harvested grape varieties under microvinification conditions, where the dynamics of the alcoholic fermentation process was carried out. The alcoholic fermentation of the must represents a decisive link, because it is the stage of wine „birth”. The quality level of the wine depends largely on the way, in this stage it is carried out. Alcoholic fermentation is an anaerobic process by which fermentable carbohydrates are metabolized in the main products (ethyl alcohol and CO₂) and secondary products (higher alcohols, acids, aldehyds, etc.) as a result of oxido-reduction (redox) reactions, under the action of yeast enzymic equipment.. Among monoglucides, glucose, mannose and fructose ferment easier, but galactose - much harder. The remaining hexoses and pentoses do not ferment under the action of yeasts, but are destroyed by other microorganisms. Reactions occurring in alcoholic fermentation are determined by the enzymes in the yeast cells or yeast extracts [16, 17]. To determine the physicochemical indices and the organoleptic properties of the obtained wines, methods of analysis were used according to the standards in force, as well as those recommended by the OIVV [18]. The harvested grapes were processed in the microwinery section at the Department of Oenology. The grapes were harvested in different regions of the Republic of Moldova. The highest concentration of sugar was determined in Feteasca Neagră and Rara Neagră varieties, where the concentration was 228 and 223g/dm³, respectively (tabel 1). The lowest concentration of sugar was determined in the must of Feteasca Albă and Feteasca Regală varieties, where sugar concentration reached 170g/dm³ (tabel 3.1). The pH index in the must varies in the interval from 3,4 to 3,5. Titratable acidity is lower in white varieties compared to red varieties. For white varieties the titratable acidity varies from 5,4 to 5,8 g/dm³, but in the red must it is higher and varies from 6 to 7 g/dm³ (table 1) (19).

Table 1.

Physico-chemical indices of must from white and red grapes

| Grape varieties | Date of harvest | Grape origin | Initial indices of grapes | | | |
|-----------------|-----------------|--------------|---------------------------|--|-------------------|--|
| | | | Density [*] | Sugar ^{**} g/dm ³ | pH ^{***} | Titratable acidity ^{****} , g/dm ³ |
| Feteasca Albă | 19.09.2018 | Cricova | 1074 | 170 | 3,4 | 5,4 |
| Feteasca Regală | 20.09.2018 | Cricova | 1074 | 170 | 3,4 | 5,8 |
| Feteasca Neagră | 14.09.2018 | Cahul | 1096 | 228 | 3,5 | 6,3 |
| Rara Neagră | 25.09.2018 | Purcari | 1094 | 223 | 3,5 | 7,0 |

* According to OIV rules , OIV – MA - AS2 - 01B;

** According to OIV rules, OIV – MA – AS311-01;

*** According to OIV rules, OIV – MA – AS313-15;

**** According to OIV rules, OIV - MA – AS313-01

Results and discussions

The process control was performed every day during the alcoholic fermentation, determining the density and temperature of the environment. The alcoholic fermentation control of the Feteasca Albă must is represented in figure 1.

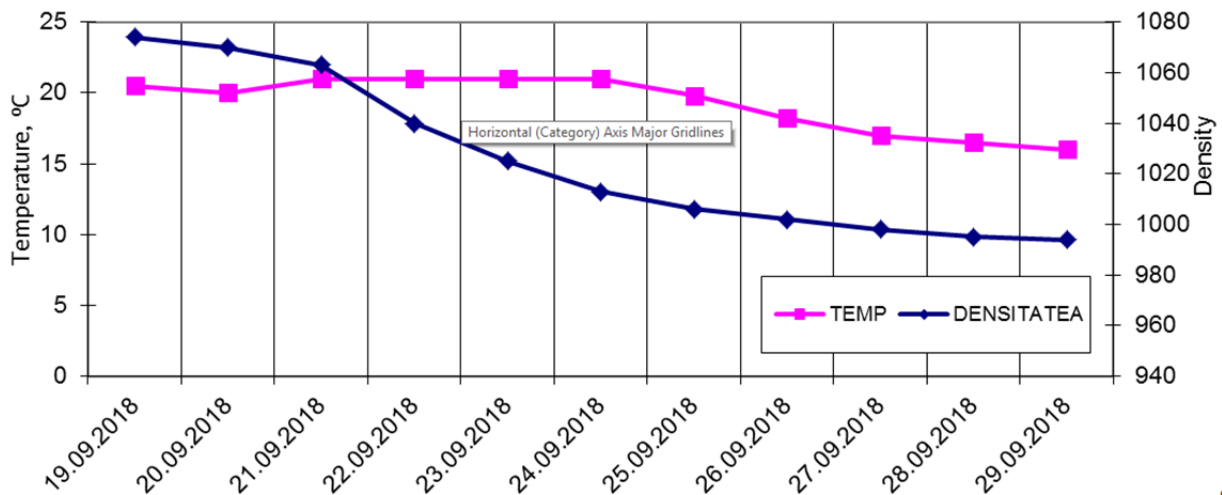


Figure 1. Dynamics of the process of alcoholic fermentation of Feteasca Albă must in microwinery conditions (harvest year 2018).

Figure 1 shows that alcoholic fermentation of the must from Feteasca Albă grape variety lasted about 11 days, from 19.09.2018 to 29.09.2018. The maximum temperature of must during fermentation was 21°C, and the minimum temperature reached - 16°C. Density values decreased from 1074 g/dm³ to 989 g/dm³. Based on the dynamics we can conclude that the initial fermentation phase of alcoholic fermentation process has taken place in the

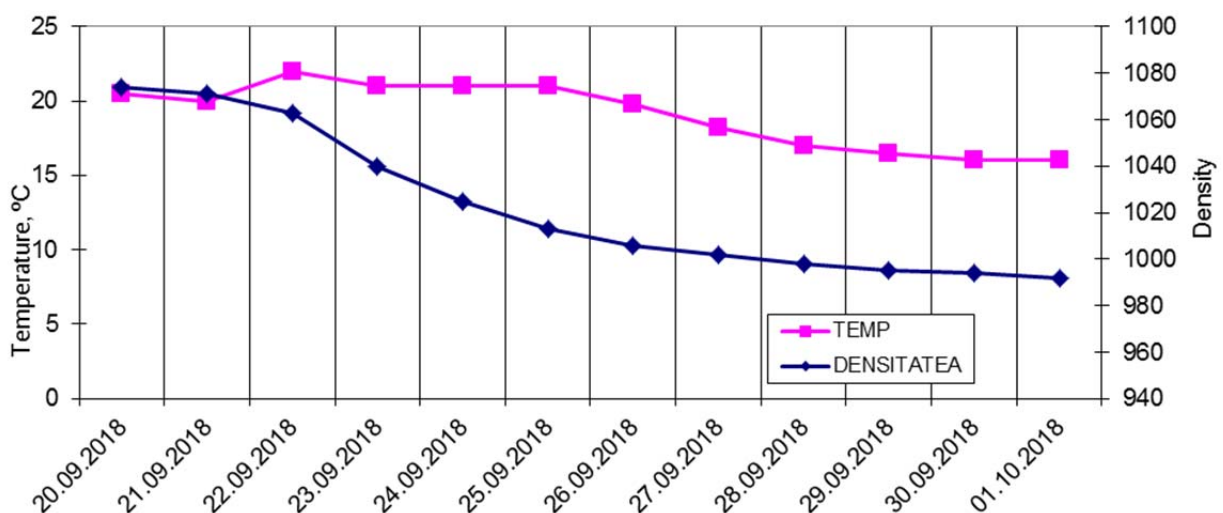


Figure 2. Dynamics of the process of alcoholic fermentation of Feteasca Regală must in microwinery conditions (harvest year 2018).

first 3 days, but the tumultuous phase has taken place in the following days and it lasted 5

days. The fermentation of Feteasca Alba must is characterized by higher values of fermentation temperature ($t=21^{\circ}\text{C}$) and by complete fermentation of sugar in the must.

Dynamics of alcoholic fermentation of Feteasca Regală must is similar to the alcoholic fermentation process performed in the Feteasca Albă must.

The maceration-fermentation process is the decomposition of sugar in the must under the action of yeasts in the presence of solid parts of the grapes (skin, skins and seeds) and the enrichment of the must with extracted constituents. This process is known as „the fermentation of must on grape mush”, found in the earlier specialty literature or „fermentation in red”.

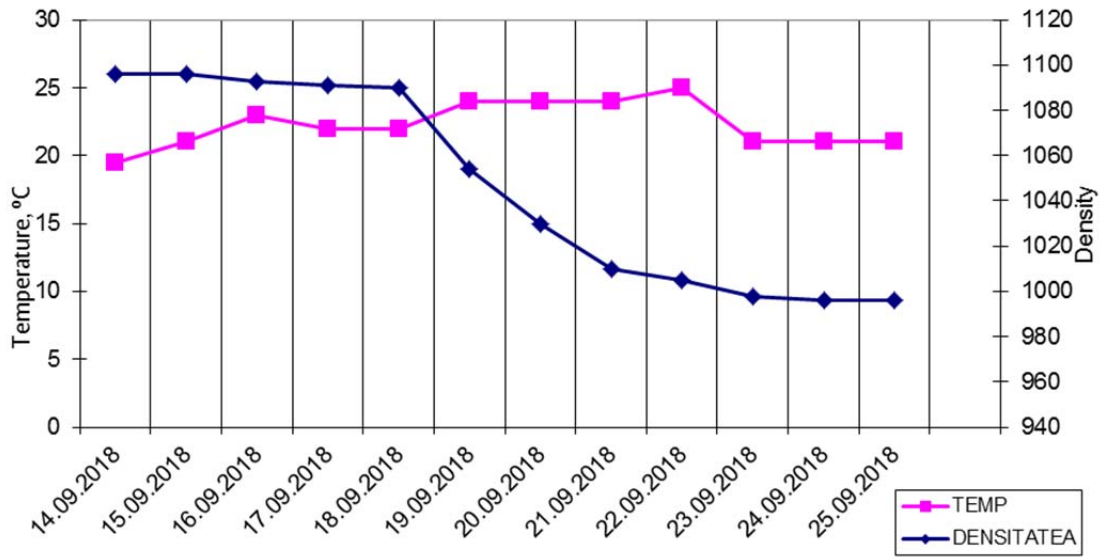


Figure 3. Dynamics of the process of alcoholic fermentation of Feteasca Neagră grape mush in microwinery conditions (harvest year 2018).

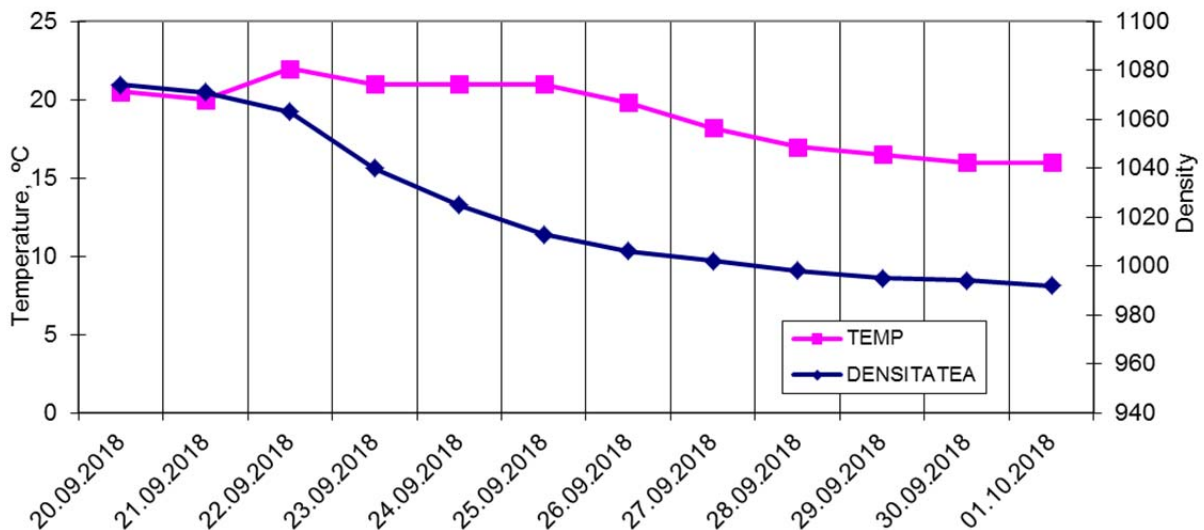


Figure 4. Dynamics of the process of alcoholic fermentation of Rara Neagră grape mush in microwinery conditions (harvest year 2018).

Figures 3 and 4 show that alcoholic fermentation of must from Feteasca Neagră and Rara Neagră grape varieties lasted approximately for 12 days, from 14.09.2018 to 25.09.2018. The maximum temperature of the must during fermentation was 25° C, and the minimum temperature was 20° C. Density values of must decreased from 1094 to 989. Based on the density dynamics we can conclude that during the first 5 days the initial fermentation phase of alcoholic fermentation process has taken place, and in the following days the tumultuous phase would take place. Dry red and white wines obtained from local varieties were subjected to physico-chemical analyzes, and the obtained results are presented in table 2.

Table 2.

The physico-chemical indices of dry red and white wines obtained from native grape varieties after fermentation and postfermentation processes (2018).

| Indices | After alcoholic fermentation | | | | After postfermentation | | | |
|---|------------------------------|-----------------|-----------------|------------|------------------------|-----------------|-----------------|-------------|
| | Feteasca Albă | Feteasca Regală | Feteasca Neagră | Rara Negră | Feteasca Albă | Feteasca Regală | Feteasca Neagră | Rara Neagră |
| Alcohol concentration, % vol | 9,8±0,2 | 9,8±0,2 | 13,4±0,2 | 13,0±0,2 | 10,0±0,2 | 10,0±0,2 | 13,4±0,2 | 13,2±0,2 |
| Mass concentration of sugar, g/dm ³ | 5,2±0,3 | 5,2±0,3 | 4,8±0,3 | 5,4±0,3 | 2,5±0,3 | 2,4±0,3 | 3,5±0,3 | 3,4±0,3 |
| Mass concentration of titratable acids, g/dm ³ | 5,4±0,2 | 6,0±0,2 | 6,4±0,2 | 6,9±0,2 | 5,5±0,2 | 6,4±0,2 | 5,52±0,2 | 6,1±0,2 |
| Mass concentration of volatile acids, g/dm ³ | 0,29±0,08 | 0,29±0,08 | 0,29±0,08 | 0,35±0,08 | 0,32±0,08 | 0,33±0,08 | 0,33±0,08 | 0,38±0,08 |
| pH | 3,4±0,01 | 3,4±0,01 | 3,5±0,01 | 3,4±0,1 | 3,4±0,01 | 3,4±0,01 | 3,5±0,01 | 3,4±0,01 |

Table 2 shows that after the post-fermentation process, degrees of alcoholic in all wines increased by 0.1-0.3% vol, except for Feteasca Neagra, which remained constant at 13.4% vol. The mass content of sugars decreased after post-fermentation, fermenting residual sugars. The concentration of titratable acidity is within the permissible limits for dry white and red wines and ranges from 5,4 to 6,9 g/dm³. The concentration of volatile acidity is quite low and falls within the allowable limits of dry white wines. The pH values of the examined wines are 3.4 to 3.5 which is characteristic for dry red and white wines.

The organoleptic characteristics of the wines obtained from the local grape varieties were also performed (table 3) [20, 21]

Table 3.

Organoleptic characteristic of red and white dry wines obtained from local varieties*

| Wine name | Organoleptic characteristics | | | |
|-----------------|---|---|---|--|
| | Clearness | Colour | Aroma | Taste |
| Feteasca Albă | Clear, without deposits and particles in suspension | A color that changes from green yellow to golden yellow | Flower aroma and honey flavor | Honey taste, good intensity and persistence. |
| Feteasca Regală | Clear, without deposits and particles in suspension | From straw colour to yellow | Adequately to the grape variety, with no extraneous nuances | The taste is pure, harmonious, with freshness, no extraneous nuances |
| Feteasca Neagră | Clear, without deposits and particles in suspension | Intense ruby color | Aroma of black currant, wild berries and dry fruits | The taste of blackberry is balanced, consistent and vigorous |
| Rara Neagră | Clear, without deposits and particles in suspension | Red-ruby not too intense, but vivid and bright | Aroma of plums, with no extraneous nuances | The taste is full, velvety, with nuance of dry fruits |

*According to the Laboratory Guide, Organoleptic Analysis of Wines and Alcoholic Products, UTM, 2014

Characterizing the sensory properties of wines obtained from varieties of native grapes, one can conclude: that all wines have a good clarity, with a color characteristic of white and red dry wines. The aroma and taste of wines are appropriate for each variety and correspond to the highest quality wines.

Conclusions

The process of alcoholic fermentation of must and grape mush from local red and white grape varieties showed that the obtained wineraw material had a duration of the alcoholic fermentation process of 11-12 days, but at different fermentation temperatures: (16-21°C) for white wine and (20-25°C) for red wine.

The study of the physico-chemical composition of white and red wines over the technological cycle has shown that most of the ethyl alcohol is formed in wines as a result of the alcoholic fermentation process and in small amounts in the post-fermentation process and in the malolactic fermentation process. The concentration of titratable acids during the technological cycle does not change unnecessarily, only for red wines during the malo-lactic fermentation process it decreases. The concentration of volatile acids over the technological cycle is gradually increasing due to the formation of acetic acid as a by-

product of alcoholic fermentation. Analyzing the pH index dynamics, we can conclude that the pH of white and red dry wines during the technological cycle is stable and does not change essentially.

The organoleptic characteristics of the red and white wines obtained from local varieties in the TUM microwinery section have sensorial characteristics, special for every grape variety and they are of the highest quality.

The elaboration and implementation of modern technologies for the production of high biological vineyard planting material for the creation of vineyards established with native and prospective varieties from the new selection have contributed substantially to the revival of Moldovan viticulture.

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